BIRS 2022 Annual Report

Banff International Research Station
for Mathematical Innovation and Discovery

CMO Casa Matemática Oaxaca
Centro de investigación y enseñanza

数学高等研究院
INSTITUTE FOR ADVANCED STUDY IN MATHEMATICS

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Instituto de Matemáticas

5-Day Workshops 2022

Jan 9	Jan 14	Dynamical Principles of Biological and Artificial Neural Networks (Online)
Jan 16	Jan 21	Emerging Insights in Insurance Statistics (Cancelled)
Jan 23	Jan 28	Geometry and Swampland (Online)
Jan 30	Feb 4	Restriction, Kakeya, and Carleson-Type Problems (Cancelled)
Feb 6	Feb 11	Additivity Problems in Quantum Information Theory (cancelled)
Feb 13	Feb 18	Sensing and Signaling in Immune Systems: Mathematics meets Biology
Feb 20	Feb 25	Predicting Pathways for Microplastic Transport in the Ocean (Online)
Feb 27	Mar 4	Stochastic Approaches to Turbulence in Hydrodynamical Equations: New Challenges at the Mathematics-Physics Interface
Mar 6	Mar 11	Interactions of gauge theory with contact and symplectic topology in dimensions 3 and 4
Mar 13	Mar 18	Probability and Quantum Information Sciences (Online)
Mar 20	Mar 25	Stochastic Mass Transports
Mar 27	Apr 1	Rate-Induced Transitions in Networked Systems
Mar 27	Apr 1	Interactions between Descriptive Set Theory and Smooth Dynamics
Apr 3	Apr 8	Women in Noncommutative Algebra and Representation Theory 3
Apr 10	Apr 15	Advances in Stein's method and its applications in Machine Learning and Optimization
Apr 17	Apr 22	Almost-Periodic Spectral Problems
Apr 24	Apr 29	At the Interface of Mathematical Relativity and Astrophysics
May 1	May 6	Interpretability in Artificial Intelligence
May 8	May 13	Inverse Problems for Anomalous Diffusion Processes
May 8	May 13	Combinatorial Reconfiguration
May 15	May 20	Emergent Collective Behaviors: Integrating Simulation and Experiment
May 22	May 27	New Interactions Between Statistics and Optimization
May 29	Jun 3	Cross-community collaborations in combinatorics
May 29	Jun 3	Dynamics and Data Assimilation, Physiology and Bioinformatics: Mathematics at the Interface of Theory and Clinical Application
Jun 5	Jun 10	Poisson Geometry, Lie Groupoids and Differentiable Stacks
Jun 12	Jun 17	Arithmetic Aspects of Algebraic Groups
Jun 19	Jun 24	Modern Breakthroughs in Diophantine Problems
Jun 26	Jul 1	Mathematical Frameworks for Integrative Analysis of Emerging Biological Data Types (Cancelled)
Jul 3	Jul 8	Derived Categories, Arithmetic, and Reconstruction in Algebraic Geometry
Jul 3	Jul 8	Markov Chains with Kinetic Constraints and Applications
Jul 10	Jul 15	Mathematical aspects of the Physics with non-self-Adjoint Operators
Jul 17	Jul 22	Theoretical and Applied Aspects for nonlocal Models
Jul 24	Jul 29	Communication Complexity and Applications, III
Jul 31	Aug 5	Interfacial Phenomena in Reaction-Diffusion Systems
Aug 7	Aug 12	Mathematical Models in Biology: from Information Theory to Thermodynamics
Aug 14	Aug 19	Extremal Combinatorics and Geometry
Aug 21	Aug 26	Mathematical Questions in Wave Turbulence (Cancelled)
Aug 28	Sep 2	Specialisation and Effectiveness in Number Theory
Sep 4	Sep 9	New interfaces of Stochastic Analysis and Rough Paths
Sep 11	Sep 16	Rank Conjectures in Algebraic Topology and Commutative Algebra
Sep 18	Sep 23	Building Networks: Women in Complex & Nonlinear Systems
Sep 25	Sep 30	Noncommutative Geometry and Noncommutative Invariant Theory
Oct 2	Oct 7	Defects and Distortions of Layered Complex Fluids
Oct 9	Oct 14	New trends in Mathematics of Dispersive, Integrable and Nonintegrable Models in Fluids, Waves and Quantum Physics
Oct 16	Oct 21	Interactions between Hessenberg Varieties, Chromatic Functions, and LLT Polynomials
Oct 23	Oct 28	New Ideas in Computational Inverse Problems
Oct 30	Nov 4	Topology in Dimension 4.5
Nov 6	Nov 11	Recent Progress in Kinetic and Integro-Differential Equations
Nov 13	Nov 18	Analytic and Probabilistic Combinatorics
Nov 20	Nov 25	Smooth Functions on Rough Spaces and Fractals with Connections to Curvature Functional Inequalities
Nov 27	Dec 2	Topics in Multiple Time Scale Dynamics
Dec 4	Dec 9	Toric Degenerations

2-Day Workshops 2022

Apr 8	Apr 10	Mathematical Constitutive Models and Numerical Methods to Simulate Soft Tissue Under Impact Loading
Apr 22	Apr 24	Multiplex Brain Networks
Apr 29	May 1	Ted Lewis SNAP Math Fair Workshop 2020
May 6	May 8	Canadian Math Kangaroo Contest Meeting
Jun 3	Jun 5	Alberta-Montana Combinatorics and Algorithms Day
Jun 17	Jun 19	Canadian Abstract Harmonic Analysis Symposium (CAHAS) 2020
Jun 24	Jun 26	Multitaper Spectral Analysis (Online)
Jul 8	Jul 10	Mathematical challenges in computational chemistry: multiscale, multiconfigurational approaches, machine learning
Jul 15	Jul 17	Math Attack Summer School for Girls
Sep 9	Sep 11	Almost Periodicity in Aperiodic Order
Oct 14	Oct 16	Recent progress in detection and prediction of epilepsy
Nov 18	Nov 20	L-functions in Analytic Number Theory
Dec 9	Dec 11	2-Day Workshop on the Network of Collaborations for Women In Science, Technology, Engineering, and Mathematics

Focused Research Group

Mar 13	Mar 20	Computability and complexity of statistical behavior of dynamical systems
May 22	May 29	Dynamics of biopolymers across multiple scales
May 29	Jun 5	Decomposition Theories for Discrete Dynamical Systems: An Approach to Modularity of Biological Systems
Jun 5	Jun 19	Geometric Interpretation and Visualization of Multi-Parameter Persistent Homology
Jun 12	Jun 25	Cohomogeneity Two Manifolds of Positive Sectional Curvature
Jul 10	Jul 17	Studying PDE dynamics via optimization with integral inequality constraints
Jul 17	Jul 24	Novel perspectives in kinetic equations for emerging phenomena
Aug 14	Aug 21	SYZ mirror symmetry and its applications
Aug 21	Aug 28	Novel fluid/structure/field (FFSI) modeling framework in the context of ion channels (Cancelled)
Oct 30	Nov 6	Predicting and Preventing Wellbore Leakage
Nov 13	Nov 20	Mathematical Modelling and Machine Learning for Phonetics
Nov 20	Dec 4	Non-Classical Constructions in Tensor Categories and Conformal Field Theory

Research in Teams

Mar 6	Mar 13	Spontaneously Stochasticity in Turbulence Theory
Mar 20	Mar 27	Shapes from Echoes
Jun 19	Jun 26	Random motions in Markov and semi-Markov environments and their applications
Jun 26	Jul 3	Functor Calculus, Cartesian Differential Categories, and Operads
Jul 24	Jul 31	Algebraically integrable domains
Jul 24	Aug 7	Linearization Techniques for Holomorphic Functions and Lipschitz-Free Spaces
Sep 11	Sep 25	Small Maximal Independent Sets
Sep 25	Oct 2	Geometry of Rotation Sets
Sep 25	Oct 2	Implicit-Explicit Time Integration Methods
Nov 20	Nov 27	Symmetries of Gravity at the Black Hole Horizon

Banff International Research Station

2022

5-Day Workshops

Dynamical Principles of Biological and Artificial Neural Networks (Online)
January 9 - 14, 2022

Organizers:

Zachary Kilpatrick (University of Colorado)
Sue Ann Campbell (University of Waterloo)
Alona Fyshe (University of Alberta)
Joel Zylberberg (York University)

Artificial intelligence (AI) has recently undergone a revolution, through the use of artificial neural networks, and deep learning. These techniques were developed by simplifying the details of mathematical models of neurons in the brain, and assembling thousands (or in some cases, millions), of these artificial neurons into gigantic networks. This approach has dramatically advanced progress in artificial vision, the control of autonomous vehicles, medical diagnostics, and many other challenging areas of AI research. Spurred on by those successes, neuroscientists have turned to these same artificial neural networks to model the computations performed by real brains: excitingly, the activation patterns of artificial neurons in ANNs often bear strong resemblance to those observed in the real brain.

Despite these recent successes at the neuroscience-AI intersection, there are many deep mathematical questions still to answer: 1) given their enormous size and complexity, how can we understand the operations performed by a fully-trained deep learning algorithm, or (analogously) an animal's brain?; 2) how does the dynamics of activations within biological and artificial neural networks evolve and interact over different timescales (seconds, hours, days, etc.)?; 3) how does randomness in the environment and/or within the neuronal networks themselves contribute to the function of these networks?; 4) what features most enhance (or degrade) the computational power of neuronal networks?; 5) how do brains and AI systems reason in the face of uncertainty? This workshop will brought together AI researchers, neuroscientists, and mathematicians, to answer these questions. In so doing, it aimed to advance all three of those disciplines, leading to better AI algorithms, and potentially better diagnosis and treatment of those with brain disorders.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5047

Participants:

Altan, Ege (Northwestern University)
Bakhtiari, Shahab (MILA)
Barbosa, Joao (École normale supérieure)
Beiran, Manuel (Columbia University)
Bondanelli, Giulio (Italian Institute of Technology)
Campbell, Sue Ann (University of Waterloo)
Cayco-Gajic, Alex (École normale supérieure)
Chatterjee, Subhrasankar (Indian Institute of Technology)
Chen, Liang (University of Waterloo)
Choi, Hannah (Georgia Institute of Technology)
Chung, SueYeon (Columbia University)
Cimesa, Ljubica (École normale supérieure)
Clopath, Claudia (Imperial College London)
Curto, Carina (The Pennsylvania State University)
Eissa, Tahra (University of Colorado Boulder)
Ekelmans, Pierre (Mainz university)
Engel, Tatiana (Cold Spring Harbor Laboratory)
Fyshe, Alona (University of Alberta)
Galves, Antonio (University of Sao Paulo)
Genkin, Mikhail (Cold Spring Harbor Laboratories)
Gerstner, Wulfram (EPFL)
Greenwood, Priscilla (University of British Colombia)
Huang, Chengcheng (University of Pittsburgh)
Huth, Alex (University of Texas Austin)
Jazayeri, Mehrdad (Massachusetts Institute of Technology)
Kar, Kohitij (Massachusetts Institute of Technology)
Kilpatrick, Zachary (University of Colorado)
Lahrach, Othman (École normale supérieure)
Lajoie, Guillaume (U Montreal & Mila)
Langdon, Chris (Cold Spring Harbor Laboratories)
Londono Alvarez, Juliana (Pennsylvania State University)
Martin, Andrea E. (Max Planck Institute for Psycholinguistics)
Mastrogiuseppe, Francesca (University College London)
Nguyen, Danny (Five Rings Capital)
Nicola, Wilten (University of Calgary)
Noorman, Marcella (Janelia Research Campus)
Ostojic, Srdjan (Ecole Normale Superieure)
Payeur, Alexandre (MILA)
Pina, Jason (York University)
Puelma Touzel, Maximillian (Mila - Quebec AI Institute, University of Montreal)
Qiu, Siwei (U Pittsburgh)
Richards, Blake (McGill University)
Sanderson, Nikki (Penn State University)
Savin, Cristina (New York University)
Shao, Yuxiu (École normale supérieure)
Solla, Sara A. (Northwestern University)
Song, Deying (Carnegie Mellon)
Stein, Heike (ENS, Paris)
Tchumatchenko, Tatjana (Medical Center University of Mainz & Medical Center University of Bonn)
Tolmachev, Pavel (Cold Spring Harbor Laboratory)
Tran, Khue (Stony Brook University)
Tripp, Bryan (University of Waterloo)
Valente, Adrian (École normale supérieure)
Wang, Julia (Cold Spring Harbor Laboratory)
Watters, Nicholas (Massachusetts Institute of Technology)
Wehbe, Leila (Carnegie Mellon University)
Zheng, CiCi (Cold Spring Harbor Laboratories)
Zylberberg, Joel (York University)

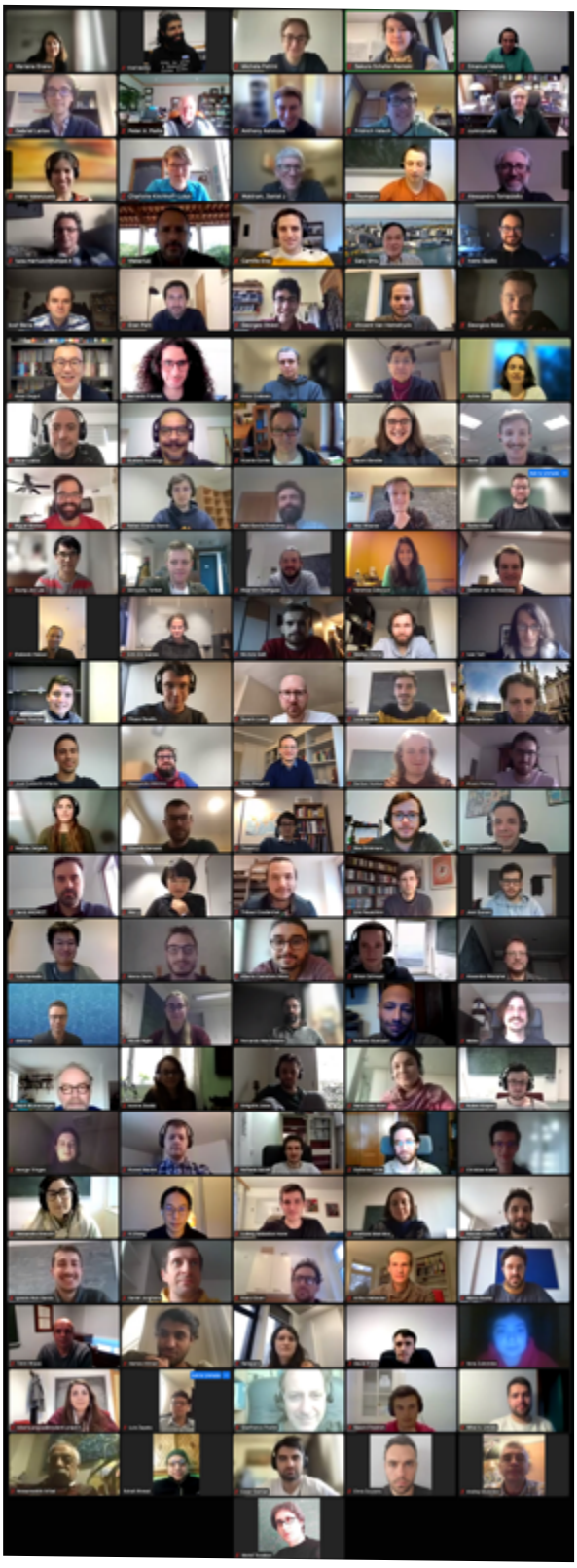
Geometry and Swampland (Online)
January 23 - 28, 2022

Organizers:

Mariana Grana (Commissariat a l'Energie Atomique, Saclay)

Michela Petrini (Sorbonne Université)

Irene Valenzuela (IFT Madrid)



Despite its undeniable success, there are evidences that the Standard Model cannot be the fundamental theory of electromagnetic, weak and strong interactions. The search for a theory beyond the Standard Model is deeply connected to another fundamental question in theoretical physics, namely understanding the structure of quantum gravity. Whatever effective theory might describe particle interactions beyond the observable energy scale must eventually be completed into quantum gravity. Recently, a lot of activity has been devoted to determine criteria which differentiate between effective low-energy field theories that can be consistently coupled to quantum gravity from theories that, even if they seem to be consistent, cannot. In the current jargon, the former are said to be in the `Landscape' while the latter form the so-called `Swampland'. A number of such criteria, or Swampland Conjectures, have been proposed in the literature and attracted considerable interest in the high energy physics community. The Swampland Conjectures have profound implications for many open issues in physics and cosmology, such as the structure of large field inflation in early-time cosmology, or the mechanism responsible for the observed late-time acceleration of the universe, to name some of the most striking examples. It is therefore extremely important and timely to put such conjectures on firmer grounds.

A concrete and particularly well developed framework to address specific questions of quantum gravity is String Theory, where the Swampland conjectures translate into conjectures regarding the structure of possible string geometries. Recent work has shown that these geometries have an elegant reformulation in terms of a generalized version of Riemannian geometry. The goal of this workshop was to explore the intriguing connections between general properties of quantum gravity and the generalized geometry of string theory. The workshop brought together the swampland community and the generalized geometry community at this unique time in which our understanding of the Swampland is quickly evolving.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5083

Participants:

Alalawi, Shabeeb (University of Bonn)
Andriot, David (LAPTh, CNRS, Annecy)
Ashmore, Anthony (University of Chicago & Sorbonne Universite)
Aspman, Johannes (Trinity College Dublin)
Baines, Stephanie (Imperial College London)
Basile, Ivano (University of Mons - UMONS)
Blair, Chris (Vrije Universiteit Brussel)
Blumenhagen, Ralph (Max-Planck-Institut fuer Physik, Munich)
Brandenberger, Robert (McGill)
Buratti, Ginevra (IFT Madrid)
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Coimbra, Andre (AEI Potsdam)
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Cortes, Vicente (Universität Hamburg)
Crabeels, Viktor (Vrije Universiteit Brussel)
Cribiori, Niccolò (MPI Munich)
Damian, van de Heisteeg (Utrecht University)
De Luca, Bruno (Stanford)
Demulder, Saskia (Max-Planck-Institut für Physik)
Diriöz, Emine (İstanbul Technical University)
Eloy, Camille (Vrije Universiteit Brussel)
Fernandez-Melgarejo, Jose J (Universidad de Murcia)
Font, Anamaria (Universidad Central de Venezuela)
García Etxebarria, Iñaki (Durham University)
Gendler, Naomi (Cornell University)
Glubokov, Andrey (Purdue University)
Gonzalo, Eduardo (Lehigh University)
Grana, Mariana (Commissariat a l'Energie Atomique, Saclay)
Grimm, Thomas (Utrecht University)
Gu, Pingyuan (Kyoto University)
Hatsuda, Machiko (Juntendo University & KEK)
Hebecker, Arthur (Institute for Theoretical Physics University of Heidelberg)
Heckman, Jonathan (University of Pennsylvania)
Herraez, Alvaro (IPhT Saclay)
Itsios, Georgios (Humboldt University)
Kirchhoff-Lukat, Charlotte (KU Leuven/ Massachusetts Institute of Technology)
Kläwer, Daniel (University of Hamburg)
Larfors, Magdalena (Uppsala University and Durham University)
Larios, Gabriel (IFT UAM-CSIC and University of Michigan)
Lavau, Sylvain (Euler Institute (EIMI) & Steklov Institute, Saint-Petersburg, Russian Federation.)
Lee, Seung-Joo (IBS-CTPU)
Loaiza-Brito, Oscar (Universidad de Guanajuato)
Lüst, Dieter (Munich)
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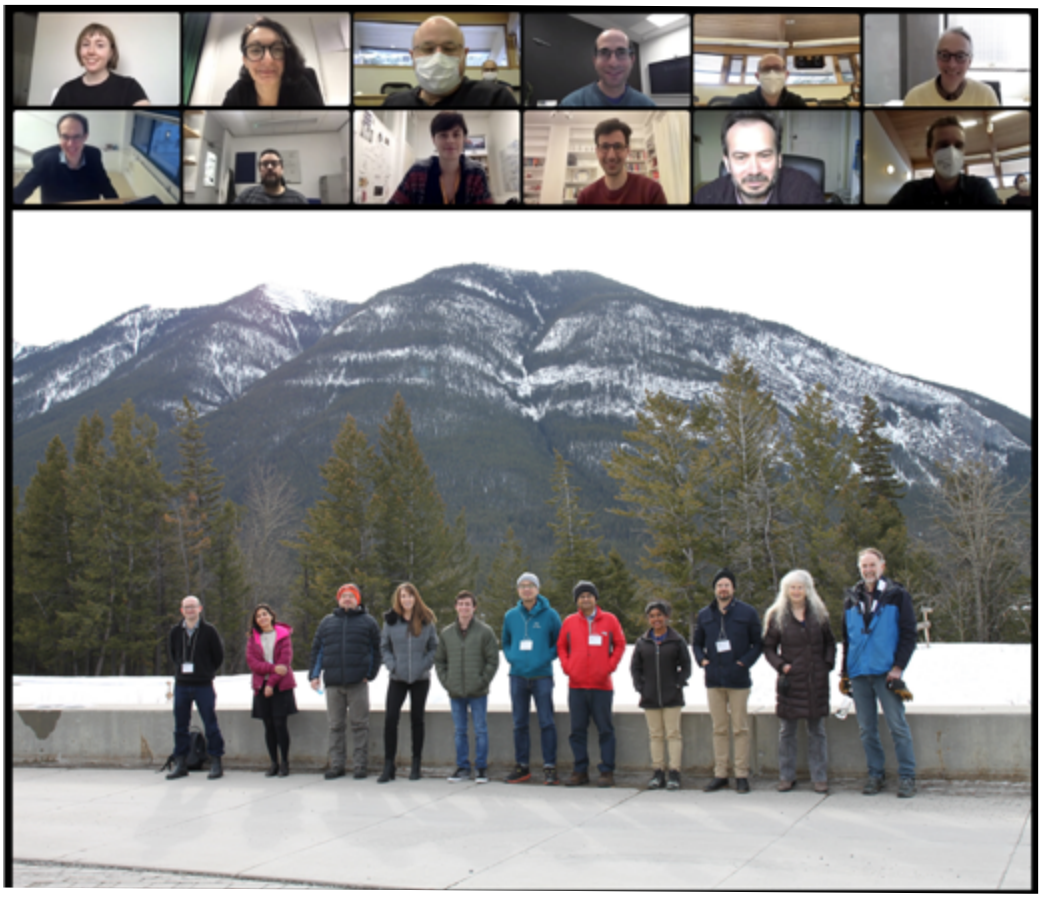
Marchesano, Fernando (IFT-Madrid)
Martucci, Luca (University of Padova)
Minasian, Ruben (CEA/saclay)
Mininno, Alessandro (Uni Hamburg)
Mohseni, Amineh (Sharif University of Technology)
Montero, Miguel (Harvard University)
Morales Parra, Juan Carlos (Heriot Watt University)
Murugesan, Subrabalan (IISER Thiruvananthapuram)
Núñez, Carmen (Buenos Aires)
Ooguri, Hirosi (Caltech & Kavli IPMU)
Palti, Eran (Ben-Gurion University of the Negev)
Pang, Yi (Tianjin University)
Parks, Peter (Synergy Systems Associates)

Petrini, Michela (Sorbonne Université)
Pezzella, Franco (INFN - Naples Division)
Plauschinn, Erik (Utrecht University)
Quirant, Joan (IFT UAM/CSIC)
Savelli, Raffaele (University of Rome -- Tor Vergata)
Shahbazi, Carlos (University of Hamburg)
Skrzypek, Torben (Imperial College London)
Sun, Kaiwen (KIAS)
Sun, Rui (KIAS)
Tahim, Makarius (UECE)
Tennyson, David (Imperial College London)
Tomasiello, Alessandro (University of Milano Bicocca)
Trivedi, Oem (Ahmedabad University)
Tsimpis, Dimitrios (University of Lyon)
Tulli, Ivan (University of Hamburg)
Valach, Fridrich (Imperial College London)
Valenzuela, Irene (IFT Madrid)
Van Riet, Thomas (KU Leuven)
Waldram, Daniel (Imperial College London)
Weigand, Timo (Hamburg University)

Sensing and Signaling in Immune Systems: Mathematics meets Biology
February 13 - 18, 2022

Organizers:

Anton Zilman (University of Toronto)
Paul Francois (McGill University)
Armita Nourmohammad (University of Washington)
Gregoire Altan-Bonnet (National Cancer Institute)



All living organisms, from bacteria to whales, are constantly encountering infectious pathogens. To battle these threats, organisms have developed diverse and sophisticated immune strategies that rely on sensing the environment and adaptively responding to pathogenic challenges. In order to perform their functions in multi-cellular organisms and populations, cells of the immune system constantly sense their environment. The information from the environment, encoded through a multitude of molecular signals, is processed by internal molecular 'machinery.' These signal-processing pathways are able to perform a staggeringly wide array of precise functions in presence of high levels of noise, cross-talk and uncertainty. The overarching questions that guided this workshop were: 1) how do immune cells and their collectives perform signal processing and decision-making on multiple spatial and temporal scales in presence of cross-talk and environmental noise? 2) how do evolutionary and molecular constraints shape these biological "computations" by the immune system? 3) how these signaling networks can be manipulated for clinical interventions in disease?

To answer these questions, a synergy between a wider variety of experimental and computational approaches is necessary. The purpose of this workshop is to bring researchers from many different fields - mathematicians, physicists, systems biologists, experimental immunologists and clinicians - to focus on the organizing mathematical principles of signaling in immune systems via synthesis of a wide range of experimental and mathematical approaches. Answering these questions advanced our understanding of the fundamental biological problems and paved the way for biomedical applications and the design of new mathematical and computer science algorithms.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5139

Participants:

Altan-Bonnet, Gregoire (National Cancer Institute)
Antebi, Yaron (Weizmann Institute)
Becca, Asquith (Imperial College)
Bhat, Mamatha (University of Toronto)
Bradley, Philip (Fred Hutch Cancer Center)
Cvijovic, Ivana (Stanford University)
Das, Jayajit (National Children's Hospital)
Dushek, Omer (Oxford University)
Dustin, Michael (University of Oxford)
Fradin, Cecile (McMaster University)
Francois, Paul (McGill University)
Goyal, Sid (University of Toronto)
Hofer, Thomas (German Cancer Research Agency)
Hoffmann, Alexander (UCLA)
Isacchini, Giulio (UC Berkeley)
Kirby, Duncan (University of Toronto)
Koseska, Aneta (Max Planck Society)
Kueh, Hao Yuan (University of Washington)
Mayer, Andreas (Princeton)
Midroni, Julie (University of Toronto)
Minervina, Anastasia (St. Jude Children's Research Hospital)
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Montague, Zachary (University of Washington)
Mora, Thierry (ENS)
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Nourmohammad, Armita (University of Washington)
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Pun, Michael (University of Washington)
Rothenberg, Ellen (California Institute of Technology)
Smith, Amber (University of Tennessee Health Science Center)
Thomas, Paul (St Jude Children's Research Hospital)
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Tsang, John (National Institute for Allergies and Infectious Diseases (NIAID))
Ukogu, Obinna (University of Washington)
Vaidehi Narayanan, Haripriya (UCLA)
Van Valen, David (Caltech)
Walczak, Aleksandra (CNRS ENS)
Wang, Shenshen (University of California Los Angeles)
Wardemann, Hedda (Heidelberg)
White, William (University of Washington)
Zilman, Anton (University of Toronto)

Predicting Pathways for Microplastic Transport in the Ocean (Online)
February 20 - 25, 2022

Organizers:

Bruce Sutherland (University of Alberta)
Michelle DiBenedetto (University of Washington)
Alexis Kaminski (University of California, Berkeley)
Ton van den Bremer (Delft University of Technology)

While microplastics are becoming recognized as a pollutant, their evolution from source to sink and their distribution in lakes, rivers and marine environments remains poorly understood. As a result, fisheries and marine biologists struggle to assess the future impact of microplastics upon aquatic ecosystems. Taking advantage of new technologies and the expertise of mathematicians, physicists, engineers and oceanographers, our workshop aimed to provide a better theoretical and physical understanding of the transport, sedimentation and resuspension of microplastics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5073

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Bang, Joo Young (University of Wisconsin)
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Blanchette, Francois (UC Merced)
Boury, Samuel (Courant Institute of Mathematical Sciences)
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Calvert, Ross (University of Edinburgh)
Camassa, Roberto (University of North Carolina)
Caulfield, Colm-cille (University of Cambridge)
Cenedese, Claudia (Woods Hole Oceanographic Institution)
Clark, Laura (Stanford University)
Davidson, Ben (University of Wisconsin)
Di Gusto, Davide (Aix-Marseille University)
DiBenedetto, Michelle (University of Washington)

Dohan, Kathleen (Eatrh & Space Research)
Donohue, Jessica (Sea Education Association)
Flierl, Glenn (Massachusetts Institute of Technology)
Fox-Kemper, Baylor (Brown University)
Gomez Navarro, Laura (Utrecht University)
Govindarajan, Rama (Tata Institute of Fundamental Research)
Guazzelli, Elisabeth (CNRS and University of Paris)
Guillomaitre, Nehemie (Princeton University)
Gupta, Akanksha (IIT Kanpur, India and University of Dundee, Scotland)
Johnson, Blair (University of Texas Austin)
Joubaud, Sylvain (Ecole Normale Superieure Lyon)
Kalisch, Henrik (University of Bergen)
Kaminski, Alexis (University of California, Berkeley)
Kapil, Mohnish (University of Alberta)
Koseff, Jeffrey (Stanford University)
Kumar, Anup (ICTS-TIFR)
Lavender Law, Kara (Sea Education Association)
Le Bars, Michael (CNRS, Aix-Marseille University)
Lermusiaux, Pierre (Massachusetts Institute of Technology)
Li, Kehan (University of Alberta)
Maandorp, Mikael (Utrecht University)
McElwaine, Jim (Durham University)
McKeon, Beverley (Caltech)
Meiburg, Eckart (UC Santa Barbara)
Mendoza, Amaia (University of the Basque Country)
Musgrave, Ruth (Dalhousie University)
Oehmke, Theresa B (Universit of New Hampshire)
Olsthoorn, Jason (Queen's University)
Onink, Victor (University of Bern/Utrecht University)
Ouellette, Nicholas (Stanford University)
Pierard, Claudio (Utrecht University)
Poulain-Zarcos, Marie (LMA & IUSTI)
Priestley, Rod (Princeton University)
Pujara, Nimish (University of Wisconsin-Madison)
Pujari, Aditya (International Centre for Theoretical Sciences)
Rahmani, Mona (UBC)
Reijnders, Daan (Utrecht University)
Richardson, Joey (Utrecht University)
Roy, Anubhab (IIT Madras)
Rühs, Siren (Utrecht University)
Sauret, Alban (UCSB Department of Mechanical Engineering)
Smith, Maddie (University of Washington)
Stone, Howard (Princeton University)
Sutherland, Bruce (University of Alberta)
Swagemakers, Jesse (TU Delft)
Thiffeault, Jean-Luc (University of Wisconsin)
Timmermans, Mary-Louise (Yale)
Valentí, Jose (The University of British Columbia)
van den Bremer, Ton (TU Delft)
van Mil, Sophie (Utrecht University)
van Sebille, Erik (Utrecht University)
Vanneste, Jacques (University of Edinburgh)
Verhille, Gautier (University Aix/Marseille)
Whittaker, Colin (University of Auckland)
Xiao, Qian (University of Oxford)
Ziervogel, Kai (University of New Hampshire)
Zippel, Seth (Woods Hole Oceanographic Institution)

Stochastic Approaches to Turbulence in Hydrodynamical Equations February 27 - March 4, 2022

Organizers:

Konstantin Khanin (University of Toronto)
Uriel Frisch (Observatoire de la Côte d'Azur)
Alessandra Lanotte (Institute of Nanotechnology)
Rahul Pandit (Indian Institute of Science)
Samriddhi Sankar Ray (International Centre for Theoretical Sciences)

The interest in turbulent flow goes back many centuries, but progress has been slow until recently, from the point of view of ab initio theory, which starts from the Euler or Navier–Stokes equations for a fluid. Since the 20th century, innumerable applications, e.g., in aeronautics or atmospheric and oceanic circulation, have been a major driving force for progress. In the last eighty years, thanks (a) to the scaling predictions of Kolmogorov in 1941, (b) to Onsager's 1949 criterion for anomalous energy dissipation, and (c) to Kraichnan's discovery of the inverse energy cascade for 2D turbulence, we have had the beginnings of a theoretical understanding.

The workshop brought together leading researchers from diverse branches of the theory of turbulence. We will discuss ways of developing a theoretical understanding of turbulence in stochastically forced hydrodynamical equations by using variants of the theories of spontaneous stochasticity and of rough paths, and regularity structures and state-of-the-art numerical simulations. We hope that cross-fertilization of ideas between these areas will foster new collaborations and lead to new developments, in mathematical, physical, and numerical aspects of problems in turbulence.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5015

Participants:

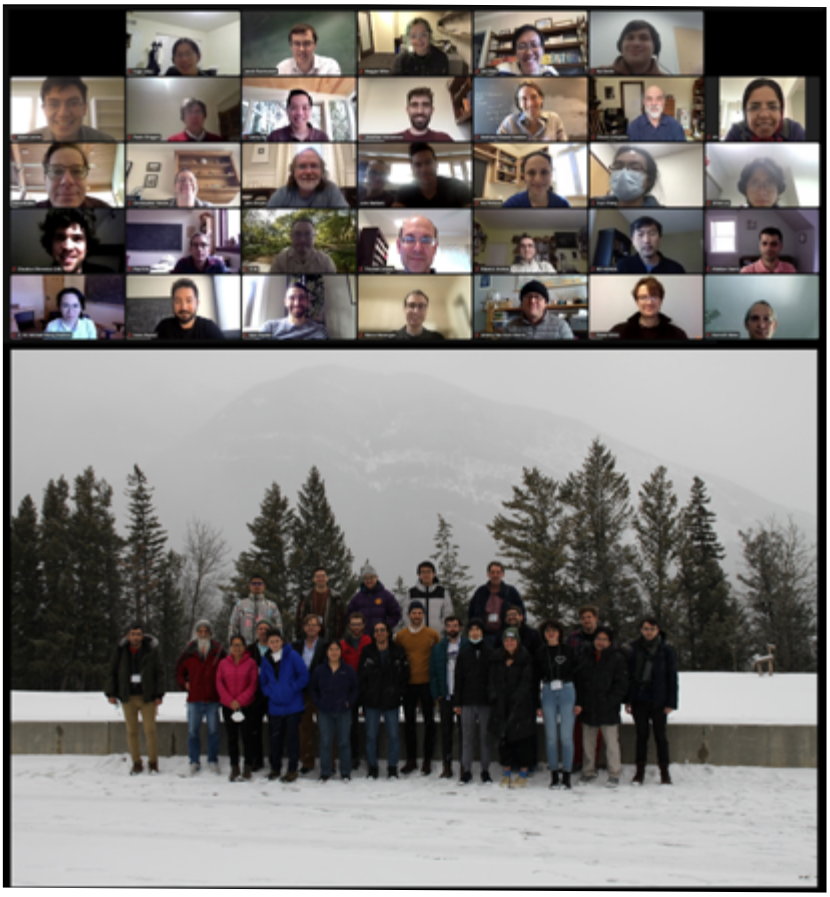
Bandak, Dmytro (UIUC)
Bec, Jeremie (CNRS, Université Côte d'Azur)
Bedrossian, Jacob (University of Maryland)
Besse, Nicolas (OCA)
Biferale, Luca (Univ. Rome)
Blumenthal, Alex (Georgia Institute of Technology)
Bo, Stefano (Max Planck Institute for the Physics of Complex Systems)

Buckmaster, Tristan (Princeton University)
Buzzicotti, Michele (University of Rome)
Ching, Emily S.C. (Chinese University of Hong Kong)
De, Sadhitro (IISC)
de Carlo, Leonardo (scuola normale superiore)
Diamond, Pat (UCSD)
Drivas, Theodore (Stonybrook)
Eyink, Gregory (JHU)
Falkovich, Gregory (Weizmann Institute of Science)
Flandoli, Franco (Scuola Normale Superiore (SNS))
Gibbon, John (Imperial College London)
Glubokov, Andrey (Purdue University)
Goldenfeld, Nigel (UCSD)
Gotoh, Toshiyuki (Nagoya Institute of Technology)
Hairer, Martin (Imperial College London)
Khanin, Konstantin (University of Toronto)
Lanotte, Alessandra (Institute of Nanotechnology)
Luo, Dejun (Chinese Academy of Science)
Mailybaev, Alexei (IMPA)
Matsumoto, Takeshi (Kyoto University)
Mattingly, Jonathan (Duke University)
Melikechi, Omar (Duke University)
Mitra, Dhrubaditya (NORDITA)
Murugan, Sugan (ICTS)
Nussenzveig Lopes, Helena (Universidade Federal do Rio de Janeiro)
Pandit, Rahul (Indian Institute of Science)
Perlekar, Prasad (TIRF Hyderabad)
Picardo, Jason (ITT Bombay)
Quastel, Jeremy (University of Toronto)
Roy, Dipankar (ICTS)
Sankar Ray, Samriddhi (International Centre for Theoretical Sciences)
Shavit, Michal (Weizmann)
Su, Langxuan (Duke University)
Sulem, Catherine (University of Toronto)
Titi, Edriss (Texas A&M University)
Vicol, Vlad (New York University)
Vincenzi, Dario (Université Côte d'Azur, CNRS)
Wang, Xueying (University of Illinois Urbana-Champaign)

Interactions of gauge theory with contact and symplectic topology in dimensions 3 and 4
March 6 - 11, 2022

Organizers:

Hans Boden (McMaster University)
John Baldwin (Boston College)
Liam Watson (University of British Columbia)
John Etnyre (Georgia Institute of Technology)



This workshop highlighted new results in low-dimensional topology from a wide range of geometric methods. Low-dimensional topology studies the global properties of geometric spaces in dimensions 3 and 4, such as 3-dimensional space and 4-dimensional space-time. Surprisingly, the study of spaces in dimensions 3 and 4 is more challenging than in higher dimensions: for instance, the famous Poincaré conjecture, which gives an intrinsic topological characterization of the sphere, was solved recently by Perelman in dimension 3, and has not yet been completely settled in dimension 4, while its higher dimensional generalizations were previously known. In fact, studying 3- and 4-dimensional spaces requires combining a variety of different approaches, many of which are geometric in nature and have their roots in theoretical physics. Much of the recent progress in this extremely active area of mathematics makes use of the interplay between sophisticated mathematical invariants (quantities that can be used to distinguish one space from another) coming from gauge theory and from contact and symplectic geometry, and clever new cut-and-paste constructions that modify known spaces in surprising ways. The workshop featured new discoveries on the shape of space and knotted objects inside space and will host leading experts from around the world.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5164

Participants:

Alishahi, Akram (University of Georgia)
Auckly, David (Kansas State University)
Baker, Kenneth (University of Miami)
Baldridge, Scott (Louisiana State University)
Baldwin, John (Boston College)
Baykur, Inanc (University of Massachusetts Amherst)
Binns, Fraser (Boston College)
Boden, Hans (McMaster University)

Boileau, Michel (Aix Marseille Université)
Boyer, Steven (Université du Québec à Montréal)
Boyle, Keegan (University of British Columbia)
Brejevs, Vitalijs (Glasgow University)
Budney, Ryan (University of Victoria)
Cahn, Patricia (Smith College)
Casals, Roger (UC Davis)
Cavallo, Alberto (Université du Québec à Montréal)
Cazassus, Guillem (University of Oxford)
Chen, Wenzhao (University of British Columbia)
Chen, Jie (McMaster University)
Collins, Sally (Georgia Institute of Technology)
Curtis, Cynthia (College of New Jersey)
Daemi, Aliakbar (Washington University)
Dai, Irving (Stanford)
Dunfield, Nathan (University of Illinois (Urbana-Champaign))
Etnyre, John (Georgia Institute of Technology)
Feehan, Paul (Rutgers University)
Gabai, David (Princeton University)
Gaudreau, Robin (N/A)
Ghiggini, Paolo (CNRS - Laboratoire Jean Leray (Nantes))
Ghosh, Sudipta (Louisiana State University)
Glubokov, Andrey (Purdue University)
Gompf, Bob (University of Texas Austin)
Gong, Sherry (Texas A&M University)
Gordon, Cameron (University of Texas at Austin)
Greene, Josh (Boston College)
Hambleton, Ian (McMaster University)
Hanselman, Jonathan (Princeton University)
Hayden, Kyle (Rutgers University - Newark)
Hayden, Kyle (Rutgers University - Newark)
Hedden, Matthew (Michigan State University)
Hendricks, Kristen (Rutgers University)
Herald, Chris (University of Nevada, Reno)
Hogancamp, Matthew (Northeastern University)
Hom, Jennifer (Georgia Institute of Technology)
Honda, Ko (University of California, Los Angeles)
Hughes, Mark (Brigham Young University)
Hutchings, Michael (University of California)
Islambouli, Gabriel (UC Davis)
Jabuka, Stanislav (University of Nevada Reno)
Juhasz, Andras (University of Oxford)
Karimi, Homayun (McMaster University)
Kim, Hee Jung (Western Washington University)
Kirby, Rob (University of California-Berkeley)
Kirk, Paul (Indiana University)
Kutluhan, Cagatay (University at Buffalo)
Leness, Tom (Florida International University)
Levine, Adam (Duke University)
Li, Jiakai (Harvard University)
Lin, Jianfeng (Tsinghua University)
Liu, Zitian (Indiana University)
Livingston, Charles (Indiana University)
Lobb, Andrew (Durham University)
Manolescu, Ciprian (Stanford University)
Marengon, Marco (Alfréd Rényi Institute for Mathematics)
Marian, Mihai (University of British Columbia)
Mark, Thomas (University of Virginia)
Martin, Gage (Boston College)
Matic, Gordana (University of Georgia)
Mrowka, Tom (Massachusetts Institute of Technology)
Mukherjee, Anubhav (Georgia Tech)
Naik, Swatee (National Science Foundation)
Naylor, Patrick (Princeton University)
Ng, Lenny (Duke University)
Ni, Yi (Caltech)
Nicas, Andrew (McMaster University)
Niemi-Colvin, Seppo (Duke University)
Owens, Brendan (University of Glasgow)
Park, B. Doug (University of Waterloo)
Petkova, Ina (Dartmouth College)
Pinzon-Caicedo, Juanita (University of Notre Dame)
Plamenevskaya, Olga (Stony Brook University)
Pongtanapaisan, Puttipong (University of Saskatchewan)
Raoux, Katherine (Max Planck Institute)
Rasmussen, Jake (Cambridge)
Ray, Arunima (Max-Planck-Institut für Mathematik)
Reinoso, Braeden (Boston College)
Rolfsen, Dale (University of British Columbia)
Ronnenberg, Mark (Indiana University)
Roy, Agniva (Georgia Tech)
Ruberman, Daniel (Brandeis University)
Sadykov, Rustam (Center for Child Development)
Sarkar, Soumen (Indian Institute of Technology Madras)
Saveliev, Nikolai (University of Maimi)
Scaduto, Christopher (University of Miami)
Shah, Pamela (University of British Columbia)
Sivek, Steven (Imperial College London)
Smith, Kai (Indiana University)
Stipsicz, Andras (Renyi Institute)
Stoffregen, Matt (Michigan State University)
Strle, Saso (University of Ljubljana)
Tosun, Bulent (University of Alabama)
Tripp, Samuel (Dartmouth College)
Truong, Linh (University of Michigan)
Van Cott, Cornelia (University of San Francisco)
Van Horn-Morris, Jeremy (University of Arkansas)
Vela-Vick, Shea (Louisiana State University)
Vertesi, Vera (University of Vienna)
Wang, Joshua (Harvard University)
Watson, Liam (University of British Columbia)
Willis, Michael (Stanford University)
Winkeler, Zachary (Dartmouth College)
Wong, C.-M. Michael (Dartmouth College)
Wu, Angela (Louisiana State University)
Zemke, Ian (Princeton University)
Zhang, Boyu (Princeton University)
Zhang, Melissa (MSRI)
Zhang, Zuyi (IndianaIndi University)
Zhou, Hugo (Georgia Tech)
Zibrowius, Claudius (Universität Regensburg)
Zung, Jonathan (Princeton)

Probability and Quantum Information Science (Online)
March 13 - 18, 2022

Organizers:

Jeffrey Schenker (Michigan State University)
Cécilia Lancien (Institut Fourier Grenoble)
Ramis Movassagh (IBM Research)
Simone Warzel (Technical University of Munich)

The recent advent of small-scale quantum processors with over 50 quantum bits (qubits) has the potential to usher in a new era of computation. It is imperative that we understand the generic aspects of near-term quantum computers, from robustness to noise and error, to possible phases of the output state, to unprecedented information theoretical challenges. The mathematics that underpins these is probability theory. The goal of this workshop was to bridge cutting-edge modern probability theory with quantum information science to advance our understanding of the generic aspects of noisy near-term quantum processes.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5111

Participants:

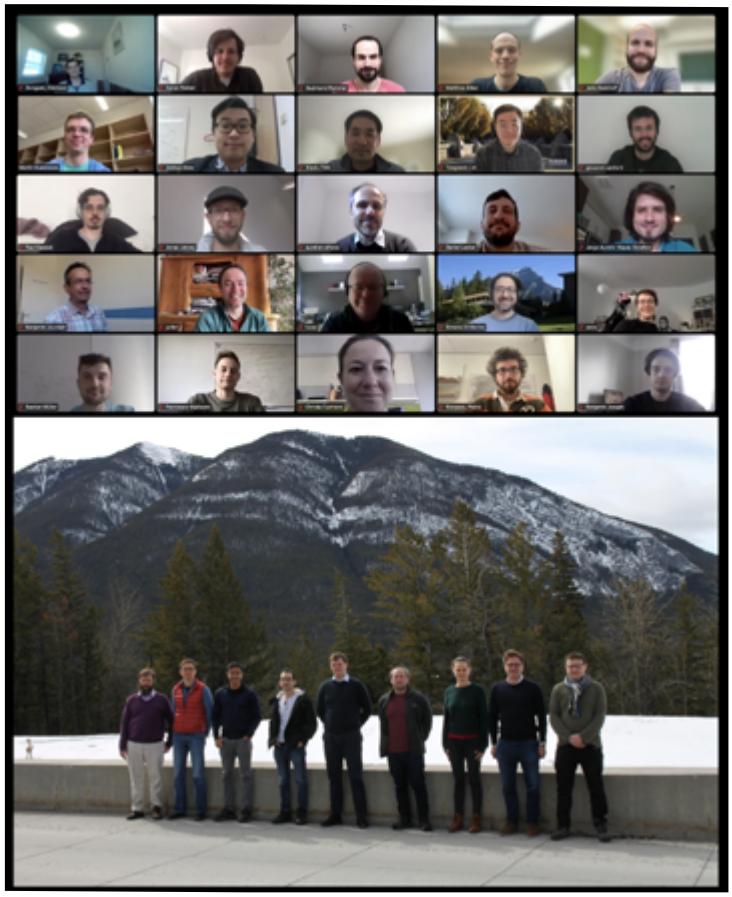
Anikeeva, Galit (MIT)
Anshu, Anurag (Harvard University)
Artymowicz, Adam (Caltech)
Babbush, Ryan (Google Inc.)
Bachmann, Sven (The University of British Columbia)
Barberis, Nicole (IonQ)
Barvinok, Alexander (University of Michigan (Ann Arbor))
Boixo, Sergio (Google)
Caha, Libor (TUM)
De Roeck, Wojciech (KU Leuven)
Deshpande, Abhinav (Caltech)
Du, Zhiqian (UC Davis)
Ekblad, Owen (Michigan State University)
Fraas, Martin (UC Davis)
Furlotte, Justin (University of British Columbia)
Garcia, Aldo (Michigan State University)
Glubokov, Andrey (Purdue University)
Grilo, Alex (CNRS, Paris, France)
Harrow, Aram (Massachusetts Institute of Technology)
Hingorani, Rahul (UC Davis)
Hunter-Jones, Nick (Stanford University)
Jackson, Thomas (UC Davis)
Jones, Barbara (IBM)
Kachkovskiy, Ilya (Michigan State University)
Klausen, Frederik (University of Copenhagen)
Korepin, Vladimir (Stony Brook)
Lakshitha, Lubashan (Michigan State University)
Lancien, Cécilia (Institut Fourier Grenoble)
Lemm, Marius (University of Tübingen)
Lloyd, Seth (MIT)
Manai, Chokri (TU Munich)
Marecek, Jakub (Czech Technical University)
Markus, Lange (SISSA)
McClean, Jarrod (Google Quantum AI)
McGreevy, John (UC San Diego)
Medhioub, Khaireddine (Tunisia Polytechnic School)

Mhiri, Hela (Institut Polytechnique de Paris)
Moon, Alvin (Copenhagen)
Moosa, Mudassir (Purdue University)
Moreno Nadales, Eloy (Michigan State University)
Mori, Ryuhei (Tokyo Institute of Technology)
Movassagh, Ramis (IBM Research)
Nachtergaele, Bruno (University of California, Davis)
oganesyan, vadim (Graduate Center, CUNY)
Pérez-García, David (Complutense University of Madrid - ICMAT)
Prosniak, Oskar (KU Leuven)
Ragone, Michael (UC Davis)
Sanders, Barry (University of Calgary)
Schenker, Jeffrey (Michigan State University)
Schraven, Severin (UBC)
Shtanko, Oles (IBM Research)
Siddhu, Vikesh (IBM Quantum)
Sulak, Anthony (Michigan State University)
Szegedy, Mario (Rutgers University)
Temme, Kristan (IBM T.J. Watson Research Center)
Vadnerkar, Siddharth (UC Davis)
Vasal, Deepanshu (University of Michigan, Ann Arbor)
Vignesh, Raman (U Chicago)
Wang, Guanyang (Rutgers University)
Warzel, Simone (Technical University of Munich)
Werner, Albert H. (University of Copenhagen)
Yang, Bowen (Caltech)
Young, Amanda (Techincal University of Munich)
Yunger Halpern, Nicole (National Institute of Standards and Technology)

Stochastic Mass Transports
March 20 - 25, 2022

Organizers:

Jan Obloj (University of Oxford)
Mathias Beiglböck (University of Vienna)
Martin Huesmann (Universität Münster)
Benjamin Joseph (University of Oxford)



Optimal transport is a theory offering a unified mathematical language for these and many other problems and a powerful methodology to understand and characterize their solutions and compute them numerically. Originally posed by G. Monge in 1781, the theory has earned Fields medals and thick monographs to testify to its importance. What happens, however, if we want to design optimal actions looking into the future? We can only trade on the current stock prices; we do not know where gravitational waves will reach us next year. As we now understand, a host of problems in economics, finance and stochastic modelling can be re-interpreted as optimal transport questions but with an additional directional, often temporal, aspect. The workshop focused on the mathematics which arises at these crossroads, which can help us to understand and solve such problems.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5166

Participants:

Acciaio, Beatrice (ETH Zürich)
Alfonsi, Aurelien (Ecole des Ponts)
Backhoff, Julio (Universität Wien – Mathematics)
Bartl, Daniel (Universität Wien – Mathematics)
Bayraktar, Erhan (University of Michigan)
Beiglböck, Mathias (University of Vienna)
Carlier, Guillaume (Université Paris Dauphine)
Chen, Xiaohui (U. Illinois at Urbana Champaign)
Chen, Dongwei (Clemson University)
Ciosmak, Krzysztof (University of Oxford)
Conforti, Giovanni (Ecole Polytechnique Paris – Mathematics)
Cox, Alexander (University of Bath)
Crowell, Robert (ETH Zurich)
Cuchiero, Christa (University of Vienna)
Cuturi, Marco (Apple / CREST ENSAE)

Deng, Shuoqing (University of Michigan)
Di Marino, Simone (Università di Genova)
Eckstein, Stephan (Universität Hamburg)
Erbar, Matthias (Universität Bielefeld)
Fathi, Max (Universite Paris-Cité)
Gassiat, Paul (Paris Dauphine - CEREMADE)
Ghosal, Promit (MIT)
Ghoussoub, Nassif (University of British Columbia)
Goldman, Michael (Ecole Polytechnique)
Gonzalez Baron, Nicolas (Universidad de los Andes)
Gozlan, Nathael (Université Paris 5 - René Descartes)
Grass, Annemarie (University of Vienna - Mathematics)
Guo, Ivan (Monash University)
Hiew, Joshua Zoen-Git (University of Alberta)
Hobson, David (University of Warwick)
Huesmann, Martin (Universität Münster)
Irons, Nicholas (University of Washington)
Jalowy, Jonas (Universität Münster)
Jiang, Yifan (University of Oxford)
Jo, Min Jun (UBC)
Joseph, Benjamin (University of Oxford)
Jourdain, Benjamin (Ecole Nationale des Ponts et Chaussées)
Juillet, Nicolas (Université de Haute Alsace)
Källblad, Sigrid (KTH Royal Institute of Technology)
Kim, Young-Heon (University of British Columbia)
Kim, Inwon (University of California, Los Angeles)
Kupper, Michael (University of Konstanz)
Lacker, Daniel (Columbia University)
Levy, Bruno (Inria Nancy Grand-Est)
Ley, Armand (Universite de Haute-Alsace)
Lim, Tongseok (Purdue University)
Loeper, Gregoire (BNP Paribas)
Mattesini, Francesco (University of Münster and MPI Leipzig)
McCann, Robert (University of Toronto)
Mikulincer, Dan (MIT)
Mondino, Andrea (University of Oxford)
Müller, Bastian (Universität Münster)
Norgilas, Dominykas (University of Michigan)
Nutz, Marcel (Columbia University)
Oberhauser, Harald (University of Oxford)
Obloj, Jan (University of Oxford)
Pal, Soumik (University of Washington)
Palmer, Aaron (University of California, Los Angeles)
Pammer, Gudmund (ETH Zurich)
Schachermayer, Walter (University of Vienna)
Schlichting, André (Universität Münster)
SHAO, Kexin (École des Ponts)
Shenfeld, Yair (MIT)
Siorpaes, Pietro (Imperial College London)
Soner, H. Mete (Princeton University)
Stozir, Marcel (University of Bath)
Sturm, Karl-Theodor (University of Bonn)
Talay, Denis (INRIA)
Tan, Xiaolu (Chinese University of Hong Kong)
Tangpi, Ludovic (Princeton University)
Touzi, Nizar (École Polytechnique)
Trevisan, Dario (Università degli Studi di Pisa)
Viquez, Jorge Aurelio (Georgia Institute of Technology)
Wiesel, Johannes (Columbia)
Yeung, Lanston (Columbia University)
Zariphopoulou, Thaleia (The University of Texas at Austin)

Rate-Induced Transitions in Networked Systems
March 27 - April 1, 2022

Organizers:

Vítor V. Vasconcelos (University of Amsterdam)
Flavia Maria Darcie Marquitti (Universidade Estadual de Campinas)
Lisa McManus (University of Hawai'i at Manoa)
Theresa W. Ong (Dartmouth College)

Motivated by ecological systems as prototypical examples of complex adaptive systems, this workshop discussed frontiers in the multidisciplinary understanding of tipping points in adaptive structures. We set 'rate-induced critical transitions' as the focal point of phase changes in biological, technological, and social systems. We focused on the role of interconnectivity in maintaining adaptive capacity and aimed to identify a collection of problems under rapidly changing exogenous forcing in order to build interdisciplinary knowledge.

