CENTRE
DE RECHERCHES
MATHÉMATIQUES

ANNUAL REPORT 2020–2022

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INTRODUCTION

The period June 2020 to May 2022 has been particularly complex for the CRM for reasons global and obvious, as well as due to more specific, cyclic challenges. In the first category, the COVID -19 pandemic unavoidably had a significant impact on our mathematical institute dedicated to supporting excellence in research through collaborations and training, with activities massively impacted by the pandemic restrictions. Among the latter challenges: the synchronous ends of cycle for all the main CRM funding grants; the change in directors with Luc Vinet ending eight productive, remarkable years at the helm of the center and the current director's term starting in the middle of 2021; and the renewal of the CRM support team with almost all current members having joined the center in 2019 or later. Per aspera ad astra - with the full support of our partners, of our members and our staff, the center has successfully concluded this period by renewing all its major grants with a funding increase of almost 15%, by continuing to organize spectacular scientific events – such as the Winter 2022 semester on Probability and Partial Differential Equations, by pursuing hybrid ways of communication and setting up the needed human and technical support infrastructure, by further expanding our training and visitor programs and starting new institutional programs and collaborations such as the Mathematicians in distress program joint with the ISM, and by expanding our outreach through the En Avant Math! program joint with CIRANO. During this period, the membership of the CRM expanded by 20% and the research activities channeled through the CRM laboratories have blossomed despite pandemic constraints. The mathematical sciences community grouped around the CRM showed an exemplary united and cohesive front in support of mathematical activities in French when the topic arose in discussions with national bodies, with many strong letters of support coming equally from English and French Quebec universities. The challenges and the opportunities facing the CRM did not end in 2022, and the same sources of strength will allow the center to further successfully pursue its mission in the service of the mathematical sciences.

Octav Cornea
Director

CRSNG NSERC
Fonds de recherche sur la nature et les technologies Québec
SIMONS FOUNDATION
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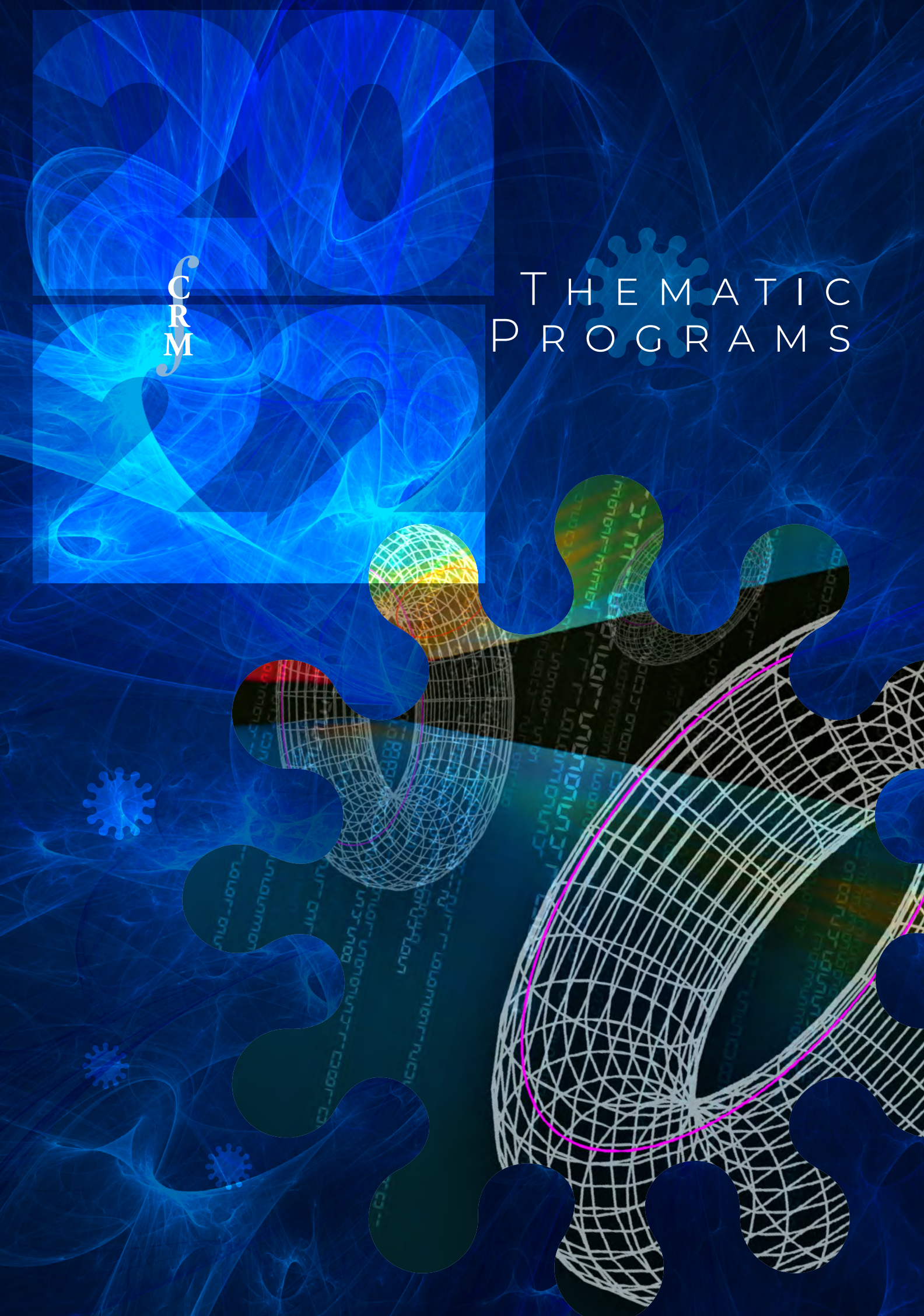
CRM

Thematic Programs



Number Theory: Cohomology in Arithmetic

August 1 to December 31, 2020

Organized by:
- Henri Darmon (McGill)
- Mladen Dimitrov (Lille)
- Antonio Lei (Laval)
- Giovanni Rosso (Concordia)

Homological tools and ideas are pervasive in number theory. To defend this assertion, it suffices to evoke the role of étale cohomology in the study of the zeta functions of varieties over finite fields through the Weil conjectures, or the cohomological approach to class field theory formulated by Artin and Tate in the 1950's. The theory of motives, a manifestation of a universal cohomology theory attached to algebraic varieties, and the attendant motivic cohomology plays a central role in describing the special values of L-functions of varieties over number fields, via the conjectures of Deligne, Beilinson-Bloch, and Bloch-Kato. Much progress in the Langlands program exploits the fruitful connection between automorphic representations and the cohomology of associated Shimura varieties and more general arithmetic quotients of locally symmetric spaces. The study of special values of L-functions and the Langlands program, widely perceived as two fundamental yet separate strands of the subject in the early 1990's, were beautifully unified in Wiles' epoch-making proof of the Shimura-Taniyama conjecture, in which this conjecture was reduced to a special instance of the Bloch-Kato conjecture for the symmetric square motive of an elliptic curve. Recent years have seen great strides in our understanding of the cohomology of the arithmetic quotients arising in the study of automorphic representations, spurred in part by the desire to extend the range of applicability of the celebrated Taylor-Wiles method. This has led to new automorphy and potential automorphy results: most spectacularly, perhaps, for abelian surfaces, as well as elliptic curves over general CM fields.

Workshops

Serre weights conjectures and geometry of Shimura varieties

August 31 to September 4, 2020

This conference was devoted to studying recent advancements concerning Serre weights conjectures and the geometry of Shimura varieties and, in particular, the interaction between these two areas.

Arithmetic quotients of locally symmetric spaces and their cohomology

October 16 to 23, 2020

This workshop had a significant computational and experimental component, in which various experts reported on experimental data that might prove valuable in solidifying our expectations.

Higher Coleman theory and applications

December 7 to 11, 2020

This workshop was dedicated to the theme of p-adic variation of automorphic representations. These automorphic representations can be realized in the coherent cohomology of certain PEL Shimura varieties. In fact, we limited ourselves to the Siegel moduli spaces of polarized abelian varieties with level structure.

An old theorem of Langlands and Li-Schwermer states that on a toroidal compactification of a Siegel modular variety of genus g and some level, for generic classical weights, the interior (or parabolic) cohomology with coefficients in the modular sheaf of that weight is concentrated in one degree i, greater or equal to 0.

When that one degree is zero, the p-adic variation of the automorphic sheaves is known, and so also the p-adic variation of the automorphic forms and representations. We refer to this body of knowledge as “Coleman theory.”

The p-adic variation of automorphic representations which are realized in the one degree i larger then 0 and less then g, a new result of V. Pilloni and G. Boxer-V. Pilloni, known as “higher Coleman theory,” is the main object of study of our workshop, together with its applications to p-adic L-functions and Eichler-Shimura isomorphisms. The workshop was preceded by a preparatory discussion group that met in the afternoons during the workshop.

Aisenstadt Chairs

Nicolas Bergeron (ENS, Sorbonne)

Wiesława Nizioł (CNRS, Sorbonne)

The Mathematics of Decision Making

September 1 to December 30, 2021

This thematic program was supposed to be held from January to June 2020, but was partially postponed to fall 2021 due to the pandemic.

Organized by:
- Margarida Carvalho (Montréal)
- Andrea Lodi (Polytechnique Montréal)
- Patrice Marcotte (Montréal)

The overarching theme of this program was the understanding and optimization of large-scale systems, with an emphasis on computational issues. One of its aims was to illustrate how recent advances in artificial intelligence (machine learning, for one) will expand the range of practical industrial and societal problems that optimization methods will have to address in the near future. Within this framework, the interplay between optimization and data science was outlined. Actually, machine learning techniques can help to solve large-scale, ill-conditioned mathematical programs, and also feed them with features learned from a population of agents. Conversely, optimization algorithms, either exact or heuristic, are routinely used to train neural networks, for instance.

The program covered a wide array of topics that involve issues such as user behaviour, mixed continuous-discrete variables, randomness, all arising in large-scale, real-life complex systems. Their proper analysis requires knowledge in game theory and decomposition, which justifies the integration of activities devoted to game theory and column generation, respectively. Two important areas of applications, namely voting systems and healthcare, completed the program.

Workshops

Optimization under uncertainty

September 27 to October 1, 2021

In organizational decision making, the vast majority of planning and operational decisions are made without a complete knowledge of both the current situation and the future. Plans that are made when part of the contextual information is uncertain are then adjusted when new information is revealed, thus allowing for recourse actions to be taken. In general, this leads to problems where sequences of decisions are made over varying time horizons and where one aims to balance both the immediate benefits of the decisions made and their future impact. For such problems, designing optimization methodologies that explicitly consider the various sources of uncertainty that are present, and efficiently produce high-

quality solutions, is quite challenging. This being said, today's access to more detailed and exhaustive databases detailing the activities of organizations, governments and populations, in addition to machine learning techniques being more readily available to analyze such databases, has greatly improved the operations research (OR) community's capacity to both describe the various sources of uncertainty more accurately and calculate the effects that the different realizations might have on the expected performance. Furthermore, driven by the advancements in both computing technologies and OR tools, one observes an ever-increasing amount of research dedicated to the development of specialized optimization methodologies capable of solving problems in realistic settings. The purpose of this workshop was to present some of the most recent and innovative technical developments in three important fields of study: stochastic combinatorial optimization, Monte Carlo methods, and robust optimization.

Agents behaviour in combinatorial game theory

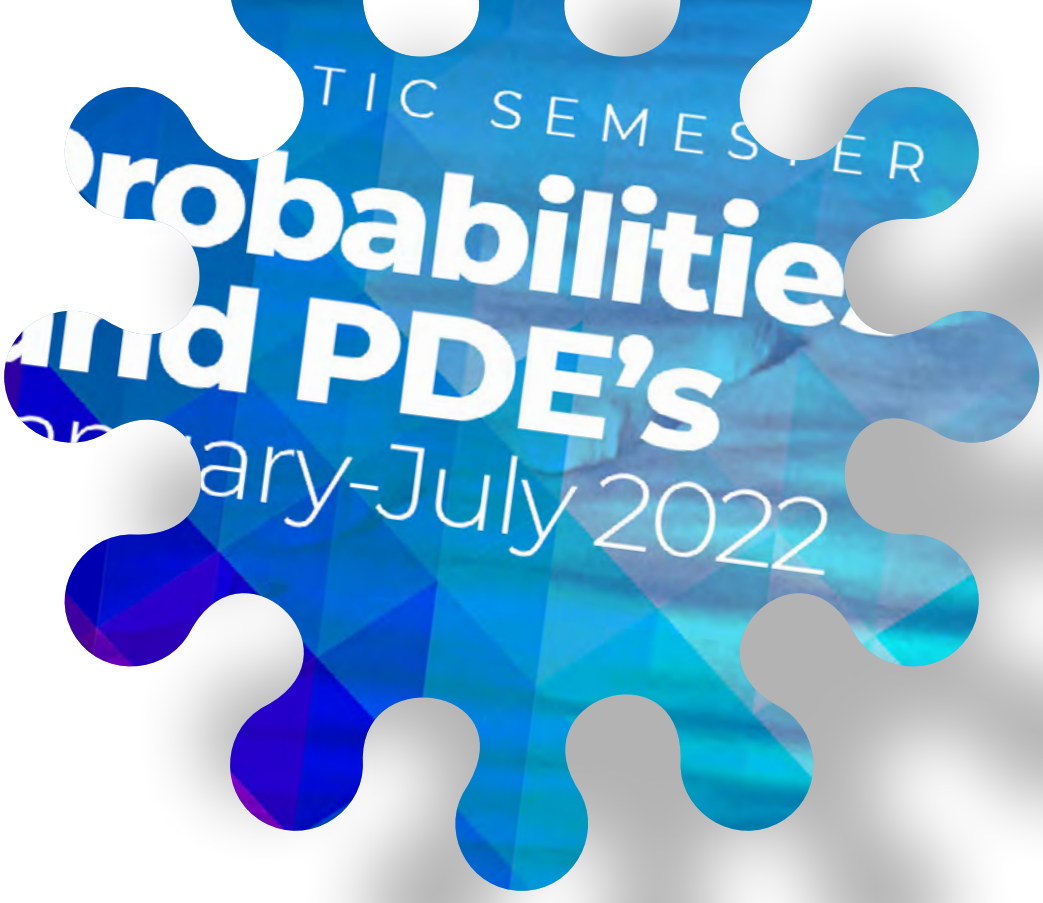
November 16 to 18, 2021

Real-world optimization processes frequently involve agents whose utilities do not match those of the decision-maker. As an example from the field of economics, first-best prices that would align the interests of selfish users with those of the society may not be available, yielding mathematical programs that must explicitly embed population behavior within their formulation. This fits the framework of MPECs (Mathematical Programs with Equilibrium Constraints) which involve, even in their simplest instances, non-convexity and non-differentiability. MPECs are generically NP-hard, and the mere existence of a solution is not assured. This raises several issues that have led to computational advances in the fields of non-differentiable optimization, exact and approximate algorithms, heuristics and meta-heuristics, etc. Actually, an MPEC can be viewed as a leader-follower game, where the follower may involve several non-cooperative players, either atomic or non-atomic, and whose behavior must be adequately assessed, for instance through reinforcement learning approaches.

The aim of the workshop was to survey recent advances in large-scale games endowed with combinatorial features, with an emphasis on learning player behavior (preferences, utilities), a process closely related to data science and machine learning. Indeed, the relationships between these disciplines, together with optimization, will be at the core of the workshop. A defining feature of the workshop is that, having been exposed to perspectives that are usually regarded as territories of separate research communities, participants will widen their knowledge of the field.

Aisenstadt Chair

Éva Tardos (Cornell)



Probability and PDEs

January 4 to May 27, 2022

The connections between probability theory on the one hand and differential and integral equations on the other, are so numerous and diverse that the task of presenting them in a comprehensive and connected manner appears almost impossible.

— Mark Kac, 1951

Organized by:

- Louigi Addario-Berry (McGill)
- Jacob Bedrossian (Maryland)
- Julien Berestycki (Oxford)
- Paul Chleboun (Warwick)
- Alessandra Faggionato (Sapienza)
- Daniel Lacker (Columbia)
- Hubert Lacoin (IMPA)
- Claudio Landim (IMPA)
- Jessica Lin (McGill)
- Pascal Maillard (IMT)
- Jean-Christophe Mourrat (Courant)
- Sarah Penington (Bath)
- Kavita Ramanan (Brown)

The interplay between differential equations and probability has only become richer and more profound since Mark Kac wrote the above lines, close to 70 years ago. The thematic program focused on two aspects of this interplay.

The thematic program's first focus was on how the introduction of randomness into PDEs (e.g., through random initial conditions, random environments, or random forcing) affects their long-term behaviour. This provided for more flexible and realistic physical models which can explain a wider range of observed behaviour. Moreover, in some cases, randomness is an unavoidable feature of any reasonable PDE model for the underlying system. This is the situation in stochastic control problems or PDE approximations for optimization problems involving multiple agents with incomplete or imperfect information.

The second aspect was how both subjects are used to build mathematical models of group dynamics, and on the interplay between such models. The phrase “group dynamics” could refer, for example, to species migration, the spread of a virus, or the propagation of electrons through an inhomogeneous medium, to name a few examples. Very commonly, the stochastic processes track the corresponding PDEs in the large-population limit. When proven to hold, it allows for information to be passed between the two mathematical subjects.

In cooperation with the AWM.

This program supported the AWM Welcoming Environment Statement.

Workshops

Interacting particle systems and hydrodynamic limits

March 14 to 25, 2022

The study of interacting particle systems is devoted to the rigorous analysis of a certain class of very high dimensional stochastic processes. These can be described in terms of a large number of randomly interacting components which evolve in a discrete space. While initially interest in the field was triggered by statistical mechanics, there are now numerous applications of these systems across the natural and social sciences; from electrical engineering, to sociology, via computer science, economics, population genetics and epidemiology. Interacting particle systems also provide a natural framework to study fundamental phenomena which occur in these applications, such as phase transitions, metastability and relaxation to equilibrium. One of the main goals is to understand and predict emergent behaviour on macroscopic scales, as a result of the microscopic dynamics and interactions of the individual components. In the past decades this field has grown in importance and established itself as one of the most active branches of probability theory. This workshop in particular encompassed the following topics: hydrodynamic limits, non-equilibrium fluctuations and metastability, Liouville quantum gravity and interface dynamics.

The aim of this workshop was to gather mathematicians working on various aspects of particle systems, during two weeks, to discuss and share recent progress in the field, with an eye toward stimulating new developments and introducing recent breakthroughs to a broader community. The first week was mainly devoted to mini-courses, given by Cristina Toninelli and Hendrik Weber, and was particularly valuable and accessible to graduate students and early career researchers, while the second week was devoted to research talks and included plenty of time for discussion and collaboration.

Mean-field games

April 11 to 15, 2022

MFG theory lies at the intersection of probability and partial differential equations (PDEs). On the one hand, MFG models raise interesting new probabilistic questions about how stochastic optimal control and game-theoretic equilibria interact with classical limit theorems; for example, even if players are influenced only by their own independent random factors, a game-theoretic interaction between players can induce a dependence between their resulting behaviours, which precludes a direct application of the law of large numbers or central limit theorem. On the other hand, the study of MFGs leads to novel PDE systems, the most famous of which is a forward-backward system coupling a Hamilton-Jacobi-Bellman equation, describing the value function of a typical player, with a Fokker-Planck equation, describing the distribution of players' behaviours.