We invited participants versed in critical transitions and challenged them to think of the adaptive capacity of their systems, the rate of change in exogenous drivers, and the impacts of their interaction. By collating multidisciplinary problems liable to rate-induced transitions, we (i) created an updated definition of resilience within this context, (ii) identified existing databases in a variety of fields that can inform early-warning signals under rate-induced transitions, and (iii) proposed a standardized set of guidelines for the future collection of data across fields.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5067

Participants:

Aguiar, Marcus (Universidade de Campinas)
Campos, Amanda (Universidade de São Paulo)
Darcie Marquitti, Flavia Maria (Universidade Estadual de Campinas)
Dutta, Partha (Indian Institute of Technology Ropar)
Jovanelly, Kristen (Dartmouth College)
Junquera, Victoria (Princeton University)
Kong, Jude (York University)
Krüger, Elisabeth (University of Amsterdam)
Levin, Simon (Princeton University)

Liao, Wenying (Harvard University)
Lu, Mingzhen (Santa Fe Institute)
McManus, Lisa (University of Hawai'i at Manoa)
Mittal, Dhruv (University of Amsterdam)
Ong, Theresa W. (Dartmouth College)
Pascual, Mercedes (University of Chicago)
Pinheiro, Flávio (Universidade Nova de Lisboa)
Rocha, Juan (Stockholm University)
Santos, Fernando P. (University of Amsterdam)
Sloot, Peter (University of Amsterdam)
Su, Chenyang (Crispy) (Dartmouth College)
Taylor, Benton (Harvard University)
Tekwa, Edward (University of British Columbia)
Terpstra, Sjoerd (University of Amsterdam)
Tilman, Andrew (USDA Forest Service - Northern Research Statio)
Vaessen, Guido (University of Amsterdam)
Vasconcelos, Vítor V. (University of Amsterdam)
Watson, James (Oregon State University)
Yang, Luojun (Princeton University)
Yitbarek, Senay (University of North Carolina Chapel Hill)
Zhan, Qi (University of Chicago)

Interactions between Descriptive Set Theory and Smooth Dynamics
March 27 - April 1, 2022

Organizers:

Matthew Foreman (University of California, Irvine)
Felipe García-Ramos (Universidad Autonoma de San Luis Potosi)
Marlies Gerber (Indiana University)
Brandon Seward (University of California, San Diego)
Anush Tserunyan (McGill University)

BIRS hosted a remarkable cross-disciplinary workshop between two subareas of mathematics (descriptive set theory and smooth dynamical systems) that have not had historical interaction. This workshop brought together researchers of all seniorities and women and underrepresented minorities in an innovative setting. The goal is to settle some of the most famous problems dating to the mid-20th century.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5134

Participants:

Allison, Shaun (Hebrew University of Jerusalem)
Andretta, Alessandro (University of Turin)
Banerjee, Shilpak (Indraprastha Institute of Information Technology)
Bartosova, Dana (University of Florida)
Basso, Gianluca (University of Lyon 1)
Ben Neria, Omer (Hebrew University of Jerusalem)
Bergfalk, Jeffrey (KGRC Vienna)
Bernshteyn, Anton (Georgia Institute of Technology)
Bowen, Matthew (Mcgill University)
Buzzi, Jerome (Orsay)
Calderoni, Filippo (University of Illinois Chicago)
Camerlo, Riccardo (University of Genoa)
Chandgotia, Nishant (Tata Institute of Fundamental Research- Centre for Applicable Mathematics)
Chen, Ronnie (McGill University)
Clemens, John (Boise State University)
Codenotti, Alessandro (University of Münster)
Conley, Clinton (Carnegie Mellon University)
Darji, Udayan (University of Louisville)

de Rancourt, Noé (Charles University)
Diaz, Lorenzo J. (PUC-Rio)
Elekes, Márton (Rényi Institute AND Eötvös Loránd University)
Etedadialiabadi, Mahmood (University of North Texas)
Foreman, Matthew (University of California, Irvine)
Frisch, Joshua (École Normale Supérieure)
Gao, Su (Nankai University)
García-Ramos, Felipe (Universidad Autonoma de San Luis Potosi)
Gerber, Marlies (Indiana University)
Glasner, Eli (Tel Aviv University)
Glubokov, Andrey (Purdue University)
Gogolev, Andrey (Ohio State University)
Goncharuk, Nataliya (University of Toronto at Mississauga)
Gonzalez Robert, Gerardo (Universidad Autonoma de San Luis Potosi)
Gorodetski, Anton (University of California - Irvine)
Grebik, Jan (Warwick University)
Huang, Wen (University of Science and Technology of China)
Ihli, Dakota (University of Illinois Urbana-Champaign)
Iyer, Sumun (Cornell University)
Jackson, Stephen (University of North Texas)
Jahel, Colin (Carnegie Mellon University)
Juschenko, Kate (University of Texas at Austin)
Kanovei, Vladimir (Institute for Information Transmission Problems of the Russian Academy of Sciences (Kharkevich Institute), Moscow, Russia)
Kerr, David (University of Munster)
Khurana, divya (Indraprastha Institute of Information Technology Delhi)
Kunde, Philipp (University of Hamburg)
Kwiatkowska, Aleksandra (University of Münster/ University of Wrocław)
Kwietniak, Dominik (Jagiellonian University)
Lakrec, Tsviqa (University of Zurich)
Le Maitre, Francois (Université Paris Diderot)
Lecomte, Dominique (Sorbonne University)
Li, Hanfeng (SUNY at Buffalo)
Malicki, Maciej (Institute of Mathematics of the Polish Academy of Sciences)
Marks, Andrew (University of California Los Angeles)
Melleray, Julien (Université Lyon 1)
Meyerovitch, Tom (Ben-Gurion University of the Negev)
Moore, Justin Tatch (Cornell University)
Moschovakis, Yiannis (University of California, Los Angeles and University of Athens, Greece)
Motto Ros, Luca (University of Turin)
Panagiotopoulos, Aristotelis (Carnegie Mellon University)
Poulin, Antoine (Mcgill University)
Rodriguez Hertz, Federico (Penn State)
Rosendal, Christian (University of Maryland)
Sabok, Marcin (McGill University)
Sahin, Ayse (Wright State University)
Sanadhya, Shrey (Ben Gurion University of the Negev, Israel)
Saprykina, Masha (KTH)
Seward, Brandon (University of California, San Diego)
Shani, Assaf (Harvard)
Shinko, Forte (Caltech)
Silva, Cesar (Willams College)
Solecki, Slawomir (Cornell)
Spaas, Pieter (UCLA)
Sullivan, Rob (University of Münster)
Tahzibi, Ali (Universidade de Sao Paolo)
Tao, Ran (Mcgill University)
Terlov, Grigory (UIUC)
Thouvenot, Jean-Paul (Sorbonne Université and CNRS)
Tornquist, Asger (University of Copenhagen)
Tserunyan, Anush (McGill University)
Tucker-Drob, Robin (University of Florida)
Valdez, Ferran (UNAM)
Vidnyanszky, Zoltan (California Institute of Technology)
Weiss, Benjamin (Hebrew University of Jerusalem)
Westrick, Linda (Penn State University)
Wolman, Michael (Caltech)
Yampolsky, Michael (University of Toronto)
Zamora, Rafael (University of Costa Rica)
Zapletal, Jindrich (University of Florida)
Zomback, Jenna (University of Illinois)
Zucker, Andrew (UC San Diego)

Women in Noncommutative Algebra and Representation Theory 3
April 3 - 8, 2022

Organizers:

Chelsea Walton (Rice University)
Karin Baur (University of Leeds)
Andrea Solotar (Universidad de Buenos Aires)
Gordana Todorov (Northeastern University)

Noncommutative algebra and representation theory are two closely intertwined areas of research that have strong ties to many other fields in mathematics and quantum physics, such as conformal field theory, operator algebras, string theory, topological field theory, and the various guises of noncommutative geometry. Noncommutative algebra creates an algebraic framework for generalizing the study of polynomials to other rings that fail to be commutative. Representation theory is a powerful tool for investigating the action of an algebraic object on a space as linear operators and matrices. As in many areas of mathematics, women and non-binary persons have been underrepresented in noncommutative algebra and representation theory. The goal of this workshop was to bring together some of the best experts and junior participants working on these topics to collaborate on research projects. All participants in the workshop were women and non-binary persons.

Like our first and second WINART workshops (held at BIRS in April 2016 and at U. Leeds in May 2019, resp.), the WINART3 workshop had a great impact on the research careers of the participants in attendance, and as a result, it will positively impact the research area as a whole.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5033

Participants:

Addabbo, Darlayne (University of Arizona)
Artenstein, Dalia (Universidad de la Republica)
Bapat, Asilata (Australian National University)
Baur, Karin (University of Leeds)
Bazier-Matte, Véronique (University of Connecticut)
Benkart, Georgia (University of Wisconsin-Madison)

Bittmann, Léa (University of Edinburgh)
Brauner, Sarah (University of Minnesota)
Canakci, Ilke (Vrije Universiteit Amsterdam)
Carbone, Lisa (Sapphire and Stone)
Colmenarejo, Laura (North Carolina State University)
Faber, Eleonore (University of Leeds)
Fedele, Francesca (Università di Verona)
Gandini, Francesca (Kalamazoo College)
Garcia Elsener, Ana (Universidad Nacional de Mar del Plata - CONICET / University of Glasgow)
Gunawan, Emily (University of Oklahoma)
Huang, Hongdi (Rice University)
Jurisich, Elizabeth (The College of Charleston)
Kambaso, Kunda (RWTH Aachen University)
Khaqan, Maryam (Stockholm University)
Kirkman, Ellen (Wake Forest University)
Marsh, Bethany (University of Leeds)
Müller, Monique (Federal University of São João del-Rei - Brazil)
Orosz Hunziker, Florencia (University of Denver)
Oswald, Amrei (University of Washington)
Plavnik, Julia (Indiana University)
Redondo, Maria Julia (Universidad Nacional del Sur)
Rossi Bertone, Fiorela (Universidad Nacional del Sur)
Schroll, Sibylle (University of Cologne)
Serhiyenko, Khrystyna (University of Kentucky)
Solotar, Andrea (Universidad de Buenos Aires)
Suarez, Pamela (Universidad Nacional de Mar del Plata)
Todorov, Gordana (Northeastern University)
Valdivieso-Díaz, Yadira (UDLAP)
Vera, Sonia (Universidad Nacional de Córdoba)
Walton, Chelsea (Rice University)
Wicks, Elizabeth (Microsoft Corporation)
Yıldırım, Emine (Queen's University)

Advances in Stein's method and its applications in Machine Learning and Optimization
April 10 - 15, 2022

Organizers:

Murat Erdogdu (University of Toronto)
Krishnakumar Balasubramanian (U. California Davis)
Larry Goldstein (University of Southern California)
Lester Mackey (Microsoft Research)

Recently a variety of state-of-the-art methods in machine learning and artificial intelligence have been developed, motivated by techniques from Stein's method, a successful tool from the field of probability theory. These methods have enabled efficient analysis of the large amounts of data being produced in several scientific fields, like neuroscience, information technology, and finance. Motivated by this success, there has been an ever-increasing interest in exploring further connections between Stein's method and machine learning. The focus of this workshop was to consolidate isolated efforts and develop a theoretically principled inferential and computational framework via Stein's method for analyzing increasingly complex models and data objects. This workshop was intended to bring together prominent and promising young and diverse researchers working on Stein's method and machine learning and to charter the path for future development in the field.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5092

Participants:

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Braverman, Anton (Northwestern University)
Campese, Simon (Hamburg University of Technology)
Chatterjee, Sourav (Stanford University)
Chen, Louis (National University of Singapore)
Eichelsbacher, Peter (Ruhr-Universitaet Bochum)
El Hanchi, Ayoub (University of Toronto)
Enouen, James (USC)
Erdogdu, Murat (University of Toronto)
Fang, Xiao (Chinese University of Hong Kong)
Fathi, Max (Universite Paris-Cité)
Goldstein, Larry (University of Southern California)
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Gretton, Arthur (University College London)
He, Ye (UC Davis)
Holmes, Susan (Stanford University)
JIN, YANHAO (UC Davis)
Kemp, Todd (UC San Diego)
Li, Yingzhen (Imperial College London)

liu, qiang (University of Texas at Austin)
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Mackey, Lester (Microsoft Research)
Minsker, Stanislav (University of South California)
Mousavi, Alireza (University of Toronto)
Nourdin, Ivan (University of Luxembourg)
Oates, Chris (Newcastle University)
Peccati, Giovanni (Luxembourg University)
Pekoz, Erol (Boston University)
Reinert, Gesine (University of Oxford)
Rinott, Yosef (Hebrew University of Jerusalem)
Roellin, Adrian (National University of Singapore)
Salim, Adil (Microsoft Research)
Schulte, Matthias (Hamburg University of Technology)
Serres, Jordan (University of Toulouse)
Shao, Qi-Man (Southern University of Science and Technology)
Shi, Jiaxin (Microsoft Research)
Shi, Zhaoyang (UC Davis)
Srinivasan, Vishwak (MIT)
Sriperumbudur, Bharath (Penn State University)
Swan, Yvik (Université libre de Bruxelles)
Vural, Mert (University of Toronto)
Wibisono, Andre (Yale University)
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Xu, Wenkai (Oxford University)
Yu, Lu (University of Toronto)
Yukich, Joseph (Lehigh University)
Zhang, Matthew (University of Toronto)
Zhilova, Mayya (Georgia Institute of Technology)

Almost-Periodic Spectral Problems
April 17 - 22, 2022

Organizers:

David Damanik (Rice University)
Svetlana Jitomirskaya (University of California, Irvine)
Leonid Parnovski (University College London)

Almost periodic problems have arisen in physics long ago in the study of electrons on a two-dimensional lattice exposed to a constant magnetic field with irrational flux (the Harper model) and more recently (in the 1980s) in the study of electrons in quasi-crystals (the Fibonacci model). It has turned out that, unlike periodic problems where one has a powerful tool for their study (Floquet-Bloch decomposition), almost periodic operators are very difficult to study, and the earliest mathematical results on these operators were obtained in the late 1970s. Since then many people have devoted their efforts to the study of spectral properties of almost periodic problems, including Avila, Bourgain, Sarnak, Simon, and Sinai. The spectral theory of almost periodic operators is much richer than that of periodic operators, with new phenomena such as Cantor spectra, purely singular continuous spectral measures or Anderson-type localization occurring in a natural, and in some settings generic, way.

Given the progress made recently and the multitude of tools employed, the meeting brought together people with various backgrounds to present recent results, exchange ideas, learn new methods, and potentially start new collaborations.

Junior participants (including current PhD students who may have been exposed to only one perspective and set of tools so far) had the opportunity to experience the breadth of the area and the whole arsenal of technical tools that have been used successfully in recent advances.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5163

Participants:

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Becker, Simon (NYU)
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Damanik, David (Rice University)
Eichinger, Benjamin (Vienna University of Technology)
Emilsdottir, Iris (Rice University)

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Fang, Licheng (Yantai University)
Fillman, Jake (Texas State University)
Filonov, Nikolai (Russian Academy of Sciences)
Galkowski, Jeffrey (University College London)
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Gohlke, Philipp (Universität Bielefeld)
Gorodetski, Anton (University of California - Irvine)
Guo, Shuzheng (Ocean University)
Gwaltney, Ethan (Rice University)
Han, Rui (LSU)
Hatinoglu, Burak (University of California, Santa Cruz)
Helffer, Bernard (Université de Nantes)
Hislop, Peter (University of Kentucky)
Hurtado, Omar (UCI)
Ivanov, Alexei (SPBU)
Jitomirskaya, Svetlana (University of California, Irvine)
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Karpechina, Ioulia (University of Alabama at Birmingham)
Kerdboon, Jiranan (University of Mississippi)
Klein, Silvius (Pontifical Catholic University of Rio de Janeiro)
Klopp, Frederic (Sorbonne Université, Paris)
Kocic, Sasa (University of Mississippi)
Kotani, Shinichi (Nanjing University, Osaka University)
Krikorian, Raphael (Universite de Cergy-Pontoise)
Kuchment, Peter (Texas A&M University)
Lagacé, Jean (King's College London)
Leguil, Martin (Université de Picardie Jules Verne)
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Wang, Chunyi (Rice University)
Wang, Fengpeng (Sun Yat-sen University)
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Zhao, Xin (UCI)
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Zhou, Qi (Nankai University)
Zhu, Xiaowen (University of California Irvine)
Zinchenko, Maxim (University of New Mexico)

At the Interface of Mathematical Relativity and Astrophysics
April 24 - 29, 2022

Organizers:

Jose-Luis Jaramillo (Université de Bourgogne)
Badri Krishnan (Albert Einstein Institute-Max Planck)
Edgar Gasperin Garcia (Instituto Superior Tecnico)
Juan A. Valiente Kroon (Queen Mary U. of London)

Mathematical relativity is concerned with the systematic study of the topological, geometric and analytic properties of solutions to the equations of the theory of general relativity. The detection of gravitational waves from the merger of black holes and neutron stars, has opened the remarkable possibility of verifying (or disproving) the predictions of mathematical relativity using observational data and numerical simulations. This workshop brought together some of the leading researchers of mathematical relativity and key researchers in relativistic astrophysics and gravitational wave science, aiming at identifying areas of potential fruitful interaction for both communities.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5025

Participants:

Agarwal, Aman (University of Guelph)
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Araneda, Bernardo (Max Planck Institute for Gravitational Physics)
Aretakia, Stefanos (University of Toronto)
Ashtekar, Abhay (Pennsylvania State University)
Backdahl, Thomas (Chalmers University)
Becerril, Ricardo (Universidad de Michoacan)
Beheshti, Shabnam (Queen Mary University of London)
Bernal, Argelia (Universidad de Guanajuato)
Bieri, Lydia (University of Michigan)
Booth, Ivan (Memorial University)
Burtscher, Annegret (Radboud University)
Cabrera Pacheco, Armando (Universitaet Tuebingen)
Capano, Collin (Max Planck Institute for Gravitational Physics Hannover)
Corichi, Alejandro (CCM UNAM Morelia)
Corman, Maxence (Perimeter Institute)
Degollado, Juan Carlos (UNAM)
Dolan, Sam (University of Sheffield)
Escamilla-Rivera, Celia (UNAM)
Feng, Justin (Instituto Superior Tecnico)
Garcia-Parrado, Alfonso (University of Cordoba)

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He, Lili (John Hopkins University)
Hennigar, Robie (University of Barcelona)
Hidalgo, Juan Carlos (UNAM)
Hilditch, David (Instituto Superior Tecnico University of Lisbon)
Hu, Tongtong (Queen Mary University of London)
Jaramillo, Jose-Luis (Université de Bourgogne)
Juárez Aubry, Benito A. (ICN UNAM)
Khera, Neev (Penn State)
Kopinski, Jaroslaw (Polish Academy of Sciences)
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Marajh, Jordan (Queen Mary University of London)
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Mars, Marc (Universidad de Salamanca)
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Minucci, Marica (Queen Mary University of London)
Mokdad, Remi, Mokdad (University of Bourgogne)
Morales, Manuel David (Universidad de Guadalajara / Jalisco State Government)
Moreno, Claudia (Universidad de Guadalajara)
Natario, Jose (Instituto Superior Técnico)
Oliveri, Roberto (Observatoire de Paris)
Ortiz, Nestor (UNAM)
Panosso Macedo, Rodrigo (University of Southampton)
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Prabhu, Kartik (University of California at Santa Barbara)
Pugliese, Daniela (University of Opava)
Racz, Istvan (Wigner Institute)
Raffaelli, Bernard (Institut de Mathématique de Bourgogne)
Ramirez-Baca, P. Isaac (University of San Luis Potosi)
Redondo Yuste, Jaime (Perimeter Institute)
Reula, Oscar (Universidad Nacional de Córdoba)
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Sansom, Robert (Queen Mary University of London)
Sarbach, Olivier (Universidad Michoacana de San Nicolas de Hidalgo)
Schnetter, Erik (Perimeter Institute for Theoretical Physics)
Senovilla, Jose M M (University of the Basque Country)
Sharma, Dhruv (U. Bourgogne)
Solomon, Adam (McMaster University)
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Interpretability in Artificial Intelligence
May 1 - 6, 2022

Organizers:

María Rodríguez Martínez (IBM - Zurich Research Lab)
Joaquin Dopazo (Fundación Progreso y Salud)
Carlos Loucera (Fundación Progreso y Salud)
An-phi Nguyen (ETH)

State-of-the-art deep learning networks are achieving strong predictive power, but the gain in accuracy often comes at the price of transparency, meaning that the prediction of the model is not interpretable. These so-called black-box models raise critical challenges in high-stake domains, such as healthcare, crime recidivism, or finance, where a wrong decision can have very harmful consequences. For instance, a tool to risk-stratify patients trained on very unbalanced datasets can assign all new cases to the most prevalent risk category, failing hence to identify clinical factors that might separate high- and low-risk patients. In other cases, ethnic, economic, or social factors, which might by chance correlate with a patient group, might be wrongly used by the model to classify new patients.

This workshop explored new developments in the field of interpretable AI that aimed to design models where the reasons for a particular prediction are transparent, and the variables that contributed the most to such predictions can be identified. Such approaches can increase the trust in a model and hence, accelerate the adoption of artificial intelligence approaches in sensitive domains.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5055

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Thais, Savannah (Princeton University)
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van Dijk, David (Yale)
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WANG, Shangying (IBM Research)
Wortel, Inge (Radboud University)
Zhong, Chudi (Duke University)

Inverse Problems for Anomalous Diffusion Processes
May 8 - 13, 2022

Organizers:

William Rundell (Texas A & M University)
Diane Guignard (University of Ottawa)
Barbara Kaltenbacher (University of Klagenfurt)

In his “annus mirabilis’’ of 1905, Einstein published four far-reaching papers. Two of these have been idolized in popular literature: the equivalence of mass and energy ($E=mc^2$) and special relativity. A third won a Nobel Prize for the photoelectric effect, but the fourth is the most cited. That was his explanation of Brownian motion, the seemingly chaotic behaviour of small particles when seen under a microscope, which was discovered in the early nineteenth century. In the Einstein formulation, the change in a particle’s direction of motion is random, and its average long-term displacement is proportional to the time taken. It is easily shown that this “random walk’’ model gives rise to one of the classical equations of mathematical physics, the so-called heat equation. This is an example of a partial differential equation, and such creatures, which are an extension of familiar ideas from calculus, are the lingua franca of the physical sciences and engineering. In such language, one interprets the first derivative of the displacement as a velocity, the second as an acceleration and so forth.

However, this tidy picture makes fundamental assumptions on the underlying materials that more recent research has shown simply don’t hold. The correction for this leads to so-called “anomalous diffusion’’ where the random walk fails the Einstein formula. The outcome is that instead of the partial differential equation with normal derivatives, one obtains an equation with fractional derivatives; these animals have quite different properties from integer-order ones.

A standard problem is to assume a physical model and its attendant parameters, such as the value of the conductivity in a heat conduction experiment. This leads, using the differential equation, to predict the temperature value at any given point in space or time. This direct or forward problem assumes that all the ingredients are known. The inverse problem, in some sense, reverses this; We may not know the value of this conductivity which may, in fact, vary from point to point, but ask the question: “If we are able to measure, say, the temperature at some later time, can we use this information to reconstruct the conductivity?’’ Questions such as these (and their positive answers) form the basis of modern medical imaging. Such inverse problems are mathematically difficult.

Using the above example, we wanted to know if our measured data allows the recovery of a unique conductivity or a whole family of possibilities. We also wanted to know if small errors in our data measurement correspond to small errors in our reconstruction of the conductivity. Unfortunately, the answer to the latter question is often negative; the accumulated randomness prohibits it in the underlying model. Quantifying this latter effect is an important question and has been intensively studied over the last few decades. This all leads to answering similar questions under the now more complex model where our integer order equation is replaced by one with fractional derivatives. This adds considerable mathematical complexity but has important physical applications; for example, a negative answer means that under “anomalous materials’’ time cannot be effectively reversed or, if so, with a fundamentally different outcome.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5043

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Li, Guanglian (The University of Hong Kong)
Li, Wenbo (University of Tennessee)
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Combinatorial Reconfiguration
May 8 - 13, 2022

Organizers:

Daniel Cranston (Virginia Commonwealth University)
Moritz Mühlenthaler (Laboratoire G-SCOP, Grenoble INP)
Ryuhei Uehara (Japan Advanced Institute of Science and Technology)
Marthe Bonamy (Laboratoire Bordelais de Recherche en Informatique)
Nicolas Bousquet (Université Claude Bernard Lyon 1)
Takehiro Ito (Tohoku University)
Naomi Nishimura (University of Waterloo)

Combinatorial reconfiguration is a young and dynamic research area that studies the relationships among multiple solutions to a problem by considering the step-by-step transformation from one solution into another. In contrast to traditional problems in mathematics, which usually entail finding a single solution, reconfiguration can either be easier (because the solutions are provided as part of the input to the problem) or more difficult (because figuring out how to change one solution into another may be more difficult than simply constructing a solution).

As a concrete example of reconfiguration, we consider the assignment of customers to power stations such that each customer obtains as much power as is required without exceeding the capacity of what each station can produce. Each such assignment can be viewed as a solution. When a station needs to be repaired, it may be necessary to change to another assignment, moving customers one-by-one to minimize disruptions. The workshop's goal was to bring together researchers in this new field, helping us develop general approaches to reconfiguration problems and establish links to other fields in mathematics and computer science.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5090

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Bonamy, Marthe (Laboratoire Bordelais de Recherche en Informatique)
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Brewster, Richard (Thompson Rivers University)
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El Sabeh, Remy (American University of Beirut)
Eto, Hiroshi (Tohoku University)
Feghali, Carl (Ens Lyon)
Fernandes dos Santos, Vinicius (Federal University of Minas Gerais (Brazil))
Fernau, Henning (Universität Trier)
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Mahmoud, Reem (Virginia Commonwealth University)
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Emergent Collective Behaviors: Integrating Simulation and Experiment May 15 - 20, 2022

Organizers:

Lennaert van Veen (Ontario Tech University)
Nicole Abaid (Virginia Tech University)
Oleg Igoshin (Rice University)
Raluca Eftimie (University of Dundee)

Collective behavior of organisms, large and small, is readily observed in nature. Birds travelling in flocks, ants forming supply lines, and on a much smaller scale, bacteria forming biofilms are just a few common examples. It is a long-standing question of how such organization emerges from the rules that individual organisms follow and the way they interact. This question is not only of profound philosophical importance, as it impacts on many facets of the natural world around us, it is also of great practical value. For instance, accurate predictions of the herding behavior of caribou would help conservation efforts and disrupting biofilm formation is an important goal of the design and maintenance of medical equipment.

It is a tantalizing observation that patterns observed in groups of organisms often show similarities across scales and species. This observation hints at the possibility that collective behavior has a certain universality, just like boiling water is described by the same quantities as boiling nitrogen despite the great difference in temperature. At this point, there is no overarching theoretical description of emergent behaviour and its universal aspects. Instead, most research is either based on experimental observations or on computer simulations. These simulations, in turn, come in different kinds and produce different types of descriptions of emergent behavior. In this workshop, we brought together experts both in experimental and computational techniques to formulate the state of affairs, explored the strengths and weaknesses of current approaches and drew up a road map for future interdisciplinary research efforts, ultimately aiming at a unified theory of emergent behavior, its origin, mechanisms and control.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5140

Participants:

Abaid, Nicole (Virginia Tech University)
Abaid, Nicole (Virginia Tech)
Alber, Mark (University of California - Riverside)
Aung, Eighdi (Virginia Tech)
Barbaro, Alethea (TU Delft)
Baskaran, Aparna (Brandeis University)
Bhattacharya, Arunim (Northern Illinois University)
Butail, Sachit (Northern Illinois University)
Carrillo, Jose (University of Oxford)
Chen, Jing (Virginia Tech)
Daftari, Katherine (UNC Chapel Hill)
Eftimie, Raluca (University of Dundee)
Fan, Gaoyang (University of Houston)
Fetecau, Razvan (Simon Fraser University)
Garnier, Simon (New Jersey Institute of Technology)
Gibbs, Karine (UC Berkeley)
Hashimoto, Amanda (Virginia Tech)
Igoshin, Oleg (Rice University)
Jain, Paras (Indian Institute of Science)
Jolly, Mohit Kumar (Indian Institute of Science)
Koch, Colin-Marius (University of Bayreuth)
Lynch, Heather (Stony Brook University)
Maffettone, Giancarlo (New York University)
Mazza, Marco (Loughborough University)
McMahon, Sean (Virginia Tech)
Ming, Zhong (Texas A&M University)
Motsch, Sebastien (Arizona State University)
Murphy, Patrick (Rice University)
Pajic-Lijakovic, Ivana (Ivana Pajic-Lijakovic, scientific advisor, University of Belgrade, Faculty of Technology and Metallurgy)
Perepelitsa, Mikhail (University of Houston)
Polyakov, Anne (University of Washington)
Porfiri, Maurizio (New York University)
Sgro, Allyson (Boston University)
Shrout, Joshua (Notre Dame)
Timofeyev, Ilya (University of Houston)
Topaz, Chad (Williams College / QSIDE Institute)
Trucu, Dumitru (University of Dundee)
van Veen, Lennaert (Ontario Tech University)
Volkening, Alexandria (Purdue University)
Wilczek, Michael (Max-Planck-Gesellschaft)
You, Lingchong (Duke University)

New Interactions Between Statistics and Optimization
May 22 - 27, 2022

Organizers:

Jonathan Niles-Weed (New York University)
Lénaïc Chizat (Université Paris Sud)
Rachel Ward (University of Texas at Austin)
Francis Bach (École normale supérieure)

Machine learning is the process by which a computer autonomously extracts knowledge from data. After years of continual progress, machine learning is now able to carry out difficult tasks such as image classification, language translation, or genomic data analysis. It typically works as follows: first a human designs a computer program with many free parameters, and then an algorithm adjusts these parameters so that the program achieves a good performance on training data. The design and analysis of such algorithms is done by researchers in optimization. But the actual goal is to solve the task for new data that does not belong to the training set. Understanding when and why a good performance on training data also leads to a good performance on unseen data is the task of researchers in statistics.

While optimization and statistics are both relevant to advance machine learning, they are distinct research communities with different tools and languages. In the past, important breakthroughs have occurred when these two communities have interacted, an example being the introduction of the Stochastic Gradient Descent algorithm, used to train most machine learning programs in today's large-scale applications. The objective of this workshop was to facilitate new interactions and collaborations between the statistics and optimization communities, with the intention of sparking new ideas at the interface of the two fields.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5140

Participants:

Bach, Francis (École normale supérieure)
Balzano, Laura (University of Michigan)
Barber, Rina Foygel (Chicago)
Bietti, Alberto (NYU)
Bruna, Joan (New York University)
Chizat, Lénaïc (Université Paris Sud)
Cohen, Nadav (Tel Aviv University)
Flammarion, Nicolas (EPFL)
Gabrie, Marylou (Ecole Polytechnique)
Gunasekar, Suriya (MSR)

Huang, Haoxiang (New York University)
Jacot, Arthur (EPFL)
Kanade, Varun (University of Oxford)
Liu, Lydia (Berkeley / Cornell)
Misiakiewicz, Theodor (Stanford)
Needell, Deanna (UCLA)
Niles-Weed, Jonathan (New York University)
Pillaud-Vivien, Loucas (EPFL)
Robeva, Elina (UBC)
Rudi, Alessandro (INRIA - Paris)
Sarkar, Purnamrita (UT Austin)
Scieur, Damien (Samsung SAIL Montreal)
Shamir, Ohad (Weizmann Institute of Science)
Shi, Bobby (UT Austin)
Simchowitz, Max (MIT)
Singh, Aarti (Carnegie Mellon University)
Srebro, Nati (Toyota Technological Institute - Chicago)
Sur, Pragya (Harvard)
Telgarsky, Matus (UIUC)
Vanden-Eijnden, Eric (Courant Institute)
Vaškevičius, Tomas (EPFL)
Villar, Soledad (Johns Hopkins)
Ward, Rachel (University of Texas at Austin)
Willett, Rebecca (University of Chicago)
Wilson, Ashia (MIT)
Woodworth, Blake (INRIA)
Xie, Yuege (UT Austin)

Cross-community collaborations in combinatorics
May 29 - June 3, 2022

Organizers:

Natasha Morrison (University of Victoria)
Jozef Skokan (London School of Economics and Political Science)
Marthe Bonamy (Laboratoire Bordelais de Recherche en Informatique)

In recent years some of the most exciting breakthroughs in Combinatorics on longstanding conjectures have resulted from innovative applications of established techniques to areas where they not necessarily used before. We harnessed the power of collaboration and brought together open-minded participants with different areas of expertise to produce novel research in a number of globally studied areas. We aspire to create new productive long-term bonds between members of the global community.

A large focus of the workshop was on the training and career enhancement of junior researchers. This was achieved through their fostering new collaborations with world-leading members of the global community during our focused small group work sessions. This gave junior participants opportunities to learn about and work in areas outside of their PhD/postdoctoral focus, gaining invaluable skills and knowledge. This will also enable them to forge meaningful relationships with senior members of the community outside their home institution, who will become informal 'mentors' for future career development.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5107

Participants:

Behague, Natalie (University of Victoria)
Boettcher, Julia (London School of Economics and Political Science)
Bonamy, Marthe (Laboratoire Bordelais de Recherche en Informatique)
Bowtell, Candida (University of Birmingham)
Collares, Mauricio (Federal University of Minas Gerais)
Gunderson, Karen (University of Manitoba)
Hoersch, Florian (TU Ilmenau)
Johnston, Tom (University of Bristol)
Letzter, Shoham (UCL)
Montgomery, Richard (University of Warwick)
Morrison, Natasha (University of Victoria)
MOTA, GUILHERME (USP)
N. Shirazi, Mahsa (University of Regina)
Nir, JD (University of Manitoba)
Norin, Sergey (McGill University)
Perkins, Will (Georgia Tech)
Rzążewski, Paweł (Warsaw University of Technology)
Skokan, Jozef (LSE)
Stein, Maya (Universidad de Chile)
Wesolek, Alexandra (Simon Fraser University)
Yap, Corrine (Rutgers University)

Dynamics and Data Assimilation, Physiology and Bioinformatics: Mathematics at the Interface of Theory and Clinical Application
May 29 - June 3, 2022

Organizers:

William Ott (University of Houston)
Noemie Elhadad (Columbia University)
Tony Humphries (McGill University)
Melike Sirlanci Tuysuzoglu (University of Colorado Anschutz Medical Campus)

Personalized predictive medicine has the potential to transform the treatment landscape. Breakthroughs will require advanced mathematical ideas, a deep understanding of human physiology, and the ability to harness the power of an ever-growing sea of clinical data. This workshop drew together a scientifically diverse team of international researchers from pure and applied mathematics, bioengineering, mathematical physiology, computer science, biomedical informatics, nutrition science, and medicine. We will forge new collaborations and strengthen existing partnerships in an effort to transform expertise in mathematics, data science, and biomedicine into personalized, predictive medicine, deeper physiologic understanding, and new mathematics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5144

Participants:

Albers, David (University of Colorado Anschutz)
Albert, Benjamin (Columbia University)
Bennett, Tellen (University of Colorado School of Medicine)
Briggs, Jennifer (University of Colorado Anschutz Medical Campus)
Cato, Kenrick (Columbia University School of Nursing)
Czerwinski, Mary (Microsoft Research)
de Wiljes, Jana (University of Potsdam)
Desai, Pooja (Columbia University)
Diniz Behn, Cecilia (Colorado School of Mines)
Elhadad, Noemie (Columbia University)
Garrish, Justin (Colorado School of Mines)
Gluckman, Bruce (The Pennsylvania State University)
Graham, Erica (Bryn Mawr College)
Han, Lifeng (US Food and Drug Administration)
Hripcsak, George (Columbia University)
Humphries, Tony (McGill University)
Jacobs, Maia (Northwestern University)
Karamched, Bhargav (Florida State University)
Laber, Eric (Duke University)
Levine, Matthew (California Institute of Technology)
Mamykina, Lena (Columbia University)
Ott, William (University of Houston)
Ranganath, Rajesh (Courant Institute, Center for Data Science NYU)

Reusch, Jane (University of Colorado SOM and RMR VAMC)
Richter, Lauren (Columbia University)
Sherman, Arthur (National Institutes of Health)
Sirlanci Tuysuzoglu, Melike (University of Colorado Anschutz Medical Campus)
Smith, Bradford (University of Colorado Denver)
Smith, Kate (University of Colorado School of Medicine)
Stroh, J.N. (University of Colorado Denver | Anschutz Medical Campus)
Tabak, Esteban (Courant Institute)
Urteaga, Inigo (Columbia University)
Wang, Yanran (University of Colorado Anschutz Medical Campus)

Poisson Geometry, Lie Groupoids and Differentiable Stacks
June 5 - 10, 2022

Organizers:

Rui Loja Fernandes (University of Illinois Urbana - Champaign)
Brent Pym (McGill University)
Henrique Bursztyn (Instituto Nacional de Matemática Pura e Aplicada)
Jiang-Hua Lu (The University of Hong Kong)

Poisson Geometry lies at the intersection of Mathematical Physics and Geometry. It originates in the mathematical formulation of classical mechanics as the semiclassical limit of quantum mechanics. Although the field has a long history, tracing back to the 19th century classics by Poisson, Hamilton, Jacobi and Lie, modern Poisson Geometry was developed in the last 40 years and is anchored on a multitude of connections with a large number of areas in mathematics and mathematical physics, including differential geometry and Lie theory, quantization, noncommutative geometry, representation theory, geometric mechanics and integrable systems. One of the landmarks of the modern era is Kontsevich's formality yielding that every Poisson manifold admits a deformation quantization. The discovery of quantum groups in the 1980s also led to a rich class of examples of Poisson manifolds related to Lie theory.

The two theories came together in late 80's in the pioneer work of Karasev and Weinstein, who understood that Lie algebroids are special kind of Poisson manifolds and that Poisson manifolds, in general, give rise to symplectic Lie groupoids. In the last 5 years there have been fascinating new applications, such as the work on shifted symplectic geometry and derived stacks which aims at establishing the deformation quantization (after Kontsevich) of derived stacks. This workshop brought together leading junior and senior researchers working on Poisson Geometry, Lie groupoids and differentiable stacks, to explore and discuss the most recent progress in the fields and to promote cross-fertilization.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5035

Participants:

Alvarez, Daniel (Toronto)
Bahayou, Amine (Kasdi Merbah University)
Balibanu, Ana (Harvard University)
Barbosa-Torres, Luis (University of Sao Paulo)
Basu, Aditya (Charles University)
Beltita, Daniel (Institute of Mathematics "Simion Stoilow" of the Romanian Academy)
Bischoff, Francis (Oxford)

Bobrova, Irina (HSE University)
Buring, Ricardo (Johannes Gutenberg-Universität Mainz)
Bursztyn, Henrique (Instituto Nacional de Matemática Pura e Aplicada)
Crooks, Peter (Northeastern University)
Cueca, Miquel (Gottingen)
de Melo, Mateus (University of São Paulo)
del Hoyo, Matias Luis (Universidade Federal Fluminense)
Diaz, Veronica (Universidad Nacional de Mar de Plata)
Djiba, Samson Apourewagne (Cheikh Anta Diop de Dakar)
Evens, Sam (University of Notre Dame)
Fernandes, Rui Loja (University of Illinois Urbana - Champaign)
Fischer, Simon-Raphael (National Center for Theoretical Sciences - Taiwan)
Fok, Chi-Kwong (New York University Shanghai)
Getzler, Ezra (Northwestern University)
Glasheen, Jou (University of Toronto)
Glubokov, Andrey (Purdue University)
Grabowski, Janusz (Polish Academy of Sciences)
Gualtieri, Marco (University of Toronto)
Harder, Andrew (Lehigh University)
Hudson, Daniel (University of Toronto)
Iglesias Ponte, David (University of La Laguna)
Jiang, Yucong (Toronto)
Jiang, Ning (UIUC)
Jonker, Caleb (University of Toronto)
Kadiyan, Lory (Max Planck Institute for Mathematics)
Karapetyan, Alex (Northwestern University)
Khazaeipoul, Ahmadreza (University of Toronto)
Kirchhoff-Lukat, Charlotte (KU Leuven/ Massachusetts Institute of Technology)
Kiselev, Arthemy (Groningen)
Krepski, Derek (University of Manitoba)
Lackman, Joshua (University of Toronto)
Lang, Honglei (China Agricultural University)
Lavau, Sylvain (Euler Institute (EIMI) & Steklov Institute, Saint-Petersburg, Russian Federation.)
Li, Yu (Max Planck Institute for Mathematics)
Liontou, Vasiliki (University of Toronto)
Logares, Marina (Universidad Complutense de Madrid)
Loizides, Yiannis (Cornell)
Lu, Jiang-Hua (The University of Hong Kong)
Marcut, Ioan (Radboud University)
Matviichuk, Mykola (McGill)
Mayrand, Maxence (University of Toronto)
Mehta, Rajan (Smith College)
Meinrenken, Eckhard (University of Toronto)
Mestre, Joao Nuno (University of Coimbra)
Miyamoto, David (University of Toronto)
Mol, Maarten (Utrecht)
Nárožný, Jiří (Charles University)
Nazari Zahraei Motlagh, Erfan (McGill)
Netto, Clarice (IMPA)
Neumann, Frank (University of Leicester)
Nunes da Costa, Joana (University of Coimbra)
Obster, Lennart (University of Coimbra)
Ortiz, Cristian (University of Sao Paulo)
Pym, Brent (McGill University)
Rogers, Chris (University of Nevada)
Roytenberg, Dima (University of Amsterdam)
Safronov, Pavel (University of Edinburgh)
Salazar, Maria Amelia (UFF-Rio de Janeiro)
Selick, Paul (Toronto)
Senapati, Sambit (UIUC)
Shen, Linhui (Michigan State University)
Shuyu, Xiao (University of Illinois Urbana - Champaign)
Sjamaar, Reyer (Cornell University)
Stanley, Thomas (University of Toronto)
Tang, Xiang Tang (St Louis)
Tolman, Susan (University of Illinois)
Villatoro, Joel (WUSTL)
Weinstein, Alan (UC Berkeley)
Witte, Aldo (Leuven)
Yapu, Luis (Universidade Federal do Rio de Janeiro)
Zambon, Marco (KU Leuven)
Zeiser, Florian (UIUC)
Zhu, Chenchang (Gottingen)

Arithmetic Aspects of Algebraic Groups
June 12 - 17, 2022

Organizers:

Alex Lubotzky (Hebrew University of Jerusalem)
Dave Morris (University of Lethbridge)
Mikhail Ershov (University of Virginia)
Gopal Prasad (University of Michigan)

The investigation of arithmetic groups has been an active and important area of mathematical research ever since it arose in the work of Gauss, Klein, Poincare, and other famous mathematicians of the 18th and 19th centuries. New points of view have recently led to progress on classical problems, opened new directions of inquiry, and revealed unexpected connections with other areas of mathematics. The workshop brought together experts in the area, researchers in related fields, and young mathematicians who wish to learn about the most recent advances and the most promising directions for the future of the field.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5161

Participants:

Abels, Herbert (Bielefeld University)
Abramenko, Peter (University of Virginia)
Acciarri, Cristina (University of Modena and Reggio Emilia)
Ali, Abid (Rutgers University)
Alsaody, Seidon (Uppsala University)
Asgarli, Shamil (University of British Columbia)
Auel, Asher (Dartmouth College)
Avni, Nir (Northwestern University)
Balaji, Vikraman (Chennai Mathematical Institute)
Bayer-Fluckiger, Eva (Ecole Polytechnique Federale de Lausanne)
Belolipetsky, Mikhail (IMPA)
Ben-Ezra, David El-Chai (Soreq NRC)
Bhaskhar, Nivedita (Sisu)
Bingöl, Fatma Kader (Universiteit Antwerpen)
Bitan, Rony (Afeka Academic College)
Bleher, Frauke (University of Iowa)
Borovoi, Mikhail (Tel Aviv University)
Braun, Amiram (University of Haifa)
Caprace, Pierre-Emmanuel (UCLouvain)
Chapman, Adam (Tel-Aviv-Yaffo Academic College)
Chernousov, Vladimir (University of Alberta)
Chow, Dylon (University of Washington)
Colliot-Thélène, Jean-Louis (Université Paris-Saclay)
Corvaja, Pietro (Università di Udine)
Ershov, Mikhail (University of Virginia)
First, Uriya (University of Haifa)
Garge, Shripad (IIT Bombay)
Glubokov, Andrey (Purdue University)
Gouthier, Bianca (Institut de Mathematiques de Bordeaux)
Greenfeld, Beeri (Univeristy of California - San Diego)
Grimm, David (Universidad de Santiago de Chile)

Guralnick, Robert (University of Southern California)
Harari, David (Universite Paris-Saclay)
Harbater, David (University of Pennsylvania)
Hartmann, Julia (University of Pennsylvania)
Hu, Yong (Southern University of Science and Technology)
Izquierdo, Diego (Ecole Polytechnique)
Kamber, Amitay (University of Cambridge)
Karpenko, Nikita (University of Alberta)
Kassabov, Martin (Cornell University)
Katoch, Vikas (Raj Kumar Goel Institute of Technology Ghaziabad)
Kionke, Steffen (University of Hagen)
Klopsch, Benjamin (Heinrich-Heine-Universität, Düsseldorf)
Kunyavskii, Boris (Bar-Ilan University)
Lee, Ting-Yu (National Taiwan University)
Lieblich, Max (University of Washington)
Lourdeaux, Alexandre (University of Alberta)
Lubotzky, Alex (Hebrew University of Jerusalem)
McReynolds, Ben (Purdue University)
Meiri, Chen (Technion)
Merkurjev, Alexander (University of California - Los Angeles)
Morris, Dave (University of Lethbridge)
Obus, Andrew (Baruch College / CUNY Graduate Center)
Pagano, Margherita (Leiden University)
Parimala, Raman (Emory University)
Pei, Zitong (Emory University)
Petrov, Victor (Saint Petersburg State University)
Pham, Lam (Brandeis University)
Pianzola, Arturo (University of Alberta)
Plotkin, Eugene (Bar-Ilan University)
Popov, Vladimir (Steklov Mathematical Institute, Moscow)
Prasad, Gopal (University of Michigan)
Radhika, M. M. (Tata Institute of Fundamental Research - India)
Raghunathan, Madabusi S. (Centre of Excellence in Basic Sciences)
Rapinchuk, Andrei (University of Virginia)
Rapinchuk, Igor (Michigan State University)
Reichstein, Zinovy (University of British Columbia)
Ren, Jinbo (Institute for Advanced Study)
Rowen, Louis (Bar Ilan University)
Saltman, David J (Center for Communications Research - Princeton)
Schein, Michael (Bar-Ilan University)
Schillewaert, Jeroen (University of Auckland)
Segev, Yoav (Ben Gurion University)
Shalom, Yehuda (Tel Aviv University)
Shpectorov, Sergey (University of Birmingham)
Singh, Anupam (IISER Pune, India)
Slutsky, Raz (Weizmann Institute of Science)
Srinivasan, Srimathy (Tata Institute of Fundamental Research)
Stavrova, Anastasia (PDMI RAS)
Suresh, Venapally (Emory university)
Tignol, Jean-Pierre (UCLouvain)
Tikhonov, Sergey (Belarusian State University)
Tomanov, George (Université Claude Bernard Lyon 1)
Tralle, Aleksy (University of Warmia and Mazury)
Tralle, Wojciech (University of Virginia)
Ure, Charlotte (University of Virginia)
Vavilov, Nikolai (St. Petersburg State University)
Venkataramana, Tyakal (Tata Institute of Fundamental Research)
Zalesskii, Pavel (University of Brasilia)
Zannier, Umberto (Scuola Normale Superiore di Pisa)
Zaynullin, Kirill (University of Ottawa)

Modern Breakthroughs in Diophantine Problems
June 19 - 24, 2022

Organizers:

Samir Siksek (University of Warwick)
Nils Bruin (Simon Fraser University)
Bianca Viray (University of Washington)
Michael Bennett (University of British Columbia)

An equation is called Diophantine if a whole number or fractional solutions are sought. Diophantine equations are named after Diophantus of Alexandria, a 3rd-century mathematician and were popularized by Pierre de Fermat, a 17th-century lawyer and amateur mathematician. Unlike most branches of mathematics, many Diophantine questions and theorems can be understood and appreciated by the general public, and the subject is a favourite with popularizers of mathematics. The methods for tackling Diophantine equations are, however, deep and varied, and the subject has recently experienced an explosion of new directions and results. This workshop brought together experts and young scholars to explore these new directions and stimulate further research into Diophantine problems.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5162

Participants:

Alpoge, Levent (Harvard University)
Anni, Samuele (Aix-Marseille Université)
Bajpai, Prajeet (University of British Columbia)
Balakrishnan, Jennifer (Boston University)
Banwait, Barinder (Ruprecht-Karls-Universität Heidelberg)
Bennett, Michael (University of British Columbia)
Best, Alexander (Vrije Universiteit Amsterdam)
Betts, Alexander (Harvard)
Bourdon, Abbey (Wake Forest University)
Bruin, Nils (Simon Fraser University)
Carr, Thomas (University of Washington)
Chan, Stephanie (University of Michigan)
Chen, Imin (Simon Fraser University)
Chidambaram, Shiva (MIT)
Coppola, Nirvana (VU Amsterdam)
Dogra, Netan (King's College London)
Gao, Ziyang (Leibniz Universität Hannover)
Garcia-Fritz, Natalia (Pontificia Universidad Católica de Chile)

Gherga, Adela (University of Warwick)
Glubokov, Andrey (Purdue University)
Goodman, Pip (MPIM Bonn)
Grieve, Nathan (Royal Military College of Canada, Carleton University and L'Université du Québec à Montréal)
Haakma, Emiel (Simon Fraser University)
Hast, Daniel (Boston University)
Honigs, Katrina (Simon Fraser University)
Ingram, Patrick (York University)
Javanpeykar, Ariyan (Universitat Mainz)
Kulkarni, Avinash (Dartmouth College)
Lawrence, Brian (UCLA)
Le Fourn, Samuel (Université Grenoble Alpes)
Levin, Aaron (Michigan State University)
Li, Wanlin (Centre de Recherches Mathématiques)
Logan, Adam (Government of Canada)
Loughran, Daniel (University of Bath)
Matschke, Benjamin (Boston University)
Michaud-Jacobs, Philippe (University of Warwick)
Mocanu, Diana (University of Warwick)
Morgan, Adam (University of Glasgow)
Najman, Filip (University of Zagreb)
Newton, Rachel (King's College London)
Nguyen, Dang Khoa (University of Calgary)
Ozman, Ekin (Bogazici University)
Padurariu, Oana (Boston University)
Pagano, Carlo (Concordia University)
Park, Jennifer (Ohio State University)
Pasten, Hector (Pontificia Universidad Catolica de Chile)
Pieropan, Marta (Utrecht University)
Poonen, Bjorn (Massachusetts Institute of Technology)
Pries, Rachel (Colorado State University)
Rivera, Carlos (University of Washington)
Rouse, Jeremy (Wake Forest University)
Schembri, Ciaran (Dartmouth College)
Schindler, Damaris (Goettingen University)
Shankar, Arul (University of Toronto)
Sijsling, Jeroen (Universität Ulm)
Siksek, Samir (University of Warwick)
Silverberg, Alice (University of California - Irvine)
Srinivasan, Padmavathi (ICERM)
Stoll, Michael (Universität Bayreuth)
Sutherland, Andrew (Massachusetts Institute of Technology)
Tanimoto, Sho (Nagoya University)
van Bommel, Raymond (Massachusetts Institute of Technology)
Voight, John (Dartmouth College)
von Känel, Rafael (IAS Tsinghua University)
Voutier, Paul (London)
Wang, Jerry (University of Waterloo)
Xiao, Stanley (University of Toronto)
Xu, Zhe (Simon Fraser University)

Derived Categories, Arithmetic, and Reconstruction in Algebraic Geometry
July 3 - 8, 2022

Organizers:

Martin Olsson (University of California Berkeley)
Laure Flapan (Michigan State University)
Katrina Honigs (Simon Fraser University)
Adam Topaz (University of Alberta)

Mathematicians working in algebraic geometry study geometric shapes which can be defined using polynomial equations.

Over the years, several technical tools have been developed to help in this task. One such tool, which has played an increasingly significant role in the subject since the 1960s, is the so-called derived category. Amazingly, recent results around this area show that derived categories (and other related structures), actually encode significant information about algebraic varieties from both arithmetic and geometric points of view. This workshop brought together mathematicians at various career stages whose interests revolve around these recent results. The organizers hope that a week of focused interactions around these new developments could lead to significant new developments in the field.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5108

Participants:

Ballard, Matthew (University of South Carolina)
Barwick, Clark (Edinburgh)
Bogomolov, Fedor (New York University)
Bragg, Daniel (University of California Berkeley)
Brakkee, Emma (University of Amsterdam)
Cadoret, Anna (Sorbonne Université)
Favero, David (University of Alberta)
Flapan, Laure (Michigan State University)
Frei, Sarah (Rice University)
Gaulhiac, Sylvain (University of Alberta)
Haine, Peter (UC Berkeley)
Hassett, Brendan (Brown University)
Honigs, Katrina (Simon Fraser University)
Huang, Jesse (University of Alberta)
Kaushal Srivastava, Tanya (IIT Gandhinagar)
Kwon, Andrew (University of Pennsylvania)
Lieblich, Max (University of Washington)
Lüdtke, Martin (Rijksuniversiteit Groningen)
Markman, Eyal (University of Massachusetts Amherst)
O'Gorman, Ronan (University of California - Berkeley)
Olsson, Martin (University of California - Berkeley)

Petok, Jack (Dartmouth College)
Pop, Florian (University of Pennsylvania)
Rapinchuk, Igor (Michigan State University)
Sankar, Soumya (Ohio State University)
Srinivasan, Padmavathi (ICERM)
Stix, Jakob (Goethe-Universität Frankfurt)
Taylor, Libby (Stanford University)
Tevelev, Jenia (University of Massachusetts)
Tirabassi, Sofia (Stockholm University)
Topaz, Adam (University of Alberta)
Torres, Sebastian (IMSA-Miami / ICMS-Sofia)
Voloch, Felipe (University of Canterbury)
Zilber, Boris (Oxford University)

Markov Chains with Kinetic Constraints and Applications
July 3 - 8, 2022

Organizers:

Cristina Toninelli (CNRS & University Paris Dauphine)
Fabio Martinelli (Universita' Roma Tre)
Shirshendu Ganguly (University of California - Berkeley)

A class of models called "Kinetically Constrained Models" (KCM), have been proposed by physicists to shed some light on the glassy behavior. KCM live on a discrete grid, each site of the grid being either empty or occupied by one particle, and dynamics evolves via a stochastic process in which moves at a certain location occur only if there are enough empty sites around. Despite being an oversimplified model, KCM display a rich phenomenology including the key dynamical features of real glassy systems. However, understanding the behavior of KCM turned out to be a hard task. On the one hand the interesting regimes are often beyond reach of numerical simulations, since KCM display an extremely slow dynamics (as do the real glassy systems).
In the last decade, an increasing number of mathematical works have been devoted to the study of KCM. These rigorous results have already had an important impact in the glassy community, confirming or disproving some conjectures that had been put forward on the basis of numerical simulations. However, several key issues remain widely open.

This workshop gathered highly qualified experts covering complementary areas that are related to the different facets of the KCM dynamics, to foster interactions among different communities and to develop novel mathematical tools to solve the open problems.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5154

Participants:

Blondel, Oriane (CNRS & Univ. Lyon 1)
Chleboun, Paul (University of Warwick)
Erignoux, Clement (INRIA, Lille)
Hartarsky, Ivailo (Univ. Paris Dauphine)
Hoffman, Christopher (Univ. of Washington)
Junge, Matthew (Baruch College)
Latz, Jan Niklas (Czech Academy of Sciences)
Liu, Kuikui (University of Washington)
Mareche, Laure (Université de Strasbourg)
Martinelli, Fabio (Universita' Roma Tre)
Salez, Justin (Ceremade Universite Paris Dauphine)
Shapira, Assaf (Université Paris Cité)

Silvestri, Vittoria (University of Rome La Sapienza)
Smith, Aaron (Department of Mathematics and Statistics, University of Ottawa)
Stauffer, Alexandre (Universita Roma Tre)
Sturm, Anja (Gottingen University)
Swart, Jan (The Czech Academy of Sciences)
Szabo, Reka (Ceremade Univ. Paris Dauphine)
Toninelli, Cristina (CNRS and University Paris Dauphine)

Mathematical aspects of the Physics with non-self-Adjoint Operators
July 10 - 15, 2022

Organizers:

Petr Siegl (Graz University of Technology)
Lyonell Boulton (Heriot-Watt University)
David Krejcirik (Czech Technical University in Prague)

This workshop facilitated interdisciplinary collaborations across the mathematical analysis and mathematical physics community, with a central role played by the theory of non-self-adjoint operators. From the point of view of applications, developing modern physical subjects, such as quantum mechanics with non-Hermitian operators, superconductivity, hydrodynamics, metamaterials or optics, are covered. High-impact mid-term aspirations include developing rigorous tools to understand complicated physical phenomena such as cloaking, turbulence and explosive behavior. On the mathematical side, invited participants will be experts in mathematical physics, microlocal, semiclassical, functional and harmonic analysis, as well as dynamical systems and PDEs.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5115

Participants:

Alexandrova, Ivana (State University of New York, Albany)
Almog, Yaniv (Ort-Braude College)
Arnal, Antonio (Queen's University Belfast)
Ben-Artzi, Jonathan (Cardiff University)
Boegli, Sabine (Durham University)
Boulton, Lyonell (Heriot-Watt University)
Câmara, Cristina (Instituto Superior Técnico - University of Lisbon)
Christiansen, Tanya (University of Missouri)
Cossetti, Lucrezia (Karlsruhe Institute of Technology)
Cuenin, Jean-Claude (Loughborough University)
D'Ancona, Piero (Universita di Roma)
Dickson, Karys (Queen's University Belfast)
Drysdale, Catherine (For Better Health)
Fanelli, Luca (Ikerbasque & UPV)
Farmakis, George (Heriot-Watt University)
Gerhat, Borbala (Czech Technical University - Prague)
Grebenkov, Denis (CNRS - Ecole Polytechnique)
Haragus, Mariana (University of Franche-Comté)

Helffer, Bernard (Université de Nantes)
Hitrik, Michael (University of California, Los Angeles)
Kleinhenz, Perry (Michigan State University)
Kramar Fijavz, Marjeta (University of Ljubljana)
Krupchyk, Katya (University of California, Irvine)
Kumar, Rakesh (Indian Institute of Technology Jodhpur India)
Kvasnickova, Romana (Czech Technical University in Prague)
Laugesen, Richard (University of Illinois Urbana - Champaign)
Lu, Zhiqin (University of Califronia, Irvine)
Milton, Graeme (University of Utah)
Mityagin, Boris (Ohio State University)
Nguyen, Tho (Czech Technical University in Prague)
Olver, Peter (University of Minnesota - Twin Cities)
Ovall, Jeff (Portland State University)
Pelloni, Beatrice (Heriot-Watt University)
Perez Pardo, Juan Manuel (Universidad Carlos III de Madrid)
Petzinna, Domenic (Heriot-Watt University)
Pinchover, Yehuda (Technion)
Ponce, Gustavo (Santa Barbara)
Siegl, Petr (Graz University of Technology)
Smith, Dave (Yale-NUS College)
Stampach, Frantisek (Czech Technical University in Prague)
Stanislavova, Milena (University of Alabama Birmingham)
Stefanov, Atanas (University of Alabama at Birmingham)
ter Elst, Tom (The University of Auckland)
Vogel, Martin (CNRS and Université de Strasbourg)
Vu, Tuyen (Czech Technical University in Prague)
Wang, Ruoyu (Northwestern University)
White, Francis (UCLA)

Theoretical and Applied Aspects for nonlocal Models
July 17 - 22, 2022

Organizers:

Ihsan Topaloglu (Virginia Commonwealth University)
Lia Bronsard (McMaster University)
Kaushik Dayal (Carnegie Mellon University)
Petronela Radu (University of Nebraska Lincoln)

Classical models in Continuum Mechanics are set in a differential framework which assumes that solutions of the systems must be smooth. However, in a variety of applications, the functions may exhibit singularities and discontinuities, so classical equations can not hold. The framework of integral operators assumes little regularity or smoothness for the inputs, thus making it ideal in applications such as image processing, biology models, and dynamic fracture. While applied communities have been using nonlocal models successfully, their rigorous mathematical analysis still lacks foundational results that would be needed in complex applications that exhibit a sudden change in behavior or material, or for which there would be a nonlinear response. The group of researchers that participated in this workshop outlined the main challenges in the field and methods for tackling them, as well as presented significant recent developments.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5102

Participants:

Aguirre Salazar, Lorena (Valdosta State University)
Antil, Harbir (George Mason University)
Biswas, Animesh (University of Nebraska-Lincoln)
Bonacini, Marco (University of Trento)
Bronsard, Lia (McMaster University)
Buczkowski, Nicole (University of Nebraska-Lincoln)
Burkovska, Olena (Oak Ridge National Laboratory)
Buttenschoen, Andreas (Univ British Columbia)
Caicedo Torres, Luis (Florida International University)
Carazzato, Davide (Scuola Normale Superiore)
Charro, Fernando (Wayne State University)
Cozzi, Matteo (University of Milan)
Cristoferi, Riccardo (Radboud University)
Cueto García, Javier (University of Castilla-La Mancha)
D'Elia, Marta (Meta)
Davoli, Elisa (TU Wien)
Dayal, Kaushik (Carnegie Mellon University)
Diehl, Patrick (Louisiana State University)
Dondl, Patrick (Albert-Ludwigs-Universität Freiburg)
Du, Qiang (Columbia University)
Eker, Mehmet (Tarsus University)
Ervin, Vince (Clemson University)
Fetecau, Razvan (Simon Fraser University)
Foss, Mikil (University of Nebraska-Lincoln)
Gai, Chunyi (UBC)
Glubokov, Andrey (Purdue University)
Glusa, Christian (Sandia National Laboratories)
Gunzburger, Max (Florida State University)

Haj Ali, Alaa (Arizona State University)
Han, Zhaolong (University of California San Diego)
Hao, Zhaopeng (Purdue University)
Huang, Hui (University of Calgary)
Huang, Kuang (Columbia University)
Jing, Tian (University of Pittsburgh)
Kim, Keon Ho (University of North Carolina at Chapel Hill)
Klar, Manuel (Trier University)
Lee, Hwi (Georgia Institute of Technology)
li, Xingjie (University of North Carolina at Charlotte)
Li, Yulong (University of Nevada-Reno)
Lipton, Robert (Louisiana State University)
Lo, Catharine WK (University of Lisbon)
Louizos, Dean (McMaster University)
Lu, Xin Yang (Lakehead University)
Meanwell, Jessie (McMaster University)
Mengesha, Tadele (The University of Tennessee)
Merabet, Ismail (University Kasdi Merbah Ouargla)
Mora, Maria Giovanna (University of Pavia)
Mora Corral, Carlos (Universidad Autónoma de Madrid)
Muratov, Cyrill (New Jersey Institute of Technology)
Myers, Alex (University of Nebraska Lincoln)
Naghibzadeh, S. Kiana (Carnegie Mellon University)
Olson, Hayley (Carnegie Mellon University)
Pagliari, Valerio (TU Wien)
Parks, Michael (Sandia National Laboratories)
Pieper, Michael (University of Nebraska-Lincoln)
Pratelli, Aldo (University of Pisa)
Qiao, Zhijun George (University of Texas Rio Grande Valley)
Radu, Petronela (University of Nebraska Lincoln)
Raihen, Nurul (Wayne State University)
Reina, Celia (University of Pennsylvania)
Scardia, Lucia (Heriot-Watt University)
Schikorra, Armin (University of Pittsburgh)
Scott, James (Columbia University)
Seleson, Pablo (Oak Ridge National Laboratory)
Silling, Stewart (Sandia National Laboratories)
Sire, Yannick (Johns Hopkins University)
Smit Vega Garcia, Mariana (Western Washington University)
Stinga, Pablo Raúl (Iowa State University)
Striet, Ludwig (University of Freiburg)
Tian, Xiaochuan (University of California San Diego)
Topaloglu, Ihsan (Virginia Commonwealth University)
Trageser, Jeremy (Sandia National Laboratories)
Ulusoy, Suleyman (American University of Ras Al Khaimah)
Vaughan, Mary (University of Texas at Austin)
Velez Santiago, Alejandro (University of Puerto Rico at Mayagüez)
Vo, Anh (University of Nebraska Lincoln)
Vollmann, Christian (Trier University)
Wang, Chong (Washington and Lee University)
Warma, Mahamadi (George Mason University)
Xu, Zirui (Columbia University)
Ye, Qihao (University of California - San Diego)
Yu, Yue (Lehigh University)
Zhang, Yanzhi (Missouri University of Science and Technology)
Zhou, Shiping (Missouri University of Science and Technology)

Communication Complexity and Applications, III
July 24 - 29, 2022

Organizers:

Mika Göös (École Polytechnique Fédérale de Lausanne)
Toniann Pitassi (University of Toronto)
Amit Chakrabarti (Dartmouth College)
Gillat Kol (Princeton University)

Communication complexity studies communication-efficient solutions for computational problems whose input is split amongst two or more players. Over the last four decades, it has proved itself to be among the most useful of abstractions in computer science. Communication is inherent to any computational task, and quantifying this communication bounds the computational complexity of the task, e.g., the size of a data-structure that supports fast updates, the number of wires in a circuit that computes a given function, the sample complexity of a learning task; or the memory required by a streaming algorithm.

A wide range of powerful combinatorial, linear algebraic, optimization, and information-theoretic techniques have been developed for proving communication lower bounds. Over the last half-decade, the development of “lifting” techniques that seek to obtain powerful communication bounds from weaker decision-tree bounds has led to some breakthroughs in central theoretical questions. At the same time, increasing sophistication in information-theoretic methods for communication complexity has led to significant advances in our understanding of data structures, algorithms on massive data and graphs, and quantum computation. The workshop brought together world experts in communication complexity and relevant algorithmic topics with the goal of advancing both core theory and applications.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5124

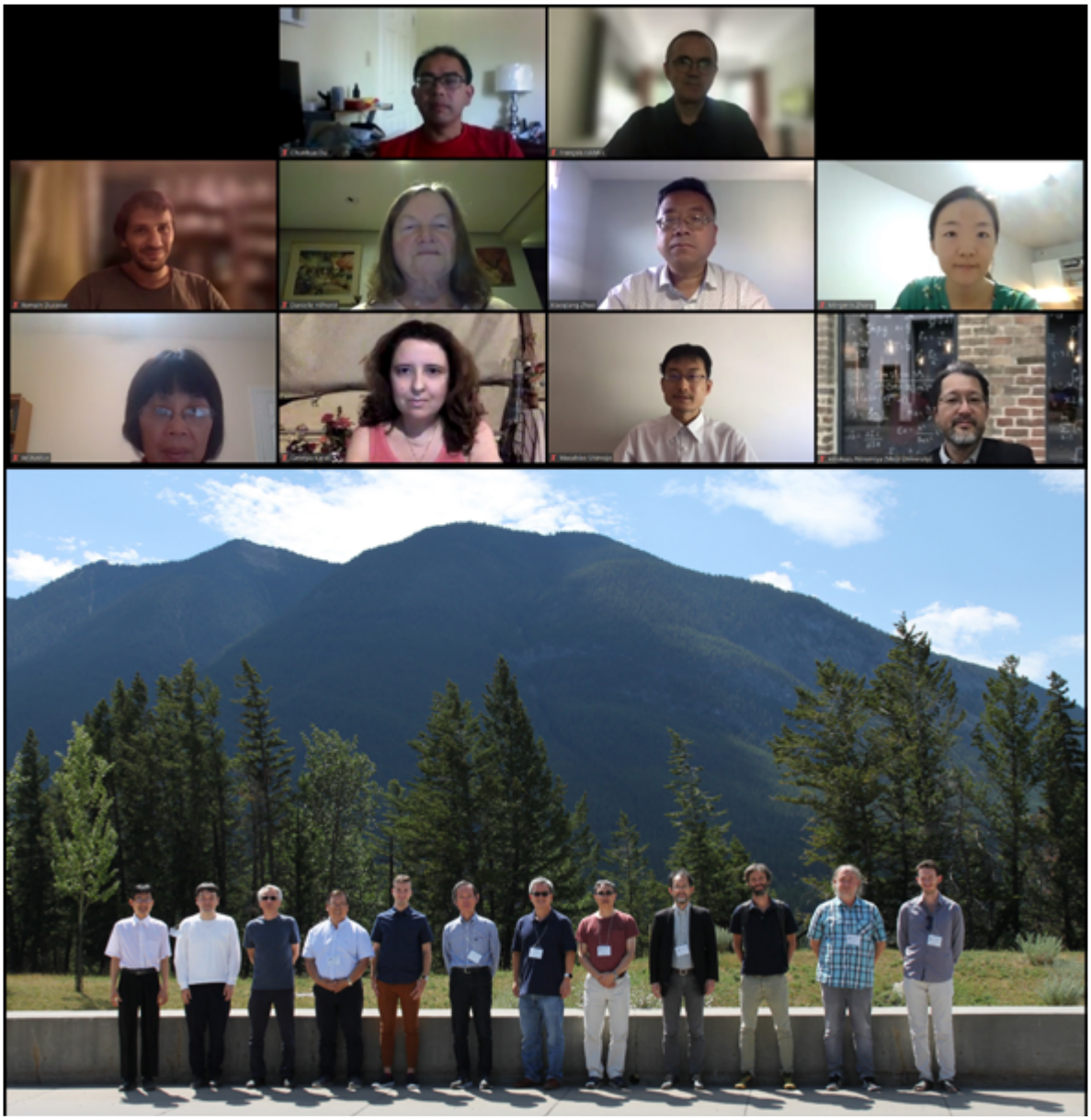
Participants:

Assadi, Sepehr (Rutgers)
Beame, Paul (University of Washington)
Ben-David, Shalev (University of Waterloo)
Braverman, Mark (Princeton University)
Chakrabarti, Amit (Dartmouth College)
Chattopadhyay, Arkadev (Tata Institute of Fundamental Research)
Davis, Ben (McGill University)
de Rezende, Susanna (LTH Lund University)
de Wolf, Ronald (Centrum Wiskunde & Informatica (CWI) and University of Amsterdam)
Efremenko, Klim (Ben-Gurion University)
Fleming, Noah (University of California, San Diego)
Gal, Anna (University of Texas at Austin)
Garg, Ankit (Microsoft Research)
Garg, Sumegha (Harvard University)
Girish, Uma (Computer Science)
Göös, Mika (École Polytechnique Fédérale de Lausanne)
Grosser, Stefan (McGill University)
Hambardzumyan, Lianna (McGill University)
Harms, Nathan (University of Waterloo)
Hatami, Hamed (McGill University)
Jain, Rahul (CQT)
Kapralov, Michael (EPFL)
Kol, Gillat (Princeton University)
Kopparty, Swastik (University of Toronto)
Koroth, Sajin (University of Victoria)
Kothari, Robin (Microsoft)
Kushilevitz, Eyal (Technion)
Larsen, Kasper Green (Aarhus University)
Le Gall, François (Nagoya University)
Loff, Bruno (University of Porto)
Lovett, Shachar (University of California San Diego)
Mahdaviyeh, Yasaman (Columbia University)
Mande, Nikhil (Centrum Wiskunde & Informatica)
McGregor, Andrew (University of Massachusetts Amherst)
Meka, Raghu (University of California, Los Angeles)
Moran, Shay (Technion)
Nordström, Jakob (University of Copenhagen and Lund University)
Oshman, Rotem (Tel Aviv University)
Pitassi, Toniann (University of Toronto)
Raz, Ran (Princeton University)
Robere, Robert (McGill University)
Saraf, Shubhangi (University of Toronto)
Saxena, Raghuvansh (Microsoft Research)
Sherif, Suhail (Vector Institute)
Sherstov, Alexander (UCLA)
Shirley, Morgan (University of Toronto)
Shraibman, Adi (The Academic College of Tel Aviv-Yaffo)
Sokolov, Dmitry (EPFL)
Sudan, Madhu (Harvard University)
Tal, Avishay (UC Berkeley)
Velusamy, Santhoshini (Harvard University)
Watson, Thomas (University of Memphis)
Weinstein, Omri (Hebrew University)
Whitmeyer, D (University of Washington)
Woodruff, David (CMU)
Yehudayoff, Amir (Technion-IIT)
Yu, Huacheng (Princeton University)
Zhan, Wei (Princeton University)
Zhang, Zhijun (Princeton University)
Zhang, Jiapeng (USC)

Interfacial Phenomena in Reaction-Diffusion Systems
July 31 - August 05, 2022

Organizers:

Hiroshi Matano (Meiji University)
Hirokazu Ninomiya (Meiji University)
Peter Polacik (University of Minnesota)
Luca Rossi (Università Roma "Sapienza")



Interfacial phenomena are observed in many fields of science, such as chemistry, physics, biology and medicine. Examples include the formation and motion of phase boundaries in multi-phase materials, the propagation of population waves in ecology, and so on. This workshop focused, among other things, on interfacial phenomena in complex environments, such as those in spatially and/or temporally heterogeneous media, those in random environments, and those in the presence of obstacles. We also focused on interfacial phenomena in biology and those related to geometry. We aimed to develop a new mathematical framework to deepen our understanding of those complex interfacial phenomena.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5165

Participants:

An, Jing (Max Planck Institute)
Angenent, Sigurd (University of Wisconsin)
Berestycki, Henri (Ecole des Hautes Etudes en Sciences Sociales Paris)
Chen, Chiun-Chuan (National Taiwan University)
Ding, Weiwei (South China Normal University)
Du, Yihong (University of New England)
Ducasse, Romain (LJLL, Université Paris Cité)
Ducrot, Arnaud (Le Havre Normandie University)
Fang, Jian (Harbin Institute of Technology)
Fujiwara, Ryu (Meiji University)
Giletti, Thomas (University of Lorraine)
Girardin, Léo (Université Claude Bernard Lyon-1)
Graham, Cole (Brown University)
Gui, Changfeng (University of Texas at San Antonio)
Guo, Jong-Shenq (Tamkang University)
Hamel, Francois (Universite d'Aix-Marseille)
Hilhorst, Danielle (CNRS and Universite Paris-Saclay)
Ikeda, Kota (Meiji University)
Ito, Ryo (Kanagawa University)
Karali, Georgia (University of Crete)
Liang, Xing (University of Science and Technology of China)
Lou, Yuan (Shanghai Jiao Tong University)
Lou, Bendong (Shanghai Normal University)
Matano, Hiroshi (Meiji University)
Matsuzawa, Hiroshi (Kanagawa University)
Monobe, Harunori (Osaka Metropolitan University)
Mori, Ryunosuke (Meiji University)
Ninomiya, Hirokazu (Meiji University)
Polacik, Peter (University of Minnesota)
Roquejoffre, Jean-Michel (Universite Paul Sabatier, Toulouse)
Rossi, Luca (Università Roma "Sapienza")
Shen, Wenxian (Auburn University)
Shimojo, Masahiko (Tokyo Metropolitan University)
Taniguchi, Masaharu (Okayama University)
Wei, Juncheng (University of British Columbia)
Wu, Chang-Hong (National Yang Ming Chiao Tung University)
Wu, Yaping (Capital Normal University)
Xiao, Dongyuan (Meiji University)
Zhang, Mingmin (Université Paul Sabatier, Toulouse)
Zhao, Xiaoqiang (Memorial University of Newfoundland)
Zhou, Maolin (Nankai University)
Zlatos, Andrej (University of California San Diego)

Mathematical Models in Biology: from Information Theory to Thermodynamics
August 07 - 12, 2022

Organizers:

Peter Thomas (Case Western Reserve University)
Michael Hinczewski (Case Western Reserve University)
Andrew Eckford (York University)

All living things, from the simplest bacteria to human beings, are made of cells. A fundamental understanding of living systems, both in health and disease, depends on understanding the complex interactions among and within living cells. Multiple scientific disciplines have separately shed light on the problems of communication and organization in living systems. Biochemistry, bioinformatics and systems biology describe the basic ingredients of cells: DNA, RNA, proteins, lipids, and their interactions. Information theory, founded by Claude Shannon, provides a framework for quantifying the flow of information through any communications system, whether living or engineered (or both, as in the rapidly growing field of synthetic biology). Statistical thermodynamics, the branch of physics concerned with transformations among different forms of energy as well as with the physics of information, sets fundamental limits on the energetic price cells must pay for the information they sense (from each other, from the environment, and their own DNA).

In the last five years, significant advances in statistical thermodynamics and the information theory of biological systems have set the stage for a deeper understanding of how cells process and organize information, make decisions, predict the future, and learn from the past. An essential link between these traditionally disparate fields is the language of mathematics, which provides a common framework within which researchers can understand each other across disciplines. The workshop on Mathematical Models in Biology: From Information Theory to Thermodynamics brought together leading experts and aspiring junior researchers from systems biology, statistical physics, information theory, and applied mathematics to develop the fundamental, linking ideas to compare recent advances in their fields and to establish new collaborations.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5155

Participants:

Abidemi, Afeez (Federal University of Technology, Akure)
Adami, Christoph (Michigan State University)
Almpanis, Apostolos (University of Warwick)
Avanzini, Francesco (University of Luxembourg)
Barato, Andre (University of Houston)
Barendregt, Nicholas (University of Colorado)
Bischofs, Ilka (Max Planck Institute for Terrestrial Microbiology)
Chen, Daniel (Case Western Reserve University)
Cheng, Yu-Chen (Dana-Farber Cancer Institute)
Dasgupta, Sabya (Microsoft Corporation)
Dixit, Purushottam (University of Florida (Physics))
Eckford, Andrew (York University)
Elayan, Hadeel (University of Toronto)
Erban, Radek (University of Oxford)
Ganzinger, Kristina (Institute for Atomic and **Molecular Physics** (AMOLF)
Grima, Ramon (University of Edinburgh)
Grover, Pulkit (Carnegie Mellon University)
Harvey, Sarah (Stanford University)
Heydari, Tiam (UBC)
Hinczewski, Michael (Case Western Reserve University)
Hong, Hyukpyo (Korea Advanced Institute of Science and Technology)
Huynh, Linh (University of Utah)
Iber, Dagmar (ETH Zurich)
Igoshin, Oleg (Rice University)
Khajouei, Farzaneh (Broad institute)
Khammash, Mustafa (ETH Zurich)
Klika, Vaclav (Czech Technical University in Prague)
Klipp, Edda (Humboldt University Berlin)
Kostal, Lubomir (Institute of Physiology, Academy of Sciences of the Czech Republic)
Levchenko, Andre (Yale University)
Lichtarge, Olivier (Baylor School of Medicine)
Lu, Zhiyue (University of North Carolina at Chapel Hill)
MacLaurin, James (New Jersey Institute of Technology)
Mahapatra, Chitaranjan (University of California San Francisco)
Mandal, Saumen (University of Manitoba)
Marzen, Sarah (Claremont McKenna College)
McGee, Ryan (Washington University in St Louis)
Moffett, Alexander (Northeastern University)
Moore, Jeremy (Yale University)
Mugler, Andrew (University of Pittsburgh)
Nguyen, Maximilian (Princeton University)
Nourmohammad, Armita (University of Washington)
Pedraza, Juan (Universidad de los Andes)
Perez-Sansalvador, Julio Cesar (INAOE)
Pierobon, Massimiliano (University of Nebraska - Lincoln)
Polani, Daniel (University of Hertfordshire)
Popovic, Lea (Concordia University)
Poulton, Jenny (AMOLF)
Prabha, Anand (Kanya Maha Vidyalaya - Jalandhar)
Pu, Shusen (Vanderbilt University/ University of West Florida)
Reinhardt, Manuel (AMOLF)
Rogan, Peter (University of Western Ontario)
Rose, Chris (Brown University)
Samuel, Damilare (Case Western Reserve University)
Sivak, David (Simon Fraser University)
Skinner, Dominic (Northwestern University)
Smith, Francesca (Imperial College London)
Stephan, Artur (WIAS Berlin)
Strang, Alexander (University of Chicago)
Stroberg, Wylie (University of Alberta)
Tam, Benjamin (University of Macau)
Thomas, Peter (Case Western Reserve University)
Timmer, Jens (University of Frieburg)
Toledo, Javier (University of British Columbia)
Vaikuntanathan, Suri (University of Chicago)
Watanabe, Yoichi (University of Minnesota - Twin Cities)
Yeung, Jake (Institute of Science and Technology Austria)
Zechner, Christoph (Max Planck Institute of Molecular Cell Biology and Genetics (Dresden))

Extremal Combinatorics and Geometry
August 14 - 19, 2022

Organizers:

Andrew Suk (University of California - San Diego)
Dhruv Mubayi (University of Illinois at Chicago)
Orit Raz (Hebrew University)
Caroline Terry (Ohio State University)

Extremal Combinatorics and Geometry workshop focused on applying combinatorial methods in number theory and geometry. The goal was to gather experts and promising young researchers in combinatorics, geometry and number theory to discuss the recent developments of combinatorial methods used in other areas. Over the past several years, in particular, several ground-breaking results have been discovered, answering some of the oldest problems in the field. This workshop was a timely event to capitalize on this momentum.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5009

Participants:

Axenovich, Maria (Karlsruhe Institute of Technology)
Balko, Martin (Charles University)
Balogh, Jozsef (UIUC)
Bárány, Imre (Alfred Renyi Institute of Mathematics)
Bohman, Thomas (Carnegie Mellon University)
Bukh, Boris (Carnegie Mellon University)
Currier, Gabriel (UBC)
Delcourt, Michelle (Ryerson)
Ezra, Esther (Bar Ilan University)
Haxell, Penny (University of Waterloo)
He, Xiaoyu (Princeton University)
Hubard, Alfredo (UPEM)
Jain, Vishesh (University of Illinois at Chicago)
Liebenau, Anita (UNSW Sydney)
Liu, Xizhi (University of Warwick)
Meagher, Karen (University of Regina)
Molla, Theo (University of South Florida)
Mubayi, Dhruv (University of Illinois at Chicago)
Pach, Janos (NYU Courant and Renyi Institute of Mathematics, Budapest)
Patáková, Zuzana (Charles University)
Pham, Huy (Stanford University)
Pohoata, Cosmin (Yale University)
Soberón, Pablo (City University of New York)
Solymosi, Jozsef (University of British Columbia)
Suk, Andrew (University of California - San Diego)
Toth, Csaba (California State University Northridge)
Walczak, Bartosz (Jagiellonian University)
White, Ethan (UBC)
Wolf, Julia (University of Cambridge)
Yepremyan, Liana (Emory University)
Yuditsky, Yelena (Université libre de Bruxelles)
Zahl, Joshua (University of British Columbia)

Specialisation and Effectiveness in Number Theory
August 28 - September 02, 2022

Organizers:

Alina Ostafe (University of New South Wales)
Cameron Stewart (University of Waterloo)
Robert Tichy (Graz University of Technology)
Julie Tzu-Yueh Wang (Academia Sinica)

Understanding the arithmetic and geometric structure of algebraic functions is fundamental in essentially every area of mathematics and has been investigated for over a century, especially in number theory and arithmetic geometry. The workshop focused on establishing links between functional properties of rational and algebraic functions and similar properties of their specialisations. While in one direction, these links are obvious, establishing them in the opposite direction presents significant challenges. For example, understanding the arithmetic structure of points on algebraic curves has attracted a lot of attention, starting with seminal work of Faltings, Lang, Mahler, Siegel, Thue, and many others, and continuing these days to be a very active research area.

The importance of this area is especially underlined by the many crucial applications that it has in other areas, such as algebraic dynamics, pseudorandomness, complex analysis, algebraic topology, and quantum graphs. The present exciting and challenging problems require deep mathematical tools coming from Diophantine approximation, algebraic and analytic number theory, arithmetic geometry, and complex analysis. We especially concentrated on new methods from analytic number theory to obtain results of a more quantitative nature, which are rather scarce for such problems. We brought together distinguished experts and younger researchers from algebraic and analytic number theory and arithmetic geometry to exchange ideas and develop coherent goals for the future development of this exciting and active research area. This will allow us to better understand the possibilities for further progress and attack a range of important concrete problems in this area.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5024

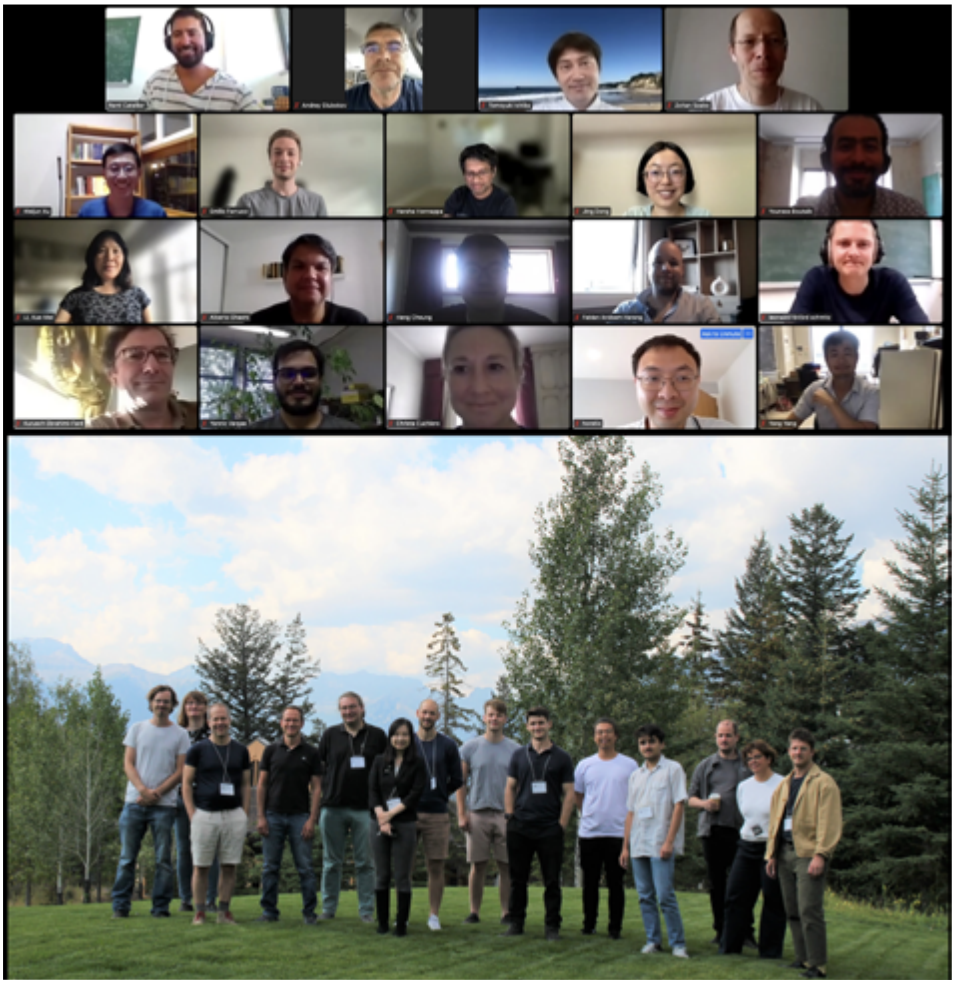
Participants:

Akhtari, Shabnam (University of Oregon)
Amoroso, Francesco (Université de Caen, Laboratoire LMNO)
Barroero, Fabrizio (Università degli studi Roma 3)
Bary-Soroker, Lior (Tel Aviv University)
Bell, Jason (University of Waterloo)
Bennett, Michael (University of British Columbia)
Bérczes, Attila (University of Debrecen)
Breuillard, Emmanuel (University of Oxford)
Bugeaud, Yann (Université de Strasbourg)
Capuano, Laura (University Roma Tre)
Checcoli, Sara (Université Grenoble-Alpes)
Chen, William (Institute for Advanced Study)
Corvaja, Pietro (Università di Udine)
Demeio, Julian Lawrence (MPIM)
Destagnol, Kevin (Université Paris-Saclay, Orsay)
Dill, Gabriel (Leibniz Universität Hannover)
Elkies, Noam D. (Harvard University)
Evertse, Jan-Hendrik (Universiteit Leiden)
Ferraguti, Andrea (Scuola Normale Superiore Pisa)
Frei, Christopher (TU Graz)
Fuchs, Clemens (University of Salzburg)
Garcia-Fritz, Natalia (Pontificia Universidad Católica de Chile)
Granville, Andrew (University of Montreal)
Grieve, Nathan (Royal Military College of Canada, Carleton University and L'Université du Québec à Montréal)
Győry, Kálmán (University of Debrecen)
Hajdu, Lajos (University of Debrecen)
Holmes, Erik (University of Calgary)
Ingram, Patrick (York University)
Jones, Gareth (University of Manchester)
Konyagin, Sergey (Steklov Institute, Russian Academy of Sciences)
Koymans, Peter (University of Michigan)
Kühne, Lars (University of Hannover)
Levin, Aaron (Michigan State University)
Luca, Florian (University of the Witwatersrand)
Masser, David (Universitat Basel)
Mello, Jorge (IMPA)
Mérai, László (Austrian Academy of Science)
Nguyen, Dang Khoa (University of Calgary)
Ostafe, Alina (University of New South Wales)
Pagano, Carlo (Concordia University)
Pakovich, Fedor (Ben Gurion University of the Negev)
Paladino, Laura (University of Calabria)
Pasten, Hector (PUC Chile)
Pila, Jonathan (University of Oxford)
Rudnick, Zeev (Tel Aviv University)
Sawin, Will (Columbia University)
Schefer, Gerold (University of Basel)
Schmidt, Harry (University of Basel)
Sha, Min (South China Normal University)
Shkredov, Il'ya (Steklov Institute of Mathematics)
Shparlinski, Igor (University of New South Wales)
Silverman, Joseph (Brown University)
Sofos, Efthymios (Glasgow University)
Stewart, Cameron (University of Waterloo)
Technau, Niclas (California Institute of Technology)
Tichy, Robert (Graz University of Technology)
Tijdeman, Robert (Leiden University)
Turchet, Amos (Roma Tre University)
Vaaler, Jeffrey (University of Texas at Austin)
Viada, Evelina (University of Göttingen)
Viray, Bianca (University of Washington)
Voloch, Felipe (University of Canterbury)
Wang, Julie Tzu-Yueh (Academia Sinica)
Widmer, Martin (Royal Holloway, University of London)
Wilms, Robert (University of Basel)
Wooley, Trevor (Purdue University)
Yasufuku, Yu (Nihon University)

New interfaces of Stochastic Analysis and Rough Paths
September 04 - 09, 2022

Organizers:

Harald Oberhauser (University of Oxford)
Hao Ni (University College London)
Jing Dong (Columbia University)
Xin Zhang (South China University of Technology)



The theory of stochastic processes provides a concise mathematical language to model and understand quantities that evolve under the influence of randomness. Over the past years, mathematicians have started to connect more recent theoretical advancements in this field to applied data science challenges that range from healthcare to computer vision. Vice versa, applied scientists and practitioners have started to explore more sophisticated mathematical tools. This workshop aimed to strengthen existing inter- and intra-disciplinary cooperations and fertilize novel collaborations.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5116

Participants:

Allan, Andrew (Durham University)
Bailleul, Ismael (Universite Rennes 1)
Bayer, Christian (Weierstrass Institute Berlin)
Blanchet, Jose (Stanford University)
Boedihardjo, Horatio (University of Warwick)
Bonnier, Patric (Oxford)
Boutaib, Youness (University of Liverpool)
Cass, Thomas (Imperial College London)
Catellier, Remi (Universite Cote d'Azur)
Cheung, Hang (University of Calgary)
Chevyrev, Ilya (University of Edinburgh)
Chhaibi, Reda (Institut de Mathématiques de Toulouse)
Cont, Rama (University of Oxford)
Cuchiero, Christa (University of Vienna)
Diehl, Joscha (University of Greifswald)
Dong, Jing (Columbia University)
Dupire, Bruno (Bloomberg)
Dyer, Joel (University of Oxford)

Ebrahimi-Fard, Kurusch (Norwegian University of Science and Technology in Trondheim)
Farghly, Tyler (University of Oxford)
Fermanian, Adeline (Mines ParisTech)
Ferrucci, Emilio (University of Oxford)
Foster, James (University of Bath)
Friz, Peter (Technische Universität and WIAS Berlin)
Gassiat, Paul (Université Paris Dauphine)
Geng, Xi (University of Melbourne)
Germ, Fabian (University of Edinburgh)
Giusti, Chad (University of Delaware)
Glubokov, Andrey (Purdue University)
Hager, Paul (Humboldt University of Berlin)
Harang, Fabian (Norwegian Business School)
Hocquet, Antoine (TU Berlin)
Honnappa, Harsha (Purdue University)
Huesmann, Martin (Universität Münster)
Ichiba, Tomoyuki (University of California Santa Barbara)
L, Tom (Alan Turing Institute)
Le, Khoa (TU Berlin)
Leahy, James-Michael (Imperial College London)
Lee, Darrick (EPFL)
Lejay, Antoine (Institute Elie Cartan)
Lemercier, Maud (Oxford)
Li, Xue-Mei (Imperial College London)
Li, Siran (Shanghai Jiao Tong University)
Lim, Uzu (University of Oxford)
Liu, Chong (ShanghaiTech University)
Lou, Hang (UCL)
Lyons, Terry (Oxford University)
Ni, Hao (University College London)
Nüsken, Nikolas (Kings College London)
Nyquist, Pierre (KTH Royal Institute of Technology)
Oberhauser, Harald (University of Oxford)
Ohashi, Alberto (Universidade de Brasilia)
Pammer, Gudmund (ETH Zurich)
Papavasiliou, Anastasia (University of Warwick)
Preiß, Rosa (Potsdam University)
Prömel, David (University of Mannheim)
Rauhut, Holger (RWTH Aachen University)
Reizenstein, Jeremy (Facebook)
Riedel, Sebastian (FernUniversität Hagen)
Salkeld, William (WIAS Berlin)
Salvi, Cristopher (Imperial College London)
Schell, Alexander (Oxford)
Schmitz, Leonard (University of Greifswald)
Szabo, Zoltan (London School of Economics)
Tao, Jiajie (UCL)
Tapia, Nikolas (WIAS Berlin)
Teichmann, Josef (ETH Zurich)
Tindel, Samy (Purdue University)
Toth, Csaba (University of Oxford)
Trevisan, Dario (Università degli Studi di Pisa)
Vargas, Yannic (TU Graz)
Wu, Yue (University of Strathclyde)
Wynne, George (Imperial College)
Xin, Tong (National University of Singapore)
Xu, Weijun (Peking University)
Yang, Yang (University of Calgary)
Yang, Danyu (Chongqing University)
Zhang, Xin (South China University of Technology)

Rank Conjectures in Algebraic Topology and Commutative Algebra
September 04 - 09, 2022

Organizers:

Nàtalia Castellana (Universitat Autònoma Barcelona)
Claudia Miller (Syracuse University)
Marc Stephan (Bielefeld University)
Srikanth B. Iyengar (University of Utah)

Commutative algebraists and algebraic topologists have made recent exciting advances on a set of decades-old conjectures that are of central importance in both fields. These conjectures concern lower bounds on total ranks of homology and have already spawned a lot of interesting mathematics in both fields, mostly independent of each other.

This workshop recreated a strong dialogue between these groups to foster an exchange of methods and approaches to these problems and to develop long-term working relationships to make more progress in the future.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5088

Participants:

Adem, Alejandro (University of British Columbia)
Amann, Manuel (University of Augsburg)
Arcila-Maya, Niny (Duke University)
Banks, Maya (University of Wisconsin)
Boocher, Adam (University of San Diego)
Briggs, Ben (MSRI)
Brown, Michael (Auburn University)
Cameron, James (University of Utah)
Carlson, Jon (University of Georgia)
Castellana, Nàtalia (Universitat Autònoma Barcelona)
Daundkar, Navnath (Indian Institute of Technology)
Davis, James (Indiana University)

Eisenbud, David (Mathematical Sciences Research Institute)
Erman, Daniel (University of Wisconsin-Madison)
Franz, Matthias (University of Western Ontario)
Garaialde Ocaña, Oihana (Universidad del País Vasco)
Grbic, Jelena (University of Southampton)
Grifo, Eloísa (University of Nebraska -- Lincoln)
Grodal, Jesper (University of Copenhagen)
Hambleton, Ian (McMaster University)
Hanke, Bernhard (University of Augsburg)
Iyengar, Srikanth B. (University of Utah)
Lupton, Gregory (Cleveland State University)
Ma, Linquan (Purdue University)
May, Clover (NTNU Norwegian University of Science and Technology)
McCullough, Jason (Iowa State University)
Miller, Claudia (Syracuse University)
Munoz, Vicente (Universidad de Malaga)
Peeva, Irena (Cornell University)
Pollitz, Josh (University of Utah)
Puppe, Volker (University of Konstanz)
Raptis, George (University of Regensburg)
Rüping, Henrik (Continentale Krankenversicherung)
Sarkar, Soumen (Indian Institute of Technology Madras)
Seceleanu, Alexandra (University of Nebraska Lincoln)
Sega, Liana (University of Missouri-Kansas City)
Senturk, Berrin (TED University)
Smith, Gregory G. (Queen's University)
Stephan, Marc (Bielefeld University)
Stojanoska, Vesna (University of Illinois - Urbana Champaign)
Szymik, Markus (University of Sheffield)
Tobias, Barthel (Max Planck Institute for Mathematics)
Ünlü, Özgün (Bilkent University-)
VandeBogert, Keller (University of Notre Dame)
Walker, Mark (University of Nebraska)
Williams, Ben (University of British Columbia)
Yalcin, Ergun (Bilkent University)
Zoller, Leopold (Ludwig Maximilian University of Munich)
Zou, Foling (University of Michigan)

Building Networks: Women in Complex & Nonlinear Systems
September 04 - 09, 2022

Organizers:

Jason Bell (University of Waterloo)

Chelsea Walton (Rice University)

Collective behavior is present across the natural and social world: starlings interact with their neighbors to trace out group patterns in the sky, cells organize during early organism development to create tissues and organs, and Twitter users respond to the posts of others to create trending topics. From a mathematical perspective, these seemingly different dynamics fall under the same umbrella: they are complex systems, systems that exhibit patterns and dynamics much richer than the behavior of the many small parts (e.g., birds, cells, or Twitter users) that they are composed of. Mathematicians working on complex systems seek to uncover the rules that govern interactions of individuals and understand how these different behaviors determine the group-level features that evolve from them.

With the goal of connecting different perspectives, fostering collaboration, and building mentorship networks, this workshop brought together researchers with expertise in a wide range of mathematical tools and applications related to complex systems. Because women are often underrepresented in mathematics workshops, we particularly highlight their many contributions to the field. All genders are welcome to celebrate an inclusive community in complex systems.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5062

Participants:

Bañuelos, Selenne (IPAM, UCLA & Cal. State Univ. Channel Islands)
Barbaro, Alethea (TU Delft)
Brooks, Heather Zinn (Harvey Mudd College)
Cook, Keisha (Clemson University)
D'Orsogna, Maria Rita (Calfiornia State University Northridge)
Daniels, Karen (North Carolina State University)
Das, Moumita (Rochester Institute of Technology)
Eissa, Tahra (University of Colorado Boulder)
Espanol, Malena (Arizona State University)
Fefferman, Nina (University of Tennessee)
Feffermen, Nina (University of Tennessee)
Hill, Kaitlin (St. Mary's University)
Hoffmann, Franca (Rheinische Friedrich-Wilhelms-Universität Bonn)
Jilkine, Alexandra (University of Notre Dame)
Kawakatsu, Mari (University of Pennsylvania)
Klotsa, Daphne (University of North Carolina)
Komarova, Natalia (University of California Irvine)
Miller, Laura (University of Arizona)
Newhall, Katie (University of North Carolina at Chapel Hill)
Pasha, Mirjeta (Arizona State University)
Popovici, Irina (US Naval Academy)
Rodriguez, Nancy (University of Colorado at Boulder)
Schwarze, Alice (Dartmouth College)
Shukla, Namrata (Banaras Hindu University, India)
Silber, Mary (University of Chicago)
Towers, Sherry (Institute for Advanced Sustainability Studies)
Tymochko, Sarah (UCLA)
Volkening, Alexandria (Purdue University)

Noncommutative Geometry and Noncommutative Invariant Theory
September 25 - 30, 2022

Organizers:

Nancy Rodriguez (University of Colorado at Boulder)
Heather Zinn Brooks (Harvey Mudd College)
Alexandria Volkening (Purdue University)
Nina Fefferman (University of Tennessee)

Noncommutativity is a truly ubiquitous phenomenon, which at its most basic level, says that the order in which one performs operations matters in general. This observation, while very simple, has profound implications in both mathematics and physics. In particular, during the early development of quantum mechanics, it was realized that a noncommutative framework was necessary to have an understanding of events that occur at the quantum scale. This, in turn, led to significant advances in the development of many branches of mathematics---including functional analysis, representation theory, noncommutative algebra---in order to provide a supporting framework for these physical theories.

Now, more than a hundred years later, noncommutative algebra, especially in its connections to geometry, is a thriving area of active research, with significant new advances being made every year. Our workshop brought together researchers to allow for both the dissemination of recent advances in these areas and for collaboration between researchers working on these topics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5084

Participants:

Bell, Jason (University of Waterloo)
Belmans, Pieter (University of Luxembourg)
Brown, Ken (University of Glasgow)
Buzaglo, Lucas (University of Edinburgh)
Calderón, Fabio (National University of Colombia)
Chan, Daniel (UNSW, Sydney)
Chivasitu, Alexandru (SUNY Buffalo)
Crawford, Simon (University of Manchester)
Gaddis, Jason (Miami University)
Goodearl, Ken (University of California, Santa Barbara)
He, Jiwei (Hangzhou Normal University)
Huang, Hongdi (Rice University)
Ingalls, Colin (Carleton University)
Kinser, Ryan (University of Iowa)
Kirkman, Ellen (Wake Forest University)
Lira Torres, Evelyn (Queen Mary University of London)
Lorenz, Martin (Temple University)
Lowen, Wendy (Universiteit Antwerpen)
Lu, Diming (Zhejiang University)
Moore, Frank (Wake Forest University)
Negron, Cris (University of Southern California)
Nguyen, Van (United States Naval Academy)
Oswald, Amrei (University of Washington)
Quddus, Safdar (Indian Institute of Science)
Reyes, Manuel (University of California, Irvine)
Rogalski, Dan (UCSD)
Satriano, Matthew (University of Waterloo)
Schedler, Travis (Imperial College London)
Sierra, Susan (University of Edinburgh)
Stafford, J. Toby (University of Manchester)
Tang, Xin (Fayetteville State University)
Ueyama, Kenta (Hirosaki University)
Ure, Charlotte (University of Virginia)
Vashaw, Kent (MIT)
Veerapen, Padmini (Tennessee Tech University)
Walton, Chelsea (Rice University)
Wang, Xingting (Howard University)
Wemyss, Michael (University of Glasgow)
Wicks, Elizabeth (Microsoft Corporation)
Won, Robert (George Washington University)
Wu, Quanshui (Fudan University)
Yakimov, Milen (Northeastern University)
Zhang, James (University of Washington)
Zhang, Yinhuo (University of Hasselt)

Defects and Distortions of Layered Complex Fluids
October 02 - 07, 2022

Organizers:

Scott MacLachlan (Memorial University of Newfoundland)
Timothy Atherton (Tufts University)
Patrick Farrell (University of Oxford)
Emmanuelle Lacaze (Sorbonne Université)
Francesca Serra (University of Southern Denmark)

Complex fluids that incorporate periodic layered order, such as smectic liquid crystals, block copolymers, membranes, and vesicles, possess remarkable properties because of the geometric and topological consequences of layering: external influences, such as boundary conditions and applied fields, may force deformations of the fluid that are incompatible with the layering, leading to geometric frustration and the spontaneous assembly of a wide variety of textures with characteristic defect structures.

Despite the remarkable experimental interest, the complicated structures that emerge in these systems have proven to be extremely challenging to model computationally. While many observed phenomena have been understood through elegant geometric approaches or by perturbing from a less-ordered phase, there have been few successful efforts to use computation to predict the structures adopted by smectics in general configurations. Such methods could be of great benefit to structure prediction, particularly in scenarios where partial smectic order exists, such as during phase transitions, or to understand dynamical phenomena such as the shape evolution of films and bubbles.

This workshop brought together computational physicists, applied mathematicians and experimentalists together to identify: Geometries and experimental phenomena of interest that have become amenable to simulation; New theoretical questions about the structure and self-assembly of layered media that could be investigated computationally; New experiments that may now be possible due to emerging computational modelling approaches; Opportunities to formulate simulation methods for other layered media beyond smectics; New mathematical approaches that might further accelerate research on the broad category of layered fluids; How to exploit the interplay of geometry, topology and computation for improved algorithms.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5159

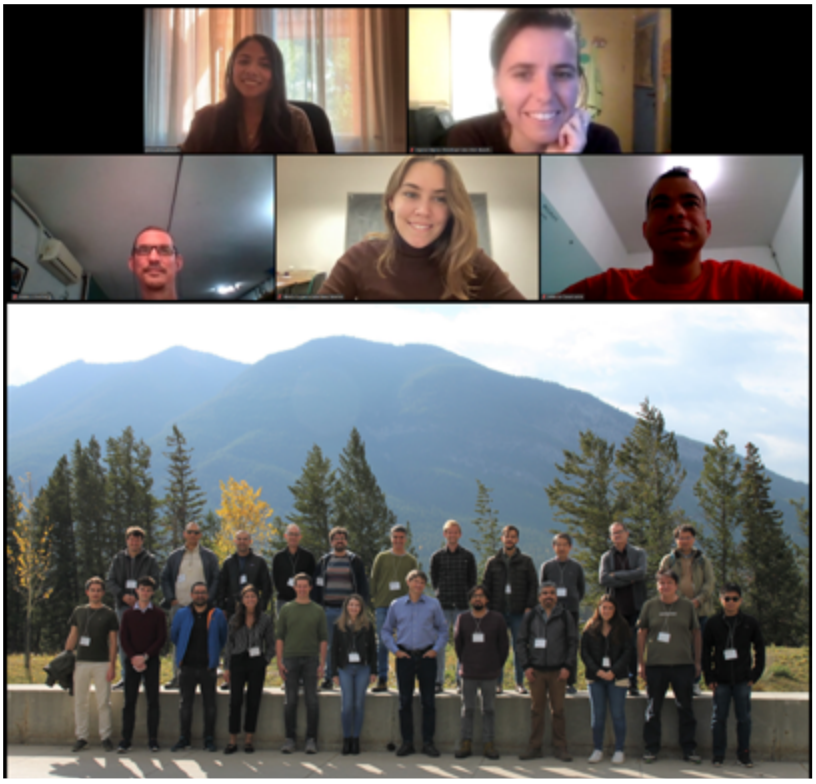
Participants:

Adler, James (Tufts University)
Andrei, Anca (Tufts University)
Atherton, Timothy (Tufts University)
Beller, Daniel (Johns Hopkins University)
Farrell, Patrick (University of Oxford)
Gharbi, Mohamed Amine (University of Massachusetts Boston)
Hamdan, Abdalaziz (Memorial University of Newfoundland and Labrador)
Hare, Sean (Johns Hopkins University)
Jackaman, James (Norwegian University of Science and Technology)
Joshi, Chaitanya (Tufts University)
Kamien, Randall (University of Pennsylvania)
Lacaze, Emmanuelle (Sorbonne Université)
Lopez-Leon, Teresa (CNRS, ESPCI Paris)
MacLachlan, Scott (Memorial University of Newfoundland)
Majumdar, Apala (University of Strathclyde)
Motram, Nigel (University of Glasgow)
Niyonzima, Jean De Dieu (Sorbonne University)
Ramage, Alison (University of Strathclyde)
Rosenblatt, Charles (Case Western Reserve University)
Selinger, Jonathan (Kent State University)
Serra, Francesca (University of Southern Denmark)
Shendruk, Tyler (University of Edinburgh)
Tran, Lisa (University of Utrecht)
Walker, Shawn (Louisiana State University)
Wittman, René (Heinrich-Heine-Universität Düsseldorf)
Xia, Jingmin (National University of Defense Technology)
Zappone, Bruno (University of Calabria)

New trends in Mathematics of Dispersive, Integrable and Nonintegrable Models in Fluids, Waves and Quantum Physics
October 09 - 14, 2022

Organizers:

Claudio Muñoz (Universidad de Chile)
Miguel Angel Alejo (Universidad de Córdoba)
Lucrezia Cossetti (Karlsruhe Institute of Technology)



This workshop gathered international experts in nonlinear dispersive PDEs coming from the less represented communities of the Americas.

The main goal to keep up to date with the current status of the field and to expose and share ideas which may produce advances in the theory also giving rise to new perspectives and approaches useful to tackle several different problems such as blow up phenomena, decay, asymptotic and stability properties of solutions, geometric flows and nonlinear PDEs, singularities, vortices and periodic solutions in fluids and fractional models.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5018

Participants:

Alejo, Miguel Angel (Universidad de Córdoba)
Cassano, Biagio (Università degli Studi della Campania)
Cavalcante, Marcio (Universidade Federal de Alagoas)
Chamorro, Diego (LaMMe)
Chen, Gong (Georgia Institute of Technology)
Corcho, Adán J. (Universidade Federal do Rio de Janeiro)
Cortez, Fernando (Escuela Politécnica)
Cossetti, Lucrezia (Karlsruhe Institute of Technology)
del Pino, Manuel (University of Bath)
Esquivel, Liliana (Universidad del Valle)
Fanelli, Luca (Ikerbasque & UPV)
Farah Dias, Luiz Gustavo (Universidade Federal de Minas Gerais)
Gancedo, Francisco (University of Seville)
García, Claudia (Universidad Autónoma de Madrid)
García-Juárez, Eduardo (Universitat de Barcelona)
Gustafson, Stephen (University of British Columbia)
Ibrahim, Slim (University of Victoria)

Jarrin, Oscar (UDLA)
Klaus, Friedrich (KIT)
Linares, Felipe (IMPA)
Martínez Martini, María Eugenia (Université París Cité)
Maulen, Christopher (Universität Bielefeld)
Mizumachi, Tetsu (Hiroshima University)
Muñoz, Claudio (Universidad de Chile)
Nakanishi, Kenji (Kyoto University)
Ntekoume, Maria (Rice University)
Pelinovski, Dmitry (McMaster University)
Poblete, Felipe (Universidad Austral de Chile)
Poyato, David (University of Granada)
Riaño, Oscar (Florida International University)
Soler, Juan (Universidad de Granada)
Sun, Ruoci (KIT)
Trespalacios, Jessica (Universidad de Chile)
Valet, Frederic (University of Bergen)
Van Den Bosch, Hanne (Universidad de Chile)
Wittenstein, Alexander (Karlsruhe Institute of Technology)

Interactions between Hessenberg Varieties, Chromatic Functions, and LLT Polynomials
October 16 - 21, 2022

Organizers:

Laura Colmenarejo (North Carolina State University)
Per Alexandersson (Stockholm University)
Martha Precup (Washington University in St Louis)
Julianna Tymoczko (Smith College)

The prime numbers are the basic building blocks for integers. In a similar fashion, LLT polynomials are becoming an important building blocks for certain types of symmetries. Hessenberg varieties are geometric objects which encode these types of symmetries.

To solve open problems about how such symmetries can be broken down into well-established and well-understood standard blocks, similar to how prime factorization works for integers, was the main goal of this workshop.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5143

Participants:

A Skandera, Mark (Lehigh University)
Abe, Hiraku (Okayama University of Science)
Abreu, Alex (Federal Fluminense University)
Adeyemo, Praise (University of Ibadan)
Alexandersson, Per (Stockholm University)
Aliniaefard, Farid (The University of British Columbia)
Athanasiadis, Christos (National and Kapodistrian University of Athens)
Balibanu, Ana (Harvard University)
Bastidas, Jose (Université du Québec à Montréal)
Benedetti, Carolina (Universidad de los Andes in Bogotá, Colombia)
Bergeron, François (Université du Québec à Montréal)
Brosnan, Patrick (University of Maryland - College Park)
Carlsson, Erik (UC Davis)
Celano, Kyle (University of Miami)
Chow, Timothy (Center for Communications Research)
Colmenarejo, Laura (North Carolina State University)
Crew, Logan (University of Waterloo)

D'Adderio, Michele (Università di Pisa)
Dahlberg, Samantha (Illinios Institute of Technology)
Douvropoulos, Theo (UMass Amherst)
Escobar, Laura (Washington University in St. Louis)
Gao, Yibo (University of Michigan)
Gillespie, Maria (Colorado State University)
Glubokov, Andrey (Purdue University)
Griffin, Sean (University of California, Davis)
Guay-Paquet, Mathieu (Université du Québec à Montréal)
Haglund, Jim (University of Pennsylvania)
Haiman, Mark (University of California, Berkeley)
Harada, Megumi (McMaster University)
Hong, Jaehyun (Institute for Basic Science)
Huh, JiSun (Ajou University)
Hwang, Byung-Hak (Seoul National University)
Kalampogia-Evangelinou, Katerina (University of Athens)
Klein, Ian (NCSU)
Kumar, Sathish (The Institute of Mathematical Sciences)
Lee, Seung Jin (Seoul National University)
Lee, Eunjeong (Chungbuk National University)
Lee, Donggun (Seoul National University)
Lesnevich, Nathan (Washington University in St Louis)
Liang, Jinting (Michigan State University)
Liao, Hsin Chieh (University of Miami)
Masuda, Mikiya (Osaka Metropolitan University)
Mayers, Nick (NCSU)
Mellit, Anton (University of Vienna)
Morales, Alejandro (University of Massachusetts Amherst)
Morse, Jennifer (University of Virginia)
Nadeau, Philippe (CNRS & University Lyon 1)
Naqvi, Yusra (University College London)
Nigro, Antonio (Federal Fluminense University)
Orellana, Rosa (Dartmouth College)
Panova, Greta (University of Southern California)
Pappe, Joseph (UC Davis)
Precup, Martha (Washington University in St Louis)
Pun, Ying Anna (CUNY-Baruch College)
Rakotondrajao, Fanja (University of Antananarivo)
Reynes, Josephine (University of Waterloo)
Sabando Alvarez, Maria Cristina (Washington University in St Louis)
Sagan, Bruce (Michigan State University)
Saliola, Franco (Université du Québec à Montréal)
Schilling, Anne (University of California Davis)
Seelinger, George (University of Michigan)
Selover, Jesse (UMass Amherst)
Shareshian, John (Washington University in St. Louis)
Simone, Mary Claire (University of California, Davis)
Sommers, Eric (University of Massachusetts)
Spirkl, Sophie (University of Waterloo)
Tewari, Vasu (University of Hawaii)
Tom, Foster (MIT)
Tymoczko, Julianna (Smith College)
Uma, V. (Indian Institute of Technology - Madras)
van Willigenburg, Steph (University of British Columbia)
Vargas, Yannic (TU Graz)
Venkitesh, S. (IIT Bombay)
Wachs, Michelle (University of Miami)
Wang, Shiyun (University of Southern California)
Wang, Jiayuan (Lehigh University)
Wang, Victor Yuan Zhang (Harvard)
Wilson, Andy (Kennesaw State University)
Woo, Alexander (University of Idaho)
Yoo, Meesue (Chungbuk National University)
Zhang, Yongxing (Nick) (University of Waterloo)
Zhang, Ruoyang (University College London)

New Ideas in Computational Inverse Problems
October 23 - 28, 2022

Organizers:

Christina Frederick (New Jersey Institute of Technology)
Yoonsang Lee (Dartmouth)
Kui Ren (Columbia University)
Yunan Yang (ETH Zurich)

Observational data is used by scientists and engineers to discover things that cannot be seen directly, for example, medical imaging to detect a brain tumor or seismic data to learn about the earth's subsurface layers. The mathematical theory of inverse problems guides the interpretation of these data by linking observables to predictions. This theory has produced powerful mathematical results that have advanced the state-of-the art in a spectrum of problems ranging from small scale (detecting degenerate epithelial cells in eye MRI) to large scale (finding faults in the earth from seismic imaging). Mathematical and computational modeling play an important role in every aspect of inversion, from how the data is collected to the process of matching data to predictions.

Rapidly emerging technologies pose new challenges that urgently call for the development of new mathematical and computational tools for inverse problems. One main challenge is learning highly detailed information that may be hard to find (e.g., cracks in geophysics, edges in imaging, breaking solitons in waves). Another challenge often seen in practice is limited data, for example, weather data measured mainly over land versus the ocean. The workshop brought together leading experts in applied mathematics and related fields and covered recent developments and core applications in geoscience, medical imaging, and machine learning. Participants shared research problems and working codes discussed in evening problem-solving sessions. The workshop included young mathematicians (recent PhDs and advanced graduate students).