Branching systems, reaction-diffusion equations and population models

May 2 to 13, 2022

The goal of this workshop was to discuss recent developments and open questions in fields at the interface of branching systems, reaction-diffusion equations and population models, including: fine asymptotics of front positions for reaction-diffusion equations, genealogies of populations under selection, free-boundary problems and hydrodynamic limits of particle systems, competition and cooperation effects in population models and particle systems with interactions and non-local reaction-diffusion equations. The workshop included short courses given by Vincent Calvez, Sylvie Méléard, Lenya Ryzhik and Jason Schweinsberg.

Unifying concepts in PDEs with randomness

May 16 to 27, 2022

In order to make deeper and more practical connections to physical problems, many branches of the theory of partial differential equations (PDEs) have started to introduce random components in their models. This includes the study of PDEs in random environments (stochastic homogenization), the analysis of PDEs with randomized initial data, and the introduction of stochastic forcing terms. Such problems incorporate various aspects of probability and analysis. The purpose of this workshop was to bring together a diversity of experts, postdocs, and students working in these different branches in order to compare perspectives and exchange ideas, techniques, and intuitions entering the analysis of these problems. As the title suggests, the ultimate goal was to identify unifying concepts within the study of PDEs with randomness. The workshop included short courses given by Scott Armstrong, Jonathan Mattingly, Pierre-Emmanuel Jabin and Vlad Vicol.

Aisenstadt Chairs

Bernard Derrida (ENS)
Isabelle Gallagher (Paris-Diderot)

Aisenstadt Chairs

The Aisenstadt Chair allows the CRM to welcome, in each of the thematic programs, world-famous mathematicians for a one-week to a one-semester stay. The recipients of the Chair give a series of lectures on preselected topics, chosen because of their relevance and impact within the thematic program, the first of which, in compliance with the donor André Aisenstadt's wish, must be accessible to a wide audience.

The holders of the Aisenstadt Chair for the period June 2020 to May 2022 were Nicolas Bergeron, Wiesława Nizioł, Éva Tardos, Bernard Derrida and Isabelle Gallagher. Their biographies are presented here. More details on the content of their lectures are available in the Bulletin of the CRM and on the CRM website.

Number Theory: Cohomology in Arithmetic

Nicolas Bergeron
(ENS, Sorbonne)

Nicolas Bergeron works in the Department of Mathematics and Applications at the École normale supérieure (ENS) in Paris, where he is currently Director. In 2001, he became Chargé de recherche at the Université Paris Sud, where he completed his habilitation in 2005 (on cohomology and the spectrum of locally symmetric varieties), and that same year became Chargé de recherche at the École normale supérieure de Paris. Bergeron was awarded the CNRS Bronze Medal in 2007. He became a junior member of the Institut universitaire de France in 2010. His main interests are the geometry and topology of locally symmetric spaces, arithmetic groups and their cohomology.

Nicolas Bergeron gave a series of six lectures, the first of which, aimed at a wide mathematical audience, was delivered on October 16 2020. The remaining 5 talks took place during the week of October 19 to 23 as part of the workshop *Arithmetic quotients of locally symmetric spaces and their cohomology.*.

Wiesława Nizioł
(CNRS, Sorbonne)

Wiesława Nizioł is Director of Research, CNRS, in the number theory team of IMJ-PRG, at Sorbonne University in Paris. Her research focuses on arithmetic geometry, and in particular p-adic Hodge theory, Galois representations, and p-adic cohomology. From 1984 to 1988, she was an Assistant Professor at Warsaw University. She obtained her Ph.D. in 1991 from Princeton University, and subsequently held positions at Harvard University, the University of Chicago and the University of Minnesota, before joining the University of Utah in 1996. She also spent time at the Institute for Advanced Study in 2010 as a visitor and in 2017 as a member, and at the Mathematical Sciences Research Institute in 2014 and in 2018, as part of programs on perfectoid spaces and on homological conjectures, respectively. From 2012 to 2019, Nizioł was Director of Research, CNRS, at ENS Lyon, and since 2020, at the IMJ-PRG at Sorbonne University.

Wiesława Nizioł gave a series of four lectures, the first of which was delivered on November 20, 2020, aimed at a wide mathematical audience. The subsequent talks took place on November 30, December 1 and December 2, 2020.

Mathematics of Decision Making

Éva Tardos
(Cornell)

Éva Tardos is a Jacob Gould Schurman Professor in the Department of Computer Science at Cornell University. She obtained her Dipl. Math. in 1981, and her Ph.D. in 1984, from Eötvös University, Budapest, Hungary. She joined Cornell in 1989 and was Chair of the Department of Computer Science from 2006 to 2010. She was elected to the National Academy of Engineering, the National Academy of Sciences, and the American Academy of Arts and Sciences. She is an external member of the Hungarian Academy of Sciences and the recipient of a number of fellowships and awards, including the IEEE John von Neumann Medal, a Packard Fellowship, the Gödel Prize, the Dantzig Prize, and the Fulkerson Prize. She was editor-in-chief of the SIAM Journal of Computing from 2004 to 2009, and is currently editor-in-chief of the Journal of the ACM, as well as editor-in-chief of other journals, including Theory of Computing and Combinatorica. In November 2019 she was named the associate dean for diversity and inclusion for Cornell Computing and Information Science, a position which is an extension of the roles Professor Tardos has been playing in leading Cornell's CIS initiatives on diversity and inclusion.

Éva Tardos gave a series of two lectures during her visit to the CRM for the Aisenstadt Chair. While the first took place on January 17, 2020, the second was held on January 19, 2022 due to the COVID-19 pandemic. The lectures focused on quantifying the behavior of video game users.

Probability and PDEs

Bernard Derrida
(ENS)

Bernard Derrida is an expert in statistical mechanics who has adapted the ideas of statistical physics to various problems in biology. He is best known for his work in statistical mechanics and is the eponym of "Derrida plots": an analytical technique for characterizing differences between Boolean networks. He received his doctorate in 1979. Since 2015, he has held the Chair of Statistical Physics at the Collège de France.
Derrida was awarded the Prix Ampère in 2001 and the IUPAP Boltzmann Medal in 2010, along with John Cardy. In 2004 he was elected to the Académie des sciences.

Bernard Derrida gave a series of three lectures during his visit to the CRM as an Aisenstadt Chair: on March 18 and 24 and on May 13, 2022. The first two took place during the workshop *Interacting Particle Systems and Hydrodynamic Limits*, and the third during the workshop *Branching systems, reaction-diffusion equations and population models*.

Isabelle Gallagher
(Paris-Diderot)

Isabelle Gallagher's research focuses on partial differential equations such as the Navier-Stokes equation, the wave equation and the Schrödinger equation, as well as harmonic analysis on the Heisenberg group. She obtained her PhD from the Université Pierre et Marie Curie in 1998. Her thesis, supervised by Jean-Yves Chemin, focused on fluid dynamics. In 2018 and 2019, she headed the Department of Mathematics and Applications at the École normale supérieure (Paris). Since 2019, she has been director of the Fondation Sciences Mathématiques de Paris. Gallagher won the CNRS Silver Medal in 2016.

Isabelle Gallagher gave a series of three lectures as part of her visit to the CRM as an Aisenstadt Chair: on May 16, 17 and 20, 2022. The presentations took place during the workshop *Unifying concepts in PDEs with randomness*.

The CRM Nirenberg Lectures

Titles and biographies of speakers in distinguished public lecture series held at the CRM between June 2020 and May 2022 are presented here. More details on the content of these lectures are available in the Bulletin of the CRM and on the CRM website.

The CRM Nirenberg Lectures in Geometric Analysis

The Nirenberg Lecture Series is named in honour of Louis Nirenberg, one of the most prominent geometric analysts of our time. Born in Hamilton, Ontario, in 1925, Louis Nirenberg studied at Baron Byng High School in Montreal and obtained his B.Sc. from McGill University in 1945. He obtained his Ph.D. in 1949 from New York University, where he later became a professor at the Courant Institute. His research achievements have been recognized by numerous prizes and awards, such as the National Medal of Science, the Chern Medal, the Crafoord Prize, the Steele Prize, the Jeffery-Williams Prize and the Abel Prize.

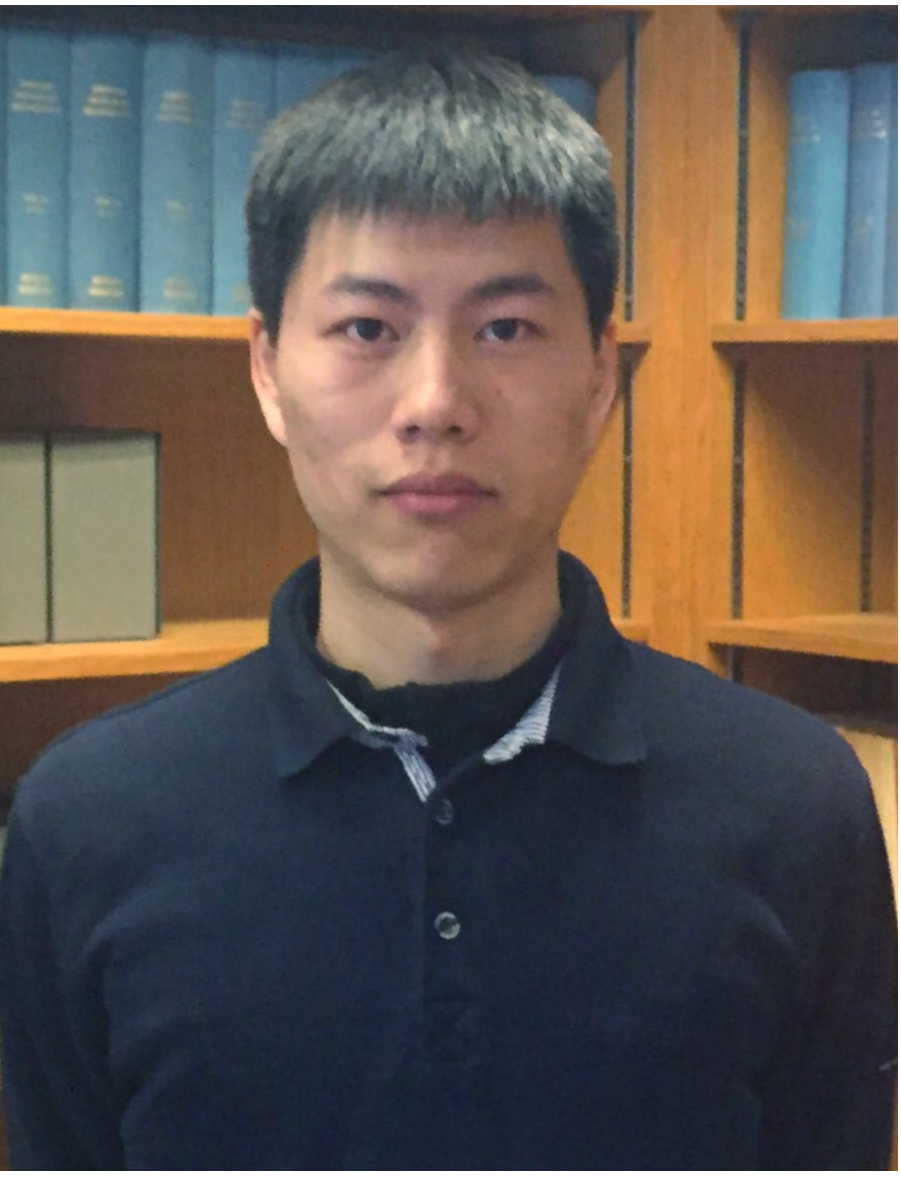
Nirenberg Lectures 2020

Organized by:
Pengfei Guan (McGill)
Dmitry Jakobson (McGill)
Iosif Polterovich (Montréal)
Alina Stancu (Concordia)

Measuring size and complexity of Riemannian manifolds; Minimal surfaces and quantitative topology

Yevgeny Liokumovich (Toronto)
September 18 and 21, 2020

Biography: Yevgeny Liokumovich received his PhD in 2015 from the University of Toronto under the supervision of A. Nabutovsky and R. Rotman. After a postdoctoral fellowship at MIT and at the Institute for Advanced Study, he returned to Toronto in 2019 as an Assistant Professor. Yevgeny Liokumovich has obtained several major results in geometric analysis, including a solution of Gromov's conjecture on Weyl's law for the volume spectrum in a recent joint work with F. C. Marques and A. Neves.



Source : Clay Mathematics Institute

Complexities of minimal hypersurfaces; Abundance of minimal hypersurfaces

Antoine Song (UC Berkeley)
September 23 and 25, 2020

Biography: Antoine Song received his PhD in 2019 from Princeton University under the supervision of F.C. Marques. He has made several spectacular advances in the theory of minimal surfaces. In particular, in his Ph.D. thesis, he presented a complete solution of Yau's conjecture on the existence of infinitely many minimal hypersurfaces in closed manifolds. Currently, Antoine Song is a Clay Research Fellow working at the University of California, Berkeley.

Nirenberg Lectures 2021

Organized by:
Pengfei Guan (McGill)
Dmitry Jakobson (McGill)
Iosif Polterovich (Montréal)
Alina Stancu (Concordia)

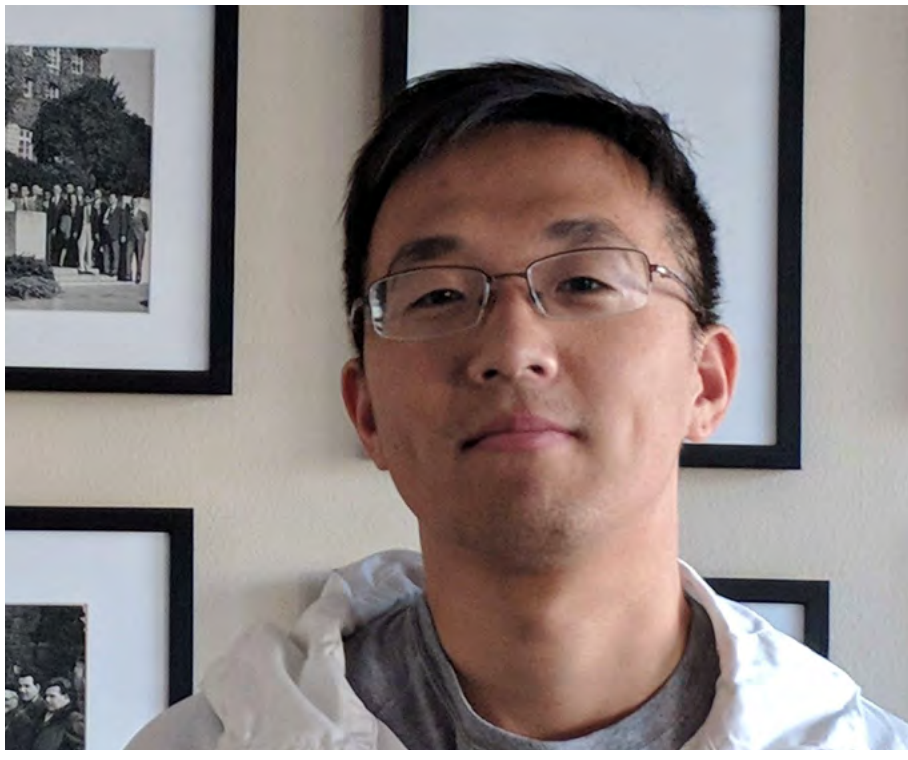
Convexity and high-dimensional phenomena; Isoperimetry in convex bodies and Eldan's stochastic localization

Bo'az Klartag
(Weizmann Institute)
October 1 and 5, 2021

Biography: Bo'az Klartag is one of the world's leading experts in geometric analysis. He obtained his doctorate from Tel Aviv University in 2004, before being appointed professor there. Bo'az Klartag is well known for his contributions to the field of asymptotic geometric analysis, particularly in the study of high-dimensional phenomena. In recognition of his fundamental contributions, he was an invited speaker at the 2006 ICM in Madrid, and was awarded the European Mathematical Society Prize in 2008 and the Erdös Prize in 2010. He is now a professor at the Weizmann Institute of Science.

Recent progress on the Kannan-Lovasz-Simonovits (KLS) conjecture and Bourgain's slicing problem (I and II)

Yuansi Chen (Duke)
October 6 and 8, 2021



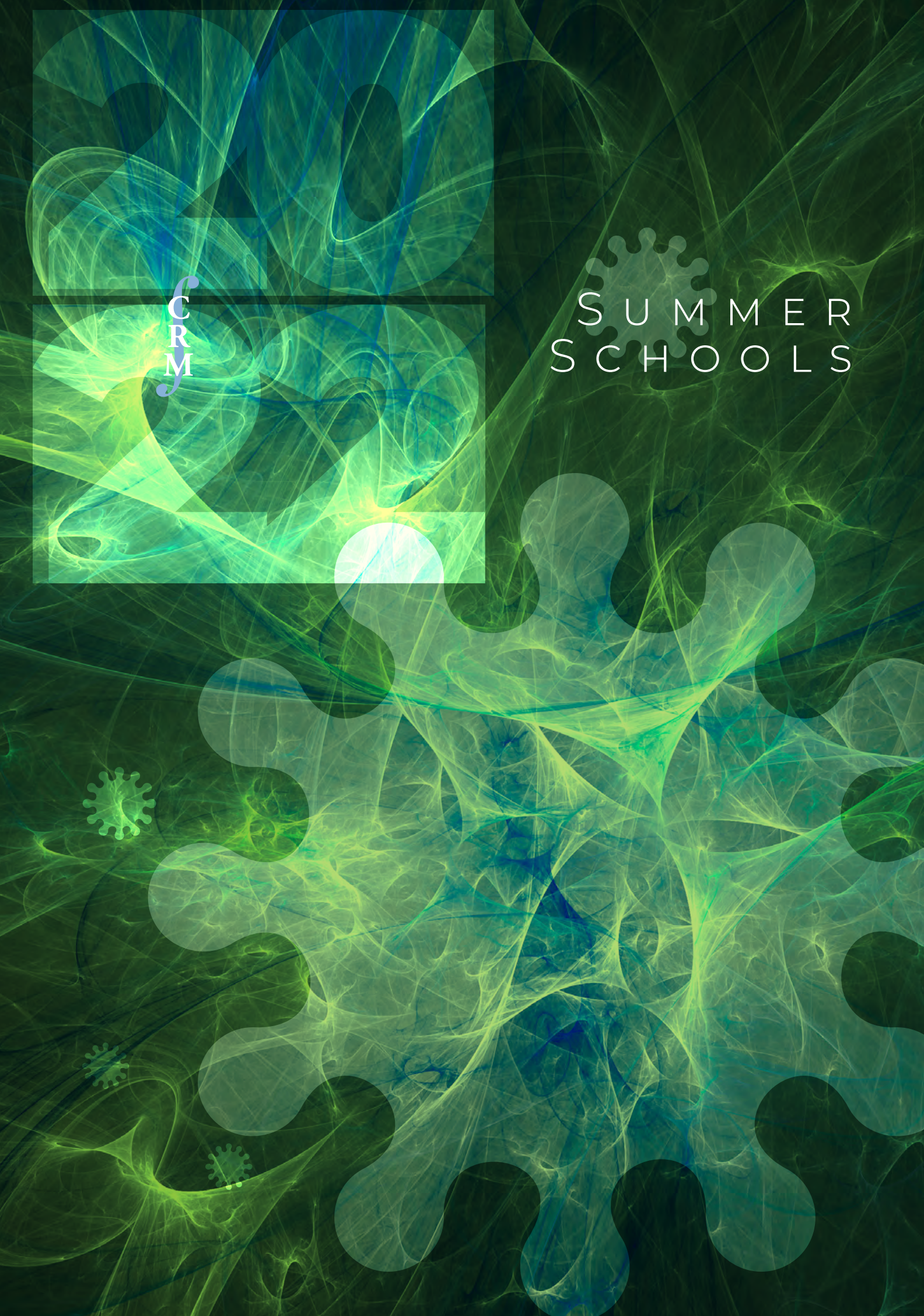
Biography: A graduate of École Polytechnique in Paris, Yuansi Chen received his PhD in Statistics from UC Berkeley in 2019. After a postdoctoral fellowship in data science at ETH Zürich, he joined the Department of Statistical Sciences at Duke University. During his time in Zürich, he made enormous progress on a conjecture proposed by Kannan, Lovász and Simonovits 25 years ago. This is a major breakthrough with implications ranging from statistics and computer science to high-dimensional geometry, where the resolution of the KLS conjecture also provides an answer to the slicing problem posed by Bourgain.

SIMONS-CRM SCHOLAR-IN-RESIDENCE PROGRAM

The Simons-CRM Scholar-in-Residence Program, funded with the generous support of the Simons Foundation, is directed towards exceptional researchers in mathematics and related areas at both the junior (less than 10 years since PhD) and senior levels, and allows the CRM to invite, for extended visits, such researchers from outside the local CRM network. During their visit, senior researchers hold the title Simons CRM Professor; junior researchers are designated as Simons CRM Scholars.

The scholars-in-residence are chosen to enhance the manifold research activities held at the CRM. In particular, they participate in and enrich the CRM thematic programs. They also contribute to the collaborative research activities of the CRM research laboratories.

Researcher	Institution
Armendariz, Inés	Universidad de Buenos Aires
Beltran, Johel	Pontificia Universidad Católica del Perú
Berestycki, Julien	University of Oxford
Cauchi, Antonio	Universitat Politècnica de Catalunya
Foxall, Eric	University of British Columbia - Okanagan
Heydenreich, Markus	Ludwig-Maximilians-Universität München
Hron, Karel	Palacký University Olomouc
Jara, Milton	Instituto de Matemática Pura e Aplicada
Landim, Claudio	Instituto de Matemática Pura e Aplicada
Mallein, Bastien	Université Sorbonne Paris Nord
Mourrat, Jean-Christophe	École Normale Supérieure - Paris
Nahmod, Andrea	University of Massachusetts Amherst
Oh, Tadahiro	University of Edinburgh
Pain, Michel	New York University
Panati, Annalisa	Université de Toulon
Penington, Sarah	University of Bath
Ramanan, Kavita	Brown University
Zeitouni, Ofer	Weizmann Institute of Science
Zhedanov, Alexei	Renmin University of China


2020
CRM
SUMMER
SCHOOLS

Every year, the CRM sponsors the Séminaire de mathématiques supérieures (SMS). It also organizes and supports other schools.

Séminaire de mathématiques supérieures

This is an annual summer school in pure and applied mathematics that has been held for over sixty years on the Université de Montréal campus. Focusing on a hot current research topic, the summer school brings together top level lecturers and students from around the world. The school is aimed primarily at graduate students. It consists of around 12 courses of about four one-hour lectures each, spread over two weeks. The courses are attended by around 40 to 60 students selected on a competitive basis. The lectures are published in a volume after the meeting. Financial support is available for accepted students.

Initiated in 1961 by the Department of Mathematics and Statistics at the Université de Montréal, the school was initially funded by the NATO Science Program. Since 2011, the school has the CRM as its main partner, and is a joint endeavour of the Canadian Mathematical Institutes (CRM, Fields, PIMS) together with the MSRI and the ISM. It also receives support from the Université de Montréal.

All decisions concerning the school, in particular the selection of future programs, is made by the SMS Steering Committee, consisting of: Hélène Barcelo (MSRI), Octav Cornea (Montréal), Henri Darmon (McGill), Deirdre Haskell (McMaster), Nilima Nigam (Simon Fraser), and Iosif Polterovich (Montréal, Director of the SMS).

SMS 2020
Discrete Probability, Physics and Algorithms

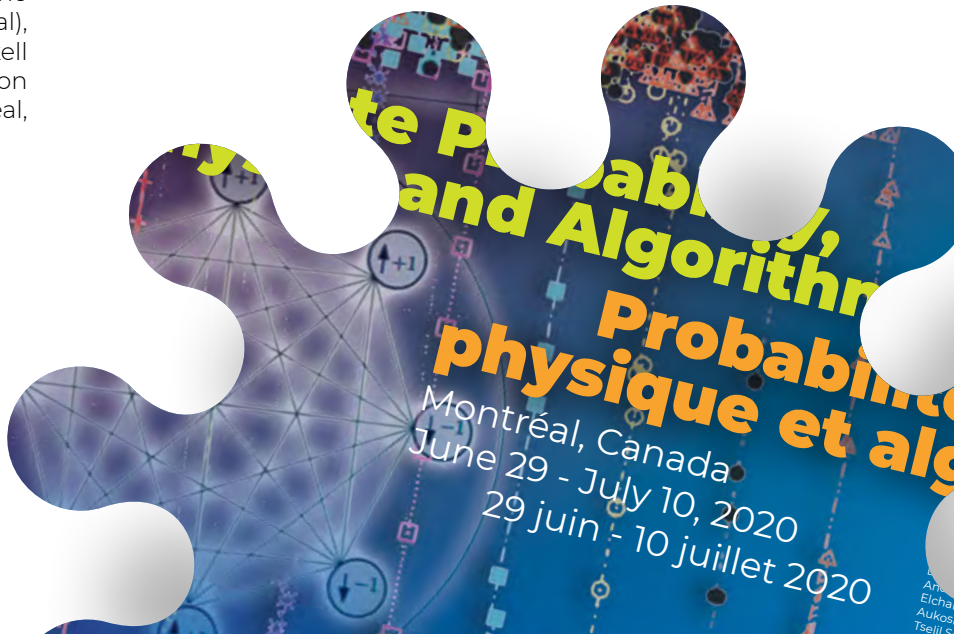
June 29 to July 10, 2020

Organized by:

- Gerard Ben Arous (NYU)
- Alexander Fribergh (Montréal)
- Lea Popovic (Concordia)

Probability theory, statistics and mathematical physics are increasingly used in computer science. The aim of this school was to offer graduate students and young researchers a unique opportunity to acquire multidisciplinary skills in a rapidly evolving field of mathematics.

Topics included spin glasses, constraint satisfiability, randomized algorithms, Monte Carlo Markov chains and high-dimensional statistics, sparse and random graphs, computational complexity, estimation and approximation algorithms. These topics fell into two main categories: spin glass problems and random algorithms.



The part of the summer school devoted to spin glasses was divided into three parts: an introductory course on traditional spin glasses, followed by two more advanced courses where spin glasses meet computer science, plus a talk on spin glass dynamics. The part of the summer school on random algorithms consisted of an introductory course on phase transitions in large random structures, followed by advanced courses on theoretical limits to computational complexity in reconstruction and inference, and on understanding rare events in random graphs and mechanical statistics models.

The two introductory courses on spin glasses and random algorithms were accompanied by three one-hour exercise sessions. A one-hour exercise session followed each of the three one-course sessions for both the introductory spin glass course and the introductory random algorithms course. The exercise sessions were led by an assistant, but focused primarily on student participation.

SMS 2021
Microlocal Analysis: Theory and Applications

May 3 to August 13, 2021

Organized by:

- Suresh Eswarathasan (Dalhousie)
- Dmitry Jakobson (McGill)
- Katya Krupchyk (California Irvine)
- Stephane Nonnenmacher (Paris-Saclay)

Microlocal analysis arose from the study of linear partial differential equations (PDEs) in the high-frequency regime, thanks to a combination of ideas from Fourier analysis and classical Hamiltonian mechanics. In parallel, similar ideas and methods had been developed since the early days of quantum mechanics, with the smallness of Planck's constant enabling the use of semi-classical methods. The junction between these two points of view (microlocal and semi-classical) only emerged in the 1970s, and has come into its own in the PDE community over the last 20 years. This methodology has enabled major advances in the understanding of linear and non-linear PDEs over the last 50 years. In addition, microlocal methods continue to find new applications

in various fields of mathematical analysis, such as the spectral theory of non-self-joining operators, scattering theory and inverse problems.

Thanks to this ever-expanding list of applications of microlocal analysis, it was an opportune moment to organize a 2021 *Séminaire de mathématiques supérieures* on the subject. The aim of the SMS is for young mathematicians, especially graduate students, to have the opportunity to learn key ideas and techniques in the field, with a focus on consolidating the foundations for potential future research. Solving and discussing solutions to exercises provided by professors is a key element. The school has benefited advanced master's students, PhD students and early-career researchers with some experience in measure theory, functional analysis, partial differential equations and/or differential geometry.

Other Summer Schools

2020 PIMS Diversity in Mathematics: Online Summer School

August 4 to 14, 2020

Organized by :

- Malgorzata Dubiel (SFU)
- Veselin Jungic (SFU)
- Malabika Pramanik (UBC)

Organized for a third year by PIMS, Diversity in Mathematics is part of a multi-year, multi-level program to promote diversity and inclusivity in STEM. Only a stable support network can improve minority representation in STEM fields. The program not only teaches exciting mathematics, but also introduces role models and creates a self-sustaining support system by training future leaders.

The two-week annual program includes a summer school. This national school encourages talented female undergraduates to specialize in a mathematics-related field at the graduate and postgraduate levels, and to consider career options focused on science and mathematics. The summer school also served as a sister program to the math camp.

CRM-PIMS Probability Summer School

May 24 to June 18, 2021

Organized by :

- Louigi Addario-Berry (McGill)
- Omer Angel (UBC)
- Mathav Murugan (UBC)
- Edwin A. Perkins (UBC)

The Summer Schools in Probability are a highlight of Canadian probability. Launched by PIMS in 2004, they take the form of two main 4-week courses, along with a number of keynote addresses and shorter mini-courses. The school is geared primarily at doctoral students and postdoctoral scholars.

The 2021 summer school took place in Montreal. It was organized independently from the thematic program in probability and PDEs, but its schedule had been coordinated with thematic program activities to avoid conflict. The school featured 4-week courses given by Louigi Addario-Berry and by Jean-Christophe Mourrat, and short courses delivered by Patricia Gonçalves, Sarah Penington, and Kavita Ramanan.

Solving Large Systems Efficiently in Multiphysics Numerical Simulations

May 31 to June 10, 2021

Organized by :

- Vivien Clauzon (Michelin)
- Jean Deteix (Laval)
- Wing Hong Felix Kwok (Laval)
- Scott MacLachlan (Memorial)

Multiphysics simulations have become an important problem that has practical applications in many fields in science and engineering. Two examples include (i) simulating the interactions between the flow of fluids in the subsurface (e.g. groundwater, oil and natural gas) and the mechanical deformation of the surrounding rock due to pressure, temperature, etc.; (ii) simulating the interactions between the ocean and the atmosphere in meteorological predictions and climate modelling. In these and many other applications, the underlying model in each regime is given by partial differential equations (PDEs), which are then discretized and solved many times over the course of the simulation. The resulting algebraic systems are typically large (with millions of degrees of freedom), sparse (each equation only depends on a few unknowns) and ill-conditioned (very sensitive to perturbations in the data), which makes their efficient solution challenging. The past 50 years have seen the rise of iterative methods and preconditioners that are highly efficient for particular types of PDEs, such as heat diffusion, fluid flow, waves arising from electromagnetism, etc. However, when different physical models interact, it becomes essential to develop techniques to solve the coupled problem efficiently, in addition to the individual components.

The goal of this summer school was to introduce fundamental solver techniques for dealing with these coupled problems. In particular, we were interested in techniques that are able to exploit modern supercomputing architecture, which often have tens of thousands of processors capable of performing many calculations in parallel.

The theoretical portion of the summer school consisted of three mini-courses that introduced the participants to fundamental techniques for large multiphysics problems: (i) stationary iterative methods, (ii) domain decomposition, and (iii) multigrid methods. These mini-courses were complemented by practical sessions, where participants were guided by well-designed problem sets in order to experiment with the methods introduced in the mini-courses, and to explore the mathematics behind these techniques. In addition there were four seminar-style talks by invited speakers, who presented their work on multiphysics simulations and/or preconditioning techniques.

Summer School in Nonlinear Dynamics for the Life Sciences with Applications to Neuroscience and Psychology

May 31 - June 11, 2021

Organized by:

- Anmar Khadra (McGill)
- Caroline Palmer (McGill)

Hosted by CAMBAM and NSERC-CREATE in Complex Dynamics

Living systems are typical examples of dynamical systems with many interrelated parts or subsystems, from small-scale cellular relationships to large-scale population relationships. Nonlinear dynamics arise when the behaviour of one subsystem, with its own dynamics, becomes the input for another subsystem, imposing certain constraints on its dynamics. Mathematics, physics, and the computational sciences have contributed important theoretical developments to the understanding of how nonlinear dynamics explain behaviour in a wide range of disciplines in natural sciences, social sciences, and life sciences, based on common principles arising from differential equations. Nonlinear dynamics underlie the developmental trajectory of living organisms; the spread of information in neural networks and disease in populations; and the prediction of evolving ecosystems in changing environments. While different challenges arise in each research area, the required quantitative models are shared across areas. These models, accompanied by statistical and computational tools, provide young scientists with a platform to understand the dynamics of their systems and to guide new experiments.

This 2-week online summer school, hosted by the Centre for Applied Mathematics in Bioscience and Medicine as well as the NSERC-CREATE in Complex Dynamics at McGill University, aimed to provide a new generation of internationally recruited trainees with the fundamental tools of this field as well as deliver lectures devoted to recent advancements made in nonlinear dynamics, including: machine learning applications; computational neuroscience developments; cellular physiology implications; and infectious disease (COVID-19) and communication transmission.

École Langlands du Centre de recherches mathématiques – Online

August 23 to 24, 2021

Organized by:

· Jean-Philippe Lessard (McGill)

The creation and first edition of this French summer school for undergraduate students was made possible by the CRM's Robert Langlands Endowment Fund.

Robert Langlands is one of the most influential contemporary mathematicians. He is best known for a set of very deep conjectures whose study has come to be known as the Langlands Program. Throughout his career, Professor Langlands has received numerous awards. In particular, his work earned him the Wolf Prize in 1996 and the Abel Prize in 2018. Beyond mathematics, Professor Langlands is interested in language learning and the pursuit of mathematical research in those languages. In addition to English, he is fluent in French, Turkish and German. In 2019 he established an endowment fund at the CRM whose purpose is to support scientific research and training activities in French.

Summer School in Nonlinear Dynamics for Life Sciences

May 30 to June 10, 2022

Organized by:

· Pouya Bashivan (McGill)
· Morgan Craig (Centre de recherche CHU Sainte-Justine)
· Frédéric Guichard (McGill)

CAMBAM, in collaboration with the CRM and with the support of the NSERC-CREATE program in complex dynamics, organized an online summer school entitled "Summer School in Nonlinear Dynamics for the Life Sciences". The summer school covered a wide range of topics on the applications of nonlinear dynamics and computation to the life sciences, from the sub-cellular world to population dynamics. The program included theoretical and practical classes taught by internationally renowned researchers in the field, as well as tutorials and computer labs to complement the course content. Instructors also supervised group projects carried out by participants. This summer school was part of CAMBAM's long-standing biannual summer schools organized as part of its training program

PIMS-CRM 2022 Summer School in Probability

May 30 to June 24 2022

Organized by:

· Louigi Addario-Berry (McGill)
· Omer Angel (UBC)
· Jonathan Hermon (UBC)
· Mathav Murugan (UBC)
· Gordon Slade (UBC)

Outreach

Titles and biographies of speakers in distinguished public lecture series held at the CRM between June 2020 and May 2022 are presented here. More details on the content of these lectures are available in the Bulletin of the CRM and on the CRM website.

Grandes conférences publiques

In order to meet the expectations of a public curious to understand the milestones in the mathematical sciences, the CRM organizes the «Grandes conférences publiques du CRM». These feature experienced speakers who communicate the beauty and power of cutting-edge mathematical research in language accessible to all.

Grandes conférences 2020-2022

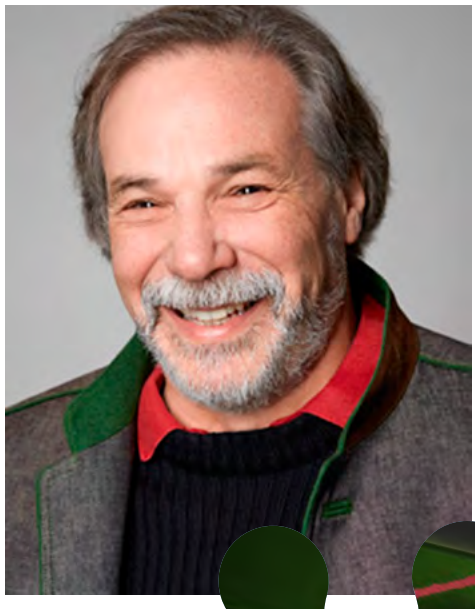
Bach et les mathématiques de la Fugue

François Bergeron (UQAM)

February 17, 2021

Organized by:
· Christiane Rousseau (Montréal)
· Yvan Saint-Aubin (Montréal)

Biography: François Bergeron is a professor at the Université du Québec à Montréal (UQAM). He is well known in the international mathematical community for his many contributions to research in combinatorics and on algebras and their representations. He is also known to the Quebec public for his numerous appearances in various forums: on the Découvertes and Les Années Lumières television programs, in the Québec Science magazine, in the Au Coeur des Sciences lecture series, and as a participant in the documentary Achever l'inachevable. His passion for the promotion of mathematics has led him to give numerous lectures in CEGEPs under the aegis of the Institut des sciences mathématiques du Québec.