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5118

Participants:

Arridge, Simon (University College London)
Bao, Gang (Zhejiang University)
Baptista, Ricardo (MIT)
Borcea, Liliana (University of Michigan)

Botvinick-Greenhouse, Jonah (Cornell University)
Chen, Zhiming (Chinese Academy of Sciences)
Choi, Bosu (Dartmouth College)
Chung, Eric (Chinese University of Hong Kong)
Engquist, Bjorn (UT Austin)
Espanol, Malena (Arizona State University)
Folarin, Samson (Concordia University Wisconsin)
Frederick, Christina (New Jersey Institute of Technology)
Guevara Vasquez, Fernando (University of Utah)
Han, Jihun (Dartmouth College)
Harris, Isaac (Purdue University)
Holbach, Lukas (Johannes Gutenberg University Mainz)
Kang, Sung Ha (Georgia Institute of Technology)
Koval, Karina (Heidelberg University)
Kuegler, Philipp (University of Hohenheim)
Lai, Rongjie (RPI)
Lee, Yoonsang (Dartmouth)
Leong, Oscar (Caltech)
Li, Qin (University of Wisconsin-Madison)
Li, Peijun (Purdue)
Liao, Wenjing (Georgia Tech)
Malcolm, Alison (Memorial University)
Mamonov, Alexander (University of Houston)
Marzouk, Youssef (Massachusetts Institute of Technology)
Minkoff, Susan (University of Texas at Dallas)
Mueller, Jennifer (Colorado State University)
Nguyen, Thi Phong (NJIT)
Ou, M. Yvonne (University of Delaware)
Ozochiawaeze, General (Purdue University)
Petra, Noemi (University of California - Merced)
Qian, Jianliang (MSU)
Qiu, Lingyun (Tsinghua University)
Ren, Kui (Columbia University)
Seck, Diaraf (Université Cheick Anta Diop de Dakar)
Stadler, Georg (New York University)
Sun, Jiguang (Michigan Technological University)
Tao, Molei (Georgia Institute of Technology)
Teckentrup, Aretha (University of Edinburgh)
Tendeng, Lena (University of Cheikh Anta Diop)
Tong, Shanyin (Columbia University)
Tran, Giang (University of Waterloo)
Tripathi, Padmesh (IIMT College of Engineering)
Tsai, Richard (University of Texas at Austin)
Tsogka, Chrysoula (University of California Merced)
Turnquist, Axel (University of Texas at Austin)
Uhlmann, Gunther (University of Washington and HKUST)
van Leeuwen, Tristan (Centrum Wiskunde & Informatica, NL)
Wang, Li (University of Minnesota)
Yacoubou Djima, Karamatou (Wellesley College)
Yang, Yunan (ETH Zurich)
Yang, Haizhao (Purdue University)
Yang, Yang (Michigan State University)
Zepeda Núñez, Leonardo (Google Research and University of Wisconsin-Madison)
Zhang, Lu (Columbia University)
Zhao, Hongkai (Duke U.)
Zhong, Yimin (Duke)
Zhou, Haomin (Georgia Institute of Technology)

Topology in Dimension 4.5
October 30 - November 4, 2022

Organizers:

Hannah Schwartz (Princeton University)
David Gay (University of Georgia)
Jason Joseph (Rice University)
Maggie Miller (Stanford University)

Mathematicians often study knotted circles in three-dimensional space as a tool to model physical phenomena such as DNA, molecules, or strings in physics. We are naturally drawn to three-dimensional problems because they seemingly resemble our three-dimensional world -- however, most real-word problems have an implicit fourth dimension: time. This motivates the analogous study of knotted surfaces in four-dimensional spaces. Just as four-dimensional techniques have been critical in our understanding of three-dimensional behaviors, we can make use of five-dimensional techniques to understand knotted surfaces. Two surfaces in a four-dimensional space can be compared by connecting them by a family of surfaces, or more generally, a three-dimensional object embedded in a five-dimensional space. Thus, this area can be thought of as 4.5-dimensional topology: studying four-dimensional mathematics through five-dimensional techniques.

In this workshop, we brought mathematicians at various stages in their careers together to better understand recent work in 4.5 dimensions. In particular, we hope to bridge the gap between a large swath of older results, which are important but completely understood only by a small segment of the community, and current very recent work that has the advantage of modern technology. By combining the perspectives of many mathematicians in this area, we hope to promote new collaborations, raise awareness of cutting-edge research, and open up a literature-dense subfield to young mathematicians.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5065

Participants:

Aranda, Roman (Binghamton University)
Auckly, David (Kansas State University)
Blackwell, Sarah (Max Planck Institute for Mathematics)
Budney, Ryan (University of Victoria)

Castro, Nick (Rice University)
Cazet, Nicholas (UC Davis)
Chen, Joye (Princeton University)
Collins, Sally (Georgia Institute of Technology)
Conway, Anthony (MIT)
Dai, Irving (Stanford University)
Fushida-Hardy, Shintaro (Stanford University)
Gabai, David (Princeton University)
Gay, David (University of Georgia)
Guu, Jin-Cheng (Stony Brook University)
Hartman, Daniel (UGA)
Harvey, Shelly (Rice University)
Hayden, Kyle (Rutgers University - Newark)
Islambouli, Gabriel (UC Davis)
Johnson, Jonathan (Oklahoma State University)
Joseph, Jason (Rice University)
Kim, Geunyoung (University of Georgia)
Kim, Seungwon (Sungkyunkwan University)
Kim, Hee Jung (Western Washington University)
Kirby, Robion (University of California - Berkeley)
Kjuchukova, Alexandra (University of Notre Dame)
Klug, Michael (University of Chicago)
Kosanović, Danica (ETH Zürich)
Krushkal, Slava (University of Virginia)
Li, Lily (Princeton University)
Lokteva, Lisa (University of Glasgow)
Longo, Vincent (University of Connecticut)
Manchester, Alex (Rice University)
Manjarrez, Fabiola (UNAM)
Matic, Gordana (University of Georgia)
McDonald, Clayton (University of Vienna)
Miller, Allison (Swarthmore College)
Miller, Maggie (Stanford University)
Nakamura, Kai (University of Texas)
Naylor, Patrick (Princeton University)
Niu, Weizhe (University of Glasgow)
Piccirillo, Lisa (MIT)
Pongtanapaisan, Puttipong (University of Saskatchewan)
Powell, Mark (Durham University)
Qin, Qianhe (Stanford University)
Ray, Arunima (Max Planck Institute for Mathematics in Bonn)
Rodriguez Viorato, Jesus (Conacyt-Cimat)
Sakalli, Sumeyra (University of Arkansas)
Schneiderman, Rob (Lehman College)
Schwartz, Hannah (Princeton University)
Sridhar, Shruthi (Princeton University)
Stine, Charles (Brandeis University)
Sundberg, Isaac (Max Planck Institute for Mathematics in Bonn)
Teichner, Peter (Max Plank Institute for Mathematics)
Thakar, Ollie (Princeton University)
Turner, Hannah (Georgia Tech)
Warren, Terrin (University of Georgia)
Watanabe, Tadayuki (Kyoto University)

Recent Progress in Kinetic and Integro-Differential Equations November 6 - 11, 2022

Organizers:

Nestor Guillen (Texas State University)
Maria Gualdani (University of Texas at Austin)
Russell Schwab (Michigan State University)
Maja Taskovic (Emory University)

This workshop brought together experts to discuss the state of the art in the mathematical analysis of kinetic equations such as the Boltzmann equation, models derived from it, as well as the class of integro-differential equations that include generators of Levy processes and fractional powers of the Laplacian. The workshop included a mini-course covering developments from the last 5 years. This course is chiefly aimed at graduated students, but should also be of benefit to early-career and senior researchers alike.

Kinetic equations model the statistical configuration of physical systems, from gases to plasmas. They are used to model phenomena in engineering, nuclear physics, astrophysics, and more. The scale at which kinetic equations describe physical phenomena is very small while remaining at a classical (that is non-quantum) scale. Many important equations in classical continuum mechanics, such as the Navier Stokes equations for an incompressible viscous fluid, or the Euler equations for inviscid flows, can be extracted out of these kinetic equations.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5101

Participants:

Ampatzoglou, Ioakeim (New York University)
Cabrera, Rene (University of Texas, Austin)
Chang-Lara, Héctor (CIMAT-Guanajuato)
Chaturvedi, Sanchit (Stanford)
Chu, Raymond (University of California Los Angeles)
Delgadino, Matias (UT Austin)

Desvillettes, Laurent (Université Paris Cité)
Dong, Hongjie (Brown University)
Golding, Will (University of Texas at Austin)
Gualdani, Maria (University of Texas at Austin)
Guillen, Nestor (Texas State University)
He, Lingbing (Tsinghua University)
Henderson, Christopher (University of Arizona)
Hepp, Solveig (Universität Bielefeld)
Heydecker, Daniel (Max Planck Institute for Mathematics in the Sciences)
Hu, Jingwei (University of Washington)
Imbert, Cyril (Ecole Normale Supérieure)
Jang, Juhi (University of Southern California)
Jang, Jin Woo (Pohang University of Science and Technology)
Kassmann, Moritz (Bielefeld University)
Kim, Chanwoo (University of Wisconsin)
Kim, Minhyun (Universität Bielefeld)
Kim, Inwon (University of California, Los Angeles)
Kumagai, Takashi (Waseda University)
Lenczewska, Julia (Wrocław University of Science and Technology)
Li, Qin (University of Wisconsin-Madison)
Lierl, Janna (TU Clausthal)
Liu, Yanze (Brown University)
Loher, Amélie (University of Cambridge)
Miller, Joseph (University of Texas at Austin)
Nowak, Simon (Universität Bielefeld)
Pavlovic, Natasa (University of Texas at Austin)
Schwab, Russell (Michigan State University)
Silvestre, Luis (University of Chicago)
Snelson, Stanley (Florida Tech)
Strain, Robert (University of Pennsylvania at Philadelphia)
Sun, Weiran (Simon Fraser University)
Tarfulea, Andrei (LSU)
Taskovic, Maja (Emory University)
Turanova, Olga (Michigan State University)
Wang, Li (University of Minnesota)
Weidner, Marvin (Universitat de Barcelona)
Winter, Raphael (University of Vienna)
Yoldaş, Havva (Delft University of Technology)
Zhang, Zhiyuan (NYU)

Analytic and Probabilistic Combinatorics
November 13 - 18, 2022

Organizers:

Miklos Bona (University of Florida)
Ricardo Gomez (National Autonomous University of México)
Mark Daniel Ward (Purdue University)
Cecile Mailler (University of Bath)

Combinatorics is a young area in mathematics that has connections to almost all older fields, such as probability theory, analysis, algebra, number theory and geometry. Therefore, combinatorialists try to apply the existing strong theorems of these other fields in their research. However, no combinatorialist can master all the tools of all of these other fields. Our workshop facilitated the learning of these tools by bringing together two separate groups of researchers, those who call themselves Analytic Combinatorialists, and those who call themselves Probabilistic Combinatorialists.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5004

Participants:

Amdeberhan, Tewodros (Tulane University)
Angtuncio Hernandez, Osvaldo (University Duisburg-Essen)
Archer, Kassie (University of Texas at Tyler)
Banderier, Cyril (Paris 13 University)
Bassino, Frédérique (Université Sorbonne Paris Nord)
Berzunza-Ojeda, Gabriel (University of Liverpool)
Bona, Miklos (University of Florida)
Bonomo, Flavia (University of Buenos Aires)
Bousquet-Mélou, Mireille (CNRS, Université de Bordeaux)
Burstein, Alexander (Howard University)
Caballero, Maria Emilia (Universidad Nacional Autónoma de México)
Caraceni, Alessandra (Scuola Normale Superiore, Pisa)
Copenhaver, Keith (Eckerd College)

Defant, Colin (Massachusetts Institute of Technology)
Devroye, Luc (McGill University)
Eslava, Laura (UNAM)
Fill, James Allen (The Johns Hopkins University)
Fraiman, Nicolas (University of North Carolina at Chapel Hill)
Galvin, David (University of Notre Dame)
George, Terrence (University of Michigan)
Glubokov, Andrey (Purdue University)
Gomez, Ricardo (National Autonomous University of México)
Greenwood, Torin (North Dakota State University)
Hackl, Benjamin (University of Klagenfurt)
Hernández-Torres, Saraí (Universidad Nacional Autonoma de Mexico)
Heuberger, Clemens (Alpen-Adria-Universität Klagenfurt)
Hitczenko, Pawel (Drexel University)
Iosevich, Alex (University of Rochester)
Janson, Svante (Uppsala University)
Kang, Mihyun (TU Graz)
Kiwi, Marcos (University of Chile)
Li, Evan (Purdue University)
Liu, Kevin (University of Washington)
Livshyts, Galyna (Georgia Institute of Technology)
Lumbroso, Jérémie (Princeton University)
Madras, Neal (York University)
Mailler, Cecile (University of Bath)
Martinez, Conrado (Universitat Politècnica de Catalunya)
Melczer, Stephen (University of Waterloo)
Mishna, Marni (Simon Fraser University)
Müller, Noela (Eindhoven University of Technology)
Novak, Jonathan (University of California, San Diego)
Owen, Megan (Lehman College, CUNY)
Panholzer, Alois (Vienna University of Technology)
Pemantle, Robin (University of Pennsylvania)
Pittel, Boris (The Ohio State University)
Prodinger, Helmut (Stellenbosch University)
Ravelomanana, Vlady (Institute de Recherche en Informatique Fondamentale)
Redlich, Amanda (University of Massachusetts at Lowell)
Reichman, Daniel (Worcester Polytechnic Institute)
Rivera-Lopez, Kelvin (Gonzaga University)
Sedgewick, Robert (Princeton University)
Selkirk, Sarah (University of Klagenfurt)
Simon, Samuel (Simon Fraser University)
Smith, Rebecca (SUNY Brockport)
Uribe Bravo, Geronimo (Instituto de Matematicas, UNAM)
Vargas, Yannic (TU Graz)
Vatter, Vincent (University of Florida)
Viola, Alfredo (University of the Republic, Montevideo, Uruguay)
Wagner, Stephan (Uppsala University)
Wallner, Michael (TU Wien)
Wang, Minmin (University of Sussex)
Wang, Zhiyu (Georgia Tech)
Ward, Mark Daniel (Purdue University)
Warnke, Lutz (University of California, San Diego)
Wesolek, Alexandra (Simon Fraser University)
Wild, Sebastian (University of Liverpool)
Yang, Laura (University of Central Florida)
Yin, Mei (University of Denver)

Smooth Functions on Rough Spaces and Fractals with Connections to Curvature Functional Inequalities
November 20 - 25, 2022

Organizers:

Luke Rogers (University of Connecticut)
Patricia Alonso Ruiz (Texas A&M)
Takashi Kumagai (Waseda University)
Nageswari Shanmugalingam (University of Cincinnati)

Many physical problems, like describing the flow of heat or the oscillation of waves, depend on the geometry of the underlying space. For example, waves are different on a sphere than on a plane or a surface shaped like a saddle because of the way they are curved. Mathematically, some of these problems can be described using analysis (via differential equations) and probability (for example, heat flow can be thought of as a macroscopic effect due to suitably averaged random behavior in many small particles). One can then think of the geometry of a space as constraining the behavior of these analytically or probabilistically defined mathematical objects, or conversely that understanding the behavior of the latter objects reveals something about the underlying geometry. Over many years, sophisticated mathematical tools have been developed to understand and describe this interplay of analysis, geometry and probability in smooth settings, such as smooth curved surfaces.

However, many physical settings do not look like smooth surfaces: lungs are not spherical, the power grid is not linear, and the boundary of a turbulent flow does not look like a surface. Some of these spaces are rough and others have some (statistical) self-similarity or fractal structure. In the past few decades mathematicians have built analytic and probabilistic tools for studying physical problems in some spaces like these, but the nature and role of geometry in these contexts are not yet clear. Studying this and related questions is primarily about understanding the properties of functions that should be thought of as “smooth’’ in these settings. This workshop brought together experts and beginning researchers, whose work involves smooth functions in rough and fractal spaces, for the purpose of sharing perspectives and techniques and with the goal of developing some frameworks for addressing significant problems in this area.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5080

Participants:

Alonso Ruiz, Patricia (Texas A&M)
Barlow, Martin (University of British Columbia)
Baudoin, Fabrice (University of Connecticut)
Björn, Jana (Linköping University)
Bjorn, Anders (Linkoping University)
Cao, Shiping (University of Washington)
Capogna, Luca (Smith College)
Chen, Zhen-Qing (University of Washington)
Chen, Li (Louisiana State University)
Chrontsios-Garitsis, Stathis (University of Illinois at Urbana-Champaign)
Di Marino, Simone (Università di Genova)
Durand-Cartagena, Estibalitz (Universidad Nacional de Educación a Distancia)
Eriksson-Bique, Sylvester (University of Jyväskylä)
Esmayli, Behnam (University of Jyväskylä)
Gibara, Ryan (University of Cincinnati)
Gordina, Masha (University of Connecticut)
Guo, Changyu (Shandong University)
Hinz, Michael (Bielefeld University)
Hu, Jiaxin (Tsinghua University)
Hytönen, Tuomas (University of Helsinki)
Kajino, Naotaka (Kyoto University)
Kigami, Jun (Kyoto University)
Korte, Riikka (Aalto University)
Kumagai, Takashi (Waseda University)
Murugan, Mathav (University of British Columbia)
Ooi, Takumu (Kyoto University)
Ota, Yuta (Kyoto University)
Pasqualetto, Enrico (Scuola Normale Superiore)
Pietruska-Paluba, Katarzyna (Uniwersytet Warszawski)
Rogers, Luke (University of Connecticut)
Sasaya, Kôhei (Kyoto University)
Shanmugalingam, Nageswari (University of Cincinnati)
Shimizu, Ryosuke (Kyoto University)
Sodini, Giacomo (Universität Wien)
Soultanis, Elefterios (Radboud University)
Sturm, Karl-Theodor (University of Bonn)
Teplyaev, Alexander (University of Connecticut)
Wang, Jing (Purdue University)
Zähle, Martina (University of Jena)
Zhang, Yi (The Chinese Academy of Sciences)

Topics in Multiple Time Scale Dynamics
November 27 - December 2, 2022

Organizers:

Hildeberto Jardon Kojakhmetov (University of Groningen)
Maximilian Engel (FU Berlin)
Cinzia Soresina (University of Graz)
Björn Sandstede (Brown University)

Dynamical Systems comprise the mathematical theory of time-dependent phenomena, which are typically modelled by ordinary and/or partial differential equations. In these models, several scales may appear. For instance, certain regulatory processes in the human body may be linked to the fact that a heartbeat takes approximately 0.6 seconds, while a circadian rhythm lasts 86400 seconds (24 hours). Another example occurs in social interactions where humans “tweet” in a time scale of seconds to minutes; chat, have conversations, meet, and take certain decisions in periods of hours to days; while they go to the polls in a time scale of years.

Challenges arise when the objects on the different scales cannot be treated isolatedly and emergent behaviour is displayed, which is only observable in the coupled model. This means that the analysis of the dynamics on each scale does not lead to a reliable description of the full system. To address such challenges, there is a wide range of active mathematical research developing methods which capture the intricacies of multiscale interactions. This workshop gathered leading experts dealing with multiple time-scale problems from both theoretical and applied perspectives. The ultimate goal is to bring together recent theoretical and applied developments, to discuss new and emerging problems and ideas, and to identify promising research directions for the future of multiscale dynamical systems.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5057

Participants:

Atif, Hira (Institute of Business Administration Karachi)
Avitabile, Daniele (VU Amsterdam)
Banerjee, Aniket (Iowa State University)
Barrera, Gerardo (University of Helsinki)
Bergland, Erik (Brown University)
Berglund, Nils (Université d’Orléans)
Bhairat, Sandeep (Institute of Chemical Technology)
Bondesan, Andrea (University of Graz)

Bonetto, Riccardo (University of Groningen)
Carter, Paul (University of California, Irvine)
Chekroun, Mickael (UCLA)
Chemnitz, Robin (FU Berlin)
De Maesschalck, Peter (Hasselt University)
de Rijk, Björn (Karlsruhe Institute of Technology)
Doorakkers, Dirk (VU Amsterdam)
Eckhardt, Daniel (Karlsruhe Institute of Technology)
Eigentler, Lukas (University of Dundee)
Engel, Maximilian (FU Berlin)
Escosio, Rey Audie (University of the Philippines Diliman)
Farotti, Marco (Università degli studi di Camerino)
Fellner, Klemens (University of Graz)
Feudel, Ulrike (Carl von Ossietzky University Oldenburg)
Garain, Koushik (National Institute of Technology Patna)
Gentz, Barbara (University of Bielefeld)
Gottwald, Georg (The University of Sydney)
Grifo', Gabriele (University of Messina)
Hernandez Vargas, Esteban (University of Idaho)
Iuorio, Annalisa (University of Vienna)
Jardon Kojakhmetov, Hildeberto (University of Groningen)
Jelbart, Samuel (TU Munich)
Kaper, Tasso (Boston University)
Katsaounis, Dimitrios (University of St Andrews)
Khan, Farhan (University Of Palermo, Italy)
Klein, Rupert (Freie Universität Berlin)
Koltai, Péter (Freie Universitat Berlin)
Kovtunenko, Victor A. (University of Graz)
Krauskopf, Bernd (University of Auckland)
Kuehn, Christian (Technical University of Munich)
Kumawat, Shyamsunder (Malaviya National Institute of Technology Jaipur)
Kuske, Rachel (Georgia Tech)
L**i, Xue-Mei** (Imperial College London)
Li, Yao (University of Massachusetts Amherst)
Lin, Bohuan (University of Groningen)
Lombardo, Maria Carmela (University of Palermo)
Mandal, Kuntal (Universitat Rovira i Virgili)
Martin, Matteo (University of Padova)
Mishra, Purnedu (Norwegian University of Life Sciences Norway)
Monahan, Adam (University of Victoria)
Mondal, Arpita (IIT Roorkee)
Morselli, David (Swinburne University of Technology and Politecnico di Torino)
Neamtu, Alexandra (University of Konstanz)
Nyabdjo Bamen, Hetsron Legrace (University of Rwanda and AIMS Ghana)
Olicón Méndez, Guillermo (FU Berlin)
Osinga, Hinke (University of Auckland)
P T, Sowndarrajan (VIT University Chennai)
Pavliotis, Grigorios (Imperial College London)
Pedersen, Morten Gram (University of Padova)
Popovic, Nikola (University of Edinburgh)
Ptashnyk, Mariya (Heriot-Watt)
Qi, Weiwei (University of Alberta)
Roberts, Timothy (Brown University)
Roque dos Santos, Edmilson (Universidade de São Paulo)
Sandstede, Björn (Brown University)
Scheel, Arnd (University of Minnesota)
Shilnikov, Andrey (Georgia State University)
Silber, Mary (University of Chicago)
Soresina, Cinzia (University of Graz)
Srivastava, Vaibhava (Iowa State University)
Sung, Baeckkyoung (University of Science & Technology Korea)
Szmolyan, Peter (TU Wien)
Tang, Quoc Bao (University of Graz)
Tian, Moyi (Brown University)
van Heijster, Peter (Wageningen University & Research)
Vitanza, Giorgia (Università degli Studi di Catania)
Wamba Makeng, Huguette Laure (University of Yaoundé 1)
Wan, Charles (Erasmus University)
Yamakou, Marius (FAU Erlangen)
Zacharis, Thomas (University of Edinburgh)

Toric Degenerations
December 04 - 09, 2022

Organizers:

Lara Bossinger (Universidad Nacional Autónoma de México)
Alessio Corti (Imperial College London)
Megumi Harada (McMaster University)
Fatemeh Mohammadi (KU Leuven)

Geometry is the study of the shapes, sizes, and patterns of the many spaces which naturally arise in mathematics and other contexts, such as the "space" of possible configurations of a robot; the space of solutions to a differential equation describing fluid flow; the space of desirable parameters that enable machine learning; and "space-time" used to model our universe. In all these examples, the fundamental geometric properties of the "space" in question directly affect its global properties – is it finite or infinite? Is it flat, or is it curved? Answers to these questions have significant consequences; indeed, general relativity informs us that gravity is an artifact of the curvature of space-time. Thus, geometry is a critical component of many science and engineering disciplines, including but not limited to physics and astronomy, chemistry, biology and biostatistics, mechanics, etc., and, naturally, the continued pursuit of geometry is central to modern mathematics.

The topic of our workshop can be thought of as spaces of solutions to polynomial equation, which additionally exhibit the maximal possible number of mutually compatible symmetries. The presence of these symmetries allows mathematicians to glean information about these spaces that would not otherwise be possible. One of our intended applications and topics was to exploit these symmetries to better understand the process of matrix completion. This is a method frequently used in automated, computer-based decision-making algorithms. A famous example where this technique is used is the "Netflix problem": how to make a computer algorithm decide which movies to recommend to a Netflix user.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5022

Participants:

Alekseev, Anton (University of Geneva)
Anderson, David (The Ohio State University)
Balla, George (RWTH Aachen University, Germany)
Bernstein, Daniel (Tulane University)

Bossinger, Lara (Universidad Nacional Autónoma de México)
Brazelton, Thomas (University of Pennsylvania)
Brion, Michel (Institut Fourier, Université de Grenoble)
Cavey, Ian (Ohio State University)
Chen, Chen (Ohio State University)
Cho, Yunhyung (Sungkyunkwan University)
Cid-Ruiz, Yairon (Ghent University)
Corti, Alessio (Imperial College London)
Crooks, Peter (Utah State University)
de Laporte, Bea (University of Cologne)
De Loera Chávez, Javier (UNAM)
Di Rocco, Sandra (KTH Stockholm)
Eckl, Thomas (University of Liverpool)
Escobar, Laura (Washington University in St. Louis)
Fang, Xin (University of Cologne)
Filip, Matej (University of Ljubljana)
Frías Medina, Juan Bosco (Universidad Michoacana de San Nicolás de Hidalgo)
Fujita, Naoki (Kumamoto University)
Garay López, Cristhian (CIMAT)
George, Courtney (University of Kentucky)
Gómez Galicia, Sergio Gerardo (Cinvestav)
Hacking, Paul (University of Massachusetts Amherst)
Harada, Megumi (McMaster University)
Hering, Milena (Edinburgh University)
Heuberger, Liana (University of Angers)
Huang, Jesse (University of Alberta)
Ilten, Nathan (Simon Fraser University)
Kalashnikov, Elana (University of Waterloo)
Karshon, Yael (University of Toronto, and Tel-Aviv University)
Kaveh, Kiumars (University of Pittsburg)
Khovanskii, Askold (University of Toronto)
Kim, Yoosik (Pusan National University (PNU))
Knutson, Allen (Cornell University)
Kosta, Dimitra (University of Edinburgh)
Küronya, Alex (Goethe Universität, Frankfurt)
Lanini, Martina (Università degli Studi di Roma Tor Vergata)
Leal, Manuel (UNAM)
Lee, Eunjeong (Chungbuk National University)
Littelmann, Peter (Cologne)
Magee, Timothy (Imperial College London)
Manon, Chris (University of Kentucky)
Melo-López, Carolina (Universidad Nacional de Colombia)
Mohammadi, Fatemeh (KU Leuven)
Mokhtar, Ahmad (SFU)
Monin, Leonid (MPI MiS Leipzig)
Müller, Henrik (Universität zu Köln)
Murata, Takuya (Institute for Research in Fundamental Sciences)
Nájera Chávez, Alfredo (Universidad Nacional Autónoma de México)
Nicaise, Johannes (Imperial College London/KU Leuven)
Petracci, Andrea (Università di Bologna)
Portakal, Irem (TU Munich)
Postinghel, Elisa (Università di Trento)
Rietsch, Konstanze (King's College, University of London)
Robins, Sharon (SFU)
Schaefer, Daniel (Universität zu Köln)
Schaffler, Luca (Roma Tre University)
Schaller, Karin (Freie Universität Berlin)
Seemann, Sebastian (KU Leuven)
Shaw, Kris (University of Oslo)
Sherman-Bennett, Melissa (MIT)
Sottile, Frank (Texas A & M University)
Steinert, Christian (RWTH Aachen University)
Süß, Hendrik (Friedrich-Schiller-Universität Jena)
Tolman, Susan (University of Illinois at Urbana-Champaign)
Ulirsch, Martin (Goethe University Frankfurt am Main)
Valdivia Fuentes, Juan Daniel (Universidad Nacional de Ingeniería Perú)
Vargas Antuna, Raúl (Centro de Ciencia Matemáticas - UNAM)
Wang, Charles (Harvard)
Weitsman, Jonathan (Northeastern)
Williams, Lauren (Harvard University)
Wrobel, Milena (University of Oldenburg)
Xu, Chenyang (Princeton)
Yu, Josephine (Georgia Institute of Technology)
Zaffalon, Francesca (KU Leuven)

Banff International Research Station

2022

2-Day Workshops

2-Day Workshops 2022

Apr 8	Apr 10	Mathematical Constitutive Models and Numerical Methods to Simulate Soft Tissue Under Impact Loading
Apr 22	Apr 24	Multiplex Brain Networks
Apr 29	May 1	Ted Lewis SNAP Math Fair Workshop 2020
May 6	May 8	Canadian Math Kangaroo Contest Meeting
Jun 3	Jun 5	Alberta-Montana Combinatorics and Algorithms Day
Jun 17	Jun 19	Canadian Abstract Harmonic Analysis Symposium (CAHAS) 2020
Jun 24	Jun 26	Multitaper Spectral Analysis (Online)
Jul 8	Jul 10	Mathematical challenges in computational chemistry: multiscale, multiconfigurational approaches, machine learning
Jul 15	Jul 17	Math Attack Summer School for Girls
Sep 9	Sep 11	Almost Periodicity in Aperiodic Order
Oct 14	Oct 16	Recent progress in detection and prediction of epilepsy
Nov 18	Nov 20	L-functions in Analytic Number Theory
Dec 9	Dec 11	2-Day Workshop on the Network of Collaborations for Women In Science, Technology, Engineering, and Mathematics

Mathematical Constitutive Models and Numerical Methods to Simulate Soft Tissue Under Impact Loading
April 8 - 10, 2022

Organizers:

Duane Cronin (University of Waterloo)

Matthew Panzer (University of Virginia)

Over the last decade, computational human body models have become prolific in both academic studies and industrial design with the aim to improve human safety in impact events, ultimately to address 'the experiment that cannot be undertaken'. That is, injurious tests on a live human cannot be undertaken, although this knowledge is critical to reduce injury risk in everyday exposures including automotive crash scenarios and sports impacts. More recently human models are critical to simulate response to automated braking and crash avoidance systems, as well as for the development of safety systems in autonomous vehicles, which cannot be addressed using traditional methods such as crash test dummies owing to the unconventional seating positions proposed.

The primary inputs to a detailed human model include geometry, boundary conditions and material properties. Material properties and constitutive models to implement these properties are widely regarded as one of the greatest challenges for the adoption and use of human models. This workshop brought together world experts in tissue characterization, constitutive modeling and human body modeling to address an urgent need to improve mathematical constitutive models representing tissues in human models. This need is driven by the original intent for these models to predict Crash Induced Injuries in automotive crash scenarios, and the current urgent need to address new seating positions in autonomous vehicles, and human pre-crash response for automated driver assist systems such as automatic braking.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2263

Participants:

Bass, Cameron 'Dale' (Duke University)
Bliven, Emily (UBC)
Cripton, Peter (UBC)
Cronin, Duane (University of Waterloo)
Decker, Will (GM/GHBMC)
Espelien, Corina (UVa)
Finan, John (UIC)
Frazer, Lance (SWRI)
Gepner, Bronislaw (University of Virginia)
Hartlen, Devon (University of Waterloo)
Hostetler, Zach Samuel (Wake Forest)
Lin, Chin-Hsu (General Motors)
Masouros, Spyros (Imperial College London)
Panzer, Matthew (University of Virginia)
Reynier, Kristen (UVa)
Rycman, Aleksander (University of Waterloo)
Singh, Dilaver (University of Waterloo)

Multiplex Brain Networks
April 22 - 24, 2022

Organizers:

Joern Davidsen (University of Calgary)
Javier Orlandi (RIKEN Center for Brain Science)
Seung-Woo Son (Hanyang University)
Peter Grassberger (Forschungszentrum Juelich)

Understanding the relationship between structure, dynamics, and function in the brain is a crucial step toward innovative solutions for brain-related diseases such as epilepsy, Parkinson's disease and Autism Spectrum Disorders, and hence, it is of immense importance to society. Complex network approaches have successfully provided new insights about the structure and function of the brain for two decades. With recent advances in data science for neuroscience, the increased complexity of the data such as neurosignals from multiple frequency bands, large-scale optical imaging of neuronal activity, and high-resolution Functional Magnetic Resonance Imaging, has led to the proposition that multilayer-network models are essential to model and understand brain dynamics. This workshop builds on early successes using this framework and brought together a diverse group of world-leading experts of various backgrounds to take the application of multiplex networks in neuroscience to the next level. Bridging the gap between complex network theory and neuroscience. We expect that this workshop and the transdisciplinary collaborations between the different fields and participants will stimulate significant advances in our understanding of the brain and indeed lead to new diagnostic methods and treatments of brain-related diseases in the future.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2263

Participants:

Adams, Elijah (University of Calgary)
Ahn, Yong-Yeol (Indiana University)
Ahn, Sora (Ewha Womans University)
Bray, Signe (University of Calgary)
Chen, Xining (University of Calgary)
Choi, Dahan (Hanyang University)
Colicos, Michael (University of Calgary)
Cone, Jackson (University of Calgary)
Culp, Jordan (University of Calgary)
Curic, Davor (University of Calgary)
Davidsen, Joern (University of Calgary)
Esteki, Koorosh (University of Calgary)
Faryadras, Mahsa (University of Calgary)
Forkert, Nils (University of Calgary)
Goh, Kwang-Il (Korea University)
Gomes da Rocha, Claudia (University of Calgary)
Gomez-Gardenes, Jesus (University of Zaragoza)
Goni, Joaquin (Purdue University)
Grassberger, Peter (Forschungszentrum Juelich)
Gruber, Aaron (University of Lethbridge)
Ha, Meesoon (Chosun University)
Jeong, Hawoong (KAIST)

Jeong, Yeonsu (Hanyang University)
Kahng, Byungnam (KENTECH)
Khazali, Banafsheh (University of Calgary)
Kim, Beom Jun (Sungkyunkwan University)
Kim, Heetae (KENTECH)
Kim, Gwangsu (KAIST)
Kwon, Yongsung (Hanyang University)
Lameu, Ewandson (University of Calgary)
Lee, Deok-Sun (Korea Institute for Advanced Study)
Lee, Mi Jin (Hanyang University)
Lee, Hae Seong (Sungkyunkwan University)
Lehnertz, Klaus (University of Bonn)
Leyva, Inmaculada (Universidad Rey Juan Carlos)
Masoliver, Maria (University of Calgary)
Masuda, Naoki (State University of New York at Buffalo)
Misic, Bratislav (McGill University)
Moesser, Melanie (University of Calgary (University of Frankfurt))
Mohajerani, Majid (Unviersity of Lethbridge)
Newton, Thomas (University of Calgary)
Nicola, Wilten (University of Calgary)
Orlandi, Javier (RIKEN Center for Brain Science)
Park, Yeongwon (Hanyang University)
Protzner, Andrea (University of Calgary)
Rezaei, Zahra (University of Lethbridge)
Seo, Hyemyung (Hanyang University)
Seo, Enubi (Hanyang University)
Son, Seung-Woo (Hanyang University)
Soriano, Jordi (University of Barcelona)
Strayer, Kathryn (University of Calgary)
Torabi, Reza (University of Calgary)
Towlson, Emma (University of Calgary)
Zhang, Coco (University of Calgary)
Zhang, Lei (Universeity of Regina)
Zochowski, Michal (University of Michigan)

Ted Lewis SNAP Math Fair Workshop 2020
April 29 - May 1, 2022

Organizers:

Sean Graves (University of Alberta)

Trevor Pasanen (University of Alberta)

Over the past few years, it has become apparent the importance in finding 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. This would be the eighteenth annual Ted Lewis Math Fair Workshop at BIRS. The workshop is extremely popular with teachers in elementary and secondary schools, provides them with resources for lesson plans, and is helping to reshape the way mathematics is being approached in schools. Problem-solving and puzzles in the classroom are 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 a front-line approach in the collaborative effort between mathematicians, more experienced teachers, and all teachers interested in professional development to improve mathematics teaching at the elementary level and beyond. To have teachers share their valuable experiences with the math fair in their own schools is the best and most useful information to others. Teachers in Alberta and participants from outside viewed the Ted Lewis Workshop as one of PIMS and BIRS's most valuable education initiatives.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2257

Participants:

Clampit, Sydney (Parkland School Division)
Dawes, Cheryl (PSD)
DeDieu, Lauren (University of Calgary)
Fehr, AJ (St. Albert Public Schools)
Graves, Sean (University of Alberta)
Hoffman, Janice (Edmonton Public Schools)
Hohn, Tiina (MacEwan University)
Leung, Fok-Shuen (University of British Columbia)
Lewis, Ted (SNAP Mathematics Foundation & U of Alberta)
Lore, Pat (Edmonton Public Schools - Centre for Education)
Lorway, Geri (Thinking 101/University of Alberta)
Maciejewski, Wes (University of Alberta)
Makokis-Lee, Monique (University of Alberta)
Niezen, Joanna (Simon Fraser University)
Northwest, Kyle (Ermineskin Elementary School)
Pasanen, Trevor (University of Alberta)
Shaw, Dolph (Edmonton Public Schools)
Wi, Dami (University of Alberta (Alumni))

Canadian Math Kangaroo Contest Meeting
May 6 - 8, 2022

Organizers:

Rossitza Marinova (Concordia University of Edmonton) Tzvetalin Vassilev (Nipissing University)

The Canadian Math Kangaroo Contest (CMKC) aims to dispel the myth that mathematics is inaccessible and difficult by using an all-inclusive and open mathematics competition to create a positive environment that emphasizes the practical and fun nature of mathematics. Since joining the International Association “Kangaroo without Borders” in 2006, the CMKC has formed hosting partnerships with multiple universities and prestigious organizations across the country. Since its inception, the CMKC has found many ways to expand the reach and scope of its unique program and to build new, complementary programs based upon the competition. Over the past 14 years, the CMKC has grown significantly from its humble beginnings with approximately 300 participants at 3 locations to just over 6900 students nationwide in the 2019 competition in more than 50 locations in 9 provinces across Canada. The purpose of the workshop was to chart the future course for Math Kangaroo in Canada.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2263

Participants:

Anton, Cristina (Grant MacEwan College)
Archibald, Jana (University of Lethbridge)
Caceres, Luis (University of Puerto Rico)
Chlebovec, Christopher (Lakehead University)
Christ, Janet (Walter Murray Collegiate)
De Silva, Supun (Athabasca University)
Fung, Agnes (Canadian Math Kangaroo Contest)
Hamdan, Mo (UNB)
Hu, Shengda (Wilfrid Laurier University)
Kharchuk, Andriy (Rare Elements)
Lin, Fuhua (Athabasca University)
Maidorn, Patrick (University of Regina)
Marinova, Rossitza (Concordia University of Edmonton)
Matthiesen, Joanna (Harris Library)
Pandeliev, Todor (General Dynamics Mission Systems)
Pandelieva, Valeria (Canadian Math Kangaroo Contest)
Passi, Kalpdrum (Laurentian University)
Pelczer, Ildiko (Concordia University Montreal)
Petterson, Josey (Canadian Math Kangaroo Contest)
Randhawa, Supreet (University of Toronto St. George)
Sendov, Hristo (University of Western Ontario)
Srivastava, Gautam (Brandon University)
Svishchuk, Mariya (Mount Royal University)
Talboom, John (Trent University)
Tomoda, Satoshi (Okanagan College)
Tran, Kyle (University of Toronto St. George)
Vassilev, Tzvetalin (Nipissing University)
Viola, Maria Grazia (Lakehead University)

Alberta-Montana Combinatorics and Algorithms Day
June 3 - 5, 2022

Organizers:

Hadi Kharaghani (University of Lethbridge)
Ryan Hayward (University of Alberta)
Mark Kayll (University of Montana)
Robert Woodrow (University of Calgary)

The event brought together faculty and students from three Alberta universities (in Calgary, Lethbridge, and Edmonton) and the University of Montana (Missoula). Combinatorics is the branch of mathematics concerned with finite sets: their properties, structures, and number. Studying the classic Rubik's Cube reveals the number of possible positions (it's 43,252,003,274,489,856,000). Understanding the cube's structure leads to efficient algorithms for solving it (an Algorithm is a sequence of well-defined instructions for solving a problem, answering a question, or even playing a game). In 2010, a group of researchers working with Google proved that every one of that staggering number of positions could be solved in no more than 20 moves.

The fields of Combinatorics and Algorithms became inextricably linked at the dawn of the computer age due to computers themselves being finite structures. This meeting offered researchers in these fields an opportunity to share their recent successes, tackle open problems together, and expose their students to the latest methods and developments.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2245

Participants:

Abdi, Davoud (University of Calgary)
Cavers, Mike (University of Toronto Scarborough)
Chen, Xinyue (University of Alberta)
Craigen, Robert (University of Manitoba)
Friggstad, Zachary (University of Alberta)
Halfpap, Anastasia (University of Montana)
Hayward, Ryan (University of Alberta)
Holzmann, Wolfgang (University of Lethbridge)
Jamshidian, Mahya (University of Alberta)
Kayll, Mark (University of Montana)
Kharaghani, Hadi (University of Lethbridge)
Miraftab, Babak (University of Lethbridge)
Morris, Joy (University of Lethbridge)
Mousavi, Ramin (University of Alberta)
Palmer, Cory (University of Montana)
Pender, Thomas (University of Lethbridge)
Sands, Bill (University of Calgary)
Van't Land, Caleb (University of Lethbridge)
Vasudevan, Kris (University of Calgary)
Wei, Ting-Han (University of Alberta)
Wood, Ryan (University of Montana)
Woodrow, Robert (University of Calgary)
Zaitsev, Vlad (University of Lethbridge)

Canadian Abstract Harmonic Analysis Symposium (CAHAS)
May 6 - 8, 2022

Organizers:

Volker Runde (University of Alberta)
Brian Forrest (University of Waterloo)
Keith Taylor (Dalhousie University)

Abstract harmonic analysis has evolved out of classical Fourier analysis; it deals with locally compact groups, their representations, and the Banach algebras associated with them.

Abstract harmonic analysis has had a strong presence in Canada's mathematical community for several decades. Since 1997, the Canadian Abstract Harmonic Analysis Symposium has been successful in bringing together researchers, from Canada and abroad, in abstract harmonic analysis and related areas, such as Banach algebras, operator algebras, and operator spaces. This meeting continued this tradition and provided a forum for researchers in the area for fruitful interaction. This particular meeting also paid tribute to Anthony To-Ming Lau, a major contributor to the area over decades, who retired effective June 30, 2020.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2235

Participants:

Anderson-Sackaney, Ben (University of Waterloo)
Choi, Yemon (Lancaster University)
Crann, Jason (Carleton University)
Daws, Matthew (University of Central Lancashire)
Elgun-Kirimli, Elcim (Acibadem University)
Forrest, Brian (University of Waterloo)
Galindo, Jorge (Universitat Jaume I)
Gardella, Eusebio (Chalmers University)
Ghandehari, Mahya (University of Delaware)
Hollingsworth, Kris (University of Minnesota)
Hu, Zhiguo (University of Windsor)
Ilie, Monica (Lakehead University)
Kazemi, Soroush (Carleton University)
Lee, Hun Hee (Seoul National University)
Lin, Ying-Fen (Queen's University Belfast)
Loy, Rick (Australian National University)
Milad, Raja (Dalhousie University)
Neufang, Matthias (Carleton University)
Ng, Chi-Keung (Nankai University)
Oztop-Kaptanoglu, Serap (University of Istanbul)
Potter, Tom (Dalhousie University)
Runde, Volker (University of Alberta)
Sangani Monfared, Mehdi (University of Windsor)
Sawatzky, John (University of Waterloo)
Spronk, Nico (University of Waterloo)
Stokke, Ross (University of Winnipeg)
Thamizhazhagan, Aasaimani (University of Winnipeg)
Thiel, Hannes (Kiel University)
Todorov, Ivan (University of Delaware)
Turowska, Lyudmila (Chalmers University)
Ulger, Ali (Koc University)
Vati, Kedumetse (University of Alberta)
Viselter, Ami (University of Haifa)
Vujicic, Aleksa (University of Waterloo)
Wiersma, Matthew (University of Winnipeg)
Willis, George (University of Newcastle, New South Wales)
Zadeh, Safoura (University of Bristol)
Zhang, Yong (University of Manitoba)
Zhu, Yihan (University of Windsor)

Multitaper Spectral Analysis (Online)
June 24 - 26, 2022

Organizers:

Charlotte Haley (Argonne National Laboratory)
Wesley Burr (Trent University)
David Riegert (Trent University)
David Thomson (Queen's University)

Fourier transforms bridge the gap between time and frequency thus making it possible to analyze data organized in time in terms of either lags or cycles. Schuster analyzed the first time series in terms of its Fourier cyclical components in 1898, whilst mathematicians have studied functions that are both finite in time and contained in a short bands in frequency since the 1960's. The Thomson multitaper method combines these two notions to estimate contributions to signal variance in terms of discrete frequency bins using bandlimited sequences. Since its publication in 1982, the multitaper method has been shown to have numerous performance advantages over other estimators, and has been applied to the analysis of time series previously thought to be "too pathological" for conventional spectrum estimators to produce any scientific conclusion, either because of small sample sizes, or because the spectrum being estimated has large range.
This workshop brought together researchers in mathematics and statistics to discuss the next generation of problems evolving from the analysis of time series and spatiotemporal data using multitaper methods.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2230

Participants:

Abreu, Luis Daniel (University of Vienna)
Aiello, Emily (Cytel)
Anitescu, Mihai (Argonne National Lab)
Boteler, Claire (Dalhousie University)
Burr, Wesley (Trent University)
Caicedo Vivas, Joan Sebastian (University of Delaware)
Chandna, Swati (Birkbeck - University of London)
Chave, Alan (Woods Hole Oceanographic Institution)
Craigmile, Peter (The Ohio State University)
Das, Proloy (Massachusetts General Hospital)

Dodson-Robinson, Sally (University of Delaware)
Frazer, William (Yale University)
Grainger, Jake (Lancaster University)
Griffith, Skyepaphora (Queen's University)
Grunbaum, Francisco Alberto (University of California, Berkeley)
Haley, Charlotte (Argonne National Laboratory)
Harrell, Justin (University of Delaware)
Hinnov, Linda (George Mason University)
Kaur, Pashmeen (The Ohio State University)
Lakey, Joe (New Mexico State University)
Lilly, Jonathan (Planetary Science Institute)
Mann, Michael (The Pennsylvania State University)
Marshall, Francois (Boston University)
McLennan, Lauren (Dalhousie University)
Olhede, Sofia (Ecole Polytechnique Federale de Lausanne)
Ott, Benjamin (Queen's University)
Park, Jeffrey (Yale University)
Patil, Aarya (University of Toronto)
Percival, Donald B. (University of Washington)
Prieto, German (Universidad Nacional de Colombia)
Qiang, Rui (The Ohio State University)
Ramirez-Delgado, Victor (University of Delaware)
Riegert, David (Trent University)
Romero, Jose Luis (University of Vienna)
Rupasinghe, Anuththara (University of Maryland, College Park)
Scharf, Louis (Colorado State University)
Sidorenko, Alexander (Renyi Institute of Mathematics)
Sigloch, Karin (CNRS Geoazur, Université Côte d'Azur)
Simons, Frederik J (Princeton University)
Somerset, Emily (University of Toronto)
Speagle, Josh (University of Toronto)
Speckbacher, Michael (University of Vienna)
Springford, Aaron (Cytel)
Sykulski, Adam (University of Lancaster)
Takahara, Glen (Queen's University)
Thomson, David (Queen's University)
Vernon, Frank (UCSD)
Yatharth, Yatharth (Queen's University)

Mathematical challenges in computational chemistry: multiscale, multiconfigurational approaches, machine learning
July 8 - 10, 2022

Organizers:

Sergey Gusarov (National Research Council Canada)
Alexander Kobryn (National Research Council Canada)
Stanislav Stoyanov (Natural Resources Canada)
Valera Veryazov (Lund University, Sweden)

This workshop was dedicated to the current mathematical and computational problems of QC, and brought together experts actively involved into development of mathematical tools and ideas for QC immediately after the world largest computational chemistry congress to be held in Vancouver in August 2020. The idea of such event is long overdue because the majority of the computational codes in quantum chemistry have been developed by
i) chemists/physicists,
ii) long time ago,
iii) grew to very large packages.

There is a need of a revision of these huge, dusty and amateur codes and approaches. We expect that this can be done by considering, planning and implementing the following:
1. Efficient use of Linear Algebra, Fast Fourier, etc.
2. Revising parallel algorithms and implementations
3. Pointing problems in QC which can benefit from Machine Learning: tuning parameters, selection of active space etc.
4. Reconsidering resources: many algorithmic solutions were made at the time of limited memory, single core architecture, etc.
5. Adaptation of new computer technologies, new hardware and their use in QC. Interaction with hardware and software developers and explaining them our immediate needs.
6. Scaling of QC algorithms with respect to the future development of hardware.
7. Deep mathematical revision of current methodologies used in QC
8. What we expect to compute in 10 years?

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2262

Participants:

Chen, Zhuoheng (Geological Survey of Canada)
Choi, Phillip (Chem. Mater. Eng)
Gusarov, Sergey (National Research Council Canada)
Higashi, Masahiro (Kyoto University)
Kobryn, Alexander (National Research Council Canada)
Liu, Jon (GSC-Calgary)
Lyubimova, Olga (N/A)
Malamace da Silva, Victor Hugo (University of Alberta)
Mane, Jonathan (Natural Resources Canada)
Pereira Da Costa, Gabriel (University of Alberta)
Ryde, Ulf (Lund University)
Siahrostami, Samira (University of Calgary)
Stoyanov, Stanislav (Natural Resources Canada)
Takahashi, Ken (Kyoto University)
Veryazov, Valera (Lund University, Sweden)

Math Attack Summer School for Girls
July 15 - 17, 2022

Organizers:

Sean Graves (University of Alberta)

Lauren DeDieu (University of Calgary)

In (STEM) fields such as mathematics, little progress has been made to increase the diversity of individuals in leadership positions. Furthermore, at co-ed camps, the young boys can often be excitable and boisterous, creating an unsatisfactory learning environment for the female participants. In the past decade, only one female student has competed on the Canadian IMO team, and the underrepresentation of women is apparent in our undergraduate math classrooms. The 2021 Math Attack Summer Camp for Girls provided a supportive environment for participants aged 14 to 17 who identify as female to meet peers with similar interests in STEM fields - particularly mathematics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2001

Participants:

Aggarson, Jeena (Student)
Andrew, Claire (Student)
Cao, Lisa (Student)
Chen, Michelle (Student)
Chen, Trinity (Student)
DeDieu, Lauren (University of Calgary)
Goyal, Isha (Student)
Hua, Jenny (High School Student)
Ji, Yonghua (Student)
Jiao, Bella (Student)
Kahlon, Karmin (Student)
Li, Sunny (Student)
Li, Ziyu (Student)
Lu, Ashlyn (Student)
Miao, Julia (Student)
Mo, Michelle (High School Student)
Nie, Milly (Student)
Pan, Chenwei (Student)
Pyatalova, Sofia (Student)
Wang, Iris (Student)
Wi, Dami (University of Alberta (Alumni))
Yang, Emily (High School Student)
Yang, Alice (High School)
Zhai, Chloe (Student)
Zhang, Caroline (Student)

Almost Periodicity in Aperiodic Order
September 9 - 11, 2022

Organizers:

Nicolae Strungaru (MacEwan University)
Michael Baake (Bielefeld University)
Natalie Frank (Vassar College)

The theory of Aperiodic Order was stimulated by the discovery of quasicrystals in the 1980s by Dan Shechtman, a discovery for which he was awarded the 2011 Nobel Prize in Chemistry. It was built upon the groundbreaking work of Yves Meyer and Roger Penrose from the 1970s, and major contributions were made by Jeffrey Lagarias and Robert Moody in the 1990s.

This area of mathematics studies systems with long-range order, typically manifested by a large Bragg diffraction spectrum but without translation symmetries. It connects seemingly different areas of mathematics, such as harmonic analysis, dynamical systems and ergodic theory, spectral theory, discrete geometry and Fourier analysis, to name just a few. This meeting focused on the recent developments regarding the connection between almost periodicity, dynamical systems and aperiodic order.