Source : professeurs.uqam.ca

International Mathematics Day at the CRM – Mathematics for a Better World

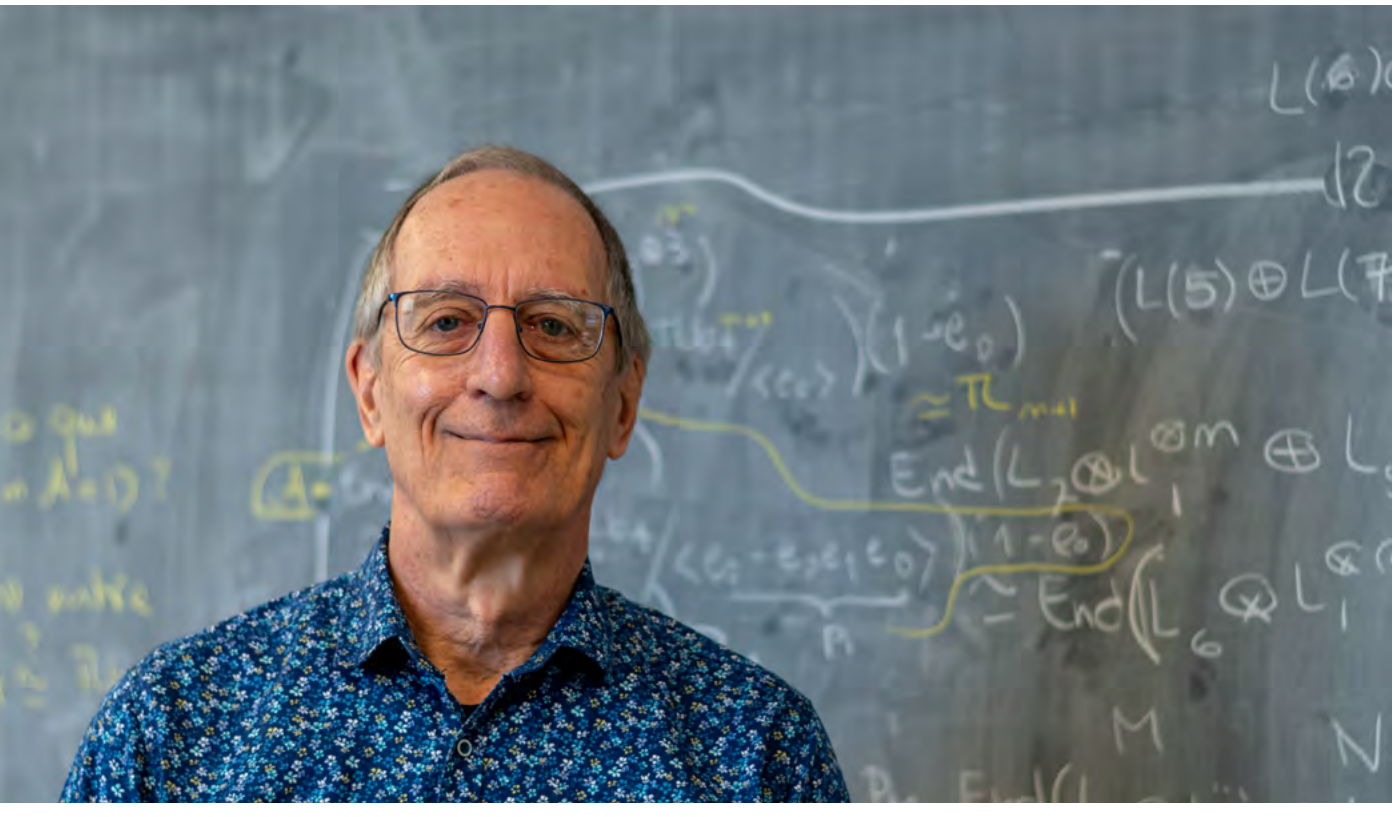
March 12, 2021

Organized by:
· Christiane Rousseau (Montréal)

1st lecture:

Un modèle simple de pandémie

Yvan Saint-Aubin (Montréal)



Biography: Yvan Saint-Aubin is a professor at the Université de Montréal. An outstanding popularizer, he gives lectures in all the province's CEGEPs and has won the Excellence in Teaching Award from the Canadian Mathematical Society, of which he is was also made a Fellow. His research focuses on algebraic aspects of statistical physics. His 1994 paper with Robert Langlands and Philippe Pouliot proposed the conformal invariance and universality hypotheses for two-dimensional percolation models; two Fields Medals were awarded for the proofs of major parts of these hypotheses.

2nd lecture:

Dépistage par groupe

Christian Genest (McGill)

Source: mcgill.ca

Biography: Christian Genest holds a Canada Research Chair at McGill University. He was awarded the Gold Medal of the Statistical Society of Canada in 2011 for his research in stochastic dependence modeling. A Fellow of the Royal Society of Canada since 2015, he was President of the Statistical Society of Canada in 2007-08, Director of the ISM from 2012 to 2015 and Editor-in-Chief of the Journal of Multivariate Analysis from 2015 to 2019. He is a popular speaker at CEGEPs..

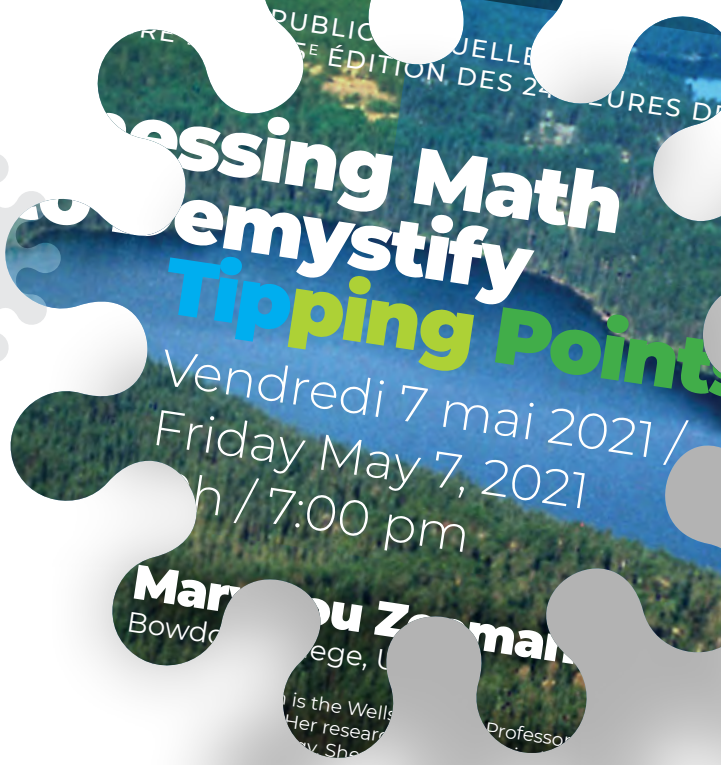
3rd lecture:

Partage équitable

Christiane Rousseau (Montréal)

Source : nouvelles.umontreal.ca

Biography: Christiane Rousseau is Professor Emeritus of Mathematics at the Université de Montréal. She was President of the Canadian Mathematical Society from 2002 to 2004. She launched and coordinated the international year “Mathematics of Planet Earth 2013” under the patronage of UNESCO. From 2011 to 2018, she sat on the executive committee of the International Mathematical Union, for which she headed the project that, in November 2019, led UNESCO to proclaim March 14 International Mathematical Day.



Harnessing Math to Demystify Tipping Points

Mary Lou Zeeman (Bowdoin)

May 7, 2021

Organized by:
- Christiane Rousseau (Montréal)
- Yvan Saint-Aubin (Montréal)

Source : bowdoin.edu

Biography: Mary Lou Zeeman is the R. Wells Johnson Professor of Mathematics at Bowdoin College in Brunswick, Maine. Her research focuses on dynamical systems and applications to mathematical biology. She was one of the co-founders of the SIAM Activity Group in Mathematics of Planet Earth. She co-directs the Mathematical Climate Research Network (MCRN). She is deeply involved in the popularization of science for sustainable development issues.

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Intelligence artificielle : entre généraliser et comprendre

Yoshua Bengio (Montréal, Mila)

October 28, 2021

Organized by:

- Henri Darmon (McGill)
- Christiane Rousseau (Montréal)

Biography: Yoshua Bengio is a full professor in the Department of Computer Science and Operations Research at the Université de Montréal, as well as founder and scientific director of Mila and scientific director of IVADO. Recognized as one of the world's leading experts in artificial intelligence and deep learning, he is co-recipient, with Geoff Hinton and Yann LeCun, of the 2018 A.M. Turing Award, considered the "Nobel Prize of computer science". He is a Fellow of both the Royal Society of London and the Royal Society of Canada, an Officer of the Order of Canada and a Canada-CIFAR Chair in AI.

Mathematics for Human Flourishing

Francis Su (Harvey Mudd)

March 14, 2022

Organized by:
- Henri Darmon (McGill)
- Christiane Rousseau (Montréal)

Source : francissu.com

Biography: Francis Su is the Benediktsson-Karwa Professor of Mathematics at Harvey Mudd College and past president of the Mathematical Association of America. In 2013, he received the Haimo Award, a national teaching award for college mathematics professors, and in 2018, he won the Halmos-Ford Writing Award. His mathematical research in geometric combinatorics includes numerous papers co-authored with undergraduate mathematics students. His work has been featured in Quanta Magazine, Wired and the New York Times. His book Mathematics for Human Flourishing (2020), winner of the Euler Book Prize 2021, offers an inclusive vision of what mathematics is, who it's for and why everyone should learn it.

Quel effet a le mot mathématique sur vous ?

Frédéric Gourdeau (Laval)

May 6, 2022

Organized by:
- Christiane Rousseau (Montréal)

Biography: Frédéric Gourdeau obtained his PhD in Functional Analysis from Cambridge University in 1989. He is a professor in the Department of Mathematics and Statistics at Université Laval, where he was chair from 2010 to 2018, and president of the Association mathématique du Québec (AMQ). His work in primary and secondary teacher training, combined with his passion for problem solving, led him to found the Association québécoise des jeux mathématiques (AQJM), which oversees a fun math competition (21,000 participants in 2019) and the Semaine des maths website (in collaboration with Jean-Marie De Koninck's SMAC project). This work has led to the development of activities for teachers and their students at all levels, such as mathematical magic, riddles, fun courses, escape challenges, shows and workshops. Recipient of several teaching awards, including the Prix national 3M d'excellence en enseignement (2006), he also won the 2014 Adrien Pouliot Award from the Canadian Mathematical Society for his outstanding contribution to mathematics education in Canada.

En Avant MATH !

June 1, 2020 to May 31, 2022

The Centre de recherches mathématiques (CRM) and the Centre interuniversitaire de recherche en analyse des organisations (CIRANO) are leading a national initiative to promote mathematics and increase numeracy. The $1 million grant was awarded by the Minister of Finance for the “Establishment of a strategy to foster the development of a highly qualified workforce in applied mathematics for leading-edge fields”.

This grant was awarded for a three-year period, ending in September 2022.

The CRM’s activities under En avant math during the period June 1, 2020 to May 31, 2022 are grouped into two main components: studies that provide evidence for reflection, and the coordination of a competition to support field activities with the objectives of promoting and enhancing the value of mathematics among various audiences.

Studies conducted by the CRM

Initial training and tools for elementary school teachers

Louise Poirier, janvier 2021

https://enavantmath.org/fr/sommaires/2022RP-01

The primary tool available to preschool and elementary school teachers for teaching mathematics is the Quebec Ministry of Education curriculum, which dictates the approach and content to be taught. A kind of social contract between the teacher and the Ministry of Education, the program is also important for other players in the world of education. It serves as a guide for textbook authors, who rely on it to develop the teaching materials used by teachers. It will also guide faculties of education in the development of mathematics didactics courses, whether in initial or in-service teacher training. As a first step, therefore, we have analyzed the primary mathematics curriculum by comparing it with previous programs (and this, since 1873) and ask whether it is in continuity with or a break from previous programs. With the program presented and analyzed, initial teacher training was analyzed. All French- and English-speaking universities in Quebec offer the Baccalauréat en éducation préscolaire et enseignement primaire program. How do universities approach the teaching of mathematics in preschool and primary school? Finally, the report presents the various types of tools available to teachers for teaching mathematics.

Louise Poirier

Portrait of Québec in the field of mathematics

Laïla Oubenaïssa and Louise Poirier, June 2021

https://enavantmath.org/fr/sommaires/2021RP-19

This report is a factual portrait of the situation of Quebec students in relation to mathematics. It presents tables that will provide food for thought about STEM in Quebec.

Two databases were used to conduct this project on Quebec's mathematical portrait. On the one hand, data from international OECD tests related to mathematics and numeracy, in particular the TIMSS and PISA tests. On the other hand, data from the Bureau de la Coopération Interuniversitaire (BCI) (Inter-University Cooperation Bureau), in order to assess whether there is a shortage of new mathematics teachers in Quebec.

Experiences in numeracy – Exploring cases: United Kingdom, Australia, France, Singapore, Ontario and Quebec

Laïla Oubenaïssa and Louise Poirier, April 2022

https://enavantmath.org/fr/sommaires/2022RP-09

This report presents the results of an analysis of numeracy experiences in five countries: the United Kingdom, Australia, Canada with two jurisdictions, Quebec and Ontario, Singapore and France. The narrative of each numeracy experience is articulated around the frameworks, institutions, programs and projects, as well as the resources the country has developed. To do this, we consulted various documents, articles, study reports, official websites and so on. This project enabled us to draw up a portrait of the different approaches and interventions adopted by certain countries to tackle a complex issue and a skill that is increasingly defined as a basic and essential skill.

A call for field activities aimed at a variety of audiences: preschool, primary and secondary school, including parent-child activities, college and university, as well as activities for the general public.

Two competitions were held.

23 projects were selected:

- 1 project for students with autism;
- Projects for primary school students;
- Projects for secondary school students;
- Projects for college and university students;
- A project for high school and college teachers.

Summaries of these projects can be found on the En avant MATHS ! website:

https://enavantmath.org/#projets

Mathematics for Action

Published on March 14, 2022, to mark International Mathematics Day, *Mathematics for Action: Supporting Science-Based Decision Making* is a series of policy briefs produced by UNESCO, the Centre de recherches mathématiques (CRM) of Canada, the International Mathematical Union, the International Science Council and their partners.

Christiane Rousseau, with the CRM's assistance, was the manager of the toolkit project, which was produced by a consortium composed of the:

- **African Institute for Mathematical Sciences (AIMS)**
- **African Mathematical Union (AMU)**
- **Centre de recherches mathématiques (CRM)**
- **UNESCO Cat II centre CIMPA (Centre international de mathématiques pures et appliquées)**
- **European Mathematical Society (EMS)**
- **Institut des sciences mathématiques et de leurs interactions (INSMI) of the CNRS**
- **Institut de valorisation des données (IVADO), Canada**
- **International Commission on Mathematical Instruction (ICMI)**
- **International Mathematical Union (IMU)**
- **International Science Council (ISC)**

Mathematics for Action: Supporting Science-Based Decision-Making focuses on engaging stories of mathematics in action. Written by mathematicians and thought leaders from across the globe, the collection of briefs provides a fascinating demonstration of the role of maths in addressing the world's most pressing challenges in the face of accelerating global change. They cover a wide spectrum of topics related to the Sustainable Development Goals, from drawing maps of poverty to measuring the gender gap, modeling a pandemic and food systems, forecasting climate change, and measuring biodiversity. These issues are complex and multi-faceted and call for diverse perspectives and interdisciplinary solutions.

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Equity Diversity and Inclusion

As an institute dedicated to research in the mathematical sciences, the CRM is committed to offer an equitable, diverse and inclusive environment to all members of its community. The benefits of this approach are well researched. Towards this goal, the CRM identifies three broad principles:

1. **Aim for equal opportunities by implementing inclusive and equitable practices, by consulting its community, and by adapting its practices to address the needs of all.**
2. **Value diversity by showcasing and celebrating projects by marginalized groups in mathematics.**
3. **Facilitate access to mathematical knowledge and research for marginalized groups.**
4. **Support research and teaching in French in order to attract French speaking students from Québec and other countries, particularly those coming from disadvantaged and marginalized groups.**

These four principles will serve as guidelines for future actions and commitments. The values associated with inclusion and equity are part of the foundations of the CRM for which the commitment to these principles is in continuous evolution. Central to its vision, the CRM acknowledges each and every person's unique identity. Through its actions, the CRM also aims to increase its members' awareness of the impact of unconscious bias and to better position itself against its negative consequences.

The CRM is implementing such initiatives so that diverse voices can participate and contribute equitably at all levels of its organisation. The CRM rejoices in the diversity of its members and it encourages access to activities for all, regardless of their individual characteristics, including gender, age, religion, living with a disability, being a member of First peoples, of a racialized group or of any other marginalized group.

The CRM wants to celebrate and highlight the diversity of its community and to incite mathematical curiosity in the largest possible audience by opening its doors as wide as possible!

CRM EDI Committee 2020-22

Rosalie Bélanger-Rioux (McGill)
Rustum Choksi (McGill)
Roderick Causley (McGill)
Ryan Gibara (Laval)
Alexandre Girouard (Laval)
Veronique Hussin (Montréal)
Matilde Lalín (Montréal)
Josée Leclerc (CRM)
Alina Stancu (Concordia)

CRM EDI Activities

Women in Mathematics During the Time of COVID

March 8, 2021

Organized by: Rustum Choksi (McGill), Matilde Lalín (Montréal), Jessica Lin (McGill), Alina Stancu (Concordia)

On International Women's Day, the CRM welcomed four outstanding women mathematicians who presented their recent work.

Speakers:
Caroline Colijn (Simon Fraser)
Chikako Mese (Johns Hopkins)
Lillian Pierce (Duke)
Lea Popovic (Concordia)

Celebrating Women in Mathematics in 2021

May 12, 2021

Organized by: International Centre for Mathematical Sciences

Online screening of the film: Words of Women in Mathematics in the Time of Corona.

Connecting Women in Mathematics Across Canada Workshop (CWiMAC)

June 2 to 3, 2021

Organized by: Lucy Campbell (Carleton), Ailana Fraser (UBC), Matilde Lalín (Montréal), Karen Meagher (Regina), Lucia Moura (Ottawa)

The 2021 Connecting Women in Mathematics Across Canada (CWiMAC) workshop was held online, preceding the 75th+1 Anniversary Meeting of the Canadian Mathematical Society.

CWiMAC workshops are organized in coordination with the CMS Women in Mathematics Committee. These workshops aim to support the career development of junior female-identified academics in the Canadian mathematics community. The 2021 CWiMAC workshop included invited presentations, panels, and networking events aimed at advancing the careers of junior participants. There was also a session of contributed talks by students and postdoctoral fellows.

Narrowing the Gap: Addressing Mathematical Inequity in Indigenous Education

June 21, 2021

Organized by: Rustum Choksi (McGill), Alina Stancu (Concordia)

Celebrating National Indigenous Peoples Day, a day to honour Indigenous Peoples presence and history, with speaker Melania Alvarez (Pacific Institute for the Mathematical Sciences) on the activities that UBC and SFU do with indigenous groups and discussing her work on mathematical education for First Nations communities in BC.

A Celebration of Women in Analysis in Canada

March 8, 2022

Organized by: Linan Chen (McGill), Rustum Choksi (McGill), Alexandre Girouard (Laval)

This workshop, which took place on International Women's Day, was designed as a celebration of the exceptional careers of four women analysts in the Canadian mathematical community.

Speakers:
Christiane Rousseau (Montréal)
Almut Burchard (Toronto)
Alina Stancu (Concordia)
Malabika Pramanik (UBC)

OTHER ACTIVITIES

The CRM organizes and sponsors several other activities in various areas of mathematics. These activities may be part of the so-called general program, which take place at the CRM or outside its facilities, or are organized by other institutions. They can also be part of the interdisciplinary and industrial program or be organized by the laboratories.

The general program is used to fund a variety of scientific events, ranging from highly specialized workshops for a small number of researchers to conferences bringing together hundreds of participants. The general program aims to encourage the development of research in mathematical sciences at all levels. The program is flexible and projects are considered as they are proposed.