This meeting is dedicated to the memory of our colleague Uwe Grimm, who unexpectedly passed away last year.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2232

Participants:

Baake, Michael (Bielefeld University)
Berthe, Valerie (IRIF)
Bustos-Gajardo, Alvaro (Open University)
Coons, Michael (California State University, Chico)
Cortez, Maria Isabel (Pontificia Universidad Católica de Chile)
Damanik, David (Rice University)
Emilsdottir, Iris (Rice University)
Frank, Natalie (Vassar College)
Gähler, Franz (Universität Bielefeld)

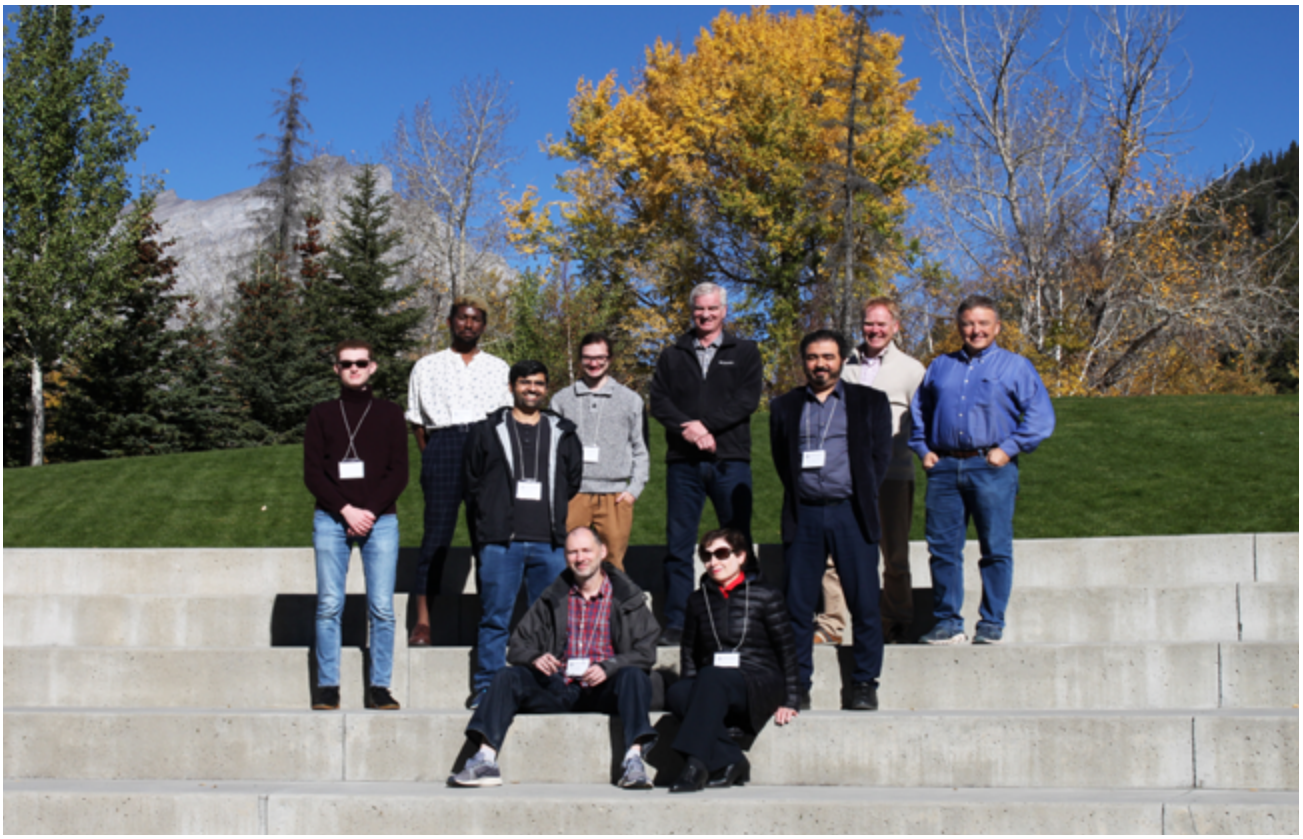
García-Ramos, Felipe (Universidad Autonoma de San Luis Potosi)
Glubokov, Andrey (Purdue University)
Grimm, Jasper (University of York)
Hauser, Till (Max Planck Institute Bonn)
Humeniuk, Adam (MacEwan University)
Kellendonk, Johannes (Universite Claude Bernard Lyon 1)
Keller, Gerhard (Universitat Erlangen-Nurnberg)
Klick, Anna (Bielefeld University)
Korfanty, Emily Rose (University of Alberta)
Lagarias, Jeffrey (University of Michigan)
Lee, Jeong-Yup (Catholic Kwandong University)
Lenz, Daniel (Friedrich-Schiller-Universität Jena)
Manibo, Neil (University of Bielefeld/Open University)
Mazac, Jan (Bielefeld University)
Miro, Eden Delight (Ateneo de Manila University)
Moody, Robert (University of Victoria)
Pouti, Aisling (MacEwan University)
Richard, Christoph (FAU Erlangen-Nuremberg)
Robinson, E. Arthur (George Washington University)
Rust, Dan (The Open University)
Sadun, Lorenzo (University of Texas at Austin)
Sell, Daniel (Nicolaus Copernicus University)
Sing, Bernd (University of the West Indies)
Spindeler, Timo (University of Bielefeld)
Staynova, Petra (University of Derby)
Strungaru, Nicolae (MacEwan University)
Walton, Jamie (University of Nottingham)
Walton, Jamie (University of Nottingham)
Whittaker, Mike (University of Glasgow)
Yassawi, Reem (Open University)

Recent Progress in Detection and Prediction of Epilepsy
October 14 - 16, 2022

Organizers:

Elena Braverman (University of Calgary)

Gordon Teskey (University of Calgary)



Human epilepsy is a common neurological disorder, 0.6% of Canadian suffer from it. The focus of this 2-days meeting is the mathematical processing of epilepsy-associated EEG data and its role in seizure analysis and diagnostics. This workshop brought together three groups of researchers: physicians specializing in drug-resistant epilepsy, behavioral neuroscientists, and applied mathematicians. Thanks to the first group, extensive clinical data is available with a detailed description. The second group experiments with animals, and some data analysis methods can be applied to clinical data as well. This is a conference, a brainstorming activity and a training opportunity for research associates, postdoctoral fellows and graduate students involved in all three groups. The participants are members of the mathematics and statistics departments, neurology, clinical neurosciences, cell biology, physiology, psychology and practicing medical doctors.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2244

Participants:

Bazhan, Yanina (University of Calgary)
Beck, Asad (University of Washington)
Braverman, Elena (University of Calgary)
Campbell, Sue Ann (University of Waterloo)
Cavers, Michael (University of Toronto Scarborough)
Davidsen, Joern (University of Calgary)
Girvitz, Daniel (University of Calgary)
Lefebvre, Jeremie (University of Ottawa)
Luczak, Artur (University of Lethbridge)
Mohajerani, Majid (University of Lethbridge)
Nicola, Wilten (University of Calgary)
Patton, Andrew (University of Calgary)
Rai, Juhi (Shri Ramdeobaba College of Engineering and Management)
Rich, Scott (Krembil Brain Institute)
Teskey, Gordon (University of Calgary)
Valiante, Taufik A. (Krembil Brain Institute)
Vasudevan, Alexander (Oxford University)
Ware, Tony (The University of Calgary)

L-functions in Analytic Number Theory
November 18 - 20, 2022

Organizers:

Alia Hamieh (University of Northern British Columbia)
Habiba Kadiri (University of Lethbridge)
Greg Martin (University of British Columbia)

Human epilepsy is a common neurological disorder, 0.6% of Canadian suffer from it. The focus of this 2-days meeting is the mathematical processing of epilepsy-associated EEG data and its role in seizure analysis and diagnostics. This workshop brought together three groups of researchers: physicians specializing in drug-resistant epilepsy, behavioral neuroscientists, and applied mathematicians. Thanks to the first group, extensive clinical data is available with a detailed description. The second group experiments with animals, and some data analysis methods can be applied to clinical data as well. This is a conference, a brainstorming activity and a training opportunity for research associates, postdoctoral fellows and graduate students involved in all three groups. The participants are members of the mathematics and statistics departments, neurology, clinical neurosciences, cell biology, physiology, psychology and practicing medical doctors.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2003

Participants:

Akbary, Amir (University of Lethbridge)
Akhtari, Shabnam (Pennsylvania State University)
Baluyot, Siegfred (American Institute of Mathematics)
Bao, Zhengheng (UBC)
Baril Boudreau, Félix (University of Lethbridge)
Bellotti, Chiara (UNSW Canberra)
Benli, Kubra (University of Lethbridge)
Bennett, Michael (University of British Columbia)
Bhattacharya, Shubhrajit (University of British Columbia)
Bose, Arnab (University of Lethbridge)
Cech, Martin (Concordia University)
Cha, Byungchul (Muhlenberg College)
Chandee, Vorrapan (Kansas State University)
Choi, Stephen (Simon Fraser University)
chorge, shashank (University of Rochester)
Cicek, Fatma (University of Northern British Columbia)
Cully-Hugill, Michaela (University of New South Wales Canberra)
Das, Sourabh (University of Waterloo)
Devin, Lucile (Université du Littoral)
Elma, Ertan (University of Lethbridge)
Ermoshin, Ivan (Saint Petersburg State University)
Ernvall-Hytonen, Anne-Maria (University of Helsinki)
Fazzari, Alessandro (American Institute of Mathematics)
Feuerverger, Andrey (University of Toronto)
Fiori, Andrew (University of Lethbridge)
Fiorilli, Daniel (CNRS Université Paris-Saclay)
Florea, Alexandra (UC Irvine)
Gheisari, Hiva (University of Lethbridge)
Hamieh, Alia (University of Northern British Columbia)
Hathi, Shehzad (UNSW Canberra)
Hiary, Ghaith (Ohio State University)
Jacobson, Jr., Michael (University of Calgary)
Jalalvand, Fatemeh (University of Calgary)
Kadiri, Habiba (University of Lethbridge)
Kazemlou, Daniel (University of Bonn)
Kerr, Bryce (UNSW Canberra)
Khale, Tanmay (University of Illinois Urbana-Champaign)
Kim, Seoyoung (University of Goettingen)
Kin Ming, Tsang (UBC)
Kwan, Chung Hang (University College London)
Kwon, Soun-Hi (Korea University)
Lalin, Matilde (Université de Montréal)
Lamzouri, Youness (Institut Élie Cartan de Lorraine)
Lee, Etan (UNSW Canberra)
Lee, Min (University of Bristol)
Leong, Nicol (UNSW Canberra)
Li, Wanlin (Centre de Recherches Mathématiques)
Li, Junxian (Universität Bonn)
Lin, Yongxiao (Shandong University)
Lugmayer, Solomon (The university of York)
Lumley, Allysa (York University)
Males, Joshua (PIMS/University of Manitoba)
Malik, Amita (Max Planck Institute for Mathematics)
Markham, Taylor (University of Calgary)
Martin, Greg (University of British Columbia)
Mathurin-Moe, Martha (University of Lethbridge)
Milinovich, Micah (University of Mississippi)
Murty, Ram (Queens University)
Muthukrishnan, Subramani (Indian Institute of Information Technology)
Ng, Nathan (University of Lethbridge)
Nguyen, Dang Khoa (University of Calgary)
Patnaik, Manish (University of Alberta)
Platt, David (University of Bristol)
Ramare, Olivier (CNRS / Aix Marseille Univ.)
Sahay, Anurag (University of Rochester)
Samanta, Praneel (University of Iowa)
Scheidler, Renate (University of Calgary)
Sedunova, Alisa (St. Petersburg State University)
Shen, Quanli (Shandong University (Weihai))
Sinha, Kaneenika (IISER Pune)
Starichkova, Valeriia (UNSW Canberra)
Streipel, Jakob (University of Maine)
Stucky, Joshua (University of Georgia)
Tanabe, Naomi (Bowdoin College)
Tran, Ha (Concordia University of Edmonton)
Treviño, Enrique (Lake Forest College)
Trudgian, Tim (University of New South Wales Canberra)
Turnage-Butterbaugh, Caroline (Carleton College)
Vatwani, Akshaa (IIT Gandhinagar)
Vo, Tan (UNBC)
Vu, Truong (University of Illinois at Chicago)
Whitehead, Ian (Swarthmore College)
Wong, Peng-Jie (National Center for Theoretical Sciences)
Xiao, Stanley (University of Northern British Columbia)
Yip, Chi Hoi (University of British Columbia)
Zaman, Asif (University of Toronto)

Network of Collaborations for Women In Science, Technology, Engineering, and Mathematics
December 9 - 11, 2022

Organizers:

Laleh Behjat (University of Calgary)
Shohini Ghose (Wilfrid Laurier University)
Catherine Mavriplis (University of Ottawa)
Anne Ndegwa (University of Calgary)

The Network of Collaborations workshop was organized by the Natural Sciences and Engineering Research Council (NSERC) Chairs for Women in Science and Engineering (CWSE). A key objective of the NSERC CWSE program was to raise the level of participation and retention of women in science, technology, engineering, and mathematics (STEM). The intended format for the 2-day workshop was for participants, who are all women academics in STEM, to come together to exchange ideas, foster creative collaborations, and interdisciplinary interactions, and provide a forum for vigorous research-oriented discussions. The focus of the 2-day workshop was on creative collaborations in research and development. The program specifically included activities to actively support early-career researchers from underrepresented groups in STEM. The project groups are comprised of academics from across Canada and come from multidisciplinary fields, including engineering, science, and mathematics. The goal of the research project collaboration was to develop new research/technologies in disease detection using biomarkers, adaptive exoskeletons using smart technology, and new methods for resource recovery and analysis in wastewater.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2005

Participants:

Agrawal, Nisha (University of Ontario Institute of Technology)
Bauer, Kristine (University of Calgary)
Behjat, Laleh (University of Calgary)
Bekker, Jessica (University of Calgary)
Bodkhe, Sampada (Polytechnique Montréal)
Charbonneau, Marie (University of Calgary)
Coe, Imogen (Toronto Metropolitan University)
Farenhorst, Annemieke (University of Manitoba)
Franz-Odendaal, Tamara (Mount Saint Vincent University)
Ghose, Shohini (Wilfrid Laurier University)
Hardeman Morrill, Rachel (University of Calgary)
Hennessey, Eden (Wilfrid Laurier University)

Jakobi, Jennifer (University of British Columbia)
Jones, Kim (McMaster University)
Kaur, Kamalpreet (National Research Council, Montreal)
Langelier, Eve (Sherbrooke University)
MacDonald, Jane Shaw (Simon Fraser University)
Mavriplis, Catherine (University of Ottawa)
Mayes-Tang, Sarah (University of Toronto)
Nascimento, Nathalia (University of Waterloo)
Ndegwa, Anne (University of Calgary)
Ploeg, Heidi-Lynn (Queens University)
Pulicharla, Rama (York University)
Rajulapati, Chandra (University of Manitoba)
Willis, Lisa (University of Alberta)

Banff International Research Station

2022

Focussed Research Group

Focused Research Group

Mar 13	Mar 20	Computability and complexity of statistical behavior of dynamical systems
May 22	May 29	Dynamics of biopolymers across multiple scales
May 29	Jun 5	Decomposition Theories for Discrete Dynamical Systems: An Approach to Modularity of Biological Systems
Jun 5	Jun 19	Geometric Interpretation and Visualization of Multi-Parameter Persistent Homology
Jun 12	Jun 25	Cohomogeneity Two Manifolds of Positive Sectional Curvature
Jul 10	Jul 17	Studying PDE dynamics via optimization with integral inequality constraints
Jul 17	Jul 24	Novel perspectives in kinetic equations for emerging phenomena
Aug 14	Aug 21	SYZ mirror symmetry and its applications
Aug 21	Aug 28	Novel fluid/structure/field (FFSI) modeling framework in the context of ion channels (Cancelled)
Oct 30	Nov 6	Predicting and Preventing Wellbore Leakage
Nov 13	Nov 20	Mathematical Modelling and Machine Learning for Phonetics
Nov 20	Dec 4	Non-Classical Constructions in Tensor Categories and Conformal Field Theory

Computability and Complexity of Statistical Behavior of Dynamical Systems
March 13 - 20, 2022

Organizers:

Michael Yampolsky (University of Toronto)

Cristóbal Rojas (Universidad Católica de Chile)

Dynamical systems are often used to model natural phenomena, with a large number of applications, and computer simulations of dynamical systems are playing an increasingly important role in exploring and forecasting the long-term features of concrete systems. However, recent theoretical developments indicate that systems exhibiting a physically robust behavior that challenges the modern paradigm of computer simulations may be more common than it was previously thought. It becomes therefore highly desirable to develop a theoretical understanding of what makes the long-term behavior of a dynamical system difficult to compute, and of how and when one can hope for reliable and efficient methods to produce certified computations. Our research group sought to understand how the dynamical, analytical or geometrical properties of a system affect the computational aspects of predicting its long-term features. In particular, we focused on studying different aspects of the computational intractability phenomenon in dynamics, in order to determine the extent to which we can expect to actually encounter these kinds of systems around us.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg253

Participants:

Berger, Pierre (CNRS - Sorbonne Université)
Gaidashev, Denis (University of Uppsala)
Helfter, Mathieu (Institut Mathématique de Jussieu)
Rojas, Cristóbal (Universidad Católica de Chile)
Yampolsky, Michael (University of Toronto)

Dynamics of Biopolymers Across Multiple Scales
May 22 - 29, 2022

Organizers:

Adriana Dawes (The Ohio State University)

Cells rely on an internal network of biopolymers to provide structural support and scaffolding for a diverse set of biological processes. Actin is one such biopolymer, capable of orchestrating higher-order processes that ultimately drive macroscale behaviour including cell motility. Actin polymer filaments, in addition to the proteins that act upon these structures, form an interconnected biological meshwork displaying complex and heterogeneous spatiotemporal dynamics. The actin polymers continuously remodel both themselves and the meshwork they form, resulting in a dense network with various micro-structures. Mathematical models provide a powerful method to gain insight into and create predictions of fundamental mechanisms underlying observable phenomena. However, a unique challenge is presented in modelling semi-flexible polymers in an active-matter system existing across a broad length scale, spanning from the level of protein molecular interactions to the moving, whole-cell level.

This Focused Research Group brought together a team of women in mathematical biology to develop connected stochastic and continuum models to represent actin dynamics at the micro- and macro-scales, respectively. These mathematical formulations incorporate biologically relevant parameters and link large-scale behaviour, inferred from experimental observations to small-scale, local interactions. We implemented concrete measures to bridge these micro-macro scale representations and subsequently investigate the sensitivity of these measures to changes in the parameter space. Taken together, these models predict the time-resolved evolution of the actin network by connecting actin dynamics across scales. The jointed models will enable exploration of the relationship between local actin dynamics and global whole-cell behaviour.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg264

Participants:

Bannish, Brittany (University of Central Oklahoma)
Copos, Calina (Northeastern)
Dawes, Adriana (The Ohio State University)
Gasior, Kelsey (University of Ottawa)
Rostami, Minghao W. (Syracuse University)

Decomposition Theories for Discrete Dynamical Systems: An Approach to Modularity of Biological Systems May 29 - June 5, 2022

Organizers:

Claus Kadelka (Iowa State University)

One of the major challenges to our understanding of how biological systems from individual cells to ecosystems work is that there don't seem to be "fundamental laws" of biology, like those that exist for physics, from equations that describe the effect of gravity to rules that govern the interactions of elementary particles with each other. Now, that the life sciences are increasingly becoming data-rich through newly emerging technologies, more biological systems can be modeled mathematically. This opens up the possibility of looking for fundamental design principles of systems in their mathematical representations.

One of those principles is hypothesized to be modular design, meaning that systems are built from basic components, highly preserved across species and across evolutionary time, but combined in all sorts of new ways. By analogy, a Chevy and a Ferrari consist basically of the same type of components, such as alternators and gearboxes, but they are assembled in very different ways to create a great variety of automobiles. This program investigated a class of dynamic simulation models of the molecular machinery inside mammalian cells, hoping to identify such modular structures that could be used as basic building blocks. This research could open up a new venue to one of the fundamental laws governing biological systems and their evolution.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg001

Participants:

Kadelka, Claus (Iowa State University)
Laubenbacher, Reinhard (University of Florida)
Murrugarra, David (University of Kentucky)
Veliz-Cuba, Alan (University of Dayton)
Wheeler, Matthew (University of Florida)

Geometric Interpretation and Visualization of Multi-Parameter Persistent Homology
June 5 - 19, 2022

Organizers:

Claudia Landi (Università di Modena e Reggio Emilia)
Robyn Brooks (Boston College)
Celia Hacker (Ecole polytechnique federale de Lausanne)
Barbara Ilse Mahler (KTH)

An international group of six woman mathematicians, each from a different country and three continents, are meeting at BIRS to pursue their research project on the geometric understanding of large and high-dimensional data sets. The group got together in 2019 during the Second Workshop of Women in Computational Topology in Canberra and aims at playing an effective role in the innovative field of Topological Data Analysis.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg267

Participants:

Bapat, Asilata (Australian National University)
Brooks, Robyn (Boston College)
Hacker, Celia (Ecole Polytechnique Federale de Lausanne)
Landi, Claudia (University of Modena and Reggio Emilia)
Mahler, Barbara Ilse (KTH)
Stephenson, Elizabeth (Institute of Science and Technology Austria)

Cohomogeneity Two Manifolds of Positive Sectional Curvature
June 12 - 25, 2022

Organizers:

Catherine Searle (Wichita State University)

Our group split our time at BIRS between two projects: the first was the cohomogeneity two project we described in our proposal, and the second was on estimating the lengths of geodesics.

The broad goal was to classify such cohomogeneity in two actions: that is, to find all possible M, up to diffeomorphism, and G, and to describe the action of G on M up to (equivariant) diffeomorphism. Coming into our stay at BIRS, our goal was to prove a classification theorem in low dimensions for closed, simply-connected, positively curved manifolds admitting an isometric, non-polar, cohomogeneity two actions.

A useful tool for such actions is the G-manifold reduction, see Grove and Searle and Skjelbred and Straume. The idea is to reduce the G-action on M to the case of a core group, cG, acting on a core manifold, cM. The core group cG is defined to be NG(H)/H, where NG(H) denotes the normalizer of H in G, the set of g such that gHg−1=H. The core manifold cM is defined to be the closure of the set MH of points in M fixed by (a particular copy of) H. The quotient cM/cG is isometric to M/G, and the principal isotropy of the action of cG on cM is the identity only. Thus, the only properties of the original G-action that are not preserved in the reduction are that cM might not be simply connected and cG might not be connected. Note that the original action is polar if and only if the core group cG is finite.cM might not be simply connected and cG might not be connected. Note that the original action is polar if and only if the core group cG is finite.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg800

Participants:

Alpert, Hannah (Auburn)
Contreras Peruyero, Adriana Haydeé (Centro de Ciencias Matemáticas UNAM)
Kerr, Megan (Wellesley College)
Rotman, Regina (University of Toronto)
Searle, Catherine (Wichita State University)

Studying PDE Dynamics Via Optimization with Integral Inequality Constraints
June 12 - 25, 2022

Organizers:

David Goluskin (University of Victoria)
David Papp (North Carolina State University)
Ian Tobasco (University of Illinois Chicago)

Partial differential equations arise ubiquitously as laws of physics and other mathematical models across the scientific and engineering disciplines. The solutions to these equations describe the behavior of the systems modeled by the equations, but very often the solutions are too complicated to be found exactly. As an example from one of many disciplines, equations governing the flow of liquids or gases can be simple to write down, but solutions corresponding to extremely intricate turbulent motions of the fluids are impossible to find. One approach in such cases is to use powerful computers to approximate single solutions. A second complementary approach is to seek mathematical statements that give only partial information about solutions, but that apply broadly to all possible solutions. This Focused Research Group aimed to improve and apply methods that take the latter approach. This was done by using recently developed tools from the field of optimization to solve research questions in the field of partial differential equations. This required to bring together researchers in both of these largely separate mathematical disciplines, which is made possible by the BIRS Focused Research Group program.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg243

Participants:

Carlson, Elizabeth (University of Victoria)
Fantuzzi, Giovanni (Imperial College London)
Fuentes, Federico (Universidad Catolica de Chile)
Goluskin, David (University of Victoria)
Korda, Milan (CNRS)
Papp, David (North Carolina State University)
Tobasco, Ian (University of Illinois Chicago)

Novel Perspectives in Kinetic Equations for Emerging Phenomena
July 12 - 24, 2022

Organizers:

Mattia Zanella (University of Pavia)
Jingwei Hu (University of Washington)
Lorenzo Pareschi (University of Ferrara)
Weiran Sun (Simon Fraser University)

Recent research efforts established strong parallelism between systems of interacting agents and the classical kinetic theory of rarefied gases, which is described by Boltzmann-type equations. Analytical and numerical methods developed for the study of these systems have allowed the computation of unexpected global behaviour, like the formation of stable curves for wealth distribution or the emergence of opinion consensus as a minimal energy state.

The application of kinetic theory to emergent phenomena in biology, epidemiology and social sciences opens new fascinating questions that will push further the borders of our mathematical understanding and methodologies.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg198

Participants:

Herty, Michael (RWTH Aachen University)
Hu, Jingwei (University of Washington)
Medaglia, Andrea (University of Pavia)
Pareschi, Lorenzo (University of Ferrara)
Qiu, Jinniao (University of Calgary)
Sun, Weiran (Simon Fraser University)
Yang, Yang (University of Calgary)
Zanella, Mattia (University of Pavia)

SYZ Mirror Symmetry and its Applications
August 14 - 21, 2022

Organizers:

Siu Cheong Lau (Boston University) **Conan Leung** (Chinese University of Hong Kong)

Mirror symmetry is a deep duality between symplectic geometry and complex geometry. It has made striking predictions on enumerative geometry and has motivated amazing developments in algebraic and symplectic geometry. The Strominger-Yau-Zaslow approach to mirror symmetry has made a very successful progress in explaining mirror symmetry in terms of Lagrangian torus fibrations.

In this workshop, we discussed new developments and applications of SYZ mirror symmetry by combining the various analytic and Floer theoretical techniques found in recent years, including mirror construction via Fukaya isomorphisms, mirror symmetry of pairings, equivariant Lagrangian Floer theory and Lagrangian correspondence, quiver algebroid stacks, hypertoric varieties. Moreover, we will investigate emerging links between noncommutative geometry and networks widely used in data science.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg503

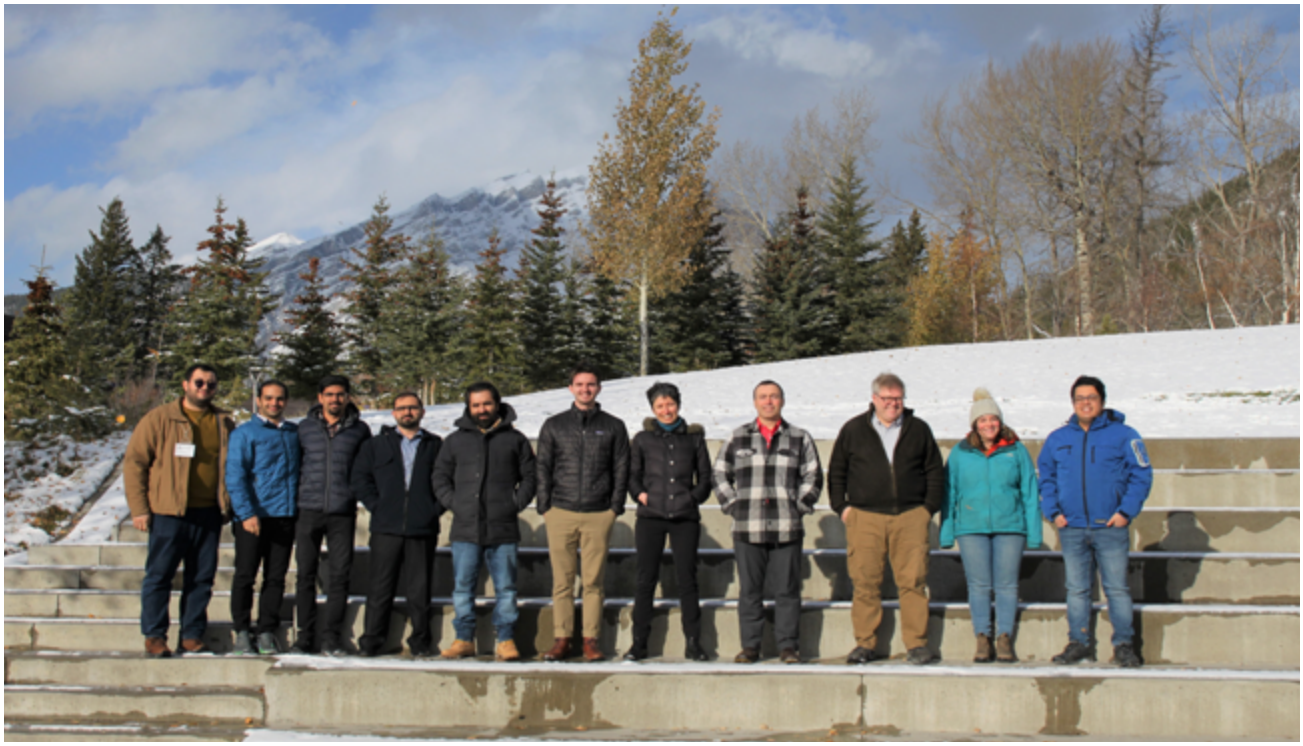
Participants:

Cho, Cheol-Hyun (Seoul National University)
Kim, Yoosik (Pusan National University (PNU))
Lau, Siu Cheong (Boston University)
Li, Leon (The Chinese University of Hong Kong)
Lin, Yu-Shen (Boston University)
Suen, Yat-Hin (IBS Center for Geometry and Physics)
Zheng, Xiao (Chinese University of Hong Kong)

Predicting and Preventing Wellbore Leakage
October 30 - November 6, 2022

Organizers:

Ian Frigaard (University of British Columbia)
Ida Karimfazli (Concordia University)
Seyed Mohammad Taghavi (Université Laval)



Canada is entering an era of P&A (Plug and Abandonment) in which 1000's of oil & gas wells will be abandoned annually for the foreseeable future, highlighting the critical question of safe long-term abandonment of these wells. Leaking wells (i.e. when natural gas seeps from wellbores) are threats to the environment and public safety of Canada, and they can result in the destruction of near-well ecosystems, environment pollution (e.g. groundwater contamination), GHG emissions and safety hazards (explosion risks). This workshop brought together mathematically oriented scientists and engineers to develop complementary and interlinked studies addressing knowledge gaps underlying these societally important issues.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg258

Participants:

Akbari, Soheil (Laval University)
Charabin, Scott (UBC)
Frigaard, Ian (University of British Columbia)
Ghazal, Abdallah M. (Concordia University)
Hassanzadeh, Hossein (Laval University)
Izadi, Mahdi (UBC)
Karimfazli, Ida (Concordia University)
Rahmani, Hossein (Laval University)
Taghavi, Seyed Mohammad (Laval University)
Trudel, Élizabeth (University of British Columbia)

Mathematical Modelling and Machine Learning for Phonetics
November 13 - 20, 2022

Organizers:

Paul Tupper (Simon Fraser University)

Phonetics is the study of the sounds of the world's languages and how they are used to communicate. A wealth of information is known by linguists about which sounds are used, how they are produced, how children learn these sounds, and how the use of sounds differs between different groups of speakers. Still, many fundamental questions remain unanswered relating to this important part of human language.

This Focussed Research Group brought together mathematicians and computer scientists interested in phonetics with linguists seeking ways to:
i) handle the massive amounts of data that are available in the human speech stream, and
ii) develop mathematical models to clarify research questions and guide the empirical study.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg241

Participants:

Behne, Dawn (Norwegian University of Science and Technology)
Curtu, Rodica (University of Iowa)
Jongman, Allard (University of Kansas)
McMurray, Bob (University of Iowa)
Sereno, Joan (University of Kansas)
Tupper, Paul (Simon Fraser University)
Wang, Yue (SFU)

Non-Classical Constructions in Tensor Categories and Conformal Field Theory
November 20 - December 4, 2022

Organizers:

Andrew Schopieray (University of Alberta)
Terry Gannon (University of Alberta)
Julia Plavnik (Indiana University)

Just as general science cannot proceed without evidence and experimentation, the mathematical sciences cannot proceed without a robust set of examples to make observations, and test conjectures upon. In the 1980s, inspired by mathematical physics, mathematicians were developing what would become the definition of tensor, fusion, and modular tensor categories. These mathematical objects require copious amounts of data to describe, which is a reflection of their initial inspirations from conformal field theory, but also of their application to diverse fields such as invariants of knots and links, vertex operator algebras, and von Neumann algebras, to name a few. Almost all known examples of these fundamental mathematical objects come from classical families that have been known since the genesis of the field, and a small number of classical constructions create new examples from the old. A finite list of “exotic” or non-classical examples has been found though, for which there is no known connection to classical examples using known constructions. Evans \& Gannon, and subsequently Grossman \& Izumi have proposed the existence of infinite families of non-classical examples, and on a combinatorial/number-theoretic level, these non-classical examples can be constructed from classical examples using a yet-to-be-described amalgamation construction. Our focused research group, drawn from a diverse collection of experts in complementary fields of study, aims to describe the mathematical underpinnings of this construction to bring about a new and non-classical era in the study of tensor categories and related fields.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/focussed-research-groups/22frg002

Participants:

Edie-Michell, Cain (University of California San Diego)
Gannon, Terry (University of Alberta)
Gill, Brandon (University of Alberta)
Ng, Siu-Hung (Louisiana State University)
Nikshych, Dmitri (University of New Hampshire)
Pena Pollastri, Hector Martin (Indiana University)
Plavnik, Julia (Indiana University)
Riesen, Andrew (University of Alberta)
Schopieray, Andrew (University of Alberta)
Tucker, Henry (University of California, Riverside)

Banff International Research Station

2022

Research in Teams

Research in Teams

Mar 6	Mar 13	Spontaneously Stochasticity in Turbulence Theory
Mar 20	Mar 27	Shapes from Echoes
Jun 19	Jun 26	Random motions in Markov and semi-Markov environments and their applications
Jun 26	Jul 3	Functor Calculus, Cartesian Differential Categories, and Operads
Jul 24	Jul 31	Algebraically integrable domains
Jul 24	Aug 7	Linearization Techniques for Holomorphic Functions and Lipschitz-Free Spaces
Sep 11	Sep 25	Small Maximal Independent Sets
Sep 25	Oct 2	Geometry of Rotation Sets
Sep 25	Oct 2	Implicit-Explicit Time Integration Methods
Nov 20	Nov 27	Symmetries of Gravity at the Black Hole Horizon

Spontaneously Stochasticity in Turbulence Theory
March 6 - 13, 2022

Organizers:

Konstantin Khanin (University of Toronto)

The turbulence problem is one of a very few old-standing classical physics problems which is still almost completely open. In recent years it became clear that the problem related to spontaneous stochasticity plays a crucial role in the turbulence phenomenon. The proposed research group worked on numerical and analytical approaches to the problem of spontaneous stochasticity.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/research-in-teams/22rit004

Participants:

Bandak, Dmytro (UIUC)
Khanin, Konstantin (University of Toronto)
Mailybaev, Alexei (IMPA)

Shapes from Echoes
March 6 - 13, 2022

Organizers:

Konstantin Khanin (University of Toronto)

Can a drone hear the shape of a room? Can it work out its own location in the room from the echoes of a sound event? Can a car or another ground-based vehicle do the same? These types of questions are being studied by Mireille Boutin and Gregor Kemper at BIRS. Specifically, they assume that four microphones are placed on a drone. Then a loudspeaker, either at a fixed location or also mounted on the drone, emits a single sound impulse. With some delay, depending on the distance traveled by the sound, the microphones receive the echoes bouncing off the walls. Is the information contained in the delays enough to reconstruct the shape of the room? In a 2020 paper, Boutin and Kemper proved that the answer is “yes” with probability one. Their argument used methods from computational commutative algebra.

Now they are focusing on the case of ground-based vehicles, which, counterintuitively, is harder, and on the reverse question of whether and how a drone can determine its own location from echoes bouncing off the walls of a room it already knows. They are also working on practical questions of how to deal with measurement errors in the delay times. These issues need to be dealt with for real-world applications.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/research-in-teams/22rit002

Participants:

Boutin, Mireille (Purdue University)
Kemper, Gregor (Technical University of Munich)

Random Motions in Markov and Semi-Markov Environments and their Applications
June 19 - 26, 2022

Organizers:

Anatoliy Swishchuk (University of Calgary)
Anatoliy Pogoruy (Zhytomyr Ivan Franko State Univ.)
Ramón Martín Rodríguez-Dagnino (Tecnologico de Monterrey)

The workshop was devoted to the study of random motions (for example, telegraph or transport models) in Markov and semi-Markov environments and their applications. Applications include, in particular, modelling of the stock price in finance via the exponential random telegraph process. An Analogue of the Black-Scholes formula for European call option price will be obtained in this case. Another application will be considered to obtain a generalization of the Black-76 formula in commodity markets by regarding Markov or semi-Markov modulated volatility in the forward pricing of energy markets' products.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/research-in-teams/22rit234

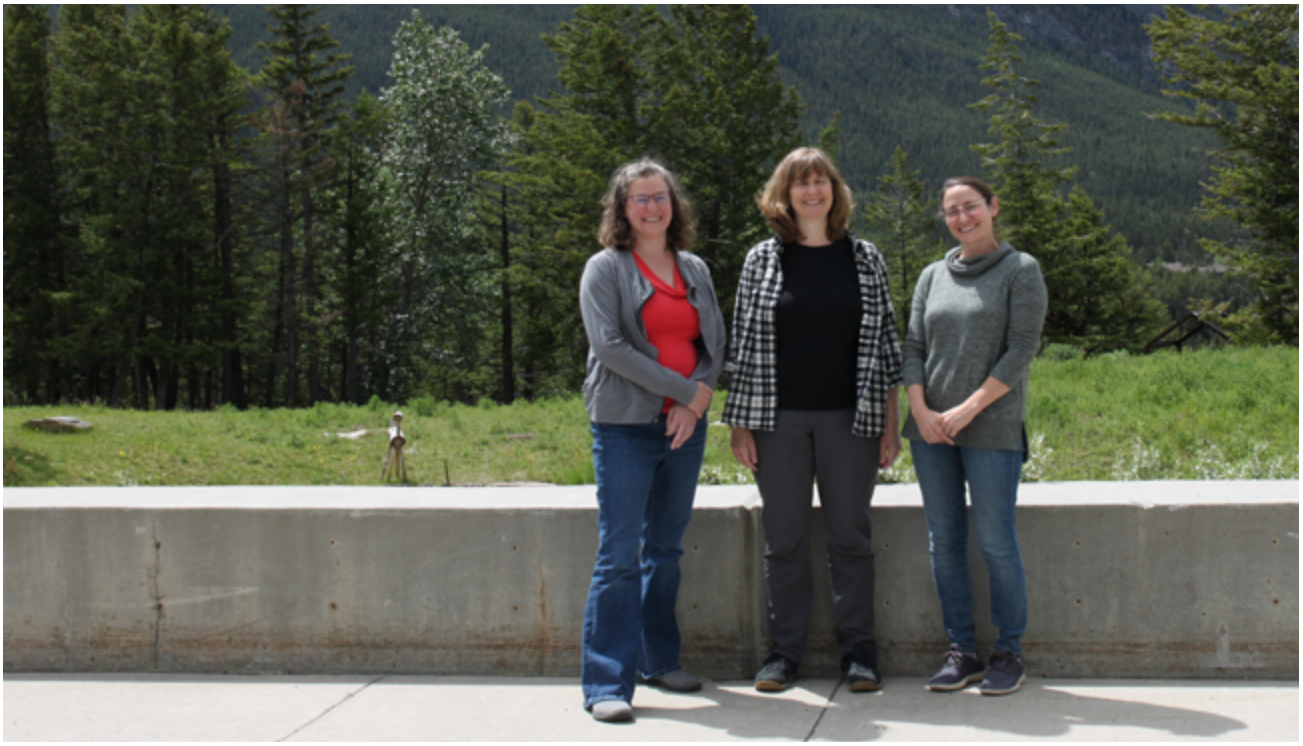
Participants:

Pogoruy, Anatoliy (Zhytomyr Ivan Franko State University)
Rodríguez-Dagnino, Ramón Martín (Tecnologico de Monterrey)
Swishchuk, Anatoliy (University of Calgary)

Functor Calculus, Cartesian Differential Categories, and Operads
June 26 - July 3, 2022

Organizers:

Kristine Bauer (University of Calgary)
Brenda Johnson (Union College)
Sarah Yeakel (University of California, Riverside)



A basic goal of algebraic topology is to find algebraic invariants that classify topological spaces up to various notions of equivalence. Computing such invariants can be extremely difficult, yet can lead to spectacular outcomes. Some of the most acclaimed results in algebraic topology and K-theory in recent years, including Hill, Hopkins and Ravenel's solution to the Kervaire Invariant One problem and Voevodsky's use of motivic homotopy theory in resolving longstanding conjectures in K-theory, are founded on such computations.

Broadly speaking, we sought to further these comparisons by
1. finding analogues of theorems from homotopy calculus in abelian calculus,
2. identifying how such theorems area result of the differential category structure in abelian calculus, and
3. generalizing this relationship to create and compare results in various versions of functor calculus.

In the long term, we expect the flow of information to yield a new framework for dealing with unreduced functors in homotopy calculus, a topic with few results and important applications.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/research-in-teams/22rit268

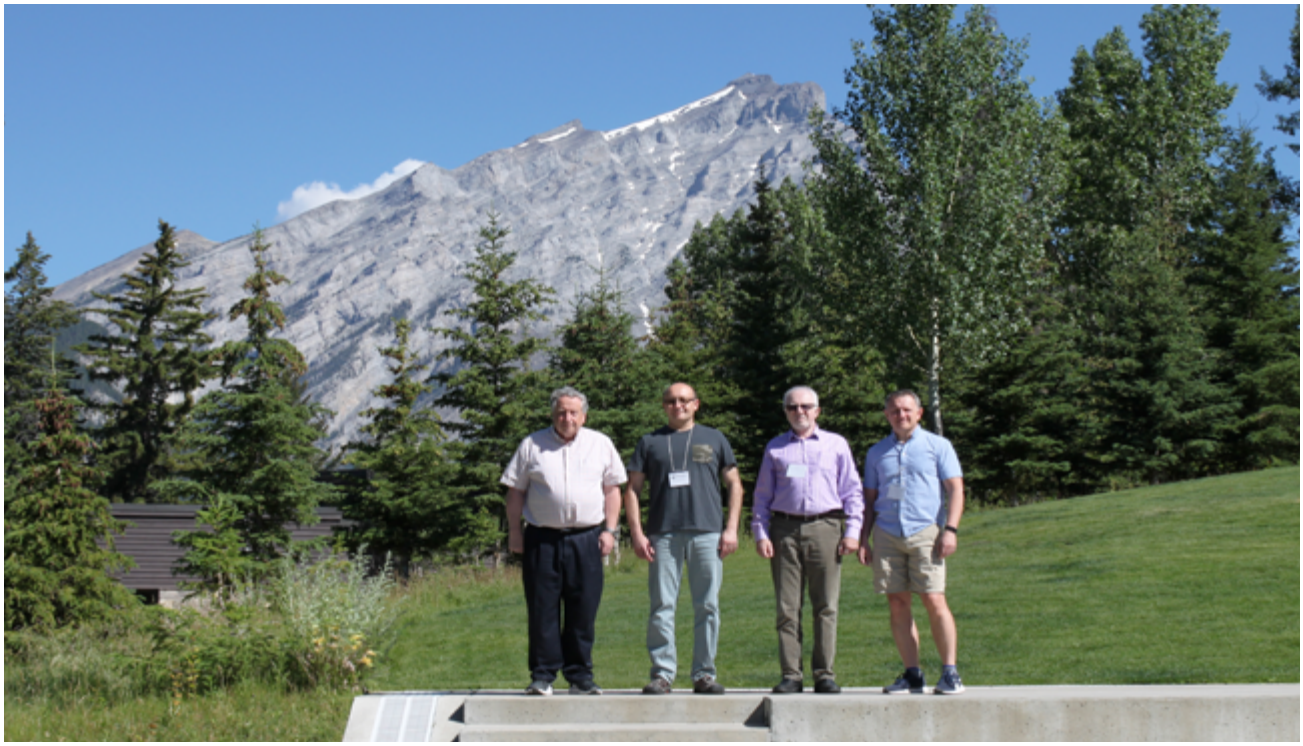
Participants:

Bauer, Kristine (University of Calgary)
Johnson, Brenda (Union College)
Yeakel, Sarah (University of California, Riverside)

Algebraically integrable domains
July 24 - 31, 2022

Organizers:

Vladyslav Yaskin (University of Alberta)
Mark Agranovsky (Bar-Ilan University)
Alexander Koldobsky (University of Missouri)
Dmitry Ryabogin (Kent State University)



The main theme of the research activities concerns algebraically integrable domains. The first study of such domains goes back to Newton and is connected to Kepler's laws of planetary motion. Let D be an infinitely smooth bounded domain in Rn. For a non-zero vector u in Rn and a real number t, consider the cut-off volumes of D, i.e., the volumes of parts of D on both sides of the hyperplane perpendicular to u at distance t from the origin. In Lemma XXVIII of his Principia, Newton proved that there are no domains D in R2 for which the cut-off function is algebraic (such domains are called algebraically integrable).

Three centuries later, Arnold asked for extensions of Newton's result to other dimensions and non-convex domains; see problems 1987-14, 1988-13, and 1990-27 in his book "Arnold's problems". Arnold's problem in even dimensions was solved by Vassiliev, who showed that there are no algebraically integrable bounded domains with infinitely smooth boundaries in R2n. It is still an open problem whether in odd dimensions the only algebraically integrable smooth domains are ellipsoids.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/research-in-teams/22rit259

Participants:

Agranovsky, Mark (Bar-Ilan University)
Koldobsky, Alexander (University of Missouri)
Ryabogin, Dmitry (Kent State University)
Yaskin, Vladyslav (University of Alberta)

Linearization Techniques for Holomorphic Functions and Lipschitz-Free Spaces
July 24 - August 7, 2022

Organizers:

Richard Aron (Kent State University)
Veronica Dimant (Universidad de San Andrés)
Manuel Maestre (Universidad de Valencia)
Luis Carlos Garcia Lirola (Universidad de Zaragoza)

Let $S(U;Y)$ be a set of continuous functions, defined on an open subset U of a Banach space X, taking values in a Banach space Y. In order to study this set, one natural technique is to {\em linearize} the functions in S(U;Y) by finding a new space Z and a natural mapping $\iota : U \to Z$ such that each $f \in S(U;Y)$ corresponds to a continuous linear operator $T_f : Z \to Y$ satisfying $f = T_f \circ \iota$, and conversely. The result is that the (possibly) unwieldy function f is replaced by a linear operator Tf which (possibly) is acting on a much larger, unwieldy space Z. Perhaps surprisingly, this technique often yields interesting, new results.

The origin of this proposal is that two different groups of researchers have realized that they were using the same general process of linearization, one in the complex setting to linearize many spaces of holomorphic mappings, and the other in the real setting in the study of spaces of Lipschitz functions to build the Lipschitz-free spaces. We are convinced that the deep analysis and joint research that would be done at BIRS should produce relevant advances in both fields of research.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/research-in-teams/22rit001

Participants:

Aron, Richard (Kent State University)
Dimant, Veronica (Universidad de San Andrés)
Garcia Lirola, Luis Carlos (Universidad de Zaragoza)
Maestre, Manuel (Universidad de Valencia)

Small Maximal Independent Sets
September 11 - 25, 2022

Organizers:

Jeroen Schillewaert (University of Auckland)
Jacques Verstraete (University of California - San Diego)

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/research-in-teams/22rit502

Participants:

Schillewaert, Jeroen (University of Auckland)
Verstraete, Jacques (University of California at San Diego)

Geometry of Rotation Sets
September 25 - October 2, 2022

Organizers:

Tamara Kucherenko (The City College of New York)
Jan Boronski (AGH University of Science and Technology)

We studied the dynamics of homeomorphisms on a two-dimensional torus. The asymptotic motion of orbits of such homeomorphisms can be described using vectors on a plane: the magnitude of the vector gives the speed of motion, and its direction gives a homology class which best approximates the motion. The set of all vectors realized by the orbits of the homeomorphism is called a rotation set and provides a blueprint of the overall dynamics of the system. A question that has remained unanswered for over twenty years is how to characterize all the rotation sets of torus homeomorphisms.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/research-in-teams/22rit506

Participants:

Boronski, Jan (AGH University of Science and Technology)
Kucherenko, Tamara (The City College of New York)

Implicit-Explicit Time Integration Methods
September 25 - October 2, 2022

Organizers:

Ray Spiteri (University of Saskatchewan)

Society has become increasingly dependent on the mathematical modeling of phenomena for scientific and technological advancement. This has led to an increase in demand for the fidelity of the models to reality and hence an increase in model complexity and computational demands. Although computer hardware continues to become increasingly powerful, algorithms that can take advantage of such hardware and simulate complex systems efficiently are no less essential. This focused research group examined implicit-explicit time-integration methods, which are a divide-and-conquer strategy for improving the efficiency of simulating complex mathematical models that describe important phenomena. This allows researchers to better be able to go from hypothesis to actionable policy.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/research-in-teams/22rit270

Participants:

Sandu, Adrian (Virginia Tech)
Spiteri, Ray (University of Saskatchewan)

Symmetries of Gravity at the Black Hole Horizon
November 20 - 27, 2022

Organizers:

Luca Ciambelli (Universite Libre de Bruxelles)

Obtaining an understanding of quantum gravity is a central goal in theoretical physics. While both general relativity and quantum mechanics are used extensively in our modern world, in situations where they have overlapping relevance they seem to often give rise to contradictory and puzzling results. This happens for example in black holes, very massive yet very small objects, where the gravitational force is strong at short distances. A basic feature of any physical theory is its symmetry and conservation laws. In theories like gravity, such symmetries are associated with certain substructures in space-time that are referred to as 'corners.' Recent progress in understanding the relevance of this symmetry and geometric structures gives hope that physics such as that of black hole horizons may be understood in a universal fashion, shedding light on the quantum aspects of such gravitational phenomena. This research meeting aimed to deepen the new understanding of symmetries in gravity in the context of black hole physics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/research-in-teams/22rit005

Participants:

Ciambelli, Luca (Universite Libre de Bruxelles)
Freidel, Laurent (Perimeter Canada)
Leigh, Rob (University of Illinois at Urbana-Champaign)

Banff International Research Station

2021

Cancelled 5-Day Workshops

Emerging Insights in Insurance Statistics
January 16 - 21, 2022 (Cancelled)

Organizers:

Emiliano A. Valdez (University of Connecticut)
Jingyi Cao (York University)
Arthur Charpentier (UQAM)
Himchan Jeong (Simon Fraser University)

Insurance statistics is the science that involves the analysis and interpretation of data that are used in the insurance and related financial industries. Insurance is in the business of providing us protection against unforeseen events that can have significant financial consequences. It is an industry that is useful for driving economic growth, and research related to insurance statistics continues to be useful to provide the industry with tools, models and results meaningful for decision-making by all parties affected by the industry. Insurance statistics is interdisciplinary, combining theories and applications derived from mathematics, statistics, computer science, and data science. The growth in research in such related disciplines, the access and volumes of data available, and the changing landscape of the insurance industry are enhancing the research progress. This workshop brought together experts in this growing discipline to provide a unique opportunity and a place to discuss and debate ongoing research development and emerging issues in insurance statistics. It is also intended to train young scholars interested in insurance statistics and to unlock problems that may lead to further research work.

For details, please refer to the workshop webpage*: https://www.birs.ca/events/2022/5-day-workshops/22w5119*

Restriction, Kakeya, and Carleson-Type Problems
January 30 - February 04, 2022 (Cancelled)

Organizers:

Joshua Zahl (University of British Columbia)
Nets Katz (California Institute of Technology)
Victor Lie (Purdue University)

Harmonic analysis is a branch of mathematics that studies the properties of operators such as the Fourier transform. Over the past few years, a number of powerful new techniques have been developed that have led to progress on old and difficult problems. The goal is to gather experts and young researchers to share their expertise in these techniques and disseminate them more broadly within the harmonic analysis community.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5158

Additivity Problems in Quantum Information Theory
February 6 - 11, 2022 (Cancelled)

Organizers:

Felix Leditzky (University of Illinois at Urbana-Champaign)
Nilanjana Datta (University of Cambridge)
Debbie Leung (University of Waterloo)
Graeme Smith (University of Colorado Boulder)

Information theory aims to find mathematically precise answers to fundamental questions such as how information is stored, processed, or sent reliably through noisy communication links. Towards the end of the 20th century, researchers started asking how these information-processing tasks change when information is encoded in systems exhibiting quantum-mechanical behavior. Remarkably, features of quantum mechanics such as the superposition principle and entanglement give rise to phenomena in information theory that cannot be realized with classical information-processing systems. Their discovery has led to the creation of the now thriving field of quantum information theory.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5089

Mathematical Frameworks for Integrative Analysis of Emerging Biological Data Types
June 26 - July 01, 2022 (Cancelled)

Organizers:

Aedin Culhane (Harvard TH Chan School of Public Health)
Elana Fertig (John Hopkins)
Kim-Anh LeCao (University of Melbourne)

Accurate mathematical models of biological cells during health and disease are essential in understanding biology, advancing precision medicine and treating disease. Emerging technologies, such as RNA and DNA sequencing give clinical and basic research laboratories great power to quantify tens of thousands of biological molecules and generate highly detailed biological maps at different molecular, spatial and temporal resolutions. Integrating these diverse data may provide a comprehensive multi-layer view of a biological system that cannot be obtained by considering each dataset individually. However, currently biological insight is hindered by the inherent complexity of the data and paucity of methods to integrate these data. By gathering mathematical, statistical and computational experts in the field of genomic data integration, pioneer solutions for data integration problems will be discussed. This workshop will promote the development of cutting edge mathematical, statistical and computational methods to extract reliable information from big biological data. The anticipated deliverables are a set of open source resources for international scientists to use and reuse on their own data, to accelerate the pace and impact of discoveries in this exciting field of research.

For details, please refer to the workshop webpage*: https://www.birs.ca/events/2022/5-day-workshops/22w5160*

Mathematical Questions in Wave Turbulence
August 21 - 26, 2022 (Cancelled)

Organizers:

Jalal Shatah (Courant Institute, New York University)
Tristan Buckmaster (Princeton University)
Pierre Germain (New York University)
Zaher Hani (University of Michigan)

Wave turbulence is a universal phenomenon describing the chaotic behaviors of systems as diverse as the atmosphere, the ocean, plasmas (and thus astrophysics), quantum dynamics, etc... in certain regimes where the nonlinear effects are weak. Understanding this phenomenon rigorously would be of great interest in all these physical disciplines; it is also a fascinating mathematical challenge, bringing together many domains of research: partial differential equations, probabilty, mathematical physics, and harmonic analysis.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5156

Banff International Research Station

2021

Cancelled Focused Research Groups

Novel fluid/structure/field (FFSI) modeling framework in the context of ion channels
August 21 - 28, 2022 (Cancelled)

Organizers:

Nir Gavish (Technion)
Huaxiong Huang (York University)

Tremendous progress has been made in the past century in biological sciences thanks to technological advances in experimental and measuring techniques. As was the case for physics and chemistry in the previous century, biological sciences are at a critical juncture where further advancements depend and rely crucially on the development of now quantitative tools. Mathematics will inevitably play a crucial role during the processes while biology comes increasingly more quantitative as a scientific discipline. Bio-ions and biomolecules are essential in performing biological functions in living organisms. The understanding of their roles in nerve and physiological functions has fundamental importance, as demonstrated by several Noble prize winning researchers since the prize was established. For example, Cajal shared the 1906 prize for his discovery of synaptic transmission in neural communication. Hodgkin and Huxley won the 1963 prize for their discoveries concerning the ionic mechanism involved in the excitation and inhibition in the nerve cells. The detailed discovery of the functions of single ion channels came much later, which was recognized by the 1991 prize awarded to Neher and Sakmann.

Real biological problems of ion transport are characterized by interaction on all scales and no living biological systems can function without flows. Working on problems from living biological systems requires mathematics that describes interactions of ions at the atomic scale as well as the organ scale. These problems are inherently multi disciplinary and they present formidable challenges as well as fantastic opportunities for modelers, analysts, and computational scientists. Concurrently, renewable energy devices rely on ionic transport at increasingly large densities. Thus, similar mathematical challenges arise in modeling permeability in biological ionic channels and ionic transport in nano-pores of capacitive desalination devices.

In this research group, we focus on the modeling of ionic flows through ion channels, while taking into account possible deformations in the structure of the ionic channel. Such deformations can completely change the behavior of the channel, and have not yet been systematically studied, probably due to the challenges that such a study poses. Using new approaches, we are now able to consider these problems.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/focussed-research-groups/22frg240

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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CMO 2022 Program

5-Day Workshops 2022

Apr 24	Apr 29	Algebraic Methods in Coding Theory and Communication
May 1	May 6	Integral and Metric Geometry (Online)
May 8	May 13	Advances in Mixed Characteristic Commutative Algebra and Geometric Connections
May 15	May 20	Latin American and Caribbean Workshop on Mathematics and Gender
May 22	May 27	Outstanding Challenges in Computational Methods for Integral Equations
May 29	Jun 3	Topological Complexity and Motion Planning
Jun 5	Jun 10	Modeling and Engineering of the Mammalian Embryo (Cancelled)
Jun 12	Jun 17	Mathematical and Conceptual Aspects of Quantum Theory
Jun 19	Jun 24	Geometric and Variational Methods in Celestial Mechanics
Jun 26	Jul 1	Geometric and Analytical Aspects of Nonlinear Elliptic Equations and Related Evolution Problems (Cancelled)
Jul 31	Aug 5	M^5 - Mathematics of Multiphase, Multiscale, Mutiphysics Models
Aug 7	Aug 12	Metric measure Spaces with Symmetry and Lower Ricci Curvature Bounds
Aug 14	Aug 19	Analytic and Geometric Aspects of Spectral Theory
Aug 21	Aug 26	Statistical Challenges in the Identification, Validation, and Use of Surrogate Markers
Aug 28	Sep 2	Applied Functional Analysis
Sep 4	Sep 9	Statistical and Computational Challenges Arising from Ubiquitous Molecular Measurements (Cancelled)
Sep 11	Sep 16	Theory and Computational Methods for SPDEs
Sep 18	Sep 23	Moduli, Motives and Bundles – New Trends in Algebraic Geometry
Sep 25	Sep 30	Bases for Cluster Algebras
Oct 9	Oct 14	Cobordisms, Strings, and Thom Spectra
Oct 16	Oct 21	Multiscale Modeling of Plant Growth, Pattern Formation and Actuation
Oct 23	Oct 28	Using Quantum Invariants to do Interesting Topology
Oct 30	Nov 4	Kinetic Equations: Recent Developments and Novel Applications
Nov 6	Nov 11	Mathematics and Statistics of Genomic Epidemiology
Nov 13	Nov 18	Learning in Networks: Performance Limits and Algorithms
Nov 27	Dec 2	Langlands Program: Number Theory and Representation Theory

Casa Matemática Oaxaca

2022

5-Day Workshops

Algebraic Methods in Coding Theory and Communication
April 24 - 29, 2022

Organizers:

Edoardo Persichetti (Florida Atlantic University)
Elisa Gorla (University of Neuchatel)
Marcus Greferath (University College Dublin)
Hiram H. López Valdez (Cleveland State University)
Felice Manganiello (Clemson University)

Since the seminal works of Claude Shannon in the 1940's, coding theory has been a flourishing subject for research collaborations between mathematicians, computer scientists and electrical engineers. Research problems in coding theory have evolved over the years to answer important practical questions from real-world applications. This workshop aims at bringing together researchers from different backgrounds in order to foster interdisciplinary collaborations that will push forward the research in coding theory and communication.