Activities organized at the CRM

CAMBAM Zoomposium: Multiple Timescales in Neuronal and Other Systems

June 5, 2020
Online

Organized by:
Anmar Khadra (McGill)

Course: Analysis of nonparametric Bayesian data

July 6 to 8, 2020
Online

Organized by:
Alexandra M. Schmidt (McGill)

CAMBAM workshops

July 27 to August 14, 2020
Online

Organized by:
Frédéric Guichard (McGill)
Anmar Khadra (McGill)

Young researchers in spectral geometry

August 3 to 4, 2020
Online

Organized by:
Alexandre Girouard (Laval)

Tenth Montreal Industrial Problem Solving Workshop

August 13 - 27, 2020
Online

Organized by:
Odile Marcotte (CRM)

The tenth industrial problem solving workshop in Montreal was organized jointly by the CRM and the Institute for Data Valorization (IVADO). The workshop brought together industry representatives, academic researchers, graduate students and postdoctoral fellows. The participants formed teams, each of which analyzed a problem provided by a company or a public or parapublic organization. One of the goals of the workshop was to give companies or organizations mathematical problem-solving tools. The workshop also allowed researchers and students in mathematical sciences (including data science, statistics, optimization, financial mathematics, natural language processing, etc.) to examine concrete problems. The organizers of the workshop considered it an “incubator” for collaborations between companies and university researchers and expected that the collaborative work started during the workshop would continue after it, thanks to various funding sources.

Mini conference: 50th birthday of Dima Jakobson

August 24, 2020
Online

Organized by:
Alexandre Girouard (Laval)
Jean Lagacé (King's College London)
Iosif Polterovich (Montréal)

Regional Conference on Lie Theory

October 2 to 3, 2020
Online

Organized by:
Michael Lau (Laval)
Erhard Neher (Ottawa)

Hodge theory, period application and local systems

December 3 to 7, 2020
Online

Organized by:
Steven Lu (UQAM)
Kang Zuo (Wuhan)
Carlo Gasbarri (Strasbourg)
Benjamin Bakker (UIC)
Yohan Brunebarbe (Bordeaux)

Mathematics of Alexander Shnirelman: from quantum chaos to hydrodynamics

February 26 to 27, 2021
Online

Organized by:
Andrew Comech (Texas A&M)
Dmitry Jakobson (McGill)
Boris Khesin (Toronto)
Iosif Polterovich (Montréal)

Effective communications in applied mathematics

May 6 to 28, 2021
Online

Organized by:
Jacques Bélair (Montréal)
Rebecca C. Tyson (UBC)

Differential geometry and global analysis

May 24 to 28, 2021
Online

Organized by:
Benoit Charbonneau (Waterloo)
Eveline Legendre (Toulouse)
Frédéric Rochon (UQAM)

Workshop on computer modeling of cancer biology and treatments

July 19 to 21, 2021

Organized by:
Morgan Craig (Centre de recherche CHU Sainte-Justine)
Adrianne Lena Jenner (QUT)

Algebraic combinatorics School online (Women in Mathematics conference, open to all)

June 21, 2021
Online

Organized by:
Véronique Bazier-Matte (Laval)
Souheila Hassoun (Sherbrooke)
Nancy Wallace (UQAM)

Group theory methods in physics in memory of Pavel Winternitz

July 26 to 28, 2021

Organized by:
Véronique Hussin (Montréal)
Alfred Michel Grundland (UQTR)
John Harnad (CRM; Concordia)
Zora Thomova (SUNY Polytechnic Institute)

11th Montreal Industrial Problem Solving Workshop

August 23 to 27, 2021

Organized by:
CRM and IVADO

The Eleventh Montreal Industrial Problem Solving Workshop (IPSW) brought together industry representatives, university researchers, graduate students and postdoctoral fellows. Participants formed teams, each of which analyzed a problem provided by a company, or a public or parapublic organization.

Workshop on special geometries of Riemannian manifolds

October 11 to 15, 2021

Organized by:
Ilka Agricola (Philipps-Universität Marburg)
Vestislav Apostolov (UQAM)
Robert L. Bryant (Duke)
Spiro Karigiannis (Waterloo)
McKenzie Y. Wang (McMaster)

Symposium on Risk Modeling – SRM21

November 26, 2021
Online

Organized by:
Yogendra Chaubey (Concordia)
Mélina Mailhot (Concordia)
Johanna Neslehova (McGill)

As part of the International Mathematics Day of March 14: The Canadian launch of a UNESCO publication *Mathematics for Action: Supporting Science-Based Decision Making*

March 14, 2022

Organized by:
Christiane Rousseau (Montréal)

Topology and mentoring – Day in memory of Norbert Schlomiuk

April 23, 2022

Organized by:
François Lalonde (Montréal)

Mini-course on sublinear time algorithms for approximating functions of several variables

May 16 to 18, 2022

Organized by:
Simone Brugiapaglia (Concordia)

10th Canadian Conference of Statistics Students

May 28, 2022
Online

Organized by:
Victoire Michal (McGill)
Robyn Ritchie (SFU)

Geometric and Arithmetic Frontiers of Orbifolds: a focused introductory workshop

May 30 to June 3, 2022

Organized by:
Damian Brotbek (Lorraine, Nancy)
Carlo Gasbarri (Strasbourg)
Nathan Grieve (RMC/Carleton/UQAM)
Steven Lu (UQAM)
Gianluca Pacienza (Lorraine)
Julie Wang (Academia Sinica)

Activities held outside the CRM

Café Mathématique: What is a COVID-19 model?

August 12, 2020
Online

Organized by:
Julien Arino (Manitoba)
Jacques Bélair (Montréal)
Jane Heffernan (York)
V. Kumar Murty (Fields Institute)
James Watmough (UNB)
Jianhong Wu (York)
Huaiping Zhu (York)

Montreal AI & Neuroscience

December 1 to 3, 2020
Online

Organized by:
Pierre Bellec (Montréal)
Andrea Green (Montréal)
Karim Jerbi (Montréal)
Guillaume Lajoie (Montréal)
Jean-Marc Lina (ETS)
Bratislav Misic (McGill)
Irina Rish (Montréal)
Pascal Vincent (Montréal).

SUMM 2021 – Seminars in Undergraduate Mathematics in Montreal

January 9 to 10, 2021
Online

Organized by:
Béatrice Hajjar (Montréal)
Julien Hébert-Doutreloux (Montréal)
Mathieu Pineault (Montréal)
Shophika Vaithyanathasarma (Montréal)
Anna Brandenberger (McGill)
Antoine Beaudet (UQAM)
Ludovick Bouthat (Laval)

Queer and Trans Mathematicians in Combinatorics

June 25 to 27, 2021
Online

Organized by:
Rachelle Bouchat (Indiana UPenn)
Aram Dermenjian (York)
Ray Karpman (Otterbein)
Mike Zabrocki (York)

Risk workshop

May 11 to 13, 2022
Université Laval

Organized by: CIMMUL

Annual Atlantic Conference on General Relativity

May 25 to 29, 2021
Online

Organized by:
Valerio Faraoni (Bishop's)
Andrea Giusti (Bishop's)
Fayçal Hammad (Bishop's)
Lorne Nelson (Bishop's)
Jason Rowe (Bishop's)
Brad Willms (Bishop's)

6th Canadian Conference on Applied Statistics

July 15 to 18, 2021
Online

Organized by:
Yogendra P. Chaubey (Concordia)
Fassil Nebebe (Concordia)
Arusharka Sen (Concordia)

Mathematical Congress of the Americas

July 19 to 24, 2021
Departamento de Matemática, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires

Organized by:
Mathematical Council of the Americas

A Day for Poisson

April 1, 2022
Université Laval

Organized by: CIMMUL

GEMSTONE Mini-course: Harmonic Maps, Minimal Surfaces, and Shape Optimization in Spectral Geometry

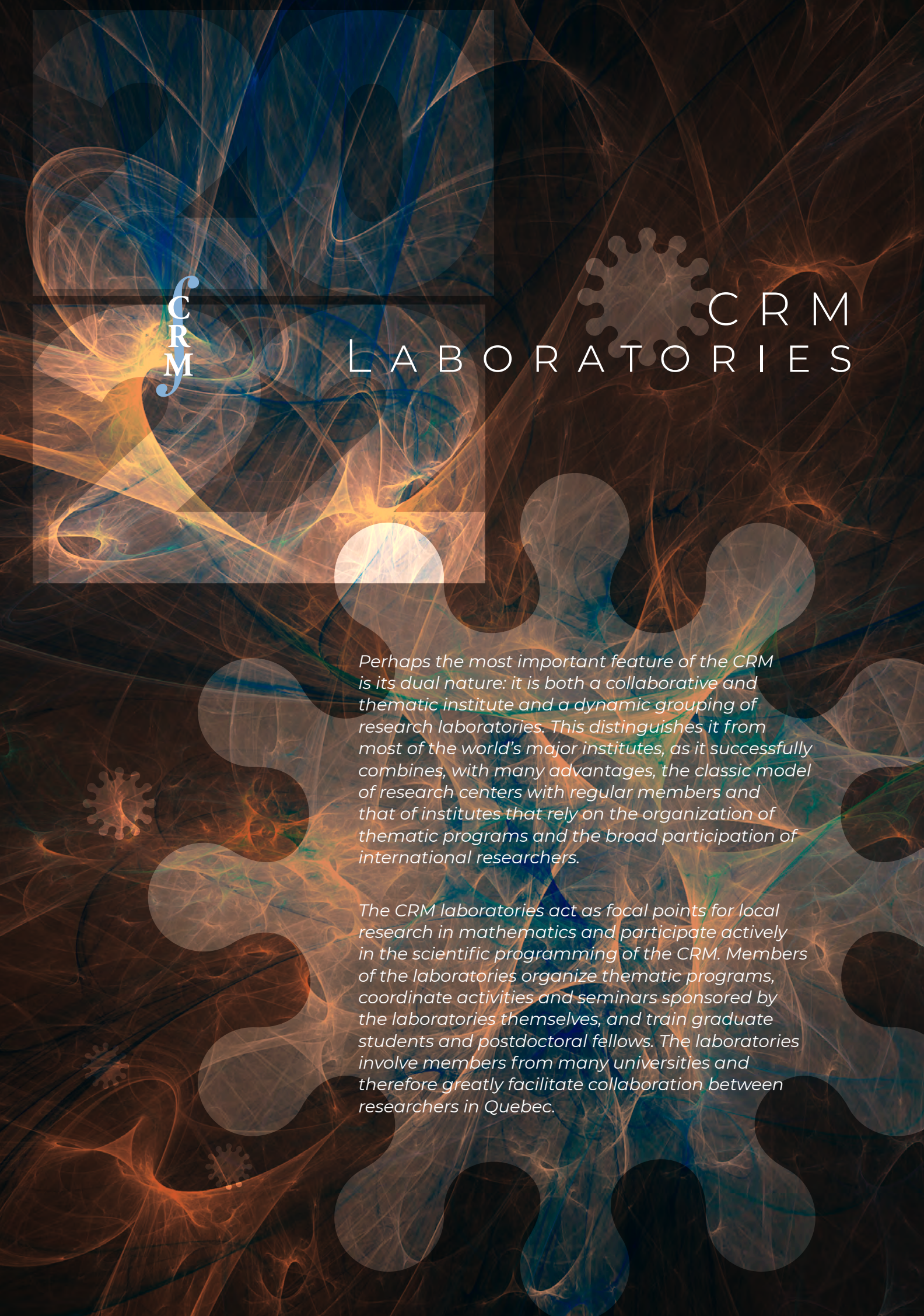
April 25, 27 and 29, 2022
Online

Organized by:
Alexandre Girouard (Laval)
Asma Hassannezhad (Bristol)
Jean Lagacé (King's College London)
Laura Monk (Bristol)

SSC Annual Meeting 2022

May 30 to June 3, 2022
Online

Organized by:
Richard Lockhart (Simon Fraser)
Shirley Mills (Carleton)
Asokan M Variyath (Memorial)
Pengfei Li (Waterloo)
Angelo Canty (McMaster)
Wendy Lou (Toronto)
Michelle Benoit (Saint-Mary's)
Marie-Pierre Nantel (Carleton)



CRM Laboratories

Perhaps the most important feature of the CRM is its dual nature: it is both a collaborative and thematic institute and a dynamic grouping of research laboratories. This distinguishes it from most of the world's major institutes, as it successfully combines, with many advantages, the classic model of research centers with regular members and that of institutes that rely on the organization of thematic programs and the broad participation of international researchers.

The CRM laboratories act as focal points for local research in mathematics and participate actively in the scientific programming of the CRM. Members of the laboratories organize thematic programs, coordinate activities and seminars sponsored by the laboratories themselves, and train graduate students and postdoctoral fellows. The laboratories involve members from many universities and therefore greatly facilitate collaboration between researchers in Quebec.

Mathematical Analysis

At the same time classical and central to modern mathematics, analysis involves the study of continuous systems, from dynamical systems to solutions of partial differential equations and spectra of operators. The members of the laboratory work in the following areas: harmonic analysis, complex analysis, several complex variables, potential theory, functional analysis, Banach algebras, microlocal analysis, analysis on manifolds, non-smooth analysis, spectral theory, partial differential equations, geometric analysis, ergodic theory and dynamical systems, control theory, mathematical physics, probability, nonlinear analysis, non-linear differential equations, topological methods in differential equations, fluid dynamics, and turbulence.

Highlights

The members of the Analysis lab were very active in the period 2020-22 and organized a variety of scientific activities. Due to the COVID-19 pandemic, most of these were online events. A mini conference for *Young Researchers in Spectral Geometry*, organized by lab member A. Girouard together with J. Lagacé (KCL), was held in early August 2020. Later that month, Girouard and Lagacé joined together with I. Polterovich to organize a mini conference in honour of the 50th birthday of lab director Dima Jakobson.

The *CRM Nirenberg Lectures in Geometric Analysis*, a distinguished lecture series created and organized by lab members P. Guan, D. Jakobson, I. Polterovich and A. Stancu, featured speakers Yevgeny Liokumovich (Toronto) and Antoine Song (UC Berkeley) in September 2020, and Yuansi Chen (Duke) and Bo'az Klartag (Weizmann) in October 2021. Also in 2021, Jakobson and Polterovich, along with A. Comech (Texas A&M) and B. Khesin (Toronto), organized a celebration of the *Mathematics of Alexander Shnirelman: from quantum chaos to hydrodynamics*.

The Séminaire de mathématiques supérieures (SMS) summer school, which took place from May to August 2021, in virtual format, was organized by Jakobson together with S. Eswarathasan (Dalhousie), K. Krupchyk (UC Irvine) and S. Nonnenmacher (Paris-Saclay). A Fields Institute Focus Program on Analytic Function Spaces and their Applications, organized by lab members D. Kinzebulatov and J. Mashreghi, as well as I. Binder (Toronto), took place in the second half of 2021. In addition, lab members were involved in organizing sessions at the meetings of the Canadian Mathematical Society as well as the Mathematical Congress of the Americas in 2021.

Various seminars continued to run online during this period, including the *CRM/Montréal/Québec Analysis Seminar* (organized by G. Dafni, A. Girouard, D. Jakobson, D. Kinzebulatov and I. Polterovich), the Geometric Analysis Seminar (organized by P. Guan, V. Tosatti and J. Vétois at McGill), the Non-local Operators, Probability and Singularities seminar, organized by D. Kinzebulatov and K. Szczypkowski (Politechnika Wrocławska), and the Spectral Geometry in the Clouds seminar, organized by A. Girouard and J. Lagacé (KCL).

The Geometric Spectral Theory Online Network (GEMSTONE) was created at the beginning of the COVID-19 pandemic. The goal of GEMSTONE is to create a framework of online scientific activities bringing together researchers working in this field all over the world.

Various lab members received honours and held distinctions during this period, including:

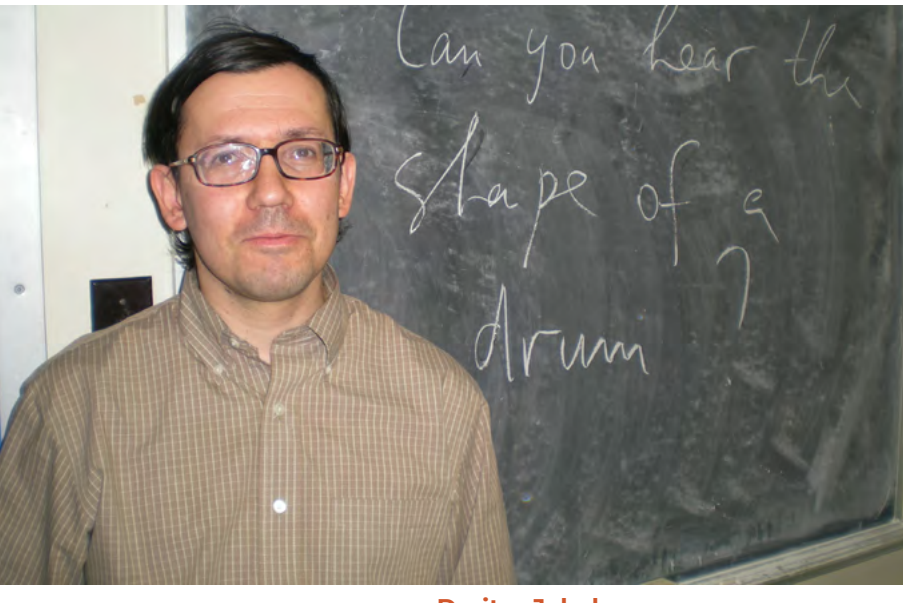
J. Mashreghi, President of the Canadian Mathematical Society (2020-22);

C. Rousseau, invited speaker at the Mathematical Congress of the Americas (2021); and

R. Raquepas (student of V. Jaksic, McGill) , the Carl Herz Prize of the ISM (2020).

Director

Dmitry Jakobson (McGill)



Dmitry Jakobson

Regular members

Maxime Fortier Bourque; Marlène Frigon; Paul Gauthier; Iosif Polterovich; Christiane Rousseau; Dana Schlomiuk (Montréal)

Francis Clarke (Claude Bernard - Lyon 1)

Abraham Boyarsky; Galia Dafni; Pawel Góra; Alexey Kokotov; Alexander Shnirelman; Alina Stancu; Ron Stern (Concordia)

Richard Fournier (Dawson College)

Robert Seiringer (Institute of Science and Technology Austria)

Line Baribeau; Alexandre Girouard; Frédéric Gourdeau; Damir Kinzebulatov; Javad Mashreghi; Thomas Ransford; Jérémie Rostand (Laval)

Dmitry Jakobson; Vojkan Jaksic; Paul Koosis; Marcin Sabok; John Toth; Anush Tserunyan; Jérôme Vétois (McGill)

Vadim Kaimanovich (Ottawa)

Tomasz Kaczynski (Sherbrooke)

Dominic Rochon (UQTR)

Associate Members

Octav Cornea; Richard Duncan; Samuel Zaidman (Montréal)

Guillaume Poliquin (College Ahuntsic)

John Harnad; Dmitry Korotkin (Concordia)

Suresh Eswarathasan (Dalhousie)

Stephen Drury; Kohur Gowrisankaran; Pengfei Guan; Niky Kamran; Ivo Klemes (McGill)

Nilima Nigam (Simon Fraser)

Frédéric Rochon (UQAM)

Applied Mathematics

The research interests of the laboratory members are quite diverse although there are several common threads that make interchange and collaboration both possible and fruitful. Active areas of research represented within the laboratory include, for example, the application of dynamical systems theory to complex phenomena, high-dimensional chaos, and biology. There is also an interest in numerical linear algebra and its applications, including the design, analysis, and implementation of effective computer algorithms. Amongst the membership one also finds expertise in numerical analysis, applied dynamical systems, quantum chemistry, biomechanics, numerical methods in fluid mechanics and electromagnetism, molecular dynamics, control, and optimization.