The workshop concentrated on three contemporary, central themes in coding theory and its applications. Algebraic coding theory tackles classical communication problems, such as error-free communication between a source and a receiver over a noisy channel, using a wide range of tools from computational algebra, algebraic geometry, and probability theory. More recently coding theory has found applications to emerging challenges in communication. The kind of problems that arise has been shifting, as our digital lives got more and more interconnected. Network Coding seeks answers to problems of maximization of information flow over networks. These answers often require establishing new communication schemes, relying on mathematical structures which were not used in this context before. In the last few years, a new set of problems with local features arose from practical applications such as distributed storage of large amounts of data. Locally recoverable codes allow the recovery of a codeword symbol's erasure by means of a small set of other codeword symbols. These codes are a central topic of research over the last few years, due also to their applicability to these problems.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5180

Participants:

Agathocleous, Eleni (CISPA Helmholtz Center for Information Security)
Aidoo, Theophilus (African Institute for Mathematical Sciences)
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Arpin, Sarah (University of Colorado Boulder)

Babah, Rahmatu (University of Ghana)
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Bariffi, Jessica (University of Zurich and German Aerospace Center)
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El Rouayheb, Salim (Rutgers University)
Etzion, Tuvi (Technion IIT)
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Franch, Ermes (University Of Bergen (Selmer center))
Franck Rivel, Kamwa Djomou (University of Dschang)
Freddy Lendé, Metouke (Université de Yaoundé 1)
Gaborit, Philippe (University of Limoges)
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Galluccio, Francisco (Universidad Nacional del Litoral - Universidad de Valladolid)
García, Ignacio (Universidad de La Laguna)
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Ghorpade, Sudhir (Indian Institute of Technology Bombay)
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Gluesing-Luerssen, Heide (University of Kentucky)
Gorla, Elisa (University of Neuchatel)
Grassl, Markus (University of Gdansk)
Greferath, Marcus (University College Dublin)
Gruica, Anina (Eindhoven University of Technology)
Guardo, Elena (Universita di Catania)
Guruswami, Venkatesan (UC Berkeley)
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Hörmann, Felicitas (German Aerospace Center (DLR))
Iglesias Curto, José Ignacio (University of Salamanca)
Jabbusch, Kelly (University of Michigan - Dearborn)
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Kaplan, Nathan (UC Irvine)
Kara, Selvi (University of Utah)
Kelley, Christine (University of Nebraska-Lincoln)
Khathuria, Karan (University of Tartu)
Kilic, Altan Berdan (Eindhoven University of Technology)
Krishnamoorthy, Raju (Bergische Universität Wuppertal)
Kumar, P. Vijay (Indian Institute of Science Bangalore)
Kyureghyan, Gohar (University of Rostock)
Lange, Tanja (Eindhoven University of Technology)
Lebacque, Philippe (Université de Franche-Comté)
Lee, Min (University of Bristol)
Li, Yezhuo (Clemson University)
Lieb, Julia (University of Zurich)
Lin, Kuei-Nuan (Penn State University, Greater Allegheny)
Lin, Hsuan-Yin (Simula UiB)
Lisonek, Petr (Simon Fraser University)
López Valdez, Hiram H. (Cleveland State University)
Lopez-Permouth, Sergio (Ohio University)
Lorenzo García, Elisa (Université de Neuchâtel)
Manganiello, Felice (Clemson University)
Marques, Adler (Federal University of Rio de Janeiro)
Marrama, Andrea (École Polytechnique)
Martinez Peñas, Umberto (University of Valladolid)
Martinez-Moro, Edgar (University of Valladolid)
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Maughan, Krystal (University of Vermont)
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Pajaziti, Antigona (Sabanci University)
Palines, Herbert (University of the Philippines)
Panero, Piergiorgio (University of Antwerp)
Paolo, Santini (Università Politecnica delle Marche)
Persichetti, Edoardo (Florida Atlantic University)
Piñero, Fernando (University of Puerto Rico at Ponce)
Pitones, Yuriko (Universidad Autónoma Metropolitana)
Podesta, Ricardo (UNC)
Polujan, Alexandr (Otto von Guericke University Magdeburg)
Pratihar, Rakhi (University of Tromsø The Arctic University of Norway)
Previato, Emma (Boston University)
Quoos, Luciane (Universidade Federal do Rio de Janeiro)
Rafieipour, Asiyeh (Ohio University)
Randrianarisoa, Tovohery (Florida Atlantic University)
Randrianarivo, Sitraka (Clemson University)
Ravagnani, Alberto (Eindhoven University of Technology)
Raviv, Netanel (Washington University in St. Louis)
Reijnders, Krijn (Radboud University)
Rodrigues, Bernardo (University of Pretoria)
Rodríguez Aldama, René (University of Primorska)
Rojas Mendoza, Erik Antonio (Federal University of Rio de Janeiro)
Rosenthal, Joachim (University of Zurich)
Roy, Sumit (IBS Center for Geometry and Physics)
Ruano, Diego (University of Valladolid)
Sabitova, Maria (CUNY Queens College)
Salama, Rahma (University of Khartoum)
Salizzoni, Flavio (Université de Neuchâtel)
Samardjiska, Simona (Radboud universiteit)
San-José, Rodrigo (Universidad de Valladolid)
Santos, Welington (Virginia Tech University)
Sardan, Keneth Joshua (University of the Philippines - Cebu)
Sarmiento, Eliseo (Instituto Politécnico Nacional)
Schenck, Hal (Auburn University)
Sidorenko, Vladimir (Technical University of Munich)
Simoens, Robin (Ghent University)
Sison, Virgilio (University of the Philippines Los Banos)
Skelton, Joseph (Grand Vida)
Slaughter, Freeman (Clemson University)
Solé, Patrick (Institut de Mathématiques de Marseille)
Soler-Escrivà, Xaro (University of Alicante (Spain))
Soljanin, Emina (Rutgers University)
Soprunov, Ivan (Cleveland State University)
Sosa Gómez, Guillermo (Universidad Panamericana. Campus Guadalajara)
Sprintson, Alex (Texas A & M University)
Storme, Leo (Ghent University)
Sudan, Madhu (Harvard University)
Swanson, Joseph (Clemson University)
Szramowski, Luke (Clemson University)
Tale Kalachi, Herve (University of Yaounde)
Tapia-Recillas, Horacio (Universidad Autonoma Metropolitana-Iztapalapa)
Tchatchiem Kamche, Hermann (University of Yaounde 1)
Tinani, Simran (University of Zurich)
Tohaneanu, Stefan (University of Idaho)
Traum, Kyle (Cleveland State University)
Tshiunza Tshibuabua, Paulin (AIMS)
Turchetti, Daniele (University of Warwick)
Várilly-Alvarado, Anthony (Rice University)
Vaz Pinto, Maria (University of Lisbon)
Vazquez-Castro, Angeles (Universitat Autonoma de Barcelona and Institute of Space Research of Catalunya)
Villarreal, Rafael (CINVESTAV-IPN)
Vontobel, Pascal (The Chinese University of Hong Kong)
Vrioni , Brikena (American International University Kuwait)
Waffo Kemgne, Martin (University of Dschang)
West, Mckenzie (University of Wisconsin-Eau Claire)
Westerbäck, Thomas (Mälardalens University)
White, Trinity (Clemson University)
Wood, Jay (Western Michigan University)
Yagob, Mohamed (AIMS - University of Calabria)
Yang, Bowen (Caltech)
Yates, Kyle (Clemson University)
Yener, Aylin (The Ohio State University)
Yilmazguc, Gulsum Gozde (Trakya University)
Zappatore, Ilaria (LIX Inria-Saclay)
Zémor, Gilles (University of Bordeaux)
Zullo, Ferdinando (Università degli Studi della Campania “Luigi Vanvitelli”)
Zumbrägel, Jens (University of Passau)

Integral and Metric Geometry (Online)
May 1 - 6, 2022

Organizers:

Andreas Bernig (Goethe University Frankfurt)
Dmitry Faifman (Tel Aviv University)
Alexander Lytchak (Karlsruhe Institute of Technology)
Alina Stancu (Concordia University)

Modern geometry consists of numerous, virtually independent fields. A unifying theme of mathematics is the uncovering of deep ties between different, seemingly unrelated facts. This workshop strived to improve our understanding of one such deep link, the Weyl principle, which we hope could form a bridge between the disciplines of integral geometry and valuation theory on one side, and metric geometry and spaces with curvature bounds on the other.

Valuation theory grew out of integral geometry, and studies such geometric quantities as volume, surface area, and their generalizations. Spaces with curvature bounds are geometric objects which are not necessarily smooth, but that retain nevertheless some of the features of smooth spaces. For example convexity/concavity properties of the distance function can be seen as a non-smooth generalization of the smooth notion of curvature of constant sign.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5181

Participants:

Aishwarya, Gautam (Tel Aviv University)
Alesker, Semyon (Tel Aviv University)
Alvarez Paiva, Juan Carlos (University of Lille)
Ambrosio, Luigi (Scuola Normale Superiore - Mathematics)
Artstein, Shiri (Tel Aviv University)
Balacheff, Florent (Universitat Autonoma Barcelona)
Balitskiy, Alexey (IAS)
Bernig, Andreas (Goethe University Frankfurt)
Bertrand, Jerome (Institut de Mathématiques de

Toulouse)
Besau, Florian (TU Wien)
Boroczky, Karoly (Renyi Institute)
Broecker, Ludwig (University of Munster)
Burago, Dmitri (Penn State)
Cavalletti, Fabio (Scuola Internazionale Superiore di Studi Avanzati)
Chasioti, Effrosyni Maria (Kent State University)
Chor, Arnon (Tel Aviv University)
Colesanti, Andrea (University of Florence)
Constantin, Vernicos (INRIA / université de Montpellier)
Dann, Susanna (Universidad de los Andes)
Deng, Qin (MIT)
Faifman, Dmitry (Tel Aviv University)
Fathi, Max (Universite Paris-Cité)
Fu, Joseph (University of Athens Georgia)
Galaev, Anton (University of Hradec Králové)
Ghomi, Mohammad (Georgia Institute of Technology)
Gonzalez Merino, Bernardo (University of Murcia)
Harvey, John (Swansea University)
Henkel, Jakob (Friedrich Schiller University Jena)
Hernandez Cifre, Maria A. (University of Murcia)
Hofstätter, Georg (Tel Aviv University)
Hoisington, Joseph (University of Georgia)
Hörrmann, Julia (ETH Zurich)
Hug, Daniel (Karlsruhe Institute of Technology)
Ivanov, Sergei V. (St. Petersburg branch of Steklov Mathematical Institute)
Izmestiev, Ivan (TU Wien)
Kapovitch, Vitali (University of Toronto)
Ketterer, Christian (University of Freiburg)
Klartag, Boaz (Weizmann institute)
Knoerr, Jonas (Technical University Vienna)
Koldobsky, Alexander (University of Missouri)
Kotrbaty, Jan (Goethe University Frankfurt)
Leinster, Tom (University of Edinburgh)
Lerario, Antonio (SISSA)
Litvak, Alexander (University of Alberta)
Livshyts, Galyna (Georgia Institute of Technology)
Ludwig, Monika (Technische Universität Wien)
Lytchak, Alexander (Karlsruhe Institute of Technology)
Mathis, Leo (Frankfurt university)
Meckes, Mark (Case Western Reserve University)
Meroni, Chiara (Max Planck Institute for Mathematics in the Sciences)
Milman, Emanuel (Technion - I.I.T.)
Milman, Vitali (Tel Aviv University)
Mishra, Chayan Kumar (Avadh University Ayodhya)
Mui, Stephanie (New York University)
Mussnig, Fabian (TU Wien)
O'Hara, Jun (Chiba University)
Perales, Raquel (CONACyT-UNAM)
Petrunin, Anton (Pennsylvania State University)
Prosanov, Roman (University of Vienna)
Radunovic, Goran (University of Zagreb)
Reitzner, Matthias (University of Osnabrueck)
Rosana, Andrea (SISSA)
Rotem, Liran (Technion - Israel Institute of Technology)
Roysdon, Michael (Brown University)
Ryabogin, Dmitry (Kent State University)
Scheuer, Julian (Cardiff University)
Schuster, Franz (Vienna University of Technology)
Schütt, Carsten (Christian-Albrechts-Universitaet)
Solanes, Gil (Autnomous University of Barcelona)
Sormani, Christina (Lehman College and CUNYGC)
Stancu, Alina (Concordia University)
Sturm, Karl-Theodor (University of Bonn)
Suárez-Serrato, Pablo (UNAM)
Tatarko, Kateryna (University of Waterloo)
Walsh, Cormac (INRIA and Ecole Polytechnique)
Wannerer, Thomas (Friedrich-Schiller-Universität Jena)
Wenger, Stefan (University of Fribourg)
Werner, Elisabeth (Case Western Reserve University)
Winter, Steffen (KIT)
Wyczesany, Katarzyna (Carnegie Mellon University)
Yepes Nicolás, Jesús (University of Murcia)
Young, Robert (New York University)

Advances in Mixed Characteristic Commutative Algebra & Geometric Connections
May 8 - 13, 2022

Organizers:

Karl Schwede (University of Utah)
Linquan Ma (Purdue University)
Luis Núñez-Betancourt (Centro de Investigación en Matemáticas)

One of the big ideas in modern mathematics is that integers (like 1, 2, 3, 4, 5, ...) in many formal ways behave similarly to polynomial equations (like y = x^2, which defines the parabola). Frequently, and perhaps surprisingly, many questions in mathematics are easier to study for polynomials than for integers. Hence intuition and results for polynomials can tell us about the integers. Commutative algebra lives at the intersection of both perspectives, and one fundamental object of study is polynomials with integer coefficients, this is called the mixed characteristic case. Recently, Yves Andre proved a long-standing open conjecture in commutative algebra in this mixed characteristic setting, relying on constructions of Scholze (and then Bhatt gave a simplified proof of the same conjecture).

This workshop aimed to foster and discuss these and other recent tools, to study some remaining open problems with mixed characteristics. The workshop brought together a diverse group of researchers from different fields, such as commutative algebra, algebraic geometry, and number theory.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5174

Participants:

Álvarez Montaner, Josep (Universitat Politècnica de Catalunya)
Badilla-Céspedes, Wágner (Universidad Juárez Autónoma de Tabasco)
Barajas Guzmán, Paul Vladimir (Universidad Autónoma de Zacatecas)
Blickle, Manuel (Johannes Gutenberg-Universität Mainz)
Cai, Hanlin (University of Utah)

Carvajal Rojas, Javier Alonso (École Polytechnique Fédérale de Lausanne)
Chan, C-Y. Jean (Central Michigan University)
Cutkosky, Steven Dale (University of Missouri - Columbia)
Dao, Hailong (University of Kansas)
Datta, Rankeya (Michigan State University)
De Stefani, Alessandro (Università degli Studi di Genova)
Dorfsman-Hopkins, Gabriel (UC Berkeley)
Duarte, Daniel (CONACyT-Universidad Autónoma de Zacatecas)
Echalaz-Álvarez, Shalom (CIMAT)
Epstein, Neil (George Mason University)
Ertl, Veronika (University Regensburg)
Espinosa Valdéz, Carlos (CIMAT)
Espinoza, Francisco (CIMAT)
Garay López, Cristhian (CIMAT)
Garzella, Jack (UCSD)
Giles, Arturo (Universidad Autónoma de Aguascalientes)
Goel, Kriti (University of Utah)
Grifo, Eloísa (University of Nebraska - Lincoln)
Guo, Haoyang (Max Planck Institute for Mathematics)
Heitmann, Ray (University of Texas)
Hochster, Mel (University of Michigan)
Iyengar, Srikanth B. (University of Utah)
Jaramillo-Velez, Delio (CINVESTAV)
Jeffries, Jack (The University of Nebraska - Lincoln)
Kovacs, Sandor (University of Washington)
Lamarche, Alicia (University of Utah)
Lank, Patrick (University of South Carolina)
Le, Uyen (Enni) (West Virginia University)
Leal, Manuel (UNAM)
León-Cardenal, Edwin (CONACyT-CIMAT)
Lozano Huerta, Cesar (CONACYT - UNAM)
Ma, Linquan (Purdue University)
Martínez-Servellón, Andrés (University of Michigan)
McDonald, Peter (University of Utah)
Miller, Claudia (Syracuse University)
Murayama, Takumi (Princeton University)
Musapaşaoğlu, Aslı (Sabanci University)
Mustata, Mircea (University of Michigan)
Núñez-Betancourt, Luis (Centro de Investigación en Matemáticas)
Pande, Swaraj (University of Michigan)
Patakfalvi, Zsolt (École polytechnique fédérale de Lausanne)
Patankar, Shravan (UIC)
Pérez Buendía, Jesús Rogelio (CIMAT)
Quinlan, Eamon (University of Utah)
R.G., Rebecca (George Mason University)
Ramírez-Moreno, Pedro Angel (CIMAT)
Reinecke, Emanuel (MPIM Bonn)
Rodríguez Villalobos, Sandra (University of Utah)
Sandoval-Gómez, Sandra (University of Notre Dame)
Sato, Kenta (Kyushu University)
Schwede, Karl (University of Utah)
Shimomoto, Kazuma (Nihon University)
Singh, Anurag (University of Utah)
Smirnov, Ilya (BCAM-Basque Center for Applied Mathematics)
Spiroff, Sandra (University of Mississippi)
Sridhar, Prashanth (Charles University in Prague)
Srinivasan, Hema (University of Missouri)
Takagi, Shunsuke (University of Tokyo)
Takamatsu, Teppei (Kyoto University)
Tucker, Kevin (UIC)
Waldron, Joe (Michigan State University)
Witaszek, Jakub (University of Michigan)
Yhee, Farrah (Purdue University)
Yoshikawa, Shou (RIKEN)
Zenteno, Adrián (CIMAT)
Zhang, Wenliang (University of Illinois, Chicago)

Latin American and Caribbean Workshop on Mathematics and Gender May 15 - 20, 2022

Organizers:

Andrea Vera Gajardo (Universidad de Valparaíso)
Gabriela Araujo (UNAM)
Carolina Araujo (IMPA)
Silvia Fernández-Merchant (California State University)

We are convinced that the organization of mathematics and gender workshops in our community is absolutely necessary. Fostering discussions on these issues is essential to understand the role of female researchers in the mathematical community and promoting their inclusion and visibility.

Regarding the inclusion criteria proposed by BIRS, and unlike many workshops exclusively designed for women in specific areas of mathematics, every research group has been encouraged to include young male researchers or students who are sensitive to gender issues. Involving the entire community in this analysis is vital to the success of this initiative. The majority of listed participants are part of the clearly underrepresented group of women actively conducting research in Latin American countries. In addition, we have invited a small group of researchers from Europe and the USA who have kept strong ties to the Latin American community and whose work with underrepresented groups in their respective countries is noticeable.

In order to strengthen and expand current networks, the group organizers look for outstanding researchers in their field with whom they have never or seldomly collaborated and who have not previously worked with each other. We expect that the groups will take advantage to start joint work that will remotely continue in the future. Moreover, we have also requested the consideration of female mathematicians who are not yet strongly involved in gender and mathematics issues.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5053

Participants:

Alba, Andrea (Universidad Autonoma de San Luis Potosí)
Albizu, Uzuri (Universidad del País Vasco)
Alvarez, Lilliam (Academia de Ciencias de Cuba)
Alves da Silva, Eduardo (IMPA)
Angeloni, Adriana (Universidade Federal Fluminense)
Araujo, Carolina (IMPA)
Araujo, Gabriela (UNAM)
Ardila, Federico (San Francisco State University)
Armendariz, Inés (Universidad de Buenos Aires)
Aroca, Fuensanta (Universidad Nacional Autónoma de México)
Arroyo, Romina M. (University of Cordoba)
Arroyo, Daisy (Universidad de Concepción)
Artebani, Michela (Universidad de Concepción)
Barberis, Laura (National University of Cordoba)
Barrios, Melani (FCEIA- UNR)
Bassols Bello, Karla (Facultad de Ciencias, UNAM)
Batistelli, Karina (Universidad de Chile)
Becerra, Noemí (Universidad de Valparaíso)
Bolivar, Addy (UJAT)
Bonomo, Flavia (Universidad de Buenos Aires)
Bossinger, Lara (Universidad Nacional Autónoma de México)
Brech, Christina (University of São Paulo)
Caballero, Maria Emilia (Universidad Nacional Autónoma de México)
Camacho, Charles (University of Washington)
Cantoral Farfán, Victoria (Georg-August-Universität Göttingen)
Carrillo, Sara (UABJO)
Cecchi Bernales, Paulina (Universidad de Chile)
Cerdeiro, Manuela (Universidad de Buenos Aires)
Chara, Maria (Universidad Nacional del Litoral)
Cirilo, Patricia (UNIFESP)
Cisneros, Bruno (UNAM)
Clapp, Mónica (Universidad Nacional Autónoma de México)
Comparin, Paola (Universidad de La Frontera)
Cordero Franco, Alvaro Eduardo (Universidad de Nuevo León)
Cortez, Maria Isabel (Pontificia Universidad Católica de Chile)
D`Urso, Luíze (IMPA)
da Luz, Adriana (UFF Rio de Janeiro)
Dalfó, Cristina (Universitat de Lleida)
de la Torre Robles, María Fernanda (Independiente)
De Nova Vázquez, Mónica (Facultad de Ciencias, UNAM)
Dias da Costa, Renato (UFRJ)
Diaz, Veronica (Universidad Nacional de Mar de Plata)
Díaz Calderón, Julio César (Universidad Nacional Autónoma de México)
Dickenstein, Alicia (University of Buenos Aires)
Dosal Trujillo, Loiret Alejandria (UNAM)
Ellis, Eugenia (Universidad de la República)
Epifanio, Irene (Universitat Jaume I)
Escobar Parra, Denisse Alejandra (Facultad de Ciencias, UNAM)
Eslami Rad, Anahita (FaMAF)
Eslava, Laura (UNAM)
España, Andrea Arlette (Universidad Autónoma de San Luis Potosí)
Espinosa Guia, Claudia Gisela (Wejen Kajen Indigenous Research Institute International A.C)
Esquivel, Liliana (Universidad del Valle)
Estevez, Gabriela (UFF)
Fardella, Carla (Universidad Andrés Bello)
Fernández-Merchant, Silvia (California State University)
Flores-Zarur, Karla (Universidad Autonoma de San Luis Potosí)
Fonseca, Alejandra (Universidad de Sonora)
Gajardo, Anahí (Universidad de Concepción)
Gallardo-Gutiérrez, Eva (Universidad Complutense de Madrid & ICMAT)
Garbagnati, Alice (Universita' degli Studi di Milano Satatle)
García, María Eugenia (Universidad Nacional de La Plata)
García Arboleda, Isabel (Pontificia Universidad Javeriana Cali)
García Velázquez, Luis Miguel (ENES Morelia)
Garcia-Colin, Natalia (ULB)
García-Ramos, Felipe (Universidad Autonoma de San Luis Potosi)
Gazol, Lourdes (Independiente)
Godoy, Yamile (FaMAF)
Gómez, Laura (Comisión Educación y Divulgación Sociedad Colombiana de Matemáticas)
Gómez Bermeo, Laura (Sociedad Colombiana de Matemáticas)
González, Ana (Udelar)
Gonzalez Casanova, Adrian (UNAM)
González Escalante, Ileana (IMUNAM-Juriquilla)
Guevara, Mucuy-Kak (Universidad Nacional Autónoma de México)
Gutierrez, Milene (Universidad de Celaya)
Hansberg, Adriana (UNAM)
Herbas, Asher (Facultad de Ciencias-UNAM)
Herbera, Dolors (Universitat Autònoma de Barcelona)
Hernández, Ma. Isabel (CIMAT-Mérida)
Hernández, Monica (IIMAS-UNAM)
Hernandez Torres, Sarai (Technion - Israel Institute of Technology)
Herreros, Pilar (Universidad Católica de Chile)
Inoquio, Irene (Universidad Austral de Chile)
Jeronimo, Gabriela (Universidad de Buenos Aires)
Jiménez Canseco, Maily Ester (Universidad Autónoma de Chiapas)
Jiménez Rolland, Rita (UNAM)
Jurado, Edith (Profesora Academia de Matemáticas)
Lalin, Matilde (Universite de Montreal)
Lara, Dolores (CINVESTAV-Instituto Politecnico Nacional)
Lara González, Estela (UCIM, UNAM)
Leemans, Dimitri (Université libre de Bruxelles)
Leon, Irma (UASLP)
Leonardi, Florencia (Universidade de São Paulo, Brasil)
Lomonaco, Luna (IMPA)

López, Beátriz (Ingeniera Biomédica.)
López Cruz, Roxana (Universidad Nacional Mayor de San Marcos)
Lopez de Medrano, Lucia (Universidad Nacional Autonoma de Mexico)
López Márquez, María del Pilar (UNAM)
Luna Olivera, Beatriz Carely (CONACYT)
Manjarrez, Fabiola (UNAM)
Martínez, Paulina (Universidad del Bío-Bío)
Martinez Adame, Carmen (UNAM)
Martínez Ruíz, Guadalupe (Instituto nacional Electoral)
Martínez Sandoval, Leonardo Ignacio (UNAM)
Matus, Josefina (Universidad de Valparaíso)
Mercado Saucedo, Alberto (Universidad Técnica Federico Santa María)
Monsivais, Renata (UNAM)
Montejano, Amanda (UNAM)
Monterroso Alfaro, Ingrid Midory (UNAM)
Monti, Martina (Università degli studi di Milano)
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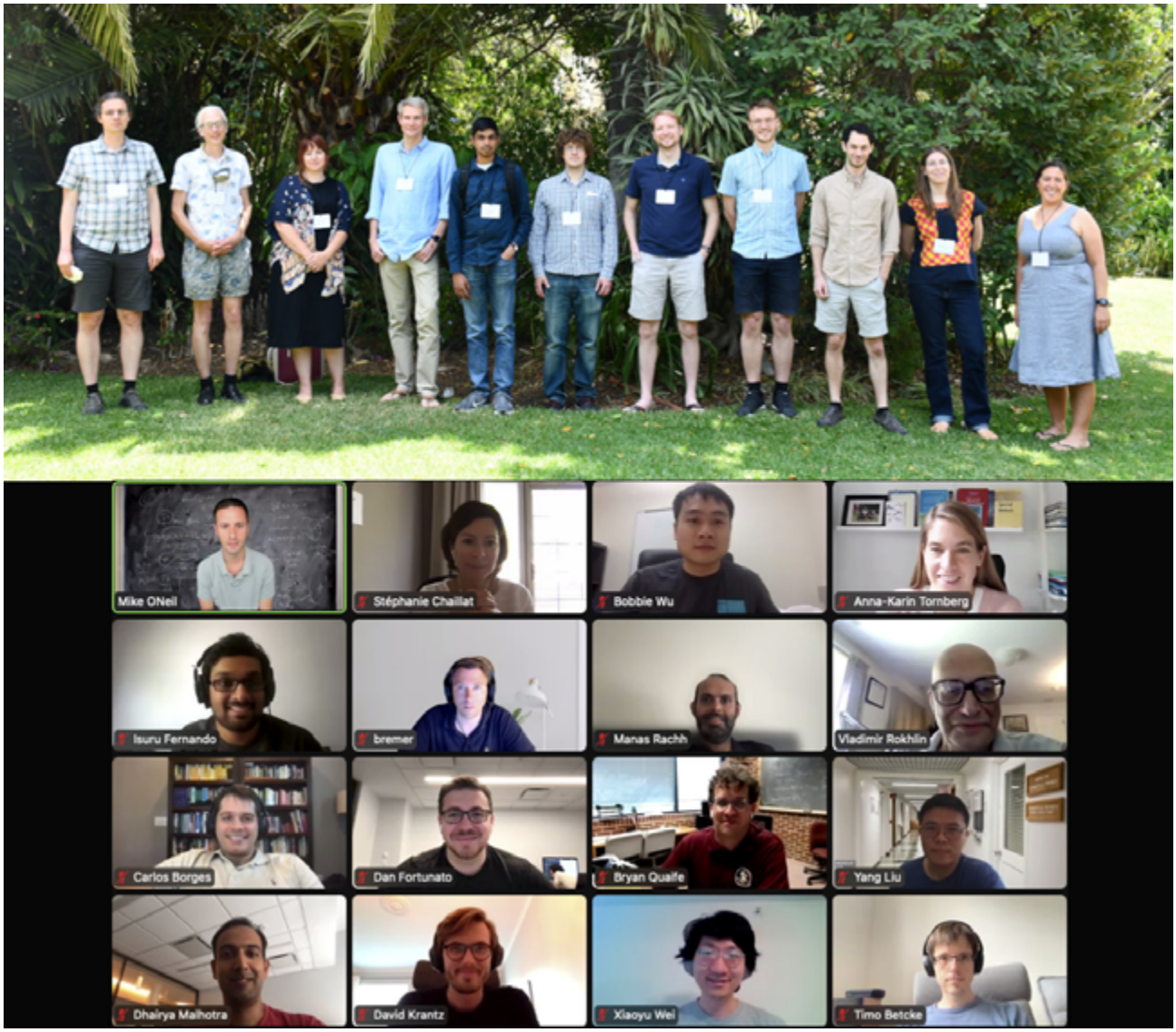
Navarro Flores, Sonia (UNAM)
Navarro-López, Eva (Universidad de Manchester y Universidad de Wolverhampton)
O'Reilly-Regueiro, Eugenia (Universidad Nacional Autonoma de Mexico)
Odabasi, Sinem (Universidad de Murcia)
Oliveros, Déborah (UNAM)
Olsen, Mika (Universidad Autónoma Metropolitana)
Ortigoza, Giovanna (Seguros Monterrey-New York Live)
Ortiz, Laura (UNAM)
Ovando, Gabriela (Universidad Nacional de Rosario)
Oyarce, Kristil (Universidad de Valparaíso)
Paiva Peñuela, Daniela (IMPA)
Pariguan, Eddy (Pontificia Universidad Javeriana)
Peñaloza Velasco, Lizbeth (Universidad del Mar)
Peñaranda, Ruby (Colegio San Luis)
Perales, Raquel (CONACyT-UNAM)
Perez Gavilan Torres, Jacinta (Jagiellonian University in Kraków)
Perez Sedeño, Eulalia (Consejo Superior de Investigaciones Científicas de España)
Piroddi, Benedetta (Università degli studi di Milano)
Pizarro, Amalia (Universidad de Valparaiso)
Plavnik, Julia (Indiana University)
Pujals, Enrique (CUNY)
Quedo, Ana Victoria (IMPA/ U. Poitiers)
Quezada, Pablo (Universidad de la Frontera)
Radovic, Darinka (Universidad de Chile)
Ramos, Alejandra (Universidad de Eslovenia)
Restrepo, Alejandra (Universidad de Antioquia)
Rey, Carolina Ana (Universidad técnica Federico Santa María)
Rincón, Elizabeth (Universidad Autónoma de Santo Domingo)
Ríos Solís, Yasmín Águeda (Tecnológico de Monterrey)
Rivera Segundo, Diana Patricia (Instituto de Matemáticas)
Rodriguez-Vallarte, Maria del Carmen (Universidad Autónoma de San Luis Potosí)
Roldan Roa, Erika (Technical University Munich and EPFL)
Romero, Guillermo (Data-Pop Alliance)
Saavedra, Patricia (UAM-Iztapalapa)
Saavedra Lago, Laura (Politecnica de Madrid)
Sáenz, Ricardo (Universidad de Colima)
Saez, Mariel (P.Universidad Catolica de Chile)
Salazar, Nisi (Universidad de Valparaíso)
Salgado, Cecilia (Rijksuniversiteit Groningen)
Sanchez, Francisca (Universidad de Valparaíso)
Santos, Luz (Universidad Autonoma de San Luis Potosí)
Schaffhauser, Florent (Universidad de los Andes)
Schaposnik, Laura (UIC)
Serna Tello, Karen Alejandra (Matemática Educativa del Instituto Politécnico Nacional (CICATA))
Simón Ramos, María Guadalupe (Universidad Autónoma de Tamaulipas)
Stein, Maya (Universidad de Chile)
Takane, Martha (UNAM)
Tartaglia, Gisela (UNLP)
Torres, Marisol (Universidad Autonoma de San Luis Potosí)
Valdés, María Elisa (Universidad de la Frontera)
Valdivieso-Díaz, Yadira (UDLAP)
Vargas González, Beatriz (Unidad Cuernavaca del Instituto de Matemáticas)
Vera Gajardo, Andrea (Universidad de Valparaíso)
Zingali Meira, Felipe (UFRJ/University of Groningen)
Zubieta, Judith (UNAM)
Zubieta, Paloma (Mathematics Institute)

Outstanding Challenges in Computational Methods for Integral Equations
May 22 - 27, 2022

Organizers:

Adrianna Gillman (University of Colorado Boulder)
Per-Gunnar Martinsson (University of Texas Austin)
Stephanie Chaillat-Loseille (CNRS)
Michael O'Neil (New York University)



As technology advances, so does the cost (both time and energy) of experimental design. For certain classes of problems (e.g. radar propagation, fluid flow, heat dispersion, structural modeling), in which the observed phenomena is well-understood and accurately modelled via the equations of classical mathematical physics, design by simulation can mitigate some of the costs associated with purely experimental design. However, in order to do this, advances in both the mathematical formulation of the problem and the computational algorithms used in their solution are needed. This workshop brought together experts in various fields of mathematics and computation to develop next-generation computational tools and algorithms that will bridge the gap between design by experiment and design by simulation.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5170

Participants:

af Klinteberg, Ludvig (KTH Royal Institute of Technology)
Agocs, Fruzsina (Flatiron Institute)
Anderson, Thomas (UMich)
Askham, Travis (NJIT)
Bagge, Joar (KTH)
Barnett, Alexander (Flatiron Institute, Simons Foundation)
Beckman, Paul (Courant Institute)
Betcke, Timo (University College London)
Biros, George (University of Texas)
Bremer, James (University of Toronto)
Cardoso Borges, Carlos (University Central Florida)
Cerfon, Antoine (Courant Institute NYU)
Chaillat-Loseille, Stephanie (CNRS)
Chen, Ke (University of Texas at Austin)
Claeys, Xavier (Sorbonne Université)
Darbas, Marion (Université Sorbonne Paris Nord)
Epstein, Charles (Flatiron Institute)
Fernando, Isuru (University of Illinois)
Fierro-Piccardo, Maria Ignacia (University College London)
Fortunato, Daniel (Flatiron Institute)
Fryklund, Fredrik (Courant Institute)
Gannon, Ashley (Florida State University)
Gillman, Adrianna (University of Colorado Boulder)
Gimbutas, Zydrunas (National Institute of Standards and Technology)
Gonzalez Casanova, Pedro (Institute of Mathematics, (UNAM))
Goodwill, Tristan (Courant Institute)
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Kailasa, Srinath (University College London)
Kaye, Jason (Flatiron Institute)
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Krantz, David (KTH)
Lai, Jun (Zhejiang University, China)
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Malhotra, Dhairya (Flatiron Institute)
Marchand, Pierre (INRIA)
Martinsson, Per-Gunnar (University of Texas Austin)
Michielssen, Eric (University of Michigan)
Miller, Owen (Yale University)
Morse, Matthew (Qualcomm AI Research)
O'Neil, Michael (New York University)
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Petek, Martin (Politecnico di Torino)
Potter, Samuel (Courant Institute)
Quaife, Bryan (Florida State University)
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Scroggs, Matthew (University of Cambridge)
Serkh, Kirill (University of Toronto)
Sorgentone, Chiara (Sapienza University of Rome)
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Wilber, Heather (University of Texas at Austin)
Wu, Bowei (University of Texas at Austin)
Xia, Qing (KTH)
Xue, Wenjin (Yale)
Yang, Haizhao (Purdue University)
Yesypenko, Anna (University of Texas at Austin)
Ying, Lexing (Stanford University)
Zhang, Yabin (University of Michigan)
Zhang, Hanwen (Yale)
Zhu, Hai (UMich)
Zorin, Denis (New York University)

Topological Complexity and Motion Planning
May 29 - June 3, 2022

Organizers:

Daniel Cohen (Louisiana State University)
Jesus Gonzalez (Cinvestav)
Lucile Vandembroucq (Universidade do Minho)

Teaching a robot to move about on an empty football field is easy. There is exactly one line joining the robot's starting and finishing points, and the robot can be instructed to move from start to finish along this line. This instruction scheme is robust in the sense that nearby starting and finishing points give rise to similar instructions. If the robot is attached to a circular track, teaching it to move is harder. The instructions "move along the shortest arc'' lead to confusion if the starting and finishing points are precisely opposite one another, as the robot doesn't know whether to move in the clockwise or counterclockwise direction. Choosing one of these two, say, the instructions "move clockwise'', yields confusion when the starting and finishing points are the same. From these instructions, the robot does not know if it should simply stay at the start/finish point, or move in a less efficient manner, looping around the circle once or twice or\ldots

The problem can be solved by giving different instructions for different pairs of starting and finishing points. If the points are precisely opposite one another, instruct the robot to move clockwise. Otherwise, instruct it to move along the shortest arc. The number, 2, of different types of robust instructions required is the topological complexity of the circle, providing a measure of how difficult it is to teach the robot how to navigate, that is, how complicated the robot motion planning problem is on the circle. The mathematical studies of these notions, for robot domains known as topological spaces, with shapes far more complex than those of a football field or circular track, are active areas of research in the field of applied topology. This workshop brought together scientists from all around the world working on diverse aspects of motion planning and topological complexity so as to provide exposure to potential new perspectives and foster collaboration, prepare young scientists for work in these rich and fascinating areas of research, and establish directions for future work and interaction in these areas.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5182

Participants:

Aguilar Guzmán, Jorge (CINVESTAV)
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Bayeh, Marzieh (University of Ottawa)
Bazzoni, Giovanni (University of Insubria)
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Bianchi, Andrea (University of Copenhagen)
Bibby, Christin (Louisiana State University)
Blagojevic, Pavle (Freie Universität)
Borat, Ayse (Bursa Technical University)
Cadavid, Natalia (CINVESTAV)
Calles Loperena, Jose Jaime (CCM-UNAM Morelia)
Cohen, Daniel (Louisiana State University)
Colin Hernandez, Nestor (CINVESTAV)
Colman, Hellen (Wright College)
Cutler, Tyrone (Universität Bielefeld)
Daundkar, Navnath (Chennai Mathematical Institute)
Delucchi, Emanuele (University of applied Arts and Sciences of Southern Switzerland)
Deshpande, Priyavrat (Chennai Mathematical Institute)
Dorta, Joseph (Louisiana State University)
Espinosa, Arturo (Adam Mickiewicz University)
Espinoza, Jesus F. (Universidad de Sonora)
Farber, Michael (Queen Mary University of London)
Fernández Suárez, Lucía (ISEL Lisbon)
García Calcines, José Manuel (Universidad de La Laguna)
Goncalves, Daciberg (University of São Paulo)
Gonzalez, Jesus (Cinvestav)
Gonzalez, Emilio José (Cinvestav)
Grant, Mark (University of Aberdeen)
Guralnik, Dan (University of Florida)
Hamoun, Said (Université Moulay Ismail)
Herald, Chris (University of Nevada, Reno)
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Ipanaque, Cesar (Universidade de Sao Paulo)
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Jiménez Rolland, Rita (UNAM)
Kallel, Sadok (American University of Sharjah)
Kandola, Shelley (University of Minnesota)
Kishimoto, Daisuke (Kyushu University)
Knudsen, Ben (Northeastern University)
Kvalheim, Matthew (University of Michigan)
Landweber, Peter (Rutgers University)
Leon-Medina, Jose Luis (Cinvestav)
Li, Kevin (University of Southampton)
Loeh, Clara (Universität Regensburg)
Macías-Virgós, Enrique (Universidade de Santiago de Compostela)
Mamouni, My Ismail (CRMEF Rabat)
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Mescher, Stephan (Martin Luther University Halle-Wittenberg)
Meshulam, Roy (Technion (Haifa))
Monod, Anthea (Imperial College London)
Mosquera Lois, David (Universidade de Santiago de Compostela)
Mrozek, Marian (Jagiellonian University)
Neumann, Frank (University of Leicester)
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Oprea, John (Cleveland State University)
Palmer-Anghel, Cristina (Université de Genève)
Pamuk, Mehmetcik (METU)
Paul, Amit Kumar (Queen Mary University of London)
Pavesic, Petar (University of Ljubljana)
Pereira-Sáez, MaríaJosé (Universidade da Coruña)
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Roque Márquez, Christopher Jonatan (UNAM)
Sadykov, Rustam (Kansas State University)
Sarkar, Soumen (Indian Institute of Technology Madras)
Scott, Jamie (University of Florida)
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Strang, Alexander (University of Chicago)
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Tancer, Martin (Charles University in Prague)
Tanré, Daniel (University of Lille)
Torres-Giese, Enrique (Trinity Western University)
Tsutaya, Mitsunobu (Kyushu University)
Vandembroucq, Lucile (Universidade do Minho)
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Zhang, Qinghai (Zhejiang University)
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Mathematical and Conceptual Aspects of Quantum Theory
June 12 - 17, 2022

Organizers:

Robert Oeckl (CCM UNAM Morelia)

Chryssomalis Chryssomalakos (ICN UNAM)

In recent years the foundations of quantum theory have seen a boost of interest and development. This is on the one hand due to their crucial role in new developments such as quantum information theory, quantum computing, and nano-scale physics. On the other hand, it is due to the increasing recognition of their relevance in big unsolved questions such as quantum gravity and black hole physics. At the same time, successful theories of physics have always relied on and driven mathematical development. The fruitful interaction with physics extends to almost all areas of mathematics but is arguably the broadest and most intense at the foundations of physics.

Thus, researchers working on conceptual and mathematical aspects of quantum theory, and especially foundations, could contribute substantially to advance these new developments and address these big questions. However, there is considerable fragmentation in this broad area with many small groups or even individual researchers working in isolation on specialized problems, particularly in Mexico. The present workshop brought together leading researchers working in a number of different directions in this area. This is with the aim to initiate or foster their mutual communication, initiate collaboration and contribute to community formation, both internationally, and in Mexico in particular.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5177

Participants:

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Brukner, Caslav (IQOQI Vienna Austria)
Chiribella, Giulio (QICI, The University of Hong Kong)
Chryssomalakos, Chryssomalis (ICN UNAM)
Colosi, Daniele (UNAM)

Corichi, Alejandro (CCM UNAM Morelia)
Dittrich, Bianca (Perimeter Institute Canada)
Finster, Felix (U of Regensburg Germany)
Flores Delgado, Ana Gabriela (ICN UNAM)
Guijosa, Alberto (ICN UNAM)
Guzmán-González, Edgar (UAM Mexico)
Hanotel Pinzón, Christian Louis (ICN UNAM)
Hardy, Lucien (Perimeter Institute Canada)
Ibort, Alberto (U Carlos III Madrid)
Juárez Aubry, Benito A. (ICN UNAM)
Kempf, Achim (U of Waterloo Canada)
Klimov, Andrei (U of Guadalajara)
Marmo, Giuseppe (U Federico II Naples Italy)
Martin, John (U of Liege Belgium)
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Rascón, Valentina (ICN UNAM)
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Runkel, Ingo (U of Hamburg Germany)
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Sorkin, Rafael (Perimeter Institute Canada)
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Zampeli, Adamantia (CCM UNAM Morelia)
Zapata, José A. (CCM UNAM Morelia)
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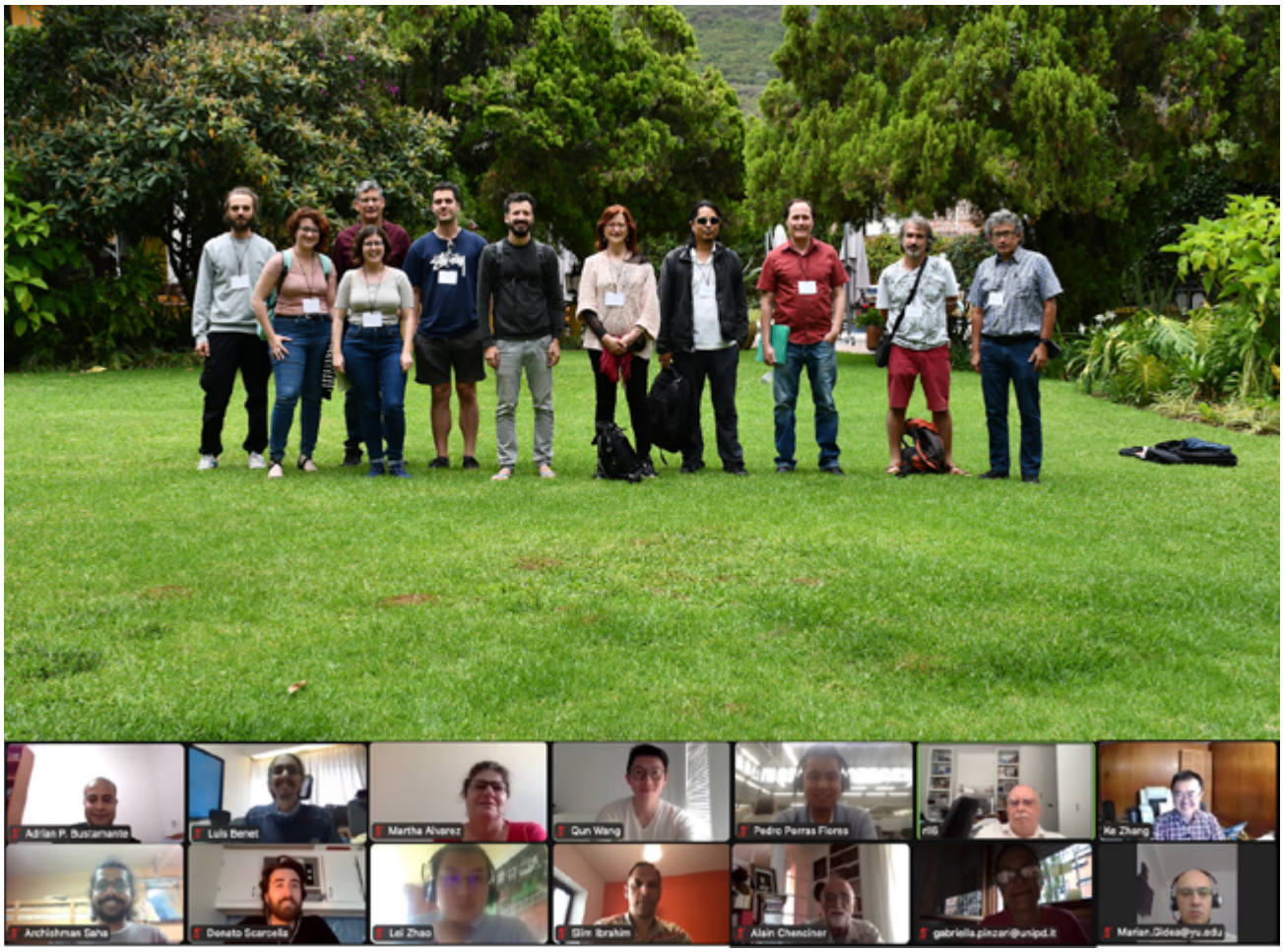
Geometric and Variational Methods in Celestial Mechanics
June 19 - 24, 2022

Organizers:

Renato Calleja (IIMAS-UNAM)
Marcel Guardia (Universitat Politècnica de Catalunya)
Jacques Fejoz (Université Paris Dauphine)
Susanna Terracini (Università di Torino)



Determining qualitative properties of the long-term behavior of the planets of the Solar system, and now also of extra Solar systems, is the oldest question in Dynamical Systems. The simplest model of the Solar system is the N-body problem: N bodies moving under the influence of the Newtonian gravitational force. Even if it has been studied for more than two centuries and despite the outstanding recent progress, the N-body problem is far from being well understood.

This workshop brought together different mathematicians who study Celestial Mechanics models from different perspectives and with different techniques to achieve a deeper understanding of the dynamics of the N-body problem.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5175

Participants:

Alvarez-Ramirez, Martha (Universidad Autonoma Metropolitana -Iztapalapa)
Barrera, Carlos (IIMAS-UNAM)
Barutello, Vivina (University of Torino)
Benet, Luis (Instituto de Ciencias Físicas, UNAM)
Bengochea, Abimael (ITAM)
Boscaggin, Alberto (Università degli studi di Torino)
Bravetti, Alessandro (UNAM)

Calleja, Renato (Universidad Nacional Autónoma de México)
Canneori, Gian Marco (Universitá di Torino)
Celletti, Alessandra (Universita' di Roma Tor Vergata)
Chen, Kuo-Chang (National Tsing Hua University)
Chenciner, Alain (IMCCE, France)
Chierchia, Luigi (Università ROMA TRE)
De Blasi, Irene (University of Turin)
de la Llave, Rafael (Georgia Institute of Technology)
Farres, Ariadna (NASA's Goddard Space Flight Center)
Fejoz, Jacques (Université Paris Dauphine)
Feltrin, Guglielmo (University of Udine)
García Azpeitia, Carlos (IIMAS-UNAM)
Gidea, Marian (Yeshiva University)
Gimeno, Joan (Georgia Tech/UB)
Giralt, Mar (Universitat Politècnica de Catalunya)
Guardia, Marcel (Universitat Politècnica de Catalunya)
Ibrahim, Slim (University of Victoria)
Jackman, Connor (CIMAT)
Kaloshin, Vadim (University of Maryland)
Maderna, Ezequiel (Universidad de la República)
Martínez del Río, David (University of Warwick)
Martinez-Seara, Tere (Universitat Politècnica de Catalunya)
Massetti, Jessica Elisa (Università degli Studi Roma Tre)
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Porras Flores, Pedro (IIMAS-UNAM)
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Zhang, Ke (University of Toronto)
Zhao, Lei (University of Augsburg)
Zhu, Shuqiang (Southwestern University of Finance and Economics)

M5 - Mathematics of Multiphase, Multiscale, Mutiphysics Models
July 31 - August 5, 2022

Organizers:

Mayank Tyagi (Louisiana State University)
Francois Bertrand (Ecole Polytechnique)
Samir Khanna (BP - USA)
Wei Ge (Chinese Academy of Sciences)
Krishnaswamy Nandakumar (Louisiana State University & Agri)

Understanding the dynamics of dispersed multiphase flow and developing models at the appropriate scales (continuum, meso and interpenetrating continua scales) remains a challenge. It is of importance not only as a scientific problem in its own merit for understanding the dynamics of volcanos, avalanches, sediment transport etc, in nature but also for its engineered applications in such areas as chemical, material, mineral and food processing applications where such processes are commonly encountered. Advanced computational algorithms and High-Performance Computing tools are enabling scientists and engineers to design and operate new manufacturing facilities that can be highly efficient and modular in design with a low energy and environmental footprint. Thus while the impact of such studies is quite broad, the workshop will focus on the three aspects of multiscale, multiphase and multiphysics models. We brought a group of leading international researchers to address current progress and challenges ahead on this topic. Although many industries (auto, aerospace ..) have already incorporated computational models as a reliable tool in their design practices to develop optimal designs, the process industry is trailing behind. This is due to a higher level of complexity in these flows. However, the next generational breakthrough in the process industry will not happen without multiphase CFD. The process industry is a key component of modern society. With increasing environmental concerns about high intensity use of fossil fuels, it is imperative that the reliability of multiphase models and their computational solutions be improved to assist in the development of a new generation of process equipment designs.

While the traditional processing industries developed in the early 1900 when our ability to solve such complex multiphase flow equations was limited, the next generation of processing industries that rely not on fossil fuel, but on renewable bio-feedstock, can be built using modular technologies with design tools built on strong foundational mathematical models for multiphase flows. The BIRS workshop brought together mathematicians, scientists and engineers working in this field to learn from each other the current state of the science of multiphase flows to enable such innovations.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5188

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Christov, Ivan (Purdue University)
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Fan, L.S. (Ohio State University)
Fox, Rodney (Iowa State University)
Gao, Xi (Guangdong Technion-Israel Institute of Technology)
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Pannala, Sreekanth (SABIC)
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Wachs, Anthony (University of British Columbia)
Woods, Andy (Cambridge University)
Wu, Chunliang (ANSYS)
Xiong, Qingang (South China University of Technology)
Zhao, Jianlin (China University of Petroleum)
Zhu, Aiqi (Institute of Process Engineering)

Metric measure Spaces with Symmetry and Lower Ricci Curvature Bounds
August 7 - 12, 2022

Organizers:

Diego Corro (Universität zu Köln)
Jesús Núñez-Zimbrón (Universidad Nacional Autónoma de México)
Masoumeh Zarei (University of Münster)
Andrea Mondino (University of Oxford)

The problem of finding a cost-optimizing way of moving goods from one place to another has been studied in Mathematics since the XVII century. A breakthrough came in the first decade of 2000 with the description of a large family of metric measure spaces where this problem can be used to define Ricci curvature lower bounds in a synthetic sense. Even though these spaces have a lot of nice geometric properties, their explicit description has proved to be a difficult problem. In this workshop, we explored how to break up such a given space into small pieces which are highly symmetric, with the intention of giving a global picture of the original space.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5066

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Cavalletti, Fabio (Scuola Internazionale Superiore di Studi Avanzati)

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Connell, Chris (Indiana University Bloomington)
Corro, Diego (Universität zu Köln)
Dai, Xianzhe (University of California, Santa Barbara)
De Ponti, Nicolò (SISSA)
Deng, Qin (MIT)
Erbar, Matthias (Universität Bielefeld)
Fiorani, Francesco (University of Oxford)
Galaz-García, Fernando (Durham University)
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Han, Bangxian (University of Science and Technology of China)
Harvey, John (Swansea University)
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Ketterer, Christian (Universität Freiburg)
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Mitsuishi, Ayato (University of Fukuoka)
Mondello, Ilaria (University of Paris XII - Creteil)
Mondino, Andrea (University of Oxford)
Moreno, Adam (Amherst College)
Navarro, Dimitri (University Oxford)
Núñez-Zimbrón, Jesús (Universidad Nacional Autónoma de México)
Palmas, Oscar (Universidad Nacional Autónoma de México)
Pan, Jiayin (Fields Institute)
Peng, Yuanlin (Tohoku University)
Perales, Raquel (CONACyT-UNAM)
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Semola, Daniele (University of Oxford)
Sturm, Karl-Theodor (University of Bonn)
Suárez-Serrato, Pablo (UNAM)
Tamanini, Luca (Universitá Bocconi)
Tewodrose, David (Nantes Université)
Tian, Wenchuan (UC Santa Barbara)
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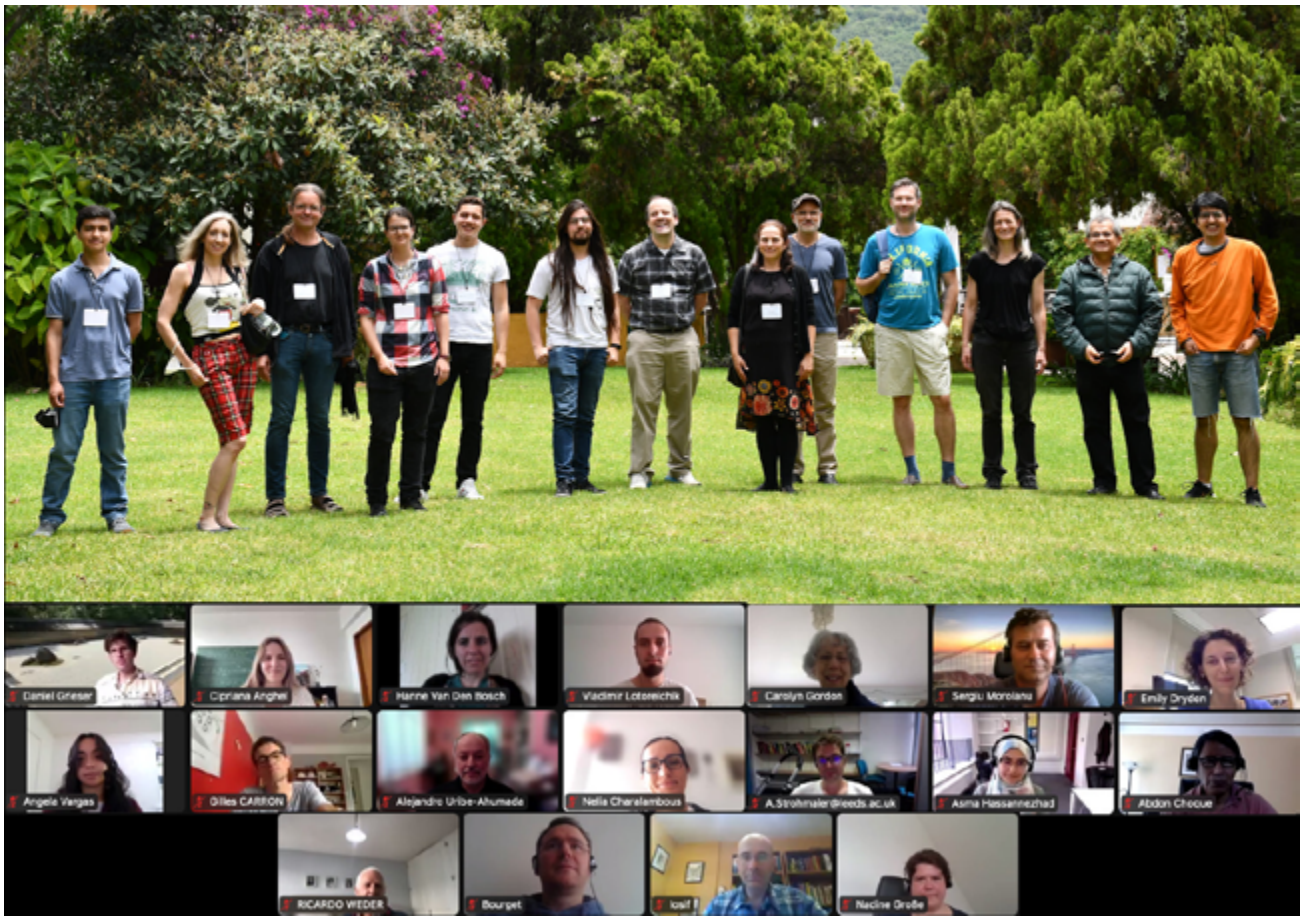
Analytic and Geometric Aspects of Spectral Theory
August 14 - 19, 2022

Organizers:

Diego Corro (Universität zu Köln)
Jesús Núñez-Zimbrón (Universidad Nacional Autónoma de México)
Masoumeh Zarei (University of Münster)
Andrea Mondino (University of Oxford)



“Spectral Theory” seeks to explain how a bell or a more complicated curved surface sounds when it vibrates, using the language of mathematics. Mathematicians want to characterize the sounds produced by a given surface. A more advanced question is: if a blind person hears a sound, can this person infer something about the surface that produces the sound? Though we can deduce some properties, such as the area of the surface, from its sound, many of these questions are still unsolved. For example, we do not know yet whether there are two different drums with smooth borders which sound the same. Other branches of spectral theory relate to other physical phenomena, for example, how heat propagates in a given space, and what frequencies allow waves to travel through a given material.