Highlights

Partially due to its more recent additions, a substantial part of the research activity of the laboratory incorporates very current topics such as machine learning, deep learning, optimal transport, stochastic optimization, compressed sensing, high-dimensional approximation, data-driven discovery of dynamical systems, reduced-order modelling, variational analysis, and rigorous numerics.

From June 2020 to May 2022 the lab hosted over 45 seminar talks, in-person, online or hybrid. In this period, the seminar has been organized by Tim Hoheisel and Simone Brugiapaglia (aided by Damien Taggedine). Courtney Paquette, in collaboration with Elliot Paquette (Probability Lab), created a graduate student seminar on Random matrix theory, optimization and machine learning at McGill in Winter 2020. In May 2022, Simone Brugiapaglia hosted a CRM mini-course on sublinear-time algorithms taught by Mark Iwen (Michigan State).

From 2020 to 2022, the laboratory has financially supported more than 15 graduate students and post-doctoral fellows. In 2021, Adam Oberman filed a US patent application on methods and systems for computing an output of a neural network layer. Brugiapaglia, Guignard, Hoheisel, and Paquette proposed a CRM Thematic Program on “Mathematical Foundations of Data Science” that will take place in Summer 2025.

Members are very active in the organization of scientific events. Among their numerous contributions in 2020-22: Brugiapaglia co-organized the ICERM Hot Topics Workshop "Safety and Security of Deep Learning" (online, April 2021); Choksi was co-chair of the SIAM Conference on Mathematical Aspects of Materials Science, (Bilbao, Spain, May 2021); Lessard was main organizer of the CRM CAMP Seminar, (June 2020-June 2021) and of the École Langlands du CRM (August 2021); Lin co-organized the CRM Thematic Program on Probability and PDEs (January 2022-May 2022) and a workshop on "Unifying Concepts in PDEs with Randomness" (online, May 2021). Paquette was the lead organizer of the "Optimization for Machine Learning" workshop at NeurIPS in 2020 and 2021 and program chair of the Montreal AI Symposium (October 2021).

Members of the laboratory received various honours in 2020-22, including:

Rustum Choksi, Leo Yaffe Award (for teaching), McGill (2021);

Antony Humphries, Principal's Prize for Excellence in Teaching, McGill (2020);

Adam Oberman, CIFAR Artificial Intelligence Chair (2021);

Courtney Paquette, CIFAR AI Chair (2020) and CIFAR's Rising Star in Artificial Intelligence (Reach Magazine, 2022).

Director

Tim Hoheisel (McGill)

Regular members

Jacques Bélair ; Robert G. Owens (Montréal)

Emmanuel Lorin (Carleton)

Simone Brugiapaglia ; Jason Bramburger ; Behrooz Yousefzadeh (Concordia)

Peter Bartello ; Peter E. Caines ; Xiao-Wen Chang ; Rustum Choksi ; James R. Forbes ; Tim Hoheisel ; Antony R. Humphries ; Jean-Philippe Lessard ; Jessica Lin ; Jean-Christophe Nave ; Adam Oberman ; Courtney Paquette ; Gantumur Tsogtgerel ; Adrian Vetta (McGill)

Diane Guignard ; Augusto Gerolin (Ottawa)

André D. Bandrauk (Sherbrooke)

Associate Members

Eusebius J. Doedel (Concordia)

Bruce Shepherd (UBC)

Tim Hoheisel

CAMBAM

Centre for Applied Mathematics in Bioscience and Medicine

CAMBAM's mission is to be a leading institution in the application of mathematics to address challenges in bioscience and medicine through partnership with industry, government and other stakeholders in society. CAMBAM meets its objectives by promoting and fostering research, teaching and training in applications of quantitative biology at all levels ranging from the molecular/genetic through single cell and whole organ physiology and biology to population dynamics and broader ecological questions, on time scales from the present to the evolutionary; honing the talents of students at all levels through unique training opportunities in academic and non-academic settings; and conducting applied research of the highest scientific rigor, meeting existent industry and societal demands in clinical and public health settings.

Highlights

CAMBAM continued to benefit from its partnership with McGill's Quantitative Life Sciences (QLS) program in running a weekly seminar series during the Fall and Winter terms in collaboration with the McGill Initiative in Computational Medicine (MiCM) and the Ludmer Centre. This seminar series, which was originally a CAMBAM event prior to this partnership, had 12 talks out of 31 allocated for CAMBAM invited or affiliated speakers during 2021-2022. Due to COVID-19, talks were held virtually with attendees ranging between 40-60. Speakers were also invited to meet the trainees after the talks to interact more closely with them. CAMBAM member Suresh Krishna took the lead in organizing this seminar series in collaboration with members of the other partners.

CAMBAM's funding from the CRM and other sources, including the William K. and Katherine W. Estes Fund and the Psychonomic Society, allowed it to award 5 fellowships to research trainees on a competitive basis. The high representation of women reflected CAMBAM's commitment to equity, diversity and inclusion.

Three one-day online workshops were organized during the summer of 2020 by CAMBAM trainees. The titles of these workshops were: (1) Interactive data visualizations in Python (July 27); (2) Problems and solutions in lifting individual behavior to population level dynamics (August 6); (3) Computational modeling to study cancer biology and treatment (August 13).

Anmar Khadra

CAMBAM and McGill's NSERC-CREATE program in Complex Dynamics of Brain and Behavior teamed up to organize the "Summer School in Nonlinear Dynamics for the Life Sciences with Applications to Neuroscience and Psychology" (May 31 to June 11, 2021). Unlike previous summer schools, this event was held virtually via zoom. The school was funded by the William K. and Katherine W. Estes Fund and the Psychonomic Society as well as the CRM. Another CAMBAM summer school, entitled "Summer School in Nonlinear Dynamics for the Life Sciences", was held May 30 to June 10, 2022.

Several members of CAMBAM have participated actively and successfully in establishing the Digital Health Network that will be funded by the Fonds de recherche du Québec (FRQ). That includes Anmar Khadra, Fred Guichard, Jacques Belair, Fahima Nekka and Morgan Craig.

Director

Anmar Khadra (McGill)

Regular members

Jacques Bélair; Morgan Craig (Centre de recherche du CHU Sainte-Justine); Guillaume Lajoie; Alain Vinet (Montréal)

Pouya Bashivan; Mathieu Blanchette; Maurice Chacron; Erik Cook; Paul François; Gregor Fussmann; Leon Glass; Michael Guevara; Frédéric Guichard; Antony R. Humphries; Anmar Khadra; Svetlana V. Komarova; Suresh Krishna; Brian Leung; Michael C. Mackey; Jacek Majewski; Christopher Pack (McGill)

Frithjof Lutscher (Ottawa)

Associate Members

Fahima Nekka (Montréal)

Lea Popovic (Concordia)

Caroline Palmer (McGill)

Lydia Bourouiba (MIT)

Juli Atherton (UQAM)

CICMA

Centre interuniversitaire en calcul mathématique algébrique

CICMA includes researchers working in number theory, group theory, and algebraic geometry. Algebraic geometry is a broad discipline having close links with diverse fields from arithmetic to theoretical physics.

Number theory has developed over the last decades following two major trends: on one hand algebraic number theory, including such themes as the study of special values of L-functions attached to arithmetic objects, which originates in the work of Gauss and Dirichlet and leads to the modern conjectures of Deligne, Beilinson, and Bloch–Kato. Another theme of algebraic number theory, originating in the Langlands program, postulates a close link between arithmetic L-functions and automorphic representations.

On the other hand, analytic number theory addresses deep and subtle questions concerning the distribution of primes. It makes use of mathematical analysis techniques, especially functions of several complex variables and spectral theory. Number theory in all its different flavors is particularly well represented in the laboratory.

Highlights

In 2020-2022, laboratory members received several awards, including:

Patrick Allen, NSERC Discovery Accelerator Supplement (2021);

Henri Darmon, Simons Fellow (2022);

Eyal Goren, Fellow of the Canadian Mathematical Society (2021);

Andrew Granville, Fields Institute Fellow (2021); CRM-Fields-PIMS Prize (2021);

Dimitris Koukoulopoulos, invited speaker at the International Congress of Mathematicians (2022); “Chaire Courtois II en recherche fondamentale” from the FAS of UdeM, a prestigious 7-year appointment (2021); his work on the Duffin-Schaeffer conjecture with Fields medallist James Maynard was listed among the top 10 discoveries by the magazine Québec Science (2021);

Matilde Lalín, Krieger-Nelson Prize of the Canadian Mathematical Society (2022); Fellow of the Canadian Mathematical Society (2022);

Antonio Lei, NSERC Discovery Accelerator Supplement (2021);

Giovanni Rosso, University Research Award, Concordia (2020) (a research achievement by an early-career faculty member who has demonstrated potential to assume a leadership role during the first five years at Concordia).

Director

Henri Darmon (McGill)

Regular members

Andrew Granville ; Dimitris Koukoulopoulos ; Matilde Lalín (Montréal)

Chris Cummins ; Chantal David ; Adrian Iovita ; Hershy Kisilevsky ; John McKay ; Giovanni Rosso (Concordia)

David Dummit (Vermont)

Hugo Chapdelaine ; Jean-Marie De Koninck ; Antonio Lei ; Claude Levesque (Laval)

Patrick Allen ; Henri Darmon ; Eyal Goren ; John Labute ; Michael Lipnowski ; Michael Makkai ; Peter Russell (McGill)

Damien Roy (Ottawa)

Ram Murty (Queen's)

Associate Members

Brad Rodgers (Queen's)

Henri Darmon

CIRGET

Centre interuniversitaire de recherches en géométrie et topologie

Topology and differential geometry are fundamental disciplines of mathematics whose richness and vitality, evident throughout history, reflect a deep link to our experience of the universe. They are a focal point of modern mathematics and indeed several domains of mathematics have recently shown a strong trend towards a geometrization of ideas and methods: two cases in point are mathematical physics and number theory.

The main themes to be pursued include the topological classification of 3-dimensional manifolds; the quantization of Hitchin systems and the geometric Langlands program; the classification of special Kähler metrics; the study of symplectic invariants, especially in dimension 4; non-linear partial differential equations in Riemannian geometry, convex geometry, and general relativity; and Hamiltonian dynamical systems. Two further domains are represented within CIRGET: algebraic geometry and geometric group theory.

Highlights

With the lockdown, the seminars became essential for CIRGET as a place for members to maintain regular contact. The Symplectic Seminar adjusted immediately and used our new virtual existence as an opportunity to join forces with other universities. CIRGET is now part of the Symplectic Zoominar, a joint seminar organized by CIRGET, the Institute for Advanced Studies and Princeton, the University of Tel Aviv, and the University of Paris-Saclay. All talks are streamed live and recorded so that they can be viewed at any time. Because this is a global seminar, talks typically are viewed over 500 times. The Geometry and Topology Seminar and the Geometric Group Theory Seminar quickly followed the virtual example, with all talks live streamed and recorded, but continued to be organized locally. As nobody could travel to conferences during the summer, both seminars continued until July 24, 2020, and resumed the following September.

In 2020-21, a fourth seminar series was born: CIRGET Junior. Organized entirely by students, this seminar series met virtually 10 times during the year. During that academic year, CIRGET also organized two virtual conferences: a Mini-workshop on Hodge Theory, Period Mapping and Global Analysis, and a Workshop on Differential Geometry and Global Analysis.

In 2020-22, laboratory members receiveds several awards, including:

Egor Shelukhin, André-Aisenstadt prize (joint with Robert Haslhofer) (2020); Sloan Research Fellow (2021)

Director

Steve Boyer (UQAM)

Regular members

Octav Cornea ; François Lalonde ; Iosif Polterovich ; Egor Shelukhin (Montréal)

Vestislav Apostolov ; Steven Boyer ; Olivier Collin ; André Joyal ; Julien Keller ; Steven Lu ; Duncan McCoy ; Frédéric Rochon (UQAM)

Pengfei Guan ; Jacques Hurtubise ; Niky Kamran ; Mikaël Pichot ; Piotr Przytycki ; Brent Pym ; Peter Russell ; Valentino Tosatti ; Daniel T. Wise (McGill)

Jean-Philippe Burelle ; Virginie Charette (Sherbrooke)

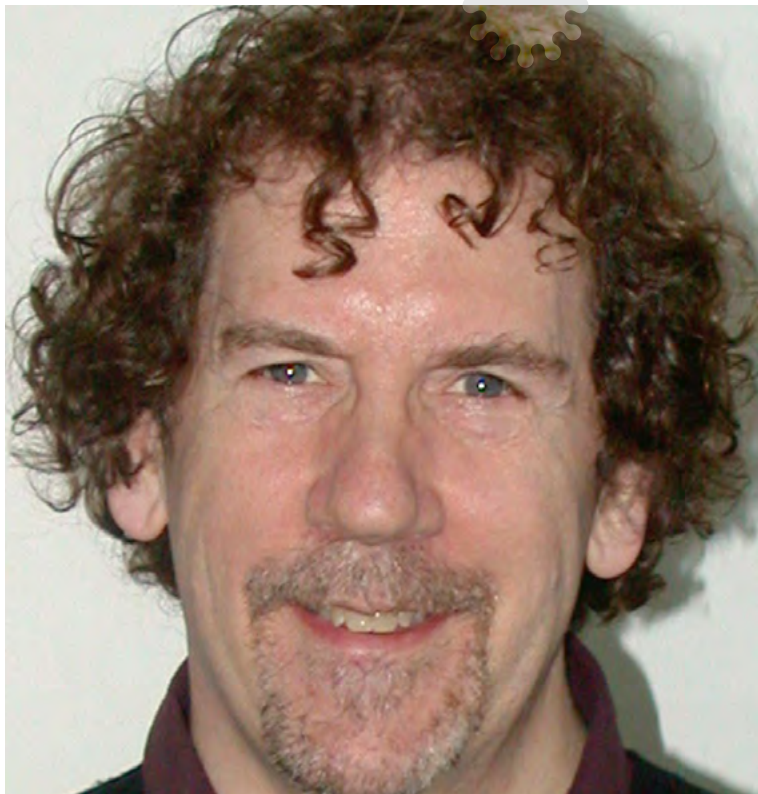
Associate Members

John Harnad (Concordia)

Dmitry Jakobson ; Marcin Sabok ; John A. Toth (McGill)

Maia Fraser (Ottawa)

Clément Hyvrier (Cégep de Saint-Laurent)



Steven Boyer

GIREF

Le groupe interdisciplinaire de recherche en éléments finis

GIREF brings together researchers from various academic institutions, with the aim of promoting research, training and interaction with industry in the field of numerical modeling and simulation. GIREF members are involved in numerous collaborations with industrial and academic partners, in fields related to modeling and the use of numerical methods to solve multiphysics problems.

As a university laboratory, GIREF offers solid training in numerical mathematics, and its graduates (at all levels) are in demand in industry and university laboratories. There have been 20 graduates over the past ten years, 15 of whom have gone on to secure positions in industry (10 in Quebec and 5 in France), with the remainder working in teaching (Canada, France, Switzerland). The placement rate of our students during this period is 100%, with most of them securing a position before submitting their dissertation or defending their thesis.

GIREF specializes in applied mathematics with a strong industrial focus, as demonstrated by its 15-year partnership with Michelin. This collaboration revolves around the joint development of the MEF++ finite element software, which was initiated at GIREF over 20 years ago. MEF++ now has over 500 users on a daily basis at Michelin. Over the past 5 years, GIREF's main research themes have been: numerical analysis of mixed problem solving schemes; large deformation solid mechanics; multiphysics and multiphase simulation; high-performance scientific computing; mesh adaptation and precision control; and mathematical ecology.

Highlights

The 2021 edition of the CRM-ULaval summer school entitled "Solving large systems efficiently in multiphysics numerical simulations" took place from May 31 to June 10, 2021. The aim of this summer school was to introduce fundamental resolution techniques for dealing with highly coupled multiphysics problems. The school looked closely at techniques capable of exploiting the modern supercomputing architecture, which often features tens of thousands of processors that can perform many calculations in parallel.

Jean Deteix

The partnership in epidemiology with researchers from the Research Group on Epidemiology of Zoonoses and Public Health (GREZOSP) of the Université de Montréal continued; publication of “Mechanistic movement models reveal ecological drivers of tick-borne pathogen spread” in the Journal of the Royal Society Interface (2021).

GIREF (André Fortin and Jean Deteix) contributed to the project “Interdisciplinary research to understand changing food-web dynamics and threats to food security in the northern boreal forest” (2021). This project’s aim was to better understand how subarctic food webs are impacted by anthropogenic global changes, including industrial disturbances and climate change.

Director

Jean Deteix (Laval)

Regular members

Michel C. Delfour (Montréal)

André Garon (Polytechnique Montréal)

Jean Deteix; Nicolas Doyon; André Fortin; Robert Guénette; Khader Khadraoui; Felix Kwok; René Therrien; José Manuel Urquiza (Laval)

Sophie Léger Auffrey (Moncton)

Associate Members

Stéphane Étienne; François Guibault; Dominique Pelletier (Polytechnique Montréal)

Yves Secrétan (INRS)

Alain Cloutier; Marie-Laure Dano; Claire Deschênes; Guy Dumas; Mathieu Olivier (Laval)

Mohamed Farhloul (Moncton)

Yves Bourgault (Ottawa)

Marie-Isabelle Farinas (UQAC)

Pietro-Luciano Buono (UQAR)

Youssef Belhamadia (AUS)

LACIM

Laboratoire d'algèbre, de combinatoire et d'informatique mathématique

LACIM is an institutional research center at UQAM, uniting researchers, postdoctoral fellows and students whose main research themes are rooted in combinatorics and its links with algebra and computer science.

The center is recognized internationally as one of the leading research centers in algebraic combinatorics, enumerative combinatorics and word combinatorics, with additional research axes in bioinformatics and algorithm analysis.

Highlights

The Canada Research Chair Tier 1 "Algebra, Combinatorics and Mathematical Computer Science" held by LACIM member Hugh Thomas.

Through its regular members Thomas Brüstle and Hugh Thomas, LACIM is a partner in an EPSRC (Engineering and Physical Sciences Research Council, United Kingdom) grant. Starting in 2020, the project brings together 14 researchers at four sites (Paris, Amiens, Leicester and Montreal) and supports travel of postdoctoral fellows and researchers associated with the project.

Christophe Hohlweg

LACIM has played a key role in the creation of a new series of biennial conferences entitled "Workshop on Algebraic Combinatorics of the Symmetric Groups and Coxeter Groups". The first two first two editions were held in 2021 (postponed from 2020) and 2022; the next will take place in July 2024.

In addition to numerous conferences organized jointly by LACIM members during the period June 2020 to May 2022, LACIM researchers and students organized an ISM discovery school: Summer School of Algebraic Combinatorics (2021).

In 2020-2022, LACIM members received several honours, including:

François Bergeron, Fellow of the Canadian Mathematical Society (2021).