In the workshop, we brought together researchers of different scientific backgrounds at different stages of their academic careers from all over the world in order to provide them with a stimulating environment. There were several survey talks, but the main focus of the workshop was working in groups. We especially encouraged women and researchers from Latin America to participate in the workshop to increase their visibility within the scientific community.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5149

Participants:

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Charalambous, Nelia (University of Cyprus)
Choque-Rivero, Abdon (UMSNH)
del Río, Rafael (UNAM)
Dryden, Emily (Bucknell University)
Fedosova, Ksenia (Albert-Ludwigs-Universität Freiburg)
Gordon, Carolyn (Dartmouth College)
Grieser, Daniel (University of Oldenburg)
Große, Nadine (University of Freiburg)
Hassannezhad, Asma (University of Bristol)
Jakobson, Dmitry (McGill University)
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Lotoreichik, Vladimir (Czech Academy of Sciences)
Moreno, Javier (Universidad de los Andes, Bogota)
Moroianu, Sergiu (Romanian Academy of Sciences)
Patiño López, Andrés Felipe (Universidad de los Andes, Bogota)
Pérez, Camilo (Universidad de los Andes)
Polterovich, Iosif (Université de Montréal)
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Rowlett, Julie (Chalmers University and the University of Gothenburg)
Sher, David (DePaul University)
Silva Pereyra, Luis Octavio (UNAM)
Spilioti, Polyxeni (Aarhus University)
Strohmaier, Alex (Univ. of Leeds)
Uribe, Alejandro (University of Michigan)
Van den Bosch, Hanne (Universidad de Chile)
Vargas, Angela (Pontifical Catholic University of Chile)
Vertman, Boris (Universität Oldenburg)
Vig, Amir (University of Michigan)
Villegas-Blas, Carlos (Universidad Nacional Autonoma de Mexico)
Weder, Ricardo (UNAM)
Winklmeier, Monika (Universidad de los Andes, Bogotá)
Zhu, Xuwen (Northeastern University)

Statistical Challenges in the Identification, Validation, & Use of Surrogate Markers
August 21 - 26, 2022

Organizers:

Layla Parast (University of Texas at Austin)
Lang Wu (University of British Columbia)
Peter Gilbert (Fred Hutchinson Cancer Center)

In studies examining the effectiveness of an intervention, the availability of a surrogate marker that could be used to estimate the intervention effect and could be observed earlier than the primary outcome would allow researchers to make conclusions regarding effectiveness with less required follow-up time. Statistical methodological research on identifying such surrogate markers, assessing the value of such markers, determining when these markers should be collected, and developing tools to use these markers for future studies has led to numerous available methods and has highlighted a number of limitations. There is little agreement on the appropriate approach to identify, validate, and use surrogate markers. This workshop brought together statisticians, biostatisticians, and epidemiologists to build on recent methodological advances in the evaluation of surrogate markers to identify robust methods that could appropriately be used in practice while also quantifying potential risks if certain necessary assumptions are violated.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5184

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Chan, Ivan (Bristol Myers Squibb)
chen, aiying (Sanofi)
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Garcia, Tanya (UNC Chapel Hill)
Gilbert, Peter (Fred Hutchinson Cancer Center)
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Halloran, M Elizabeth (Fred Hutch and U Washington)
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Hejblum, Boris (Inserm Bordeaux Population Health)
Heng, Fei (University of North Florida)
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Huang, Yunda (Fred Hutchinson Cancer Center)
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Moodie, Zoe (Fred Hutch)
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Nieto-Barajas, Luis E. (ITAM - Mexico)
Ning, Xi (UNCC)
Ong, Fenny (UHasselt)
Otwombe, Kennedy (University of the Witwatersrand)
Pan, Yinghao (University of North Carolina at Charlotte)
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Peng, Kangyi Ken (Simon Fraser University)
Peng, Roger (Johns Hopkins University)
Peng, Yingwei (Queen University)
Peng, James (UW)
Petkau, John (University of British Columbia)
Platt, Robert (McGill University)
Qin, Jing (National Institutes of Health – NIAID)
Qiu, Jin (Zhejiang University of Finance and Economics)
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Rosin, Sam (UNC)
Rotnitzky, Andrea (Di Tella University)
Shafie Khorassani, Fatema (University of Michigan)
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Thiebaut, Rodolphe (U-Bordeaux)
Ulloa Perez, Ernesto (University of Washington)
van der Laan, Mark (University of California Berkeley)
van der Laan, Lars (University of Washington)
Vandebosch, An (Janssen Pharmaceuticals)
VanderWeele, Tyler (Harvard Public Health)
Wang, Liqun (University of Manitoba)
Wang, Xuan (Harvard University)
Wang, Rui (Harvard Pilgrim Health Care Institute)
Wang, Tao (Yunnan Normal University)
Williamson, Brian (Kaiser Permanente Washington Health Research Institute)
Wolock, Charles (UW)
Wu, Lang (The University of British Columbia)
Wu, Stephanie (Harvard T.H. Chan School of Public School)
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Yi, Grace (University of Western Ontario)
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Zeng, Leilei (University of Waterloo)
Zhang, Xuekui (UNIVERSITY OF VICTORIA)
Zhang, Bo (Fred Hutch)
Zhang, Donghui (Sanofi)
Zhang, Wenxin (Berkeley)
Zhao, Sihai (University of Illinois at Urbana-Champaign)
Zhao, Yinshan (Population Data BC)
Zheng, Congping (YNU)
Zhou, Guohai (Harvard University)

Applied Functional Analysis
August 28 - September 2, 2022

Organizers:

Feng Dai (University of Alberta)
Ronald DeVore (Texas A & M University)
Vladimir Temlyakov (University of South Carolina)
Sergey Tikhonov (ICREA & Centre de Recerca Matemàtica)

The workshop was focused on important recent developments and progress in applied functional and harmonic analysis. It provided not only a platform for strengthening the mathematical research in this area but also an opportunity for the participants in knowing the emerging areas of research.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5167

Participants:

Adcock, Ben (Simon Fraser University)
Aldroubi, Akram (Vanderbilt University)
Asipchuk, Aleh (Oleg) (Florida International University)
Bilyk, Dmitriy (University of Minnesota)
Bondarenko, Andrii (Norwegian university of science and technology)
Buhmann, Martin (Justus-Liebig University)
Burusheva, Leyla (Lomonosov Moscow State University)
Dai, Feng (University of Alberta)
De Carli, Laura (Florida International University)
De Marchi, Stefano (University of Padova)
Dinh, Dũng (Vietnam National University)
Feng, Han (City University of Hong Kong)
Garrigos, Gustavo (University of Murcia)
Ge, Yan (City University of Hong Kong)
Gonçalves, Felipe (University of Bonn)
Gorbachev, Dmitry (Tula State University)
Gu, Yi (Yunnan University)
Han, Bin (University of Alberta)
Jäger, Janin (University of Giessen)
Kashin, Boris (Steklov Mathematics Institute)
Kolomoitsev, Yurii (University of Göttingen)
Kosov, Egor (Steklov Mathematical Institute)
Kroo, Andras (Alfred Renyi Institute of Mathematics)
Kutzarova, Denka (University of Illinois at Urbana-

Champaign)
Leviatan, Dany (Tel Aviv University)
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Mashreghi, Javad (Laval University)
Niu, Yeli (Shanghai Normal University)
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Schechtman, Gideon (Weizmann Institute)
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Sun, Xingping (Missouri State University)
Temlyakov, Vladimir (University of South Carolina)
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Xu, Yuan (University of Oregon)
Xu, Guiqiao (Tianjin Normal University)
Ye, Wenrui (University of International Business and Economics)
Ye, Qi (South China Normal University)
Zhou, Ding-Xuan (City University of Hong Kong)

Theory and Computational Methods for SPDEs
September 11 - 16, 2022

Organizers:

David Cohen (Chalmers University of Technology and University of Gothenburg)
Marta Sanz-Solé (University of Barcelona)
Annika Lang (Chalmers University of Technology and University of Gothenburg)
Samy Tindel (Purdue University)

This workshop brought together a number of world experts in the theoretical analysis of these equations, which model dynamical systems disturbed by noise together with specialists in scientific computing, in a first meeting of its kind.

Mathematical models based on SPDEs play an increasingly important role in modern science, society, and industry. They have an impact on a wide variety of applications from biology and neurology to finance and engineering. Effective and efficient simulations of such models can only be done with a deep theoretical understanding of the dynamical properties of SPDEs as well as of numerical algorithms. The aim of this workshop was to gather two sub-communities (theory and numerical analysis for SPDEs) to address challenges in our relatively young research field. Young talents as well as influential mathematicians came to Banff from numerous international institutes (Austria, China, France, Germany, Netherlands, Spain, Sweden, Switzerland, UK, USA) as well as Canadian researchers (Edmonton, Ottawa, Vancouver). The participants of this workshop presented and discussed the current state of their respective disciplines. We also wish to stimulate a fluid communication between the theory and practice of SPDEs, in order to initialize new collaborations on promising research directions in our area.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5172

Participants:

Andersson, Adam (Chalmers University of Technology and University of Gothenburg)
Balan, Raluca (University of Ottawa)
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Berg, André (Umeå University)
Bessaih, Hakima (Florida International University)
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Brzezniak, Zdzislaw (York University)
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Campbell, Stuart (Heriot Watt University)
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Cerrai, Sandra (University of Maryland)
Chaparro Jaquez, Luis Mario (University of Leeds)
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Erdoğan, Utku (Eskişehir Technical University)
Feng, Xiaoli (Xidian Univeristy)
Geldhauser, Carina (Lund University)
Gerencsér, Máté (TU Wien)
Gess, Benjamin (Universität Bielefeld & MPI MiS Leipzig)
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Huang, Chuying (Fujian Normal University)
Hutzenthaler, Martin (University of Duisburg-Essen)
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Jin, Diancong (Huazhong University of Science and Technology)
Khoshnevisan, Davar (University of Utah)
Kloeden, Peter (University of Tuebingen)
Kovács, Mihály (Pázmány Péter Catholic University and Budapest University of Technology and Economics and Chalmers University)
Kruse, Raphael (Martin-Luther-Universität Halle-Wittenberg)
Krylov, Nicolai (University of Minnesota)
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Ortiz-Latorre, Salvador (University of Oslo)
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Peszat, Szymon (Jagiellonian University)
Petersson, Andreas (University of Oslo)
Prohl, Andreas (Universität Tübingen)
Quer-Sardanyons, Lluís (Universitat Autònoma de Barcelona)
Reiß, Markus (Universität zu Berlin)
Röckner, Michael (Bielefeld University)
Salimova, Diyora (Albert-Ludwigs-University of Freiburg)
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Shardlow, Tony (University of Bath)
Sheng, Derui (Chinese Academy of Sciences)
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Wang, Mengchao (Radboud University)

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Zheng, Guangqu (The University of Liverpool)
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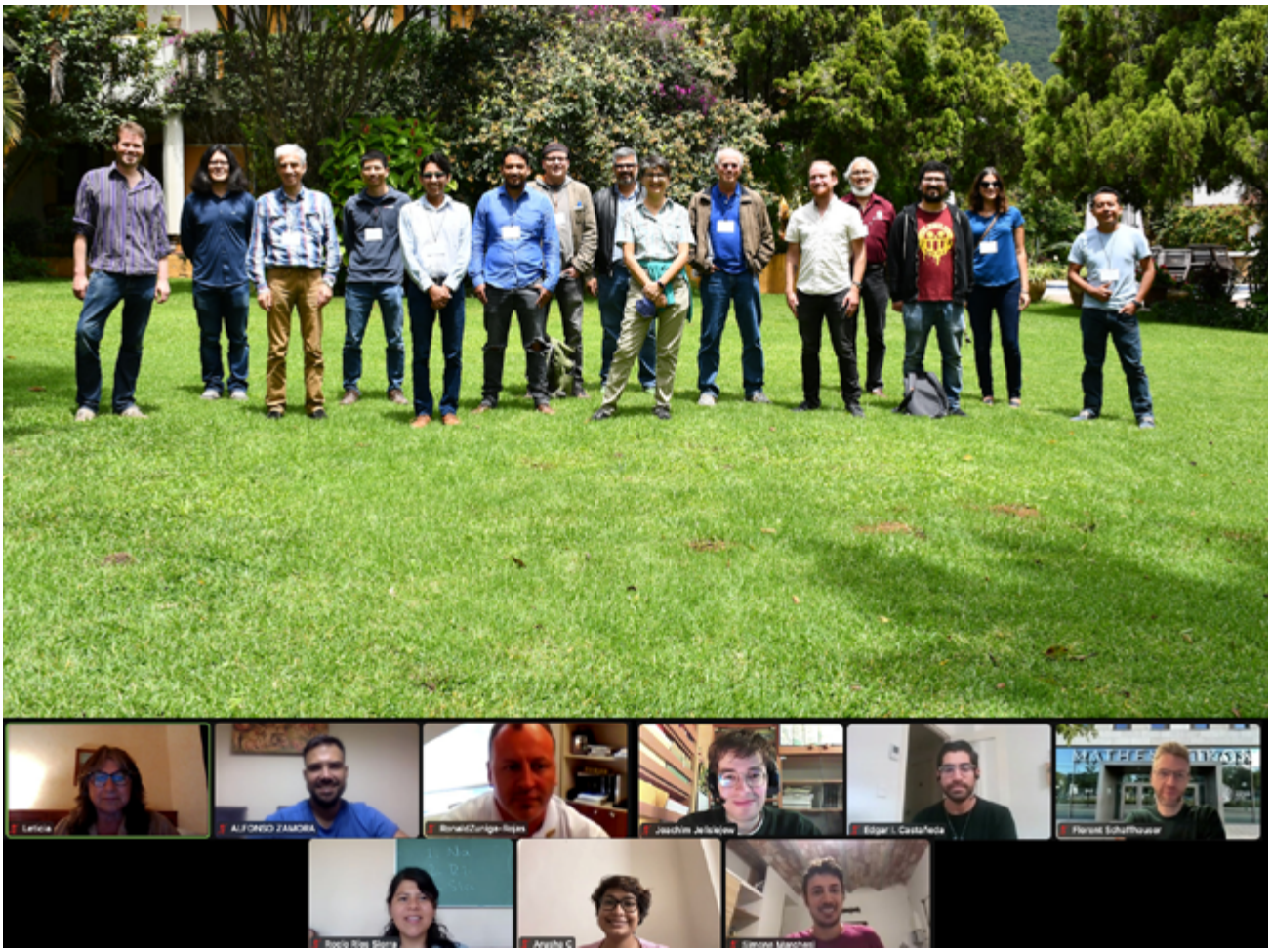
Moduli, Motives and Bundles – New Trends in Algebraic Geometry
September 18 - 23, 2022

Organizers:

Pedro Luis del Angel Rodriguez (Centro de Investigacion en Matematicas)

Frank Neumann (University of Leicester)
Alexander Schmitt (Freie Universität Berlin)



Classification problems are doubtless some of the most important problems in mathematics. Normally objects are classified with respect to a notion of symmetry, equivalence or isomorphism. As geometers, we are really happy when the classifying set of symmetries turns out to be a geometric object as well. When this is the case, the geometry of this classifying object tells us something about the classification problem itself, basically points of this geometric object correspond to the isomorphism classes of the structures one wants to classify. These classifying or moduli spaces can then be studied themselves with methods from algebraic geometry. Nowadays, apart from the classical techniques such as invariant theory developed during the 19th and 20th century to study these moduli spaces, other new techniques are used such as derived categories or motivic homotopy theory. A problem arises when the classification problem gives rise to too many symmetries and no moduli space can be directly constructed. A modern way to deal with this problem is to use the language of algebraic stacks, which intrinsically allows to keep track of all the isomorphisms and gives rise to the notion of a moduli stack, a more abstract categorified version of a moduli space, but nevertheless tractable with methods from algebraic geometry. Fundamentally important in geometry, topology, arithmetic and physics is the classification of vector bundles and principal bundles over a fixed algebraic variety and the associated moduli spaces and moduli stacks have very rich geometric structures. This workshop gave fresh insights into new methods and techniques for the study of these moduli spaces and moduli stacks including GIT methods, derived categories and motivic homotopy theory. Organized in partnership with the Clay Mathematics Institute and the Foundation Compositio.

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Zangani, Natascia (University of Trento)
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Bases for Cluster Algebras
September 25 - 30, 2022

Organizers:

Alfredo Nájera Chávez (UNAM)
Laurent Demonet (Google France)
David Hernandez (Université de Paris)
Jan Schroer (University of Bonn)

The theory of cluster algebras emerged in the year 2000 as a combinatorial approach to studying bases for quantum groups. Since then, commutative cluster algebras and their quantum deformations have been present in very diverse areas of mathematics and theoretical physics.

Constructing bases for both commutative and quantum cluster algebras and understanding their multiplicative structure is a meeting point of techniques and ideas from combinatorics, mirror symmetry, representation theory and quantum groups.

This topic has attracted the attention of distinguished mathematicians such as the Fields medalist Maxim Kontsevich and the 2018 Chern medalist Masaki Kashiwara. In the last 4 years, there has been remarkable progress in the problem of constructing bases for cluster algebras and relating them to the canonical bases for quantum groups. Understanding the relationships among these approaches is a difficult and important task that has been undertaken by various groups of researchers in recent years. This was a great moment to bring these groups together for a focused workshop on bases for cluster algebras.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5173

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Casbi, Elie (Max Planck Institute)
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Fei, Jiarui (Shanghai Jiao Tong University)
Felikson, Anna (University of Durham)
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Fraser, Chris (Michigan State University)
Frías Medina, Juan Bosco (Universidad Michoacana de San Nicolás de Hidalgo)
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Gómez Galicia, Sergio Gerardo (Cinvestav)
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Gunawan, Emily (University of Oklahoma)
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Iyama, Osamu (The University of Tokyo)
Kamnitzer, Joel (University of Toronto)
Kashiwara, Masaki (RIMS, Kyoto University)
Keller, Bernhard (Université Paris Cité)
Kelley, Elizabeth (University of Illinois Urbana - Champaign)
Kim, Myungho (Kyung Hee University)
Kimura, Yoshiyuki (Osaka Prefecture University)
Koshevoy, Gleb (Institute for Information Transmission Problems Russian Academy of Sciences)
Labardini-Fragoso, Daniel (Universidad Nacional Autónoma de México)
Leclerc, Bernard (Université de Caen)
Lekili, Yanki (Imperial College London)
Li, Li (Oakland University)
Li, 2003 (University of Vienna)
Liu, Tianle (University of Southern California)
Magee, Timothy (King's College London)
Mandel, Travis (University of Oklahoma)
Manon, Christopher (University of Kentucky)
Melo-López, Carolina (Universidad Nacional de Colombia)
Mou, Lang (University of Cambridge)
Muller, Gregory (University of Oklahoma)
Musiker, Gregg (University of Minnesota)
Nájera Chávez, Alfredo (Universidad Nacional Autónoma de México)
Nakanishi, Tomoki (Nagoya University)
Oya, Hironori (Tokyo Institute of Technology)
Park, Euiyong (University of Seoul)
Peng, Tina (University of Southern California)
Pinet, Théo (Université de Paris)
Plamondon, Pierre-Guy (University de Versailles Saint-Quentin)
Pressland, Matthew (University of Glasgow)
Qin, Fan (Shanghai Jiao Tong University)
Qiu, Yu (Tsinghua University)
Reading, Nathan (North Carolina State University)
Ressayre, Nicolas (Université Claude Bernard Lyon 1)
Santos Silva, Jorge (Universidad Nacional Autónoma de México)
Schiffler, Ralf (University of Connecticut)
Schroer, Jan (University of Bonn)
Se-Jin, Oh (Ewha Womans University)
Serhiyenko, Khrystyna (University of Kentucky)
Shan, Peng (Tsinghua University)
Shapiro, Alexander (University of Edinburgh)
Shen, Linhui (Michigan State University)
Sherman-Bennett, Melissa (MIT)
Simental, José (Max Planck Institute)
Todorov, Gordana (Northeastern University)
Treffinger, Hipolito (Université de Paris)
Tumarkin, Pavel (Durham University)
Valdivia Fuentes, Juan Daniel (Universidad Nacional de Ingeniería Perú)
Valdivieso-Díaz, Yadira (UDLAP)
Wang, Charles (Harvard University)
Weng, Daping (UC Davis)
Williams, Harold (University of Southern California)
Williams, Lauren (Harvard University)
Wilson, Jonathan (University of Central Lancashire)
Wright, Kayla (University of MInnesota)
Wu, Yilin (University of Science and Technology of China)
Yakimov, Milen (Northeastern University)
Yu, Tony Yue (California Institute of Technology)
Zhang, Sylvester (University of Minnesota - Twin Cities)
Zhou, Yan (Peking University)

Cobordisms, Strings, and Thom Spectra
October 9 - 14, 2022

Organizers:

Omar Antolín Camarena (UNAM)
Andrew Baker (University of Glasgow)
Tobias Barthel (Max Planck Institute)
Ulrike Tillmann (University of Oxford & University of Cambridge)

Topology studies the geometric properties of shapes which are unchanged by continuous deformations. Of essential importance in the subject is the concept of manifold, a notion of space which turns out to play an important role both in pure mathematics as well as in theoretical physics. Cobordisms provide a way to understand manifolds that were pioneered by Pontryagin and Thom in the middle of the last century, and they also form the basic building block in Atiyah and Segal's axiomatic approach to quantum field theories. Through subsequent extensive and often surprising developments in the last few decades, cobordisms now provide a deep link between manifolds to geometry, representation theory, and physics.
This workshop provided a timely opportunity to bring together leading researchers and younger mathematicians interested in topics related to the topology of manifolds, cobordism, and Thom spectra. In particular, there were introductory and overview talks on the frontier of research in this subject as well as contributed talks by other participants.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5045

Participants:

Angel, Andres (Universidad de los Andes)
Antolín Camarena, Omar (UNAM)
Baker, Andrew (University of Glasgow)
Barthel, Tobias (Max Planck Institute)
Basterra, Maria (University of New Hampshire)
Basu, Samik (Indian Statistical Institute)

Basu, Somnath (Indian Institute of Science Education & Research Kolkata India)
Bayindir, Haldun Ozgur (University of London)
Beardsley, Jonathan (University of Nevada, Reno)
Bianchi, Andrea (University of Copenhagen)
Blanchet, Christian (Universite Paris Cite)
Boger, Dorin (-)
Bohmann, Anna Marie (Vanderbilt University)
Bonatto, Luciana (University of Oxford)
Borisov, Dennis (University of Windsor)
Brav, Chris (Moscow Institute of Physics and Technology)
Bustamante, Mauricio (Universidad Católica de Chile)
Cai, Jiahe (University of Copenhagen)
Calle, Maxine (The University of Pennsylvania)
Cantarero Lopez, Jose Maria (CIMAT)
Caputi, Luigi (University of Aberdeen)
Chakraborty, Rabi (Westfalische-Wilhelms Universitat Munster)
Chedalavada, Anish (UIC)
Cohen, Ralph (Stanford University)
Darby, Alastair (Xi'an Jiaotong-Liverpool University)
Deutsch, Arye (Hebrew university of Jerusalem)
Devalapurkar, Sanath (Harvard University)
Dubey, Amartya Shekhar (National Institute of Science Education and Research, India.)
Edson, Nzaganya (Stellenbosch University)
Fernandes, João (University of Copenhagen)
Garkusha, Grigory (Swansea University)
Gepner, David (Johns Hopkins University)
Ghosh, Sayan (Ramakrishna Mission Vidyamandira)
González, Ana (Universidad de la Republica Uruguay)
Haugseng, Rune (Norwegian University of Science and Technology)
Hertl, Thorsten (Georg-August Universität Göttingen)
Hess, Kathryn (Ecole Polytechnique Federale de Lausanne)
Hill, Michael (University of California, Los Angeles)
Hoekzema, Renee (Free University of Amsterdam)
Jiménez Rolland, Rita (UNAM)
Joyal, André (Université du Québec à Montréal)
Kandel, Santosh (California State University Sacramento)
Klang, Inbar (Columbia University)
Kreck, Matthias (Bonn University)
Krulewski, Cameron (Massachusetts Institute of Technology)
Kupers, Alexander (University of Toronto)
Landi, Eugenio (Penn State)
Lee, Catherine (University of California Berkeley)
Liang, Jiacheng (Southern University of Science and Technology)
Lin, Hai (Southeast University and Tsinghua Univ)
Liu, Leon (Harvard University)
Lupercio, Ernesto (CINVESTAV)
Magen, Roy (Columbia University)
Mandell, Michael A. (Indiana University)
Mantione, Agnese (University of Münster)
McTague, Carl (Boston College)
Miller, Haynes (Massachusetts Institute of Technology)
Morava, Jack (Johns Hopkins University)
Moreno, Juan (University of Colorado Boulder)
Mukerjee, Himadri Kumar (North-Eastern Hill University Shillong)
Mulayim, Hakan (Mimar Sinan Fine Arts University)
Nandy, Ahina (University of Osnabrueck)
Neumann, Frank (University of Leicester)
Ortega Fernández, Gustavo (UNAM)
Osorno, Angelica (Reed College)
Pacheco-Tallaj, Natalia (Massachusetts Institute of Technology)
Palmer-Anghel, Martin (Mathematical Institute of the Romanian Academy)
Ponto, Kate (University of Kentucky)
Prakash Yadav, Suraj (Indian Institute of Science Education and Research Pune)
Quinn, Ryan (University of Amsterdam)
Raj, Ajay (Comenius University)
Ranaivomanana, Hosana (Stellenbosch University)
Randal-Williams, Oscar (University of Cambridge)
Raptis, George (University of Regensburg)
Razack, Ismail (University of Picardie - Jules Verne)
Richter, Birgit (University of Hamburg)
Robertson, Marcy (University of Melbourne)
Rognes, John (University of Oslo)
Rolfsen, Dale (University of British Columbia)
Rovi, Carmen (Loyola University Chicago)
Rudyak, Yuli B. (University of Florida)
Sagave, Steffen (Radboud University Nijmegen)
São João, José (Stockholm University)
Scheimbauer, Claudia (TU Munich)
Schlossberg, Eli (University of Minnesota - Twin Cities)
Schommer-Pries, Christopher (University of Notre Dame)
Segovia, Carlos (UNAM)
Semikina, Julia (University of Muenster)
Serrano Garcia, Higinio (CINVESTAV)
Sheinbaum, Daniel (FQ-UNAM)
Smith, Marshall (University of Minnesota - Twin Cities)
Soulié, Arthur (Institute for basic science - Center for Geometry and Physics)
Spong, Matthew (Ruhr Universität Bochum)
Stehouwer, Luuk (Max Planck Institute for Mathematics)
Steimle, Wolfgang (University of Augsburg)
Stojanoska, Vesna (University of Illinois - Urbana Champaign)
Stöveken, Lukas (University of Muenster)
sutrave, vaibhav (University of California Santa Cruz)
Taggart, Niall (Utrecht University)
Tillmann, Ulrike (University of Oxford and University of Cambridge)
Upmeier, Markus (University of Aberdeen)
Uribe, Bernardo (Universidad del Norte)
Vershinin, Vladimir (Universté de Montpellier)
Villarreal, Bernardo (CIMAT)
Waugh, Alexander (University of Washington)
Xicoténcatl, Miguel (CINVESTAV)
Yan, Guoqi (University of Notre Dame)
Zhang, Shangjie (UCSD)
Zhu, Heyi (University of Illinois)

Multiscale Modeling of Plant Growth, Pattern Formation and Actuation
October 16 - 21, 2022

Organizers:

Anja Geitmann (McGill University)

Plant growth and development involve the flux of molecules from one cell to another, the mechanical deformation of structures, and the exchange of signals between cells and tissues. Mathematical modeling of these complex biological processes has allowed life scientists to better understand the regulatory principles that govern plant functioning and development. However, translating 'biology' into mathematical algorithms is challenging. The power of a modeling approach is determined by the conceptual understanding of biological processes and their causal relationships, as well as the ability of the researcher to quantify essential input parameters.

The workshop focused on the intersection of three areas: molecular signaling (hormonal control and exchange of signaling molecules), network modeling (mathematical representation of biological feedback mechanisms), and biomechanical concepts (physical and mechanical analysis of force-driven deformation or cells and tissues). The workshop provided a forum for mathematicians, physicists and engineers to develop, exchange and challenge novel approaches to simulate these complex biological processes in an integrated manner. The long-term goal is to improve our understanding of plant growth, pattern formation and motion.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5179

Participants:

Alber, Mark (University of California - Riverside)
Anderson, Charles (Penn State University)
Asnacios, Atef (CNRS/Université de Paris)
Band, Leah (University of Nottingham)

Barbacci, Adelin (INRAE Toulouse)
Bidhendi, Amir J (McGill University)
Blyth, Mark (University of East Anglia)
Boudaoud, Arezki (Ecole polytechnique)
Cieslak, Mik (University of Calgary)
Coen, Enrico (John Innes Center)
Cosgrove, Daniel (Penn State Univ)
Dickmann, Johanna (ENS de Lyon)
Dimitrova, Elena (California Polytechnic State University)
Durney, Clinton (John Innes Institute)
Eloy, Christophe (IRPHE - Centrale Marseille)
Fai, Thomas (Brandeis University)
Forterre, Yoël (CNRS Marseille)
Geitmann, Anja (McGill University)
Godin, Christophe (INRIA)
Gosselin, Frederick (Polytechnique Montreal)
Grieneisen, Veronica (Cardiff University)
Hamant, Olivier (Ecole Normale Suprieure de Lyon)
Hay, Angela (Max Planck Institute for Plant Breeding Research)
Jayasankar, Aravind (McGill University)
Jönsson, Henrik (University of Cambridge)
Kirchhelle, Charlotte (INRAE/ENS de Lyon)
Laubenbacher, Reinhard (University of Florida)
Mahadevan, L (Harvard University)
Maizel, Alexis (University of Heidelberg - Center for Organismal Studies)
Martin, Olivier (Institut des Sciences des Plantes de Paris Saclay)
Mjolsness, Eric (UC Irvine)
Monk, Nick (African Institute for Mathematical Sciences - Ghana)
Mosca, Gabriella (Max Planck Institute for Plant Breeding Research/Technical University of Munich)
Moulia, Bruno (INRAE - Clermont-Ferrand)
Moulton, Derek (Oxford University)
Oliveri, Hadrien (University of Oxford)
Palubicki, Wojtek (Adam Mickiewicz University)
Prusinkiewicz, Przemyslaw (University of Calgary)
Ray, Ratula (Technical University Munich)
Robinson, Sarah (Sainsbury Laboratory - Cambridge)
Roddy, Adam (Florida International University)
Routier-Kierzkowska, Anne-Lise (University of Montreal)
Runions, Adam (University of Calgary)
Smith, Richard (John Innes Centre - Norwich)
Smithers, Euan (University of Cambridge)
Tsiantis, Miltos (Max Planck Institute for Plant Breeding Research)
Yu, Jingyi (Penn State)
Zhang, Sulin (Penn State)
Zhang, Yao (Huazhong University of Science and Technology)
Горшкова, Татьяна (Russian Academy of Sciences)

Using Quantum Invariants to do Interesting Topology
October 23 - 28, 2022

Organizers:

Liam Watson (University of British Columbia)
Elisenda Grigsby (Boston College)
Andrew Lobb (Durham)

This workshop centred on new advances in topology resulting from quantum invariants, a novel collection of algebraic objects that are currently experiencing a period of intense development. These invariants have their origins in knot theory, that is, the study of knotted loops in three-dimensional space. Beginning with Jones' discovery of a new invariant of knots in the 80s, quantum invariants have grown into a wide-reaching algebraic discipline with ramifications that extend beyond the study of knots and links. Indeed, the most recent developments - pioneered by Khovanov - move these polynomial invariants to homological invariants which have, in recent years, provided new insight into the 4-dimensional topology. The workshop brought together a broad range of experts from around the world working in quantum-homological invariants of knots and links with the aim of tackling new problems in topology with these tools.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5171

Participants:

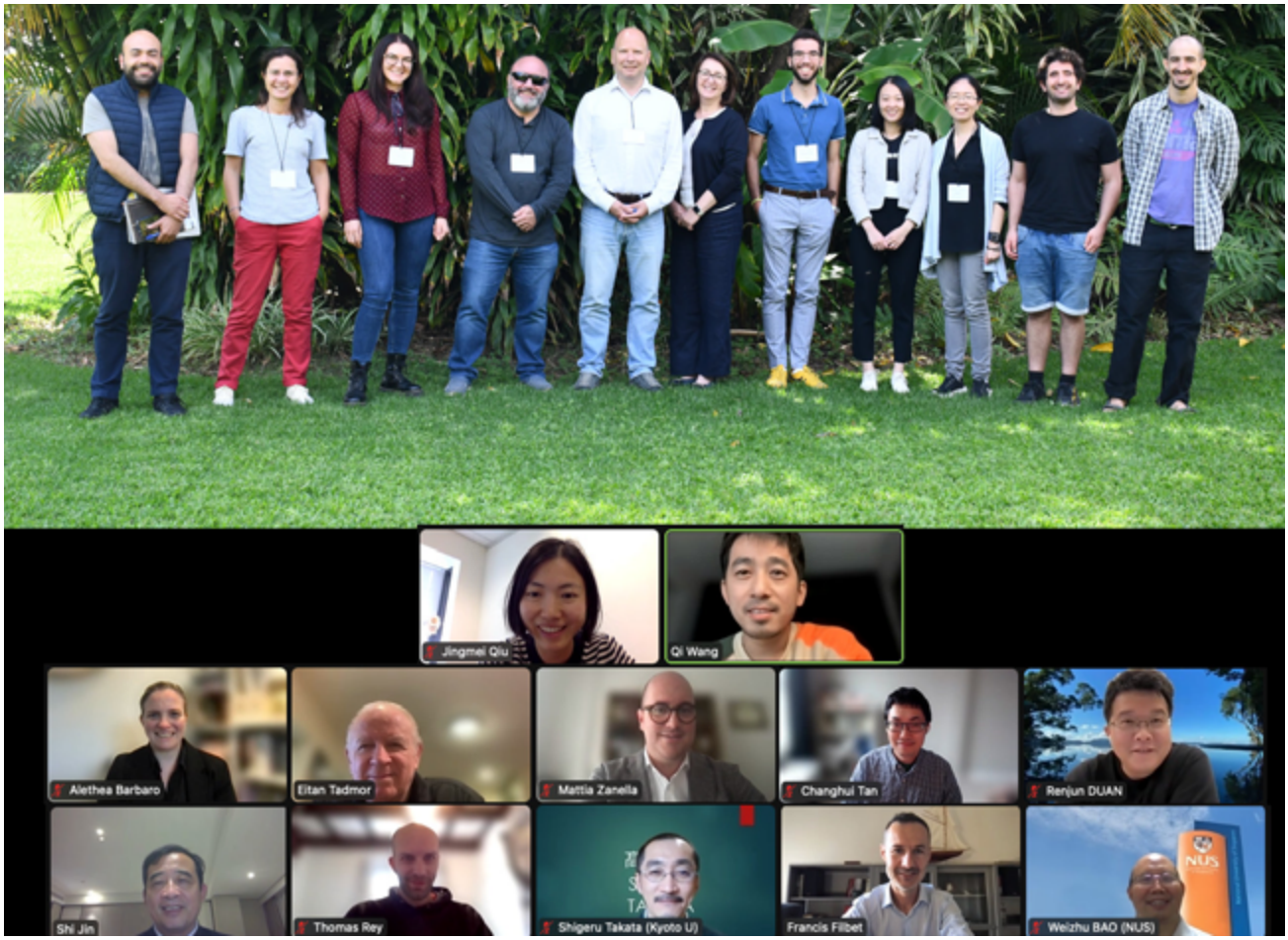
Alishahi, Akram (University of Georgia)
Baldwin, John (Boston College)
Bar-Natan, Dror (University of Toronto)
Boileau, Michel (Aix Marseille Université)
Bonahon, Francis (University of Southern California)
Boyle, Keegan (University of British Columbia)
Dancso, Zsuzsanna (University of Sydney)
Glubokov, Andrey (Purdue University)
Gordon, Cameron (University of Texas at Austin)
Gorsky, Eugene (UC Davis)
Hayden, Kyle (Rutgers University - Newark)
Hendricks, Kristen (Rutgers University)
Herald, Chris (University of Nevada, Reno)
Hubbard, Diana (Brooklyn College, CUNY)
Hugelmeyer, Cole (Stanford)
Kirk, Paul (Indiana University)
Kose, Feride Ceren (University of Georgia)
Lescop, Christine (Université Grenoble Alpes)
Levine, Adam (Duke University)
Lewark, Lukas (Regensburg)

Lipshitz, Robert (University of Oregon)
Livingston, Charles (Indiana University)
Lobb, Andrew (Durham)
Mandin-Hublé, Yohan (Grenoble)
Manolescu, Ciprian (Stanford University)
Marché, Julien (Sorbonne Université)
Marian, Mihai (University of British Columbia)
Martin, Gage (MIT)
Meilhan, Jean-Baptiste (Université Grenoble Alpes)
Miller, Allison (Swarthmore College)
Moore, Allison (Virginia Commonwealth University)
Moussard, Delphine (Marseille)
Picarillo, Lisa (MIT)
Ruberman, Daniel (Brandeis University)
Sazdanovic, Radmila (NC State University)
Shimizu, Tatsuro (Kyoto)
Truong, Linh (University of Michigan)
van der Veen, Roland (University of Groningen)
Wagner, Emmanuel (Université de Paris)
Watson, Liam (University of British Columbia)
Willis, Michael (Texas A&M University)
Zemke, Ian (Princeton University)
Zhang, Melissa (MSRI)
Zibrowius, Claudius (Universität Regensburg)

Kinetic Equations: Recent Developments and Novel Applications
October 30 - November 4, 2022

Organizers:

Jose Carrillo (University of Oxford)
Alina Chertock (North Carolina State University)
Min Tang (Shanghai Jiao Tong University)
Marie-Therese Wolfram (University of Warwick)



Starting with Boltzmann's seminal idea of describing the dynamics of a large system of interacting particles by its statistical distribution, kinetic theory has become a powerful tool to model for example the transport of charged carriers in plasma and semiconductor crystals or the herding behavior of large animal flocks. More recently kinetic theory made its way into socio-economic applications, for instance to describe the dynamics of trading agents in economic markets. Various mathematical and computational techniques have been developed in the respective fields to analyze the complex behavior of large interacting particles systems. However many questions in classical as well as novel applications are still open. The workshop brought together experts working on different aspects of kinetic theory to facilitate exchange, advance further in the field and promote novel research directions.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5169

Participants:

Aceves Sanchez, Pedro (University of California, Los Angeles)
Bailo, Rafael (University of Oxford)
Bao, Weizhu (National University of Singapore)
Barbaro, Alethea (TU Delft)
Caceres, Maria José (Universidad de Granada)
Calzola, Elisa (Università di Verona)
Carrillo, Jose (University of Oxford)

Chertock, Alina (North Carolina State University)
Choi, Young-Pil (Yonsei University)
Delgadino, Matias (UT-Austin)
Duan, Renjun (Chinese University of Hong Kong)
Düring, Bertram (University of Warwick)
Filbet, Francis (Université de Toulouse)
Franceschi, Jonathan (Universita di Pavia)
Ha, Seung Yeal (Seoul National University)
Hernández, Yunay (Universidad Politécnica del Estado de Morelos)
Ji, Hangjie (North Carolina State University)
Jin, Shi (Shanghai Jiao Tong University)
Kalise, Dante (Imperial College London)
Liu, Jian-Guo (Duke University)
Lukácová, Mária (Johannes Gutenberg-Universität Mainz)
Mancini, Simona (Universite d'Orleans)
Motsch, Sebastien (Arizona State University)
Pareschi, Lorenzo (University of Ferrara)
Qiu, Jingmei (University of Delaware)
Rey, Thomas (Université de Lille)
Ruiz I Balet, Domenec (Imperial College London)
Sun, Weiran (Simon Fraser University)
Tadmor, Eitan (University of Maryland)
Takata, Shigeru (Kyoto University)
Tan, Changhui (University of South Carolina)
Tang, Min (Shanghai Jiao Tong University)
Tang, Sui (University of California Santa Barbara)
Veiga, Maria Han (University of Michigan)
Wang, Li (University of Minnesota)
Wang, Qi (SWUFE)
Wolfram, Marie-Therese (University of Warwick)
Wu, Jeremy (UCLA)
Zanella, Mattia (University of Pavia)

Mathematics and Statistics of Genomic Epidemiology
November 6 - 11, 2022

Organizers:

Jesse Shapiro (University of Montreal/McGill University)
Alex Bouchard (University of British Columbia)
Leonid Chindelevitch (Imperial College, London)

This workshop focused on some mathematical and statistical challenges faced by the discipline of genomic epidemiology, which tries to study the spread, transmission, and other characteristics of infectious disease-causing microbes by leveraging the information contained in their genome. These challenges are exacerbated by the large amounts of data, the relative difficulty of ascertaining transmission patterns in real-life observations, and the inherent heterogeneity of microbes.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5186

Participants:

Agarwal, Piyush (Simon Fraser University)
Ahmad, Isa (Imperial College)
Amjad, Khan (UWO)
Anciaux, Yoann (Montpellier)
Anwar, Muhammad Zohaib (Simon Fraser University)
B Franceschi, Vinicius (Imperial College London)
Becker, Devan (Wilfrid Laurier University)
Blenkinsop, Alexandra (Imperial)
Bosia, Carla (Politecnico di Torino and Italian Institute for Genomic Medicine)
Bouchard, Alexandre (University of British Columbia)
Brettschneider, Julia (University of Warwick)
Brown, Kevin (Public Health Ontario / University of Toronto)
Bull, Shelley (University of Toronto)
Burkett, Kelly (University of Ottawa)
Bursell, Madeline (NCSU)
Cabibbe, Andrea (San Raffaele Scientific Institute)
Castillo-Ramirez, Santiago (UNAM)
Chen, Yu (Imperial College)

Chindelevitch, Leonid (Imperial College, London)
Cooper, Ashley (CFIA)
Croucher, Nicholas (Imperial College London)
Cruz Maldonado, Carlos Roberto (UNAM)
Day, Troy (Queen's University)
de Visser, Arjan (Wageningen University)
De Vos, Bob (Nostics)
Derelle, Romain (Imperial College)
Dexter, Nick (Florida State University)
Didelot, Xavier (University of Warwick)
Drake, Kieran (Imperial College London)
Duvvuri, Venkata (Public Health Ontario)
Escalera-Zamudio, Marina (University of Oxford)
Feil, Edward (University of Bath)
Feng, Jingxue (SFU)
Gandon, Sylvain (CNRS)
Gascuel, Olivier (Centre National de la Recherche Scientifique & Muséum National d'Histoire Naturelle)
Gerrish, Philip (University of New Mexico)
Greenwood, Celia (Lady Davis Institute for Medical Research)
Greenwood, Priscilla (University of British Colombia)
Gu, Hong (Dalhousie University)
Haider, Diana (Dalhousie)
Herbeck, Joshua (Bill & Melinda Gates Foundation)
Ho, Lam (Dalhousie University)
Horsfield, Samuel (Imperial College London)
Ionita-Laza, Iuliana (Columbia University)
Kalinowski, Jorn (Bielefeld University)
Kenney, Toby (Dalhousie)
Kepler, Lenora (NCSU)
Kim, Jee In (Dalhousie)
King, Aaron (University of Michigan)
Koelle, Katia (Emory University)
Lees, John (EMBL-EBI)
Lewandowski, Julia (Dalhousie University)
Li, Jingyi Jessica (University of California Los Angeles)
Li, Hongzhe (University of Pennsylvania)
Libbrecht, Maxwell (SFU)
Liu, Lei (Washington University in Saint Louis)
Liu, Molly (Western)
MacPherson, Ailene (Simon Fraser University)
Mahé, Pierre (bioMérieux)
Martin, Guillaume (CNRS)
Mehta, Rohan (Emory)
Mishra, Swapnil (University of Copenhagen)
Moreira, Sandrine (INSPQ)
Mortimer, Tatum (Harvard T.H. Chan School of Public Health)
Murall, Carmen (PHAC)
Naderi, Noura (McGill University)
Nguyen, Matthew (University of British Columbia)
Olabode, Abayomi (Western University)
Ostrovnaya, Irina (Memorial Sloan-Kettering Cancer Center)
Otto, Sally (University of British Columbia)
Park, Yeongseon (Emory University)
Pe'er, Itsik (Columbia University)
Peña Miller, Rafael (UNAM)
Perfeito, Lilia (LIP - Laboratório de Instrumentação e Física Experimental de Partículas)
Qiu, Xueting (Harvard School of Public Health)
Rasmussen, David (NC State)
Ratmann, Oliver (Imperial College London)
Rennen, Eva (Nostics)
Semenova, Elizaveta (Oxford)
Senghore, Madikay (Harvard School of Public Health)
Shapiro, Jesse (University of Montreal/McGill University)
Shi, Cen (NCSU)
Spencer, Simon (University of Warwick)
Stockdale, Jessica (Simon Fraser University)
Tang, ZhengZheng (University of Wisconsin Madison)
Taylor, Bradford (Harvard TH Chan School of Public Health)
Unruh, Leonhardt (Imperial College)
Vieira, Ana (Imperial College)
Volz, Erik (Imperial College London)
Wan, Yu (Imperial College London)
Weissman, Daniel (Emory University)
Wheeler, Nicole (University of Birmingham)
Wu, Jianhong (York University)
Xi, Xiaoyue (University of Cambridge)
Yauck, Mamadou (Université du Québec à Montréal)
Zhou, Xiang (University of Michigan)
Zhukova, Anna (Institut Pasteur)

Learning in Networks: Performance Limits and Algorithms
November 13 - 18, 2022

Organizers:

Bruce Hajek (University of Illinois)
Yihong Wu (Yale University)
Jiaming Xu (Duke University)

The workshop focused on statistical learning, algorithms, information and computational limits, in large-scale networks. The overall objective of the workshop is to develop a better understanding of the information-theoretic and computational barriers to making significant inferences from large-scale network data. The topics were organized into three interrelated areas, ranging from inference problems for single graphs to inference involving two graphs to the classification of graphs from general families.

The workshop brought together the leading researchers in this area to discuss recent results and open problems, as well as to explore new mathematical techniques and models to study from network data. Besides tutorials and research presentations, the workshop encouraged and provided time for attendees to form study groups to have focused discussions on research problems and directions that arose during the workshop. We anticipated that around ten participants were graduate students and postdoctoral fellows interested in statistical learning in large-scale networks.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5185

Participants:

Ameen ur Rahman, Taha (University of Illinois)
Bresler, Guy (MIT)
Fan, Zhou (Yale University)
Gao, Chao (University of Chicago)
Gaudio, Julia (Northwestern University)
Hajek, Bruce (University of Illinois)
Kang, Xiaohan (University of Illinois)
Kunisky, Dmitriy (Yale University)
Mao, Cheng (Georgia Tech)
Perkins, Will (Georgia Tech)
Polyanskiy, Yury (Massachusetts Institute of Technology)
Racz, Miklos (Princeton University)
Schramm, Tselil (Stanford)
Wang, LeLe (University of British Columbia)
Wang, Weina (Carnegie Mellon University)
Wang, Haoyu (Yale)
Wein, Alex (UC Davis)
Wu, Yihong (Yale University)
Xu, Jiaming (Duke University)
Zadik, Ilias (MIT)

Langlands Program: Number Theory and Representation Theory
November 27 - December 2, 2022

Organizers:

Luis Lomeli (Pontificia Universidad Catolica de Valparaiso)
Luis Dieulefait (Universitat de Barcelona)
Anne-Marie Aubert (Centre National de la Recherche Scientifique)
Manish Mishra (IISER Pune)

Langlands' functoriality conjectures predict a vast generalization of the classical reciprocity laws of Class Field Theory, providing crossroads between Number Theory and Representation Theory. The conjectures are both local and global and pertain a connected reductive group and its Langlands dual group.

This workshop introduced young mathematicians in México and Latin America to current research topics in the Langlands Program. We also promoted the participation of women and graduate students from diverse backgrounds in a workshop where experts in the field from across the world gathered to expand upon the frontiers of current research. In addition to research talks, there were three courses that will also be accessible to mathematicians working in closely related fields.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5178

Participants:

Abdellatif, Ramla (UPJV-Amiens)
Adler, Jeffrey (American University)
Adrian, Moshe (CUNY)
Ali, Abid (Rutgers University)
Amestica, Emilio (Pontificia Universidad Católica de Valparaíso)
Anandavardhanan, U. K. (IIT Bombay)
Arote, Prashant (IISER Pune)
Atobe, Hiraku (Hokkaido University)
Aubert, Anne-Marie (Centre National de la Recherche Scientifique)
Bakeberg, Jacksyn (Boston University)
Balodis, Kristaps (University of Calgary)
Ban, Dubravka (Southern Illinois University)
Barrera, Daniel (Universidad de Santiago de Chile)
Berry, Rose (University of East Anglia)
Beuzart-Plessis, Raphael (CNRS Aix-Marseille Université)
Blasco, Laure (Université Paris-Saclay)
Blondel, Corinne (CNRS)
Boumasmoud, Reda (Universität Zürich)
Bouthier, Alexis (Sorbonne Université)

Burgi, Jakob (University of Heidelberg)
Castillo, Victor (Pontificia Universidad Católica de Chile)
Cely, Jorge (University of Haifa)
Chaudouard, Pierre-Henri (IMJ-PRG Université de Paris)
Chen, Cheng (University of Minnesota)
Chufeng, Nien (Hunan Normal University)
Ciubotaru, Dan (University of Oxford)
Cruz, Jose (University of Calgary)
Cui, Peiyi (University of East Anglia)
Cunningham, Clifton (University of Calgary)
del Castillo, Héctor (Universidad de Santiago de Chile)
Dieulefait, Luis (Universitat de Barcelona)
Dihua, Jiang (University of Minnesota)
Dijols, Sarah (University of Calgary)
Dragos, Fratila (Université de Strasbourg)
Dudas, Olivier (Aix-Marseille University)
Emory, Melissa (Oklahoma State University)
Fintzen, Jessica (University of Bonn)
Flikkema, Janet (Radboud Universiteit)
Fox, Maria (Oklahoma State University)
Friedberg, Solomon (Boston College)
Giannotta, Enzo (Universidad de Buenos Aires, Facultad de Ciencias Exactas y Naturales)
Gleason, Ian (University of Bonn)
Godoy, Marco (Universidad de Santiago de Chile)
Grobner, Harald (Universität Wien)
Gutierrez, Luis (Universidad Austral de Chile)
Haines, Thomas (University of Maryland)
Hamann, Linus (Princeton University)
Harris, Michael (Columbia University)
Hazeltine, Alexander (Purdue University)
Heiermann, Volker (Universite d'Aix-Marseille)
Henniart, Guy (Université Paris-Saclay, Orsay, France)
Ivanov, Alexander (Universität Bonn)
Kasem, Omar (University of East Anglia)
Kim, Yeansu (Chonnam National University)
Kim, Ju-Lee (MIT)
Kreutz, Tobias (MPIM Bonn)
Kurinczuk, Robert (University of Sheffield)
Lafforgue, Vincent (CNRS Institut de Mathématiques de Jussieu - Paris Rive Gauche)
Lanard, Thomas (CNRS)
Landim, Thiago (Sorbonne Université)
Lapid, Erez (Weizmann Institute of Science)
Lee, Pak-Hin (University of Warwick)
Li, Qihang (University of Maryland)
Li-Huerta, Daniel (Harvard University)
Lin, Jie (Duisburg-Essen University)
Liu, Baiying (Purdue University)
Liu, Dongwen (Zhejiang University)
Llerena, Juan Pablo (Universidad de Chile)
Loke, Hung Yean (National University Singapore)
Lomeli, Luis (Pontificia Universidad Catolica de Valparaiso)
Lu, Yan-Der (Université Paris Cité)
Matringe, Nadir (Université Paris Cité)
Mayeux, Arnaud (Université Clermont-Auvergne)
Metya, Nilava (Rutgers University)
Minguez, Alberto (University of Vienna)
Mishra, Manish (IISER Pune)
Mondal, Amiya (IISER Berhampur)
Morra, Stefano (Université Paris 8)
Moussaoui, Ahmed (Université de Poitiers)
Murnaghan, Fiona (University of Toronto)
Nadimpalli, Santosh (IIT-Kanpur)
Navarro, Javier (Pontificia Universidad Católica de Valparaíso)
Nevins, Monica (University of Ottawa)
Oi, Masao (Kyoto University)
Onn, Uri (Australian National University)
Pacetti, Ariel (University of Aveiro)
Palacios, Luis (Universidad de Santiago de Chile)
Pande, Aftab (Universidade Federal do Rio de Janeiro)
Pantoja, Jose (Pontificia Universidad Católica de Valparaíso)
Papachristoforou, Constantinos (University of Sheffield)
Pattanayak, Basudev (IIT BOMBAY)
Plymen, Roger (University of Manchester)
Przebinda, Tomasz (University of Oklahoma)
Qin, Chuan (Sorbonne University)
Raghuram, Anantharam (Fordham University)
Ray, Mishty (University of Calgary)
Sarkar, Mabud Ali (Burwan University)
Savin, Gordan (University of Utah)
Schoemann, Claudia (Université de la Polynésie Française)
Schwein, David (Universität Bonn)
Sécherre, Vincent (Université de Versailles Saint-Quentin)
Sengun, Haluk (University of Sheffield)
Shan, Yi (ENS)
Smith, Jerrod (University of Calgary)
Solleveld, Maarten (Radboud Universiteit Nijmegen)
Sommella, Maxime (Université d'Aix-Marseille)
Song, Shin Eui (University of Maryland)
Sorensen, Claus (University of California San Diego)
Sorkatti, Layla (Southern Illinois University)
Stevens, Shaun (University of East Anglia)
Szumowicz, Anna (Caltech)
TAM, Kam-Fai (Geo) (Radboud University)
Tiwari, Ekta (University of Ottawa)
Tornaría, Gonzalo (Universidad de la República)
Trias, Justin (Imperial College London)
Tsai, Cheng-Chiang (Academia Sinica, Taiwan)
Van Order, Jeanine (Universität Bielefeld)
Vigneras, Marie-France (Jussieu Paris 7)
Wang, Yingying (Universität Duisburg-Essen)
Xue, Cong (CNRS, Institut de Mathématiques de Jussieu - Paris Rive Gauche)
Yu, Hongjie (Weizmann Institute of Science)
Zenteno, Adrián (CIMAT)
Zhang, Qing (Huazhong University of Science and Technology)
Zhang, Lei (National University of Singapore)
Zhang, Zhiyu (MIT)
Zhao, Ruishen (Morningside Center of Mathematics)
Zou, Jiandi (TECHNION - Israel Institute of Technology)
Zou, Konrad (Universität Bonn)

Casa Matemática Oaxaca

2022

Cancelled 5-Day Workshops

Modeling and Engineering of the Mammalian Embryo
June 5 - June 10, 2022 (Cancelled)

Organizers:

Jianping Fu (University Of Michigan, Ann Arbor)
Janet Rossant (Hospital for Sick Children, University of Toronto)
Eric Siggia (Rockefeller University)

The mammalian embryo is a paradigm of regulative development and self-organization, making it a fascinating system for quantitative experimentation and analysis and mathematical modeling. Most of our current knowledge of mammalian embryology is derived from studies of the mouse embryo, leading to astonishing discoveries of self-organizing and emergent properties ("the laws of development") manifest during embryonic development. Importantly, recent advances in generating human embryo-like structures from human pluripotent stem cells and in vitro cultured human embryos have led to exciting new human-related embryological models that are promising for advancing human embryology. Thus, the aspiration for this BIRS workshop is to bring together world-leading embryologists, theoretical physicists, mathematicians and bioengineers, who share common interests in studying the laws of development, to tackle emerging open questions in the field of embryology. This BIRS workshop will help initiate new collaborations between the attendants, and such collaborative efforts will lead to novel integrative approaches that incorporates quantitative experimentation and analysis and mathematical models developed from formal mathematical or physical principles.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5176

Geometric and Analytical Aspects of Nonlinear Elliptic Equations and Related Evolution Problems
June 26 - July 1, 2022 (Cancelled)

Organizers:

Filomena Pacella (University of Roma "Sapienza")
Mónica Clapp (Universidad Nacional Autónoma de México)
Bernhard Ruf (Università degli Studi di Milano)

The workshop will focus on the interplay between some stationary and evolution differential equations which appear in a large number of problems in sciences. They represent mathematical models for the study of important phenomena in physics, engineering, biology, medicine etc. The workshop is aimed at gathering leading international experts and younger talented researchers from many countries, to promote exchange of ideas .It is an excellent opportunity for an update overview of the state of the art in the study of these important equations as well as an occasion of implementing collaborations among participants.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5168

Statistical and Computational Challenges Arising from Ubiquitous Molecular Measurements September 4 - 9, 2022 (Cancelled)

Organizers:

Jeffrey Leek (Johns Hopkins Bloomberg School of Public Health)
Elizabeth Purdom (UC Berkeley)

The cost of collecting molecular measurements about our DNA, RNA, and their abundances has dropped dramatically over the last five years. Genomic data is now ubiquitous across biology and medicine. But while the data have become ever cheaper to collect and store, efficiently extracting useful information from these measurement still remains a significant challenge. Solving this challenge could better allow us to use new knowledge about our genomes to understand our ancestry, how our bodies develop, and how we can predict and treat diseases.