Director

Christophe Hohlweg (UQAM)

Regular members

Ibrahim Assem ; Thomas Brüstle ; Shiping Liu (Sherbrooke)

Anne Bergeron ; François Bergeron ; Alexandre Blondin Massé ; Srečko Brlek ; Christophe Hohlweg ; Gilbert Labelle ; Vladimir Makarenkov ; Christophe Reutenauer ; Vladimir Reinharz ; Franco Saliola ; Hugh Thomas (UQAM)

Alain Goupil (UQTR)

Sylvie Hamel (Montréal)

Benoît Larose (Champlain)

Associate Members

Abdoulaye Banire Diallo (UQAM)

Camille Coti (ETS)

Jean-Philippe Labbé (ETS)

Claudia Malvenuto (La Sapienza)

Yann Palu (Amiens)

Vincent Pilaud
(LIX, École polytechnique)

Viviane Pons (Orsay)

Mila

Institut québécois d'intelligence artificielle

Founded in 1993 by Professor Yoshua Bengio of the Université de Montréal, Mila is an artificial intelligence research institute that today brings together over 1,000 researchers specializing in machine learning, making it the world's largest academic research center in machine learning. Based in Montreal, Mila's mission is to be a global hub of scientific advances that inspire innovation and the growth of AI for the benefit of all. Mila is a not-for-profit organization recognized worldwide for its significant contributions to the field of deep learning, particularly in the areas of language modeling, machine translation, object recognition and generative models.

Highlights

Members are very active in organizing scientific events. These include: CIFAR DLRLSS Summer School 2021 (July 2021); EEML Summer School (July 2020); Incentives for Better Evaluation at ICLR 2022 (April 2022); Tackling Climate Change with ML at NeurIPS (2021); Causal Inference & Machine Learning at NeurIPs (December 2021); Tackling Climate Change with ML at ICML (July 2021); Beyond Static Papers: Rethinking How We Share Scientific Understanding in ML at ICLR (May 2021); Hardware-Aware Efficient Training of Deep Learning Models at ICLR (May 2021); Tackling Climate Change with ML at NeurIPS (December 2020); CIFAR Workshop Causal Inference across Machine Learning, Economics, Philosophy, and Beyond (July 2020).

En 2020-22, Mila members received many honours, including : Yoshua Bengio, Fellow of the Royal Society of London (2020), Chevalier de la Légion d'honneur (2022), Princesse des Asturies Prize (Spain, 2022), Pierre-Devijver Prize (2022).

Director

Yoshua Bengio (Montréal)

Academic members

Aishwarya Agrawal ; Pierre-Luc Bacon ; Yoshua Bengio ; Glen Berseth ; Aaron Courville ; Emma Frejinger ; Gauthier Gidel ; Rex Devon Hjelm ; Simon Lacoste-Julien ; Guillaume Lajoie ; Bang Liu ; Ioannis Mitliagkas ; Liam Paull ; Guillaume Rabusseau ; Alain Tapp ; Vincent Pascal ; Irina Rish ; Dhanya Sridhar ; Guy Wolf (Montréal)

Laurent Charlin ; Jian Tang (HEC Montréal)

Andrea Lodi ; Christopher Pal (Polytechnique Montréal)

Jackie Cheung ; William Hamilton ; Golnoosh Farnadi ; Derek Nowrouzezahrai ; Timothy J. O'Donnell ; Prakash Panangaden ; Joëlle Pineau ; Doina Precup ; Reihaneh Rabbany ; Siamak Ravanbakhsh ; Siva Reddy ; Blake Richards ; David Rolnick (McGill)

Industrial members

Fernando Diaz ; Marc G. Bellemare ; Cheng-Zhi Anna Huang ; Hugo Larochelle ; Danny Tarlow (Google)

Adriana Romero ; Pascal Vincent (Meta)

Geoffrey Gordo ; Nicolas Le Roux ; Alessandro Sordoni (Microsoft Research)

Dzmitry Bahdanau (ServiceNow)

Yoshua Bengio

Laboratoire de physique mathématique

The mathematical physics group is one of the oldest laboratories at the CRM. The group carries out research in many of the most active areas of mathematical physics: coherent non-linear systems in fluids, optics, and plasmas; classical and quantum integrable systems; the spectral theory of random matrices; percolation phenomena; conformal field theory; quantum statistical mechanics; spectral and scattering theory of random Schrödinger operators; quasi-crystals; relativity; spectral transform methods; foundational questions in quantization; asymptotics of eigenstates; coherent states; wavelets; supersymmetry; the symmetry analysis of PDEs and difference equations; representation theory of Lie groups and quantum groups; and the mathematical structure of classical and quantum field theories.

Highlights

The PhysMath laboratory continued to hold its weekly mathematical physics seminar on Tuesday afternoons at the CRM. The McGill University Physics Department's theoretical physics seminars also continued to be held weekly, on Mondays and Wednesdays, at noon. Most PhysMath Tuesday seminars were held in person, but could also be accessed by zoom; participants were generally of both types, with roughly equal numbers attending in person and by zoom. The organizers of the Tuesday mathematical physics seminars were: William Witczak-Krempa and postdoctoral fellow Gilles Parez.

The laboratory gained two new external associate members: Benjamin Doyon, Professor at King's College London, a very frequent visitor to the CRM, with considerable overlap of interests with several of our members, and Ian Marquette, Senior Research Fellow at the University of Queensland, Australia, who is also a frequent visitor, having completed his PhD under the supervision of Pavel Winternitz at Université de Montréal in 2009.

Sadly, the laboratory also suffered three great losses in 2021-2022: our long-standing distinguished members and dear friends, Pavel Winternitz and Jiri Patera, both passed away, to our great sadness and regret, as did our longest-serving external member, colleague, friend and collaborator, Decio Levi.

In 2020-22, prizes and distinctions awarded to laboratory members included :

Robert Brandenberger, Canadian Association of Physicists medal for Lifetime Achievement in Physics (Dec. 2021)

Simon Caron-Huot, Canadian Association of Physicists Herzberg Medal (Dec. 2021)

Luc Vinet, Member, Order of Canada (Sept. 2021)

Yvan Saint-Aubin, Prix Publication en français Gisèle-Lamoureux des Fonds de recherche du Québec (Oct. 2021).

Director

John Harnad (Concordia)

Regular members

Véronique Hussin ; Manu Paranjape ; Jirí Patera ; Yvan Saint-Aubin ; Luc Vinet ; Pavel Winternitz ; William Witczak-Krempa (Montréal)

Marco Bertola ; Alfred Michel Grundland ; Richard Hall ; John Harnad ; Dmitry Korotkin (Concordia)

Robert Brandenberger ; Simon Caron-Huot ; Keshav Dasgupta ; Sarah M. Harrison ; Jacques Hurtubise ; Alexander Maloney (McGill)

Alexei Zhedanov (RUC)

Vasilisa Shramchenko (Sherbrooke)

Alfred Michel Grundland (UQTR)

Associate Members

Alexander Hariton ; François Lalonde (Montréal)

Stéphane Durand (Édouard-Montpetit)

Libor Snobl (CTU)

Alexander Shnirelman (Concordia)

Nicolas Crampé (CNRS, Tours)

Robert Conte (ENS Cachan)

Johannes Walcher (Heidelberg)

Robert Seiringer (ISTA)

Bertrand Eynard (IPhT, CEA Saclay)

Alexander Its (IUPUI)

Ferenc Balogh (John Abbott College)

Benjamin Doyon (King's College)

Vojkan Jaksic ; Niky Kamran ; John Toth (McGill)

Jean-Pierre Gazeau ; Igor Loutsenko (Paris 7)

Peter Zograf (St-Petersburg)

Decio Levi (Studi Roma Tre)

Alexander Turbiner (UNAM)

John Harnad

PhyNum

Physique numérique

Applied mathematics now plays an important role in the biomedical field and especially neurosciences. The research activity at PhysNum (“Numerical Physics”) has two main themes: pharmacometrics and brain imaging.

Director

Jean-Marc Lina (ÉTS)

Regular members

Karim Jerbi ; Fahima Nekka (Montréal)

Frédéric Lesage (Polytechnique Montréal)

Habib Benali ; Christophe Grova (Concordia)

Jean-Marc Lina (ÉTS)

Maxime Descoteaux (Sherbrooke)

Jean-Marc Lina

Probability Laboratory

The research interests of the group span theoretical and applied, continuous and discrete probability. One important stream of research within the laboratory is the development and analysis of probabilistic models for physical, biological, statistical, and computational systems. The creation of this laboratory highlights the quality of probability research in the Montreal region and the recent influx of researchers in this area.

Highlights

In 2020 and 2021, together with colleagues from other parts of Canada, lab members co-created and organized the “online open probability school”, which consisted of an extended sequence of mini-courses on diverse topics in probability. All courses took place online. Most courses consisted of three 1-hour lectures, and all were open to all interested participants and have been publicly archived for pedagogical purposes.

In 2020, lab member Elliot Paquette and CRM Applied Math lab member Courtney Paquette also created the RMT-ML-OPT seminar, designed to introduce local graduate students to topics at the interface of random matrix theory, machine learning and optimization.

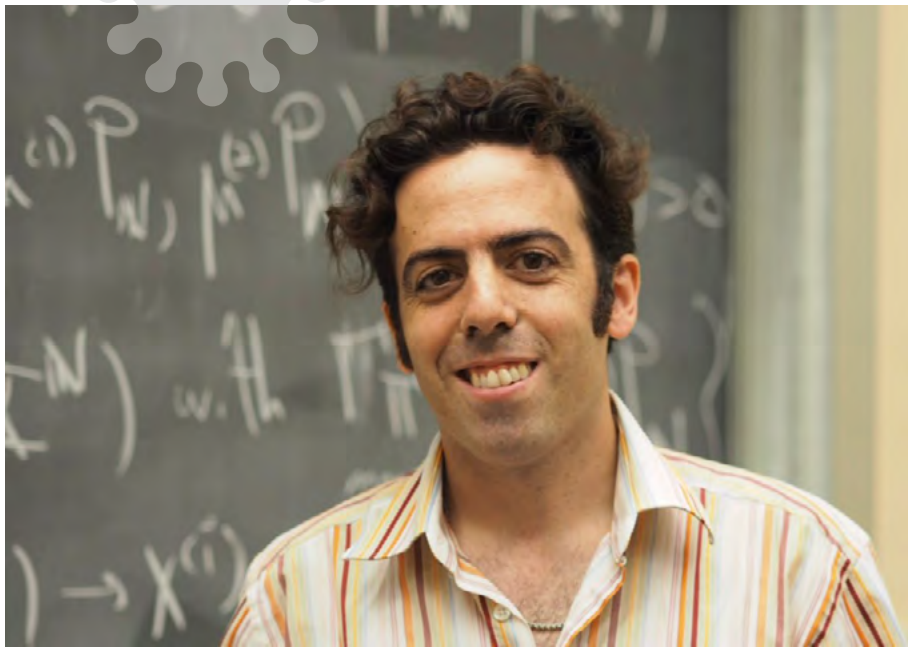
In July 2020, Lea Popovic delivered a summer school on Chemical Reaction Networks in Torini, Italy. Professor Popovic also organized the Séminaire de Mathématiques Supérieures in June-July 2020.

The CRM-PIMS summer schools in probability are a highlight of Canadian probability. Created by PIMS in 2004, they consist of two main 4-week-long courses and 3 mini-courses, as well as short research presentations by summer school participants. The school took place virtually in 2021 (with long courses from Louigi Addario-Berry and Jean-Christophe Mourrat) and in person in 2022 (with long courses from Frank den Hollander and Ivan Corwin).

Finally, from January-May 2022, the lab spearheaded the organization of the CRM's thematic semester on Probability and Partial Differential Equations.

In 2020-22, members of the laboratory received several distinctions, including:

Louigi Addario-Berry, Simons Fellow (2021).



Louigi Addario-Berry

Director

Louigi Addario-Berry (McGill)

Regular members

Alexander Fribergh ; Sabin Lessard (Montréal)

Donald Dawson (Carleton)

Lea Popovic ; Wei Sun ; Xiaowen Zhou (Concordia)

Louigi Addario-Berry ; Linan Chen ; Luc Devroye ; Jessica Lin ; Elliot Paquette ; Bruce Reed (McGill)

Raluca Balan ; Aaron Smith (Ottawa)

Hélène Guérin ; Janosch Ortmann (UQAM)

Associate Member

Andrew Granville (Montréal)

Louis-Pierre Arguin (CUNY, Baruch College)

Dmitry Jakobson ; Vojkan Jaksic (McGill)

Jean-François Coeurjolly (UQAM)

Quantact

Actuarial and Financial Mathematics Laboratory

The laboratory's members develop and use probabilistic and statistical methods to analyze issues having a financial impact on society. The research interests of Quantact members include FADR insurance, actuarial statistics, actuarial finance, and mathematical finance, as well as the mathematics of risk and ruin theory. Here are a few of the themes studied by Quantact members: pricing and provisioning in property and casualty (P&C) insurance; solvency of financial institutions; financial innovation in insurance (pricing and covering of variable annuities and market-linked insurance products); the modeling of longevity risk and mortality and its impacts on life insurance and pension schemes; the quantification of the impact of natural disasters and other extreme events; dependency models; measures of risk; models for the frequency and severity of disasters; stochastic control of risk processes and stochastic optimization; and the statistical analysis of big data in insurance.

Highlights

José Garrido, Professor in the Department of Mathematics and Statistics at Concordia University and a founding member of Quantact, officially retired in June 2021. José played a major role in the development of actuarial science as a university academic discipline in Montreal, Quebec, Canada and internationally, in various aspects: research, graduate student training and sustained involvement in various organizations. A virtual celebration was held on June 22, 2021. On this occasion, the creation of an award in his honour was revealed: the Actuarial Mathematics Award in Honour of José Garrido. We would like to congratulate José on all he has achieved in his 35-year career. He has played a major role in the careers of most Quantact members.

Despite the pandemic situation, the Quantact laboratory still managed to organize numerous virtual seminars over the course of 2020-2021. These webinars continued into 2022. Seminar presenters included university professors, practitioners and graduate students.

Due to the Covid-19 situation, Actuarial Student Day - Quantact 2020 was held in virtual mode. The organizing committee divided the day into three 2-hour sessions in which two students gave their presentations in virtual mode (June 4, 11 and 17).

Étienne Marceau

Quantact members Mathieu Boudreault, Anne MacKay, Mathieu Pigeon and Jean-François Renaud were involved in the organization of the 2020 International Conference on Insurance : Mathematics and Economics (August 6 – 8, 2020).

In 2020-2022, laboratory members received several awards, including:

David Ardia (avec Luc Villandré), IVADO Covid-19 initiatives (2021);

Maciej Augustyniak, feature article in Quantitative Finance journal (2021);

José Garrido, Canadian Institutes of Actuaries Silver Award (2020);

Mélina Mailhot, Collaborative Research Team Award from the Canadian Statistical Sciences Institute (CANSSI) (2021).

Directors

Anne MacKay (UQAM) (2020-2020)

Patrice Gaillardetz (Concordia) (2020-2021)

Étienne Marceau (Laval) (2021-)

Members

Maciej Augustyniak ; Philippe Gagnon ; Manuel Morales (Montréal)

David Ardia (HEC Montréal)

Patrice Gaillardetz ; José Garrido ; Frédéric Godin ; Cody Hyndman ; Yang Lu ; Mélina Mailhot (Concordia)

Hélène Cossette ; Marie-Pier Côté ; Étienne Marceau (Laval)

Jean-Philippe Boucher ; Mathieu Boudreault ; Arthur Charpentier ; Anne MacKay ; Mathieu Pigeon ; Jean-François Renaud ; Alexandre F. Roch ; Clarence Simard (UQAM)

Statistics Laboratory

Statistical methods and reasoning play an important role in the advancement of knowledge. Be it through surveys from sampling, the measure of socio-economic indicators, clinical trials to compare various biomedical treatments, or the study of the survival of an animal population in ecology, statistical methodology can be found everywhere in the sciences. Recently, statistics has undergone a revolution in its techniques and approaches. This revolution has been driven by the need to analyze very large data sets and data with more complex structure, and by the advent of powerful computers. Statistical methodology is now addressing problems whose structure is very complex, such as the analysis of brain images or genome data, and new methodology (such as data mining) is being developed for large data sets. The computational aspect of statistics is thus becoming more and more important, but of course mathematics continues to be the foundation of statistics.

Statistics has many application areas and in particular the laboratory includes several researchers in biostatistics. StatsLab members include the leaders of the Quebec school of statistics, who work on topics such as statistical learning and neural networks, survey sampling, analysis of functional data, statistical analysis of images, dependence structures, Bayesian analysis, analysis of time series and financial data, and resampling methods.

Highlights

In 2020-2022, laboratory members received several awards, including:

Yoshua Bengio, title of Chevalier de la Légion d'honneur by the Government of France (2022); Princess of Asturias Award by the Government of Spain (2022);

Marzia Angela Cremona, Research Medal Award from the Faculty of Business Administration at Université Laval (2021);

Josée Dupuis, American Society of Human Genetics Mentorship Award (2020);

Christian Genest, Abel Gauthier Award from the Association mathématique du Québec (2020), an annual award that acknowledges significant original work and community involvement, aimed at improving education and fostering a greater interest in mathematics;

Shirin Golchi, FRQS Chercheurs-boursiers Junior 1 (2022);

Mireille Schnitzer, CRC tier 2 designation (2020), Association of Faculties of Pharmacy Canada New Investigator Research Award (2020);

David A. Stephens, SSC Gold Medal (2022).

Director

Erica E.M. Moodie (McGill)

Regular members

Mylène Bédard; Yoshua Bengio; Pierre Duchesne; David Haziza; Christian Léger; Florian Maire; Alejandro Murua; Bouchra Nasri; François Perron; Mireille Schnitzer (Montréal)

Bouchra Nasri (École de santé publique, Montréal)

Debbie J. Dupuis; Aurélie Labbe; Bruno Rémillard (HEC Montréal)

Yogendra P. Chaubey; Arusharka Sen (Concordia)

Belkacem Abdous; Alexandre Bureau; Anne-Sophie Charest; Ting-Huei Chen; Thierry Duchesne; Khader Khadraoui; Lajmi Lakhal Chaieb; Louis-Paul Rivest; Denis Talbot; Audrey-Anne Vallée (Laval)

Masoud Asgharian; Sahir R. Bhatnagar; Christian Genest; Shirin Golchi; Abbas Khalili; Erica E. M. Moodie; Johanna Nešlehová; Robert W. Platt; James O. Ramsay; Paramita Saha Chaudhuri; Alexandra M. Schmidt; Russell Steele; David A. Stephens; David B. Wolfson; Archer (Yi) Yang (McGill)

Taoufik Bouezmarni; Félix Camirand Lemyre; Klaus Herrmann; Éric Marchand (Sherbrooke)

Marie-Hélène Descary; Sorana Froda; Simon Guillotte; Fabrice Larribe; Geneviève Lefebvre; Brenda MacGibbon; Karim Oualkacha (UQAM)

Associate Members

Vahid Partovi Nia (Polytechnique Montréal)

Jean-François Coeurjolly (Grenoble Alpes)

Fateh Chebana (INRS)

Nadia Ghazzali (UQTR)

Erica E.M. Moodie

Prizes

The CRM has created and manages, either alone or in collaboration, five awards to recognize excellence in mathematical sciences research: the CRM-Fields-PIMS prize, awarded jointly with the two other Canadian mathematical institutes; the André Aisenstadt Prize for outstanding achievements by young Canadian mathematicians; the CAP-CRM Prize in Theoretical and Mathematical Physics with the Canadian Association of Physicists; the CRM-SSC Prize in Statistics for Young Researchers with the Statistical Society of Canada; the CRM-ISM-AMQ Prize for outstanding article in the Annales Mathématiques du Québec (AMQ), jointly with the Institut des sciences mathématiques and the AMQ editorial board.