This workshop brings together experts in biology, computational biology, machine learning, and statistics to answer some of the large, unsolved problems presented by the explosion of molecular information we are experiencing. They will help to create ideas for extracting, understanding, and testing the information we get from these experiments to benefit the biological and medical sciences.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5183

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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IASM 2022 Program

5-Day Workshops 2021

Sep 4	Sep 9	Nonlocal Problems in Mathematical Physics, Analysis and Geometry (Cancelled)
Sep 11	Sep 16	Cross-Fertilisation of ideas from the Riemann–Hilbert Technique and the Wiener–Hopf Method (Cancelled)
Sep 25	Sep 30	Poisson Geometry and Artin-Schelter Regular Algebras (Cancelled)
Oct 2	Oct 7	Geometry and Physics of Quantum Toroidal Algebra (Cancelled)
Oct 9	Oct 14	Structured Mesh Methods for Moving Interface and Free Boundary Problems and Applications (Cancelled)
Oct 16	Oct 21	Modular Forms in Number Theory and Physics (Cancelled)
Oct 23	Oct 28	Periods and Branching Problems for Representations of Real, p-adic and Adelic Groups (Cancelled)
Oct 30	Nov 4	Cell and Tissue Mechanics: Modeling Meets Experiments (Cancelled)
Nov 6	Nov 11	Topological Data Analytic Applications of Persistent Cohomology (Cancelled)
Nov 13	Nov 18	Noncommutative Geometry meets Topological Recursion (Cancelled)

Institute for Advanced Study in Mathematics

2022

Cancelled 5-Day Workshops

Nonlocal Problems in Mathematical Physics, Analysis and Geometry
September 4 - 9, 2022 (Cancelled)

Organizers:

Itai Shafrir (Technion - Israel Institute of Technology)
Michel Chipot (University of Zurich)

Nonlinear problems are problems which solutions satisfy an equation where the different physical constants involved are depending on the solution itself. This dependence can be nonlocal in the sense that it depends on the solution globally. For instance the motion of a population can be influenced by the total population and not only by the population very locally. One of the goals of the workshop is to deepen the human knowledge in this field applied to different situations.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5193

Cross-Fertilisation of ideas from the Riemann–Hilbert Technique and the Wiener–Hopf Method
September 11 - 16, 2022 (Cancelled)

Organizers:

Anastasia Kisil (University of Manchester)
Xun Huang (Peking University)
Gennady Mishuris (Aberystwyth University)
Anna Zemlyanova (Kansas State University)

In recent years significant progress has been made within the fundamental areas of complex analysis which resulted in development of the unified transform method, numerical methods for Riemann-Hilbert problems, advances in matrix Wiener-Hopf method, and conformal mappings of multiply connected domains. This workshop will bring together world-leading experts and new generation of researchers in Riemann-Hilbert problems and Wiener-Hopf method, and related areas of complex analysis, as well as the applications of these techniques in various areas of science and technology. The fruitful collaborations between pure and applied communities within these areas (from both Academy and Industry) will promote connections between different branches of modern sciences and will help in addressing complex technological and societal challenges.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5099

Poisson Geometry and Artin-Schelter Regular Algebras
September 25 - 30, 2022 (Cancelled)

Organizers:

Zheng Hua (The University of Hong Kong)
Huang Hongdi (Rice)
Brent Pym (McGill University)
Yu Xiao-Lan (Hangzhou Normal University)
James Zhang (University of Washington)

Poisson geometry and the study of Artin-Schelter regular algebras are two important topics in mathematics. Recent advances in both topics are intimately connected with deformation theory, the study of Yang-Baxter equations, and many other topics in algebra, algebraic geometry and representation theory. These connections suggest for us to look into new ideas and new phenomena in the study of Artin-Schelter regular algebras by using Poisson geometry.

This workshop will tackle some fundamental open questions about Artin-Schelter reg- ular algebras, in particular, elliptic algebras, and their associated Poisson structures. In particular, it will focus on the correspondence between the representations of elliptic alge- bras and the symplectic leaves of their semi-classical limits, as well as on the relationship between the deformation theory of Artin-Schelter regular algebras and that of the derived category or the A-infinity-category of related projective schemes. This workshop brings together leading experts in algebra and geometry from around the world to identify and attack these outstanding problems and to collaborate for future breakthroughs.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5194

Geometry and Physics of Quantum Toroidal Algebra
October 2 - 7, 2022 (Cancelled)

Organizers:

Satoshi Nawata (Fudan University)
Boris Feigin (Higher School of Economics - Moscow)
Hiraku Nakajima (Kavli IPMU, the University of Tokyo)
Peng Shan (Tsinghua University)

The theories of rational/trigonometric/elliptic functions were developed as functions over plane/cylinder/torus, respectively, before the 20th century. Among them, the theory of elliptic functions is most interesting, and it can be understood as the parent theory of the rest. During the 20th century, the same rational/trigonometric/elliptic trichotomy has been also found in integrable systems, algebras and cohomology groups. Like the theory of functions, recent development reveals that the relationship among integrable system, algebra, geometry, and physics becomes most profound at elliptic level. In particular, Lie algebras (rational) are promoted to affine Lie algebras (trigonometric) and toroidal Lie algebras (elliptic). The workshop aims at investigating quantum versions of toroidal Lie algebras, called quantum toroidal algebras.

In fact, plenty of recent discovery in both mathematics and physics shows that quantum toroidal algebras are remarkably rich. They appear to act cohomology groups of instanton moduli spaces of four-manifolds. These algebras and their representation theory also arise from moduli spaces of flat connections, G-bundles and Higgs bundles over a torus. In physics, 4d/5d/6d dimensional reductions/oxidations of supersymmetric gauge theories are indeed related to the trichotomy of quantizations of toroidal Lie algebras. Therefore, studying quantum toroidal algebras is indispensable to understand the dynamics of the mysterious 6d (2,0) theory on M5-branes. Moreover, physics potentially provides a powerful framework for organizing and connecting known these mathematical constructions and motivates surprising new ideas. Hence, the goal of the proposed workshop is to uncover the deeper geometric and categorical structures underlying quantum toroidal algebras by exchanging ideas between mathematicians and physicists.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5190

Structured Mesh Methods for Moving Interface and Free Boundary Problems and Applications
October 9 - 14, 2022 (Cancelled)

Organizers:

Qinghai Zhang (Zhejiang University)
Zhilin Li (North Carolina State University)
John Stockie (Simon Fraser University)

Free boundaries and moving interfaces are ubiquitous in our daily activities such as pouring red wine into a glass, jumping into a swimming pool, or watching water waves at the beach. Other processes involving interfaces are much less visible, but have great impacts on our lives. For example, one mechanism by which cancel cells move around is to change the shape of their boundaries. As another example, three major components in our blood are the red cells, the white cells, and platelets; injure of blood vessels will trigger complicated chemical reactions and physical processes that occur on the interface of these cells. It is therefore extremely important to solve key problems in this scientific field so that we can save money, energy, time, and even human lives. One major tool for sciences in this field is through mathematical modeling and numerical computations. This workshop aims to bring together experts from various disciplines to work together on the analysis, modeling, computation, and applications of a wide range of free-boundary and moving-interface problems. It is our hope that scientific discoveries in this field could make this world better.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5196

Modular Forms in Number Theory and Physics
October 16 - 21, 2022 (Cancelled)

Organizers:

Ling Long (Louisiana State University)
Jaap Top (University of Groningen)
Noriko Yui (Queen's University)
Wadim Zudilin (Radboud University Nijmegen)

Modular forms have been one of the central topics in number theory for more a century and they continue to experience a wide range of applications throughout mathematics nowadays. Different incarnations of modularity, known as quasi-modular forms, quantum modular forms, Jacobi forms and Siegel modular forms regularly show up in physics topics such as mirror symmetry, topological quantum field theory, Gromov-Witten invariants, conformal field theory, Calabi-Yau manifolds. The principal goal of the proposed conference is to assess the role of various modular forms in recent developments in number theory, geometry and string theory.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5189

Periods and Branching Problems for Representations of Real, p-adic and Adelic Groups
October 23 - 28, 2022 (Cancelled)

Organizers:

Birgit Speh (Cornell)
Toshiyuki Kobayashi (The University of Tokyo)

Symmetries appear naturally in various areas of mathematics and the sciences, ranging from geometry, numbers, differential equations to quantum mechanics. The more symmetries there are, the better we can grasp the objects by group theoretic approaches. Branching problems investigate how a large symmetries break down into smaller ones, such as fusion rules, via a mathematical formulation using the language of representations and their restrictions. Branching problems have a history of study of over 80 years. In recent years there was an outburst of research activities focus- ing on the restriction of continuous symmetries in the infinite-dimensional cases, for which new geometric and analytic methods have been developed. We highlight branching problems of infinite-dimensional representations of real, p-adic and adelic reductive groups, the former carrying analytic features and the latter carrying number-theoretic features, which might lead us to a (conjecturally) unified phenomenon. A major goal of the Workshop is to capitalize on this momentum and to gather researchers from diverse mathematical disciplines to encourage new collaborations, and achieve progress in solving open questions in number theory, geometry and physics.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5191

Cell and Tissue Mechanics: Modeling Meets Experiments
October 30 - November 4, 2022 (Cancelled)

Organizers:

Xinpeng Xu (Guangdong Technion - Israel Institute of Technology)
Alexander Bershadsky (National University of Singapore)
Baohua Ji (Zhejiang University)
Len Pismen (Technion)

This interdisciplinary workshop combining discussions of theoretical modeling and experimental investigations, aims to further our understanding of the cell and tissue mechanics from the subcellular to the tissue scale with the emphasis on uniting them into a coherent picture. The research aimed at understanding how physical forces and changes in the mechanical properties of cells and tissues contribute to development, cell differentiation,

physiology, diseases, etc. The workshop is planned to take place in the new BIRS station in Hangzhou, China in the fall 2022. It will bring together the best scientists from different backgrounds (e.g., cell biology, biomechanics, biophysics, biomathematics, etc.) to exchange ideas and discuss the latest results and future directions. We hope this workshop will also strengthen the academic exchanges and cooperation between Asia and the Western world. Moreover, we particularly encourage women scientists and the emerging generation of bright young scientists to participate.

This workshop will focus on the following topics:
(1) Interplay of biochemical and mechanical aspects of cells.
(2) Interactions between cells and their microenvironment.
(3) Mechanical aspects of biological processes at the tissue level, such as morphogenesis, tissue growth, wound healing, and cancer progression.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5192

Topological Data Analytic Applications of Persistent Cohomology
November 6 - 11, 2022 (Cancelled)

Organizers:

Anthea Monod (Imperial College London)
Vin da Silva (Pomona College)

Topological Data Analysis (TDA) is a 21st-century branch of data science that seeks to leverage theory from pure mathematics to tackle modern data-analytic challenges. Today data is vastly more abundant, thanks to new technologies that facilitate measurement and collection. Moreover, the structural forms that these data can take have become increasingly complex. Much of the early success of TDA can be attributed to the persistent homology framework. This can be thought of as a multi-scale version of the classical homology theories developed in algebraic topology to measure the structural features (handles, tunnels, cavities, etc.) of a geometric object. The multi-scale approach is essential for ensuring statistical robustness, which in turn is what allows us to apply these methods meaningfully to real data sets. Persistent homology is by now very well studied, and has been integrated successfully with statistical methodology and machine learning algorithms. There are numerous applications in various fields, including sensor networks (Ghrist & de Silva, 2006), neuroscience (Chung et al., 2009), cosmology (Adler et al., 2017), and cancer research (Crawford et al., 2019). The general principle is to convert the input data into an output barcode which records all the relevant information.

Inspired by the success of persistent homology, the purpose of the present workshop is to replicate this success by developing robust, statistically integrated versions of other constructions from classical algebraic topology. In particular, we are interested in persistent versions of cohomology theory, that combine the robustness of persistence with the various sophisticated algebraic structures associated with cohomology. The research literature contains hints that this is a fertile avenue for exploration. One striking application is the use of cohomology to construct meaningful angle-valued coordinates on a data set (de Silva et al., 2011), in analogy with the construction of meaningful real-valued coordinates produced by dimensionality reduction algorithms. A more sophisticated later development (Perea, 2017) produces projective coordinates that can potentially be exploited in data analysis when considering moduli spaces of complex data objects, for example, in the spirit of (Monod et al., 2018).

We intend that this workshop will kick-start several new directions for theoretical development and will uncover potential new applications. Our list of potential participants includes TDA researchers from various backgrounds including: statistics, homotopy theory, sheaf theory, machine learning, mathematical biology.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5197

Noncommutative Geometry meets Topological Recursion
October 23 - 28, 2022 (Cancelled)

Organizers:

Masoud Khalkhali (University of Western Ontario)
Gaetan Borot (Max Planck Institute for Mathematics)
Elba Garcia-Failde (Institut de Mathématiques de Jussieu-Paris Rive Gauche)
Hannah Markwig (Eberhard Karls Universität Tübingen)
Raimar Wulkenhaar (Westfälische Wilhelms-Universität Münster)

This workshop intends to be a first meeting point for specialists and young researchers active in non-commutative geometry, free probability, and topological recursion. In the two first areas, one often wants to compute expectation values of a large class of non-commutative observables in random ensembles of (several) matrices of size N, in the large N limit. The motivations come from the study of various models of 2d quantum gravity via random spectral triples, or from the problem of identifying of interesting factors via approximations by matrix models. Topological recursion and its generalizations provide a priori universal recipes to make and compactly organize such computations, not only for the leading order in N, but also to all orders of expansion in 1/N.in such a way that bridges to other domains where topological recursion has been applied (like enumerative geometry, tropical geometry, mirror symmetry, topological and more generally low-dimensional quantum field theories) become clear.

Concretely, the last 10 years have witnessed the developement of analytic techniques to establish the existence of large N asymptotic expansions, of applications of the topological recursion to a growing class of matrix models which now include some of direct interest in the study of random spectral triples and in non-commutative probability, and of connections between the combinatorics of free probability (i.e. higher order free cumulants) and the topological recursion together with symplectic transformations acting on it. The workshop will explore the consequences of these remarkable algebraic structures axiomatized in topological recursion, which also has a counterpart for non-commutative observables, to address problems in non-commutative geometry and free probability. Knowledge will also flow in the other direction, as the very nature of topological recursion hints at connections to (non-commutative) algebraic geometry, to Hopf algebraic structures and Connes-Kreimer renormalization which deserve exploration.

The mathematical models and phenomena under consideration are common to all these fields, and we wish to unite the strength of probabilistic/asymptotic, algebraic/geometric and combinatorial approaches for the benefit of all the communities involved. This interaction should in fine lead to a better geometric understanding, more powerful computational tools, and new results.

For details, please refer to the workshop webpage: https://www.birs.ca/events/2022/5-day-workshops/22w5195

Institute for Advance Study in Mathematics (IASM) inaugurated on November 16, 2017, is designed to offer a tranquil and stimulating environment in which mathematicians worldwide get together to work, think, and exchange ideas. Based in Hangzhou, a city renowned for its natural beauty and cultural heritage, IASM welcomes about one hundred visiting scholars annually from some fifty universities and research institutions.

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UBCO 2022 Program

5-Day Workshops 2022

May 22	May 27	Emerging Challenges for Statistics and Data Sciences: Complex Data with Missingness, Measurement Errors, and High Dimensionality
May 29	Jun 3	Statistical Approaches to the Inclusion of Indigenous Knowledge in Modelling (Cancelled)
Jun 5	Jun 10	Deep Learning for Genetics, Genomics and Metagenomics: Latest developments and New Directions
Jun 12	Jun 17	Preparing for the next pandemic
Jun 19	Jun 24	Geometry, Mechanics and Computation: from Soft Matter to Animation and Beyond (Cancelled)
Jun 26	Jul 1	Combining Causal Inference and Extreme Value Theory in the Study of Climate Extremes and their Causes
Jul 3	Jul 8	Climate Change Scenarios and Financial Risk
Jul 10	Jul 15	Deep Exploration of non-Euclidean Data with Geometric and Topological Representation Learning
Jul 17	Jul 22	Derivative-Free Optimization: Linking Algorithms and Applications
Jul 24	Jul 29	Equilibrium and non-Equilibrium Pattern Formation in Soft Matter: From Elastic Solids to Complex Fluids
Jul 31	Aug 5	Driving Global Inference for New Physics with Machine Learning, Big Data and Large-Scale Statistical Simulation
Aug 7	Aug 12	Teaching First-year University Mathematics Courses: Past, Present, and Future

2-Day Workshops 2022

May 13	May 15	Scientific Workshop for Graduate Students in Mathematical Biology

Summer School 2022

Jul 31	Aug 12	Joint MSRI-BIRS Graduate Summer School - Sums of Squares Method in Geometry, Combinatorics and Optimization

UBC Okanagan

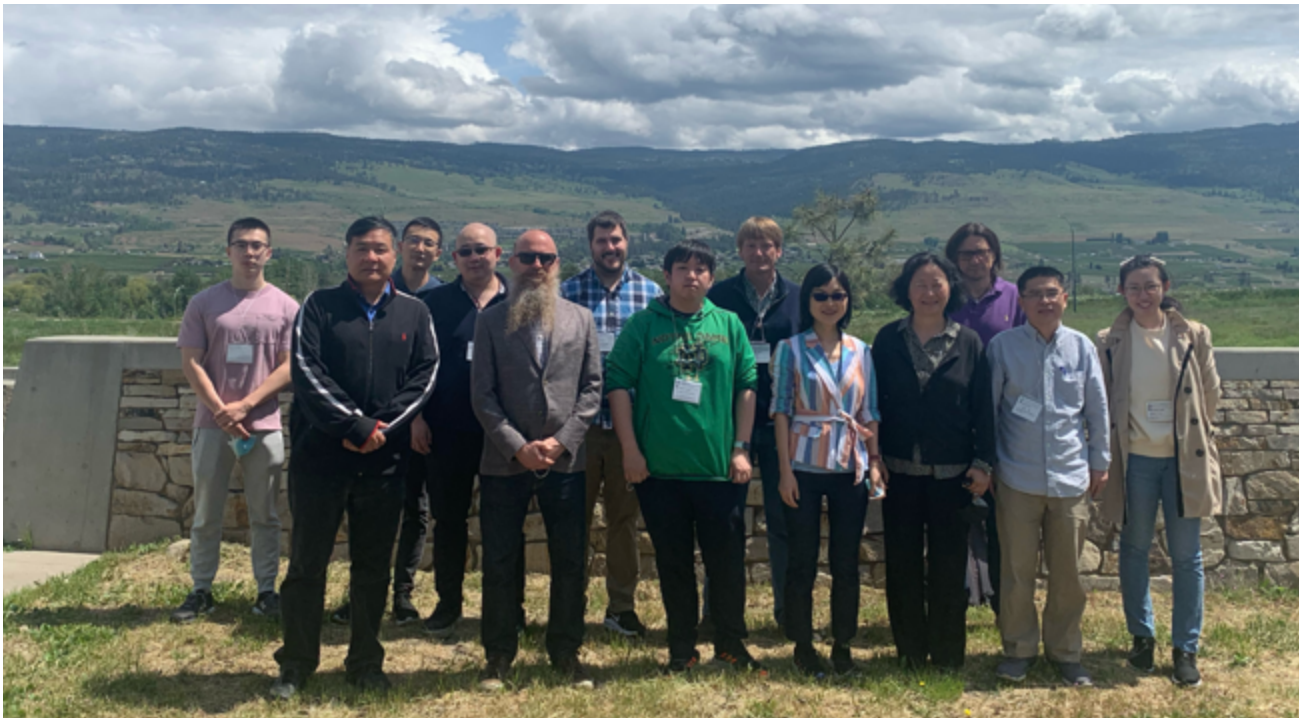
2022

5-Day Workshops

Emerging Challenges for Statistics and Data Sciences: Complex Data with Missingness, Measurement Errors, and High Dimensionality
May 22 - 27, 2022

Organizers:

Shu Yang (North Carolina State University)
David Haziza (University of Ottawa)
Peng Ding (University of California, Berkeley)
Chenyin Gao (North Carolina State University)
Grace Yi (University of Western Ontario)



Statistics and newly emerging data science are central pillars of quantitative research in social and biomedical sciences. The era of big data has revolutionized statistics with massive, heterogeneous and complex-featured data sources. It is critical and timely to bring statisticians, computer scientists, and practitioners together to share current research advances in handling novel data analytical challenges including missingness, measurement errors, and high dimensionality. This workshop brought researchers together to take a significant step forward in using big data to answer important scientific questions.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5010

Participants:

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Artman, Conor (North Carolina State University)
Banks, David (Duke University)
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Bhattacharya, Bhaskar (Southern Illinois University Carbondale)
Bian, Yuan (University of Western Ontario)
Breidt, Jay (NORC at the University of Chicago)
Briones, Elizabeth (CDC)
Bruce, Beau (US Centers for Disease Control and Prevention)
Buzas, Jeff (University of Vermont)
Cao, Hongyuan (Florida State University)
Chen, Sixia (The University of Oklahoma Health Sciences Center)
Chen, Anqi (Simon Fraser University)
Chen, Guanhua (uw)
Chen, Yuguo (University of Illinois at Urbana-Champaign)
Chen, Zhen (NC State)

Cho, Yanghyeon (Iowa State University)
Cho, Youngjoo (Konkuk University)
Crowley, Aaron (Genesis Research LLC)
Cui, Jingyu (Western University)
Dao, Mai (Wichita State University)
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Diawara, Norou (Old Dominion University)
Diedrichsen, Jörn (Western University)
Ding, Peng (University of California, Berkeley)
Dobriban, Edgar (University of Pennsylvania)
Du, Jiacong (University of Michigan)
Emami, Maryam (University of Chicago)
Fang, Yusi (University of Pittsburgh)
Fatoumata, Sanogo (Bates College)
Fujimoto, Akane (CDC)
Fuller, Wayne (Iowa State University)
Gamalo, Margaret (Pfizer)
Gao, Chenyin (North Carolina State University)
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Gao, Yujing (NC State University)
Ghosh, Trinetri (University of Wisconsin-Madison)
Gianpaolo, Zammarchi (University)
Goga, Camelia (Université de Franche-Comté)
Ha, Dang (Johnson and Johnson)
Han, Peisong (University of Michigan)
Han, Larry (Harvard University)
Hayek, Lee-Ann (Smithsonian Institution)
Haziza, David (University of Ottawa)
He, Chad (Fred Hutchinson Cancer Research Center)
Hsiao, Chi-Shian (University of Wisconsin-Madison)
Hu, Joan (Simon Fraser University)
Hu, Pingbo (Western University)
Hu, Chen (Johns Hopkins University)
Huang, Bin (Cincinnati Children's Hospital)
Huang, Jianhua (Chinese University of Hong Kong)
Huang, Chien-Min (Colorado State University)
Huynh, Kim (Other/Unknown)
Hwang, Wei-Ting (University of Pennsylvania)
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Jiang, Zhichao (University of Massachusetts)
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Jiang, Wenqing (University of New Orleans)
Jones, Michael (University of Iowa)
Josse, Julie (Inria)
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Kim, Kyoungmi (University of California Davis)
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Kwon, Yonghyun (Iowa State University)
Lee, Jaechoul (Boise State University)
Lee, Joowon (University of Wisconsin)
Leedy, Caleb (Iowa State University)
Lerdputtipongporn, Peem (Carnegie Mellon University)
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Li, Xinran (University of Illinois at Urbana-Champaign)
Li, Dongmei (University of Rochester Medical Center)
Li, Yi-Ju (Duke University)
Li, Wei (University of Florida)
Li, Guowei (The Ohio State University)
Liang, Menglu (Penn State University)
Liang, Yuanyuan (University of Maryland School of Medicine)
Linh, Cao (Florida International University)
Little, Roderick (University of Michigan)
Liu, Siyi (North Carolina State University)
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Liu, Cathy (school)
Liu, Xueyan Sherry (University of New Orleans)
Liu, Zhonghua (University of Hong Kong)
Liu, Yanyan (University in Wuhan)
Liu, Yilun (Iowa State University)
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Lu, Yan (JPS Health Network)
Lun, Zhixin (UCSF)
Ma, Guoliang (Iowa State University)
Ma, Haijun (Nektar Therapeutics)
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Nguyen, Yet (Old Dominion University)
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Pervin, Ari (Cytel)
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Poulos, Jason (Harvard Medical School)
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Qiu, Hongxiang (University of Pennsylvania)
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Ren, Haobo (Incyte)
Rimal, Ramchandra (Middle Tennessee State University)
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Wang, Yuexi (University of Chicago)
Wang, Yiming (North Carolina State University)
Wong, Raymond (Texas A&M University)
Wu, Changbao (University of Waterloo)
Wu, Lili (Microsoft)
Xiong, Yi (Fred Huchinson Cancer Center)
Xu, Tanchumin (NC State)
Yang, Shu (North Carolina State University)
Yang, Fan (University of Colorado Anschutz Medical Campus)
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Ye, Xin (Wuhan University)
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Yi, Yanqing (Memorial University of Newfoundland)
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Zhang, Yuping (University of Connecticut)
Zhang, Xiaofei (Zhongnan University of Economics and Law)
Zhang, Hongbin (City University of New York)
Zhang, Zihan (Georgia Tech)
Zhao, Anqi (National University of Singapore)
Zhao, Jiwei (University of Wisconsin-Madison)
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Zhou, Hui (University of New Orleans)
Zhu, Yachen (University of California, Irvine)
Zivich, Paul (UNC)
Zuo, Shuozhi (University of Colorado Anschutz Medical Campus)

Deep Learning for Genetics, Genomics and Metagenomics: Latest developments and New Directions
June 5 - 10, 2022

Organizers:

Iuliana Ionita-Laza (Columbia University)
Amin Emad (McGill University)
Hongzhe Li (University of Pennsylvania)
Celia Greenwood (Lady Davis Institute for Medical Research)

Deep learning is one of the most active areas in machine learning and has led to great improvements in many applications. Historically, deep learning has been extremely successful in applications to image and speech recognition. New deep learning methods have been developed in the last several years and have gained great attention in biomedical research, including research in imaging data analysis, digital phenotyping, analysis of electronic health record (EHR) data etc. Furthermore, these new methods have shown impressive results across many problems in biology. Such deep learning methods have been applied to the analysis of large-scale genetics, genomics and metagenomics data, including genotyping, analysis of single-cell RNA-seq data, annotation of non-coding variants, analysis of metagenomic data, analysis of data from gene editing and regulatory genomics.

The goal of this workshop was to bring together leading experts and junior researchers who are working at the interface between deep learning methods and genetics, genomics and metagenomics to discuss what has been done, what are the frontier research topics, what are the data sources for applying deep learning methods in genomics and metagenomics, and what are the unique challenges in developing deep learning methods and applying them in genetics and genomics research.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5085

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Cohen-Freue, Gabriela (University of British Columbia)

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Dey, Kushal (Harvard T.H. Chan School of Public Health)
Dina, Christian (institut du thorax, Nantes)
Dong, Chris (UCLA)
Du, Yuxuan (USC)
Dye, Christian (Columbia University)
Emad, Amin (McGill University)
Fabiha, Tabassum (Columbia University)
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Kwon, Young (Columbia University)
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Li, Guangyou (Columbia University)
Li, Jessica (McGill University)
Liang, Yanyu (23 and Me)
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Liu, Linxi (University of Pittsburgh)
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Sankararaman, Sriram (UCLA)
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Shu, Chang (Columbia University)
Singh, Ritambhara (Brown University)
Stern, Kiri (McGill University)
Su, Chen (McGill University)
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Takiddeen, Abdulrahman (McGill University)
Tang, Jian (HEC Montreal)
Tang, Tianqi (USC)
Tsai, Amanda (Columbia University)
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Wang, Fan (University of Toronto)
Wang, Chen (Columbia University)
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Wang, Gao (Columbia University)
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Wang, Yi (Johns Hopkins Univerisity)
Wu, Hui-Chen (Columbia University)
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Zhou, Jian (UT Southwestern Medical Center)
Zinati, Yazdan (McGill University)
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Zuo, Wenxuan (USC)

Preparing for the Next Pandemic
June 12 - 17, 2022

Organizers:

Sara Del Valle (Los Alamos National Lab)
Wasiur R. KhudaBukhsh (Nottingham)
Joel Miller (La Trobe University)
Rick Durrett (Duke University)

As of September 28, 2020, 33 million Covid-19 cases have been reported worldwide. With one million deaths attributed to the deadly infection, the pandemic has not only killed a huge number, but also caused worldwide economic disruption. In the process, it has exposed our inadequate preparation and our inability to act promptly and decisively in response to a rapidly spreading novel virus. With an objective to prepare for the next pandemic, the focus of the proposed workshop will be on the scientific questions that emerged during the current Covid-19 crisis. The overall theme of the workshop can be broadly categorized into three intertwined topics:
1) a mechanistic approach to understanding the complex dynamics of novel viruses such as the SARS-CoV-2;
2) parameter inference and proper uncertainty quantification; and
3) design of optimal intervention and policy.

The workshop brought together different communities and foster new interdisciplinary collaborations. Most importantly, the workshop aimed to train a cohort of young and diverse group of researchers into responsible scientists who will be better prepared for the next pandemic.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5058

Participants:

Bansal, Shweta (Georgetown University)
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Castro, Lauren (Los Alamos National Laboratory)
Chowell, Gerardo (Georgia State University)
Del Valle, Sara (Los Alamos National Lab)
Di Lauro, Francesco (University of Oxford)
Diekmann, Odo (Universiteit Utrecht)
Durrett, Rick (Duke University)
Funk, Sebastian (London School of Hygiene and Tropical Medicine)

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Goldenfeld, Nigel (UCSD)
Gomes, Gabriela (University of Strathclyde)
Heffernan, Jane (York University)
Hletko, Sofia (Duke University)
Huang, Jenny (Duke University)
Johansson, Michael (Centers for Disease Control and Prevention)
Kenah, Eben (The Ohio State University)
KhudaBukhsh, Wasiur R. (Nottingham)
Kim, Jinsu (POSTECH)
Kiss, Istvan (University of Sussex)
Lee, June (Duke University)
Manore, Carrie (Los Alamos National Laboratory)
Miller, Joel (La Trobe University)
Mistry, Dina (Industry)
Neal, Peter (University of Nottingham)
Pallod, Gaurav (Duke University)
Pham, Mui (Harvard T.H. Chan School of Public Health)
Rempala, Grzegorz (The Ohio State University)
Rivlin-Sanders, Sarina (University of Nottingham)
Saucedo, Omar (Virginia Tech)
Spencer, Julie (Los Alamos National Laboratory)
Stockdale, Jessica (Simon Fraser University)
Tung, Hwai-Ray (Duke University)
Vallejo, Celeste (DILIsym Services, a division of Simulations Plus)
Wascher, Matthew (University of Dayton)
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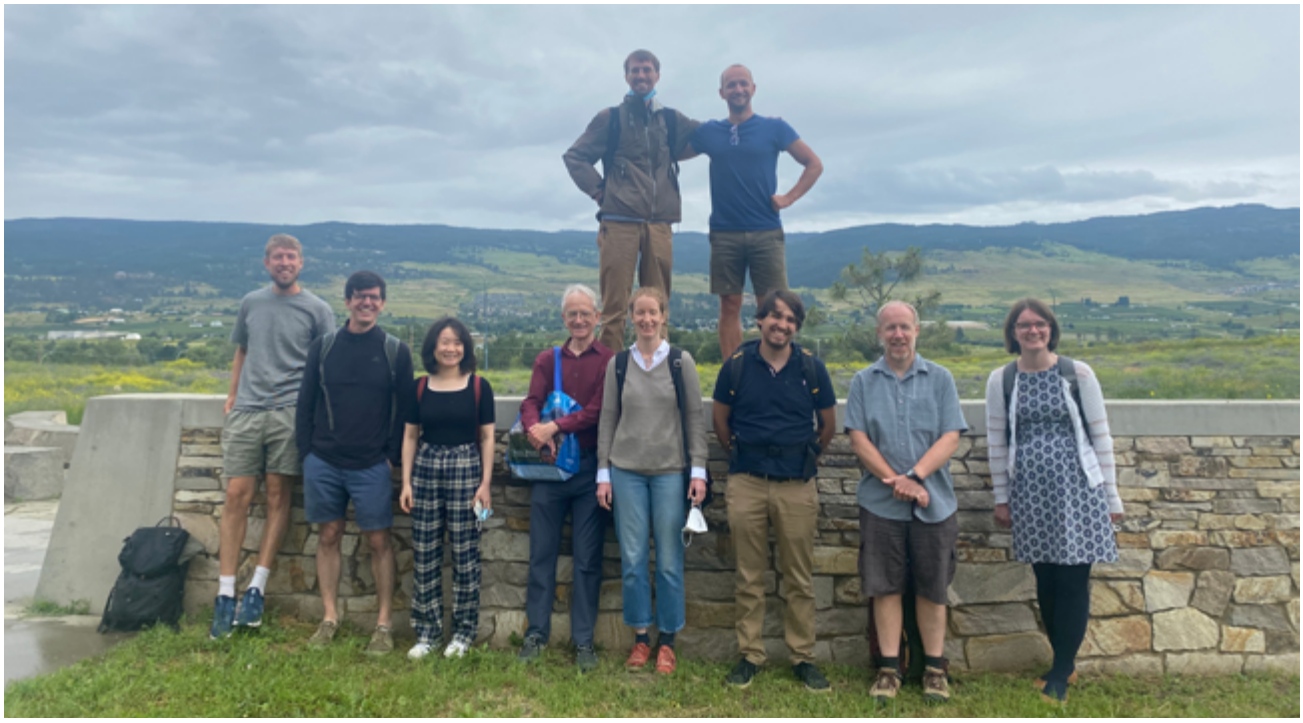
Combining Causal Inference and Extreme Value Theory in the Study of Climate Extremes and their Causes
June 26 - July 1, 2022

Organizers:

Johanna Neslehova (McGill University)
Marloes Maathuis (Eidgenössische Technische Hochschule Zürich)
Linda Mhalla (École Polytechnique Fédérale de Lausanne)
Phillippe Naveau (Climate Science and Environment Laboratory-France)



In a changing climate, the frequency and severity of climate extremes are of prime importance for human society. It is essential to understand and quantify how the behavior of extremes will differ from the past and how it might evolve in the future. Scientific answers to these questions require a novel and rigorous mathematical and statistical framework to assess and quantify causal effects on and of extremes. Achieving this goal calls for a combined research effort from three scientific fields: causal inference, extreme-value theory, and climatology. This workshop brought together leading experts from these three fields in order to develop new collaborations, identify new problems, and advance the state of the art of the budding area of causal inference for extremes.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5079

Participants:

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Genest, Christian (McGill University)
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Hannart, Alexis (LooksGoodAI)

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Henckel, Leonard (University of Copenhagen)
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Li, Jinzhou (ETH Zurich)
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Oesting, Marco (Universitat Stuttgart)
Opitz, Thomas (INRAE)
Peters, Jonas (University of Copenhagen)
Pyrina, Maria (ETH Zurich)
Reich, Brian (North Carolina State University)
Ribes, Aurélien (Météo France - CNRS)
Runge, Jakob (German Aerospace Center and TU Berlin)
Schillinger, Maybritt (ETH Zurich)
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Tuel, Alexandre (University of Bern)
Volgushev, Stanislav (University of Toronto)
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Climate Change Scenarios and Financial Risk
July 3 - 8, 2022

Organizers:

John Thompson (UBC Okanagan)
Matt Davison (University of Western Ontario)
Joan Hu (Simon Fraser University)
Apurva Narayan (UBC Okanagan)

It is generally accepted that the world's climate is undergoing rapid change. With changes in temperature and precipitation patterns, regionally and globally, particular areas could encounter longer periods of drought or sparse, but more intense rainfall events. Hence, substantial changes in agricultural production is anticipated. For example, planting in spring could be delayed due to heavy rains, or an overly lengthy drought period in summer could devastate a crop, and so on. Failure to produce over a sufficiently long period will lead to financial failure in various forms, including credit default. The financial industry is acutely aware of the potential for an increase in this form of credit risk, but there are currently only limited and insufficient ways of providing an assessment of the magnitude.

To help all financial market participants estimate climate-related risks and opportunities, the Financial Stability Board established the Task Force on Climate-related Financial Disclosures (TFCD) in 2017. Core elements of a financial disclosure framework developed by this task force include strategizing around the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning; identifying, assessing, and managing climate-related risks; formulating metrics and targets to assess and manage relevant climate-related risks and opportunities. To implement these recommendations financial institutions require innovative methodologies and approaches to identify their climate-related risks. The financial health of agriculture, forestry, fisheries, mining, tourism, and other economic sectors will be subject to climate-related shocks. This workshop provided a forum for experts in climate modelling, mathematical finance and banking as well as researchers specializing in various economic sectors to discuss these issues and identify ways in which new climate-related financial risk assessment tools may be developed.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5201

Participants:

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Whelan, Niall (Soctiabank)
Wyse, Sarah (UBC Okanagan)
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Deep Exploration of non-Euclidean Data with Geometric and Topological Representation Learning
July 10 - 15, 2022

Organizers:

Guy Wolf (Université de Montréal)
Ladislav Rampasek (Université de Montréal)
Bastian Rieck (Helmholtz Munich)
Ira Ktena (DeepMind - Google)

To fundamentally advance the frontiers of geometric and topological representation learning, a new unified perspective is required, pooling together the wide range of ideas proposed in recent years into an overarching cross-disciplinary body of knowledge. In this workshop, we aimed to build the foundations for such development by bringing together leading experts and researchers from multiple disciplines and fields, including manifold learning, graph representation learning, topological data analysis, and graph signal processing. The direct interdisciplinary interaction made possible by this workshop enabled the dissemination of knowledge and a clear view of the current state of the art in participating fields. This, in turn, is expected to result in a distilled long-term vision as well as a short-term roadmap for realizing the potential posed by our increasing understanding of intrinsic data geometry and achieving new breakthroughs enabled by it.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5125

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Gama, Fernando (Rice University)
Günnemann, Stephan (Technical University of Munich)
Hirn, Matthew (Michigan State University)
Huang, Ningyuan (Johns Hopkins University)
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Derivative-Free Optimization: Linking Algorithms and Applications
July 17 - 22, 2022

Organizers:

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Charles Audet (Poly. Montreal)
Ana Custódio (Universidade Nova de Lisboa)
Matt Menickelly (Argonne National Laboratory)

Optimization, the study of minimizing or maximizing a function subject to satisfying constraints, arises in virtually every area of science and engineering. Modern applications of optimization take many forms, each with their own unique challenges. One important form is optimization problems where the objective and/or constraint functions are provided via a "blackbox". Evaluation of the blackbox function yields a function value for the specified input at a given point, but no other information (such as derivative information). This occurs, for example, whenever the objective function relies on an executable-only computer simulation. With the rapid increase of computational science and engineering problems and associated computer simulations, problems of this form have become ubiquitous in modern applications.

Derivative-free optimization (DFO) is the design and study of optimization algorithms that use only function values without derivatives. Such algorithms provide the perfect tool for the optimization of applications based on computer simulation. DFO has made significant advances over the past decade and represents one of the most rapidly expanding fields of nonlinear optimization research. Novel algorithms have expanded the reach of DFO applications. In this workshop, we forged new connections between research focused on DFO algorithm design and novel applications of DFO.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5199

Participants:

Audet, Charles (Poly. Montreal)
Chen, Yiwen (Beihang University)
Custódio, Ana (Universidade Nova de Lisboa)
Das, Sourav (The University of British Columbia)
Dennis, John (Rice University)
Diouane, Youssef (Polytechnique Montreal)

Dzahini, Kwassi Joseph (Argonne National Laboratory)
Hare, Warren (University of British Columbia)
Huang, Dominic (University of British Columbia)
Jarry-Bolduc, Gabriel (University of British Columbia)
Kerleau, Sébastien (U. Dauphine, France)
Kojtych, Solène (GERAD, Polytec Montreal)
Larson, Jeff (Argonne National Labs, USA)
Le Digabel, Sébastien (GERAD, Polytechnique Montréal)
Liuzzi, Giampaolo (Sapienza University of Rome, Italy)
Lucet, Yves (University of British Columbia Okanagan)
Menickelly, Matt (Argonne National Laboratory)
Mueller, Juliane (Lawrence Berkeley National Lab)
Porcelli, Margherita (U Bologna, Italy)
Rinaldi, Francesco (U Padova, Italy)
Royer, Clement (Université Paris Dauphine-PSL)
Salomon, Ludovic (GERAD, Montreal)
Shoemaker, Christine (Cornell, USA & Univ. of Singapore)
Silva, Everton (Universidade Nova de Lisboa)
Tesfamariam, Solomon (The University of British Columbia)
Wild, Stefan (Argonne National Laboratory)

Equilibrium and non-Equilibrium Pattern Formation in Soft Matter: From Elastic Solids to Complex Fluids
July 24 - 29, 2022

Organizers:

Irmgard Bischofberger (MIT)
Stephen Morris (University of Toronto)
Sungyon Lee (University of Minnesota)
Ian Tobasco (University of Illinois Chicago)

Patterns are abundant in nature, from ripples and dunes that form in sand, to the wrinkling of dried fruits, our fingerprints, or the folds in our brains. How exactly do they form? By the laws of physics, of course, but why should the ripples form in this way, or the wrinkles go in that way, and why do our brains fold at all? Explaining these and other emergent patterns presents a serious and important challenge for mathematicians, physicists, and engineers alike. This workshop explored questions at the forefront of our understanding of pattern formation, focusing on identifying universal mathematical descriptions.

Two distinct paradigms are currently used to explain patterns. The workshop aimed to find links and commonality between them. Many regular patterns can be explained as being the “best” possible configuration in the sense that they optimize some quantity, usually the energy. In other more dynamic cases, patterns emerge as a result of open processes with no obvious optimum energy. Nevertheless, universal mathematical connections do exist between these two approaches, even though they are typically found in quite distinct sciences. This workshop brought together scientists from these different fields to find common explanations.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5127

Participants:

Audoly, Basile (CNRS and Ecole polytechnique)
Bacik, Karol (University of Bath)
Bico, José (ESPCI)
Bischofberger, Irmgard (MIT)
Dalnoki-Veress, Kari (McMaster University)
Datta, Sujit (Princeton University)
Davidovitch, Benny (University of Massachusetts Amherst)
Démery, Vincent (ESPCI)
Driscoll, Michelle (Northwestern University)

Dunkel, Jorn (MIT)
Duprat, Camille (Ecole Polytechnique)
Feng, Fan (University of Cambridge)
Fonseca, Irene (Carnegie Mellon University)
He, Mengfei (Syracuse University)
Hooshanginejad, Navid (Brown University)
Ichihara, Mie (University of Tokyo)
James, Richard (University of Minnesota)
Juel, Anne (University of Manchester)
Jung, Sunghwan (Cornell University)
Katifori, Eleni (University of Pennsylvania)
Khain, Evgeniy (Oakland University)
Kodio, Ousmane (Massachussetts Institute of Technology)
Kohn, Robert (New York University)
Kolinski, John (EPF Lausanne)
Kudrolli, Arshad (Clark University)
Lee, Sungyon (University of Minnesota)
Lewicka, Marta (University of Pittsburgh)
Lindner, Anke (PMMH-ESPCI and Sorbonne Université)
Marthelot, Joel (Aix-Marseille Univ IUSTI)
Morris, Stephen (University of Toronto)
Newell, Alan (University of Arizona)
Paulsen, Joseph (Syracuse University)
Peters, Ivo (University of Southampton)
Pihler-Puzovic, Draga (University of Manchester)
Plucinsky, Paul (University of Southern California)
Tobasco, Ian (University of Illinois Chicago)
Totz, Jan (MIT)
Tsai, Peichun Amy (University of Alberta)
Videbaek, Thomas (Brandeis University)
Wallace, Samuel (UIC)
Wang, Zhimeng (UIC)

Driving Global Inference for New Physics with Machine Learning, Big Data and Large-scale Statistical Simulation
July 31 - August 5, 2022

Organizers:

Matthias Danninger (Simon Fraser University)
Jonathan Cornell (Weber State University)
Nazila Mahmoudi (CERN)
Gregory Martinez (University of California, Los Angeles)

The physical sciences have entered the era of big data, and particle physics is no exception. Extremely powerful particle colliders, telescopes observing light across the energy spectrum, and precise underground experiments have been running for years and have produced remarkably detailed and complex data sets. While no definitive signal of new physics has yet emerged from these experiments, it is quite possible that hints of new phenomena are hidden in these results, only missed due to the limitations of our analysis methods. In this workshop, we brought together statisticians and physicists to discuss novel methods of data analysis, with a focus on machine learning, in which computers are programmed to think in ways akin to humans. We will launch the development of new computer tools that will allow us to overcome current computational limitations and fully test particle physics theories against all available data, potentially leading to discoveries that will shed light on some of the most profound questions in physics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5129

Participants:

Agocs, Fruzsina (Flatiron Institute)
Athron, Peter (Nanjing Normal University)
Balan, Sri Sankari alias Sowmiya (RWTH Aachen University)
Balazs, Csaba (Monash University)
Beniwal, Ankit (King's College London)
Braseth, Lasse (University of Oslo)
Bringmann, Torsten (University of Oslo)
Cappiello, Christopher (Queen's University)
Chang, Christopher (University of Queensland)
Clark, Ross (Glasgow University)
Cornell, Jonathan (Weber State University)
Danninger, Matthias (Simon Fraser University)
Gonzalo, Tomas (KIT)
Handley, Will (University of Cambridge)
Harz, Julia (Technical University of Munich)

Hergt, Lukas (University of British Columbia (UBC))
Jacob, Douglas (Monash University)
Kahlhoefer, Felix (Karlsruhe Institute of Technology)
Kvellestad, Anders (University of Oslo)
Lin, Chien (Imperial College)
Martinez, Gregory (University of California, Los Angeles)
Mohlabeng, Gopolang (University of California, Irvine)
Pacey, Holly (University of Cambridge)
Raklev, Are (University of Oslo)
Scott, Pat (Quantum Brilliance & University of Queensland)
Stenning, David (Simon Fraser University)
Stoecker, Patrick (RWTH Aachen)
Su, Wei (Sun Yat-Sen University)
Vincent, Aaron (Queen's University)
White, Martin (University of Adelaide)

Teaching First-year University Mathematics Courses: Past, Present, and Future
August 7 - 12, 2022

Organizers:

Miroslav Lovric (McMaster University)
Andie Burazin (University of Toronto Mississauga)
Lauren DeDieu (University of Calgary)
Veselin Jungic (Simon Fraser University)

The “Teaching First-year University Mathematics Courses: Past, Present, and Future” workshop brings together a group of Canadian and international university mathematics educators, including the award-winning educators and emerging leaders in the post-secondary mathematics education communities. The workshop participants examined and debated the challenges and opportunities that students, faculty, mathematics departments, and academic programs will face in the upcoming decade. Our discussions and activities will be, in many ways, driven by the impact of the COVID-19 pandemic on the post-secondary education in general, and on the role of learning and teaching of mathematics in particular.

The workshop’s main objective was to generate specific suggestions for possible large-scale modifications to entry-level mathematics curricula in Canadian universities, given the emergence of the new social, economic, and political environment caused by the COVID-19 pandemic. These modifications will aim to move us onward toward the creation of a curriculum that is rooted in the modern world, which is robust and flexible, and strongly interconnected in numerous aspects. The ultimate goal of the new curriculum will be to meet the mathematical needs of upcoming generations of undergraduate students. This workshop was a major event, building on the outcomes of several initiatives, meetings, and documents, most notably the First Year in Maths (FYiMaths) project in Australia, the far reaching 2016 U.S. document “Common Vision for Undergraduate Mathematical Science Programs in 2025,” and the “First-Year University Mathematics in Canada” conferences hosted by the Fields Institute in 2018, the University of Alberta in 2019, and, virtually, at the University of Toronto Mississauga in 2020.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5002

Participants:

Alderson, Hope (University of New Brunswick)
Archibald, Jana (Lethbridge)
Boroushaki, Shirin (Thompson Rivers University)
Bouchard, Vincent (University of Alberta)
Burazin, Andie (University of Toronto Mississauga)
Causley, Broderick (McGill University)
Chapman, Olive (University of Calgary)
Chow, Amenda (York University)
Davidson, Michelle (University of Manitoba)
DeDieu, Lauren (University of Calgary)
Desaulniers, Shawn (University of Alberta)
Desjardins, Steven (University of Ottawa)
Doolittle, Edward (First Nations University of Canada)
Duff, Ana (Ontario Tech University)
Ezzat, Shannon (Cape Breton)
Fitzpatrick, Sean (University of Lethbridge)
Ge, Chunlei (UBCO)
Hamilton, Mark (Mount Allison University)
Han, Spectrum (University of British Columbia - Okanagan)
Jungic, Veselin (Simon Fraser University)
khoury, joseph (University of Ottawa)
Lagu, Indy (Mount Royal University)
Leung, Fok-Shuen (University of British Columbia)
Lovric, Miroslav (McMaster University)
Matthews, Asia (Quest University)
McCallum, William (The University of Arizona)
Mesa, Vilma (University of Michigan)
Mosunov, Anton (University of Waterloo)
Mulberry, Nicola (SFU)
Paton, Kelly (University of British Columbia)
Postnikoff, Derek (Saskatchewan)
Rasmussen, Chris (San Diego State University)
Sargent, Pam (York University)
Singh, Shambhavi (UBCO)
Smith, Jerrod (University of Calgary)
Sodhi, Asmita (Dalhousie University)
Walls, Patrick (University of British Columbia)
Webb, Kerri (Selkirk College)
Yamin, Yas (UBCO)

UBC Okanagan

2022

2-Day Workshops

Scientific Workshop for Graduate Students in Mathematical Biology
May 13 - 15, 2022

Organizers:

Rebecca Claire Tyson (UBC Okanagan)
Daniel Coombs (University of British Columbia)
Mark Lewis (University of Victoria)

The interaction between evolution and population dynamics is a key concern under the pressures of climate change. There is already evidence that some species are evolving adaptations such as earlier emergence, and dispersal into new habitats following range shifts. Other species, however, seem much less able to adapt. For conservation purposes, it is critically important that we understand how the evolutionary pressures exerted by climate change and the mathematical dynamics of interacting populations lead to survival or extinction of species. The mathematical study of these processes, eco-evolutionary dynamics, is an area of active research, and a talented researcher from the Centre National de Recherche Scientifique in France will be coming to present his work in this area, as well as an extended lecture on the mathematical techniques used in the study of eco-evolutionary models. The workshop was aimed chiefly at graduate students in mathematical biology, who will gain skills in eco-evolutionary dynamics, and a wider network of peers and mentors through the research discussions at the workshop. In addition, a policy expert gave an interactive presentation showing the process whereby mathematical work can be included into policy, thus empowering students to make even greater contributions to society through their research.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/2-day-workshops/22w2265

Participants:

Ahmed, Shohel (University of Alberta)
Ashenafi, Yonatan (University of Alberta)
Avneet, Kaur (UBC)
Baabdulla, Arwa (University of Alberta)
Banerjee, Rituparna (UBC)
Bansal, Neha (UBC Okanagan)
Bardwell, Samantha (University of British Columbia)
Braverman, Elena (University of Calgary)
Chakraborty, Amit Kumar (University of Alberta)
Chambers, Ian (UBC Okanagan)

Claire Tyson, Rebecca (University of British Columbia Okanagan)
Coombs, Daniel (University of British Columbia)
Das, Raibatak (Applied Biomathematics Inc.)
Deng, Dongxu (University of Alberta)
Gai, Chunyi (UBC)
Gao, Shan (University of Alberta)
Garnier, Jimmy (CNRS - University Savoie Mont-Blanc)
Harrington, Peter (University of Alberta)
He, Mingyu (University of Calgary)
Hillen, Thomas (University of Alberta)
Hossain, Tareque (UBC)
Hua, Xiaotian (University of Alberta)
Irvine, Fonya (Concordia University)
Khouhak, Jalal (UBC - Vancouver)
Lawson, Jenny (University of Calgary)
Liu, Di (University of Alberta)
Newby, Jay (University of Alberta)
Nie, Shikun (University of British Columbia)
Nishi, Nuzhat Nazmul (SoftBank Robotics)
Oladele Toyin, Ogunfowote (University of Venda)
Panday, Pijush (University of Alberta)
Pelz, Merlin R (UBC)
Philippsen, Tanya (University of Victoria)
Saghafifar, Fatemeh (UBC)
Shuttleworth, Robyn (University of Saskatchewan)
Shyntar, Alexandra (University of Alberta)
Solomon, Liane (University of Alberta)
Thiessen, Ryan (University of Alberta)
Thompson, Peter (University of Alberta)
Tianxu, Tianxu (University of Alberta)
Venegas Garcia, Pablo (University of Alberta)
Virk, Navjot (UBC)
Wang, Kai (University of Alberta)
Wang, Manting (University of Victoria)
Wyse, Sarah (UBC Okanagan)
Xiaoqi, Xie (University of Alberta)
Yih, Liam (UBC)
Yosprakob, Tharana (University of Alberta)
Zhang, Hua (University of Alberta)
Zhang, Mingran (University of Victoria)
Zhang, Longhui (Harbin Institute of Technlogy)

UBC Okanagan

2022

Summer School

Joint MSRI-BIRS Graduate Summer School - Sums of Squares Method in Geometry, Combinatorics and Optimization
July 31 - August 12, 2022

Organizers:

Greg Blekherman (Georgia Tech)
Annie Raymond (University of Massachusetts Amherst)
Cynthia Vinzant ()

The study of nonnegative polynomials and sums of squares is a classical area of real algebraic geometry dating back to Hilbert's 17th problem. It also has rich connections to real analysis via duality and moment problems. In the last 15 years, sums of squares relaxations have found a wide array of applications from very applied areas (e.g., robotics, computer vision, and machine learning) to theoretical applications (e.g., extremal combinatorics, theoretical computer science). Also, an intimate connection between sums of squares and classical algebraic geometry has been found. Work in this area requires a blend of ideas and techniques from algebraic geometry, convex geometry and representation theory. After an introduction to nonnegative polynomials, sums of squares and semidefinite optimization, we will focus on the following three topics:

• Sums of squares on real varieties (sets defined by real polynomial equations) and connections with classical algebraic geometry.

• Sums of squares method for proving graph density inequalities in extremal combina- torics. Here addition and multiplication take place in the gluing algebra of partially labelled graphs.

• Sums of squares relaxations for convex hulls of real varieties and theta-bodies with applications in optimization.

The summer school gave a self-contained introduction aimed at beginning graduate students, and introduce participants to the latest developments. In addition to attending the lectures, students met in intensive problem and discussion sessions that explored and extend the topics developed in the lectures.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/summer-schools/22ss199

Participants:

Babecki, Catherine (University of Washington)
Belavadi, Manoj (Wilfrid Laurier University)
Blekherman, Greg (Georgia Tech)
Chin, Tracy (University of Washington)
Dascalu, Maria (University of Massachusetts)
Deng, Weixun (Texas A&M University)
Dionel, Jaime (University of Wisconsin)
Dunbar, Alexander (Emory University)
Fitisone, Allison (University of Kentucky)
Frankson, Shakuan (Howard University)
Gallagher, Dan (University of Massachusetts)
Garzón Mora, Sofía (Universidad de los Andes)
Heard, Sam (The University of Oklahoma)
Huang, Dominic (University of British Columbia)
Iannantuono, Alex (UBC Okanagan)
Iannuzzo, Robert (DePaul University)
Isu, Jeremiah (University of Oklahoma)
Kagy, Bryson (NC State University)
Krishan Lal, Manish (UBC Okanagan)
Kundu, Somnath (Ryerson University)
Liu, Chris (Colorado State University)
Lopez, Daniel (San Fransisco State University)
Magnan, Van (University of Montana)
Mani, Nitya (MIT)
Medrano, Olga (University of Chicago)
Mitev, Dennica (University of Pennsylvania)
Muscat, Matthew (UBC Okanagan)
Nair, Ritika (University of Kansas)
Neshat, Khashayar (University of Victoria)
Nino-Cortes, Jonathan (University of Washington)
Perkins, Kate (Harvey Mudd College)
Quintero Ospina, Rodolfo Alexander (Leigh University)
Raymond, Annie (University of Massachusetts Amherst)
Sevilla, Carlos (University of Victoria)
Shankar, Isabelle (University of Illinois)
Slobodin, Aaron (University of Victoria)
Soltani, Farhad (York University)
Sun, Yuxuan (University of Waterloo)
Sun, Shengding (Georgia Tech)
Thomas, Cameron (Moreouse College / University of Georgia)
Verreault, William (Université Laval)
Vinzant, Cynthia (University of Washington)
Wells, Michael (Portland State University)
Wesley, William (UC Davis)
Zotine, Sasha (Queen's University)

UBC Okanagan

2022

Cancelled 5-Day Workshops

Statistical Approaches to the Inclusion of Indigenous Knowledge in Modelling
May 29 - June 3, 2022

Organizers:

Stephanie Peacock (University of Calgary)
Raychelle Aluaq Daniel (The Pew Charitable Trusts)
Rowenna Gryba (University of British Columbia)
Henry Huntington (Huntington Consulting)

The inclusion of Indigenous knowledge (IK) in environmental research, monitoring, and management can promote shared learning between scientists and IK holders, empower local communities, and increase the breadth and depth of information available compared to conventional scientific studies. Despite these benefits, it remains a challenge to ethically and effectively bridge science and IK in ways that recognize the parallel yet unique aspects of each. This workshop will address one particular facet of this topic: statistical and mathematical approaches to bridging different knowledge types in modelling studies. It will bring together statisticians and mathematicians working in ecology and environmental sciences, IK researchers, and Indigenous Peoples to explore the ethical and practical considerations of including IK in modelling. Our objectives are threefold: (1) to promote awareness among scientists of the nuances and ethical considerations of engaging with IK in their research, (2) to share and develop new statistical methods for the respectful inclusion of IK in modelling studies, and (3) to introduce modelling concepts to IK holders so they can make more informed decisions about whether and how to collaborate with researchers implementing modelling approaches.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5093

Geometry, Mechanics and Computation: from Soft Matter to Animation and Beyond
May 29 - June 3, 2022

Organizers:

Eitenne Vouga (The University of Texas at Austin)
Dave Levin (University of Toronto)
L Mahadevan (Harvard University)
Sabetta Matsumoto (Georgia Institute of Technology)

Researchers in materials science and mechanical engineering, condensed matter physics and physical chemistry, and computer graphics have independently begun to use tools and approaches that are very similar, based on ideas in differential, discrete and computational geometry, combined with physics as embodied in conservation laws and optimization principles. But there is much that these communities can gain by talking to each other and explicitly collaborating.

This workshop brings together established experts and young researchers from physics, mechanics, and computer graphics to review the most recent significant discoveries, establish a common vocabulary, identify connections between these disparate fields, and initiate new connections and collaborations.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2022/5-day-workshops/22w5123

University of British Columbia Campus Okanagan (UBCO) UBC's Okanagan campus is an innovative hub for research and learning. The campus was founded in 2005 in partnership with local Indigenous peoples, the Syilx Okanagan Nation, in whose territory the campus resides. Since its inception, UBCO has experienced tremendous growth, including an increase in research funding of 366 percent.

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