CRM-Fields-PIMS Prize

The CRM-Fields-PIMS prize is the premier Canadian award for research achievements in the mathematical sciences. It is awarded jointly by the three Canadian mathematics institutes. The winner receives a monetary award and an invitation to present a lecture at each institute within one year after the award is announced.

The prize recognizes exceptional achievement in the mathematical sciences. It was established by the Centre de recherches mathématiques (CRM) and The Fields Institute as the CRM-Fields prize in 1994. In 2005, the Pacific Institute for the Mathematical Sciences (PIMS) became an equal partner in awarding the prize. The name changed to the CRM-Fields-PIMS prize, the award level increased, and the terms of reference were revised. The winner is selected by a committee appointed by the three institutes.

2021 CRM-Fields-PIMS Prize

Andrew Granville

The 2021 CRM-Fields-PIMS Prize was awarded to Andrew Granville, Professor in the Department of Mathematics and Statistics at the Université de Montréal, for his outstanding achievements in the mathematical sciences. Professor Granville's influence is measured only in part by his important research and mentoring contributions; just as essential are his love for his subject matter, his boundless energy and creativity, and his enthusiasm in communicating the beauty of mathematics to others.

Andrew Granville's broad range of accomplishments include tackling questions in arithmetic geometry, Diophantine approximation, algorithmic and cryptographic aspects, and his deep contributions to analytic number theory. A charismatic communicator, he is widely sought after as a speaker for diverse audiences. Professor Granville has more than 160 published papers to his credit, many of which appear in the field's top journals. He has also written numerous textbooks and lecture notes. The range of his writing talent extends to a theatrical play and a widely acclaimed graphic novel that explores mathematical themes.

Andrew Granville has played a significant leadership role in Canadian mathematics since obtaining his PhD from Queens University in 1987. In 2002, he joined the Department of Mathematics and Statistics at the Université de Montréal as a senior Canada Research Chair. His presence has had a galvanizing effect on the Montreal mathematics community, in particular. The list of graduate students and postdocs he has trained in his career reads like a who's who amongst the younger generation of leading analytic number theorists, including several prominent female mathematicians.

Professor Andrew Granville gave his prize lecture on December 2, 2021, in hybrid format.

Andrew Granville

Alex Tran for Quanta Magazine

2022 CRM-Fields-PIMS Prize

Bálint Virág

The 2022 CRM-Fields-PIMS prize was awarded to Bálint Virág of the University of Toronto for outstanding contributions to mathematical research in the field of probability.

Bálint Virág obtained his PhD from the University of California at Berkeley in 2000, after which he was a Moore Instructor at the Massachusetts Institute of Technology, before joining the University of Toronto in 2003 as a Canada Research Chair. He was awarded the Rollo Davidson Prize in probability, the Coxeter-James Prize in 2010 and the John L. Synge Award of the Royal Society of Canada in 2014. Professor Virág was an invited speaker at the International Congress of Mathematicians in 2014.

Bálint Virág's research spans a wide range of areas of probability, including random matrix theory, Kardar-Parisi-Zhang (KPZ) universality, and random sorting networks. Professor Virág has an outstanding record of training students and postdoctoral fellows. Many of them have gone on to become leaders in the field of probability.

Professor Bálint Virág's prize lecture took place via Zoom on October 7, 2022.

Bálint Virág

André Aisenstadt Prize in Mathematics

Created in 1991, the André Aisenstadt Prize in Mathematics, which includes a monetary award and a medal, recognizes outstanding research results in pure or applied mathematics by a young Canadian mathematician.

2020 André Aisenstadt Prize

Robert Haslhofer and Egor Shelukin

Robert Haslhofer is an Assistant Professor in the Department of Mathematics at the University of Toronto since 2015. He obtained his PhD in 2012 at the Swiss Federal Institute of Technology in Zurich. Professor Haslhofer was then a Courant Instructor at the Courant Institute of Mathematical Sciences. His research interests are centered around Geometric Analysis, Differential Geometry, Partial Differential Equations, Calculus of Variations, Stochastic Analysis, General Relativity. His research is currently supported by an NSERC Discovery Grant and a Sloan Research Fellowship.

Robert Haslhofer delivered his prize lecture on January 22, 2021.

Robert Haslhofer

Egor Shelukin

Egor Shelukhin is an Assistant Professor in the Department of Mathematics and Statistics at the Université de Montréal. He obtained his PhD in 2012 from Tel Aviv University under the supervision of Leonid Polterovich. Shelukhin was then a CRM-ISM Postdoctoral Research Fellow from 2012 to 2014. He spent the Spring semester of 2014 at the Hebrew University of Jerusalem and the Summer of 2015 at Université Lyon 1 Claude Bernard. Shelukhin was a Fellow at Institut Mittag Leffler in September 2015. From 2015 to 2017 he was a member at the School of Mathematics of the Institute for Advanced Study, Princeton. His work is centered around Symplectic Topology, Contact Topology and Geometric Analysis.

Egor Shelukhin delivered his prize lecture on February 5, 2021.

2021 André Aisenstadt Prize

Tristan C. Collins and Giulio Tiozzo

Tristan Collins is an Assistant Professor in the Department of Mathematics at MIT. He was previously Benjamin Peirce Assistant Professor at Harvard University. He studied mathematics at the University of British Columbia, where he worked with Malabika Pramanik. He then obtained his doctorate under the supervision of D. H. Phong at Columbia University. His research interests include geometry and analysis, in particular geometric flows, as well as applications of algebraic geometry to analysis and vice versa. He was awarded a Sloan Fellowship in 2018.

Giulio Tiozzo

Collins' prize lecture took place via Zoom on November 19, 2021.

Giulio Tiozzo is an Assistant Professor of Mathematics at the University of Toronto. He received his PhD from Harvard in 2013, under the supervision of C.T. McMullen. Before joining the University of Toronto, he was Gibbs Assistant Professor at Yale University, and in 2018 he was awarded the Alfred P. Sloan Fellowship. His research area is dynamical systems and ergodic theory, with applications to complex analysis, probability and geometric group theory.

Tiozzo's award lecture took place in hybrid format on October 15, 2021.

Tristan C. Collins

2022 André Aisenstadt Prize

Yevgeny Liokumovich

The 2022 André Aisenstadt Prize was awarded to Yevgeny Liokumovich (Toronto) for his numerous and fundamental contributions to geometric analysis, in particular his proof with F. Marques and A. Neves of a famous conjecture due to Gromov providing an appropriate Weyl Law for the volume spectrum of general Riemannian manifolds.

Professor Liokumovich obtained his PhD in 2015 at the University of Toronto under the supervision of Alex Nabutovsky and Regina Rotman. After several postdoctoral fellowships at top institutions in his area — Imperial College of London, MIT and IAS, he returned to a tenure-track Assistant Professorship at the University of Toronto in 2019. His research interests are centered in geometric analysis. Professor Liokumovich was one of the two 2020 Nirenberg lecturers in geometric analysis at the CRM, and he was awarded a Sloan Fellowship in 2021.

Yevgeny Liokumovich

CAP-CRM Prize

The Centre de recherches mathématiques (CRM) and the Canadian Association of Physicists (CAP) created, in 1995, on the occasion of the 50th anniversary of the CAP, a joint prize in recognition of exceptional achievements in theoretical and mathematical physics.

2021 CAP-CRM Prize

Robert Raussendorf

The CAP-CRM Prize in Theoretical and Mathematical Physics 2021 was awarded to Robert Raussendorf, University of British Columbia, in recognition of his distinguished contributions to the theory of quantum computing, including his groundbreaking work on measurement-based or "one-way" quantum computing, fault-insensitive quantum computing and numerically universal phases of quantum matter.

Professor Raussendorf has made many fundamental contributions to the theory of quantum computation. He proposed a new technique, the "one-way" or measurement-based quantum computer, which is considered one of the few viable paths to physical quantum computers. He developed a scheme for fault-tolerant quantum computation and identified a numerically universal phase of quantum matter.

Robert Raussendorf leads the Quantum Computing Grand Challenge funded by the Stewart Blusson Quantum Matter Institute at the University of British Columbia.

The prize lecture by Professor Raussendorf, delivered via Zoom, was held on April 8, 2022.

Robert Raussendorf

CRM-SSC Prize

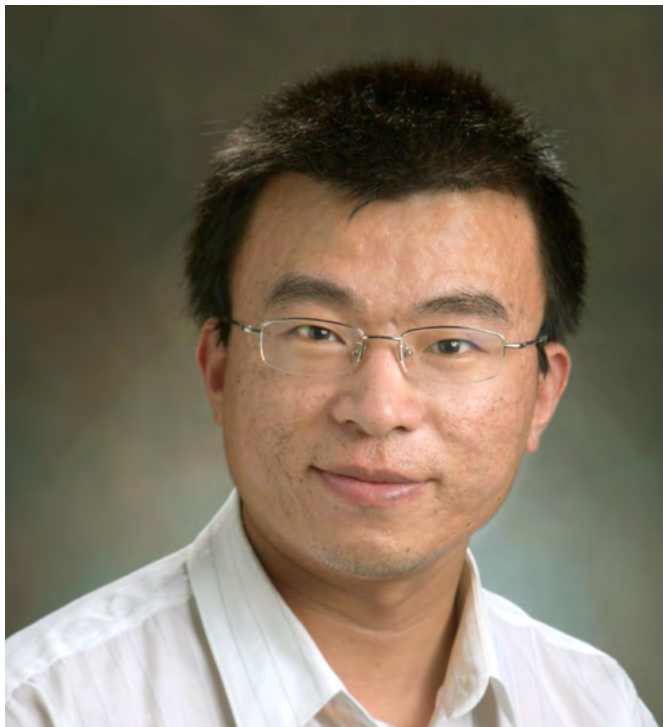
The CRM and the Statistical Society of Canada (SSC) award the CRM-SSC Prize in recognition of a statistical scientist's professional accomplishments in research during the first fifteen years after having received a doctorate.

2021 CRM-SSC Prize

Jiguo Cao

The CRM-SSC 2021 prize was awarded to Jiguo Cao "for outstanding developments in modeling and analysis of functional data and dynamic systems; for broad work in numerous applications with special focus on statistical genetics; and for remarkable aptitude for creating and nurturing productive collaborations, particularly involving students and post-doctoral fellows."

Jiguo Cao is Professor and Canada Research Chair in the Department of Statistics and Actuarial Sciences at Simon Fraser University. Jigua Cao obtained his doctorate in statistics from McGill University, under the supervision of James O. Ramsay, and then spent a year as a postdoctoral fellow in biostatistics at Yale University's School of Public Health.



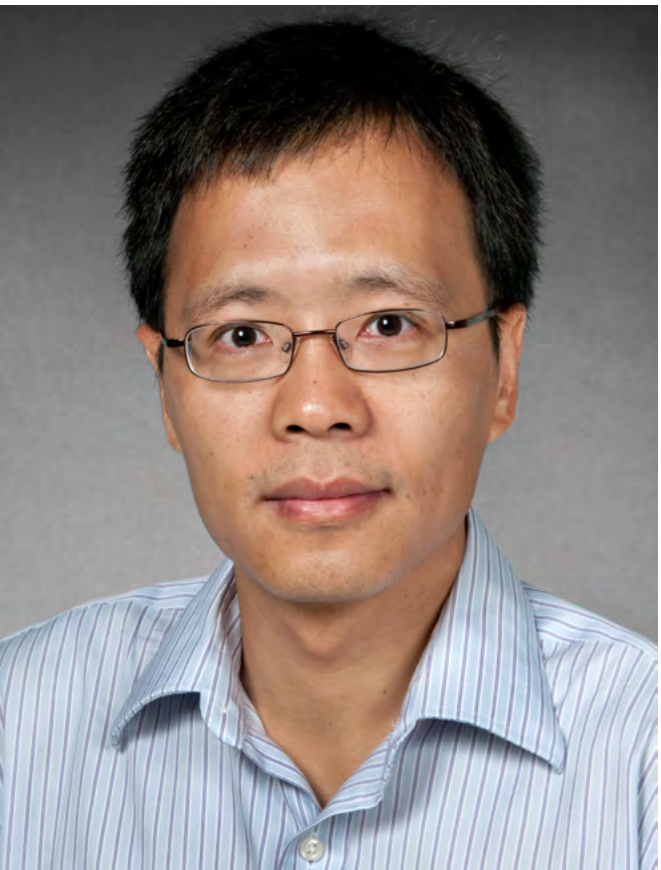
Jiguo Cao

2022 CRM-SSC Prize

Pengfei Li

Pengfei Li was awarded the CRM-SSC Prize in statistics “for ground-breaking and pioneering research contributions to the EM-test for the order of finite mixture models; for original and creative methodological developments in the areas of the empirical likelihood, density ratio models, statistical genetics, non-probability sampling; for exceptional research productivity; and excellence in statistical education.”

Pengfei Li has been a full professor in the Department of Statistics and Actuarial Science at the University of Waterloo since 2019. He is an internationally renowned researcher in the fields of finite mixture models, empirical likelihood, density ratio modeling, capture-recapture problems and non-probabilistic survey samples.



Pengfei Li

The CRM-ISM-AMQ Prize

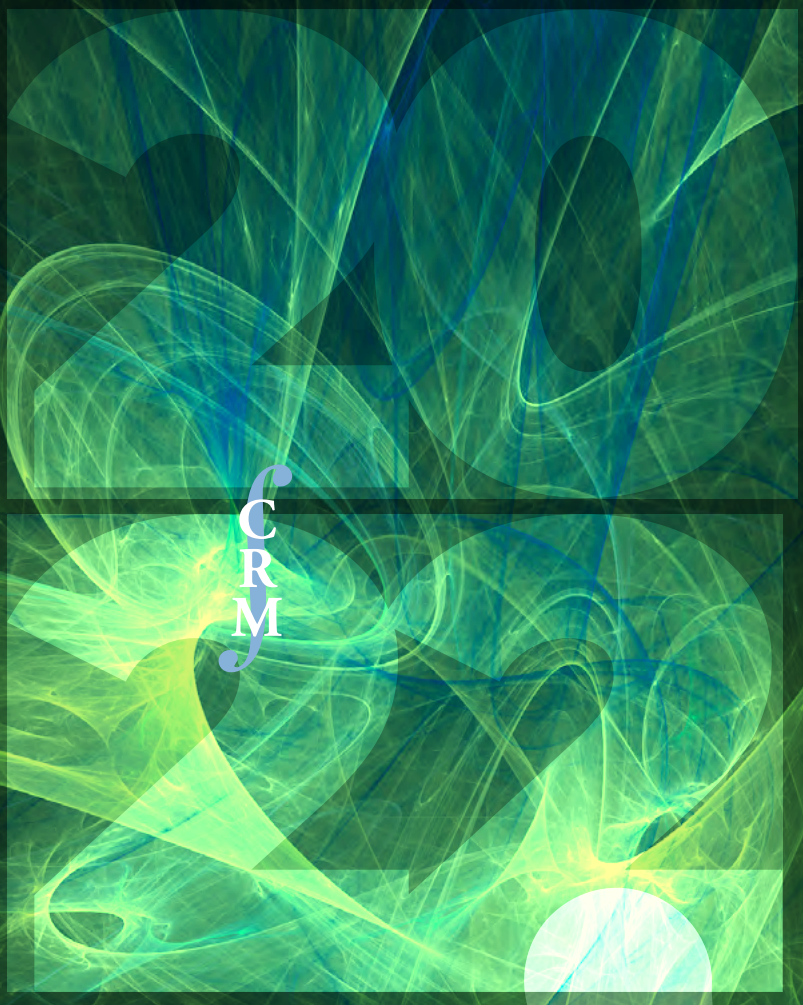
The CRM-ISM-AMQ prize is awarded annually for an outstanding publication in the Annales mathématiques du Québec (AMQ). The prize was created in collaboration between the Centre de recherches mathématiques, the Institut des sciences mathématiques and the AMQ.

The goal of the Annales mathématiques du Québec (formerly: Annales des sciences mathématiques du Québec) is to be a high level journal publishing articles in all areas of pure mathematics, and sometimes in related fields such as applied mathematics, mathematical physics and computer science. The journal was founded in 1977 and in 2013 it became a Springer journal.

2021 CRM-ISM-AMQ Prize

Francesco Amoroso and Sinnou David

For their article Covolumes, unités, régulateur : conjectures de D. Bertrand et F. Rodriguez-Villegas



Training

The CRM's mandate is to encourage the development of mathematical research at all levels. It therefore contributes to the training of young researchers, the promotion of mathematical research and the development of mathematics teaching. Almost all CRM activities in this field are organized jointly with the Institut des sciences mathématiques (ISM), which was created in 1991 and has eight partner universities: Bishop's University, Concordia University, McGill University, Université de Montréal, UQAM, UQTR, Université de Sherbrooke and Université Laval. The ISM receives financial support from its partner universities and the Quebec Ministry of Education. The ISM's mission is to coordinate and harmonize graduate programs in mathematics, to support excellence in training through scholarships and prizes, and to stimulate the interest of youth in the mathematical sciences (in particular by disseminating mathematical knowledge to teachers, young people and the general public). The ISM was directed by Professor Olivier Collin of UQAM until the end of 2021, and since then by Professor Iosif Polterovich of the Université de Montréal.

CRM-ISM Postdoctoral Fellowships

CRM-ISM Postdoctoral Fellowships are awarded to promising researchers who have recently obtained or are about to obtain a PhD in the mathematical sciences, enabling them to devote most of their time to their research work at the CRM and partner institutions. The program is highly competitive. Postdoctoral fellows collaborate with established researchers, contribute new ideas and can organize working groups on cutting-edge topics.

Antonio Alfieri (Central European)

Research area: Geometry and topology

Supervision: Steven Boyer, Olivier Collin, Duncan McCoy (UQAM)

Semen Artamonov (Rutgers)

Research area: Mathematical physics

Supervision: Marco Bertola, John Harnad, Dmitry Korotkin (Concordia)

Lea Beneish (Emory)

Research area: Algebra and number theory

Supervision: Henri Darmon, Sarah Harrison (McGill)

Fabrizio Del Monte (SISSA)

Research area: Mathematical physics

Supervision: Marco Bertola, John Harnad, Dmitry Korotkin (Concordia)

Mathilde Gerbelli-Gauthier (Chicago)

Research area: Algebra and number theory

Supervision: Henri Darmon, Michael Lipnowski (McGill)

Blake Keeler (UNC, Chapel Hill)

Research area: Mathematical analysis

Supervision: Dmitry Jakobson, John Toth (McGill), Iosif Polterovich (Montréal)

Jonathan Love (Stanford)

Research area: Algebra and number theory

Supervision: Henri Darmon, Eyal Goren, Michael Lipnowski (McGill)

Gilles Parez (UC Louvain)

Research area: Mathematical physics

Supervision: Yvan Saint-Aubin, Luc Vinet, William Witczak-Krempa (Montréal)

George Shakan (Illinois, Urbana-Champaign)

Research area: Algebra and number theory

Supervision: Andrew Granville, Dimitris Koukoulopoulos (Montréal)

Vukasin Stojisavljevic (Tel Aviv)

Research area: Geometry and topology

Supervision: Octav Cornea, François Lalonde, Iosif Polterovich, Egor Shelukhin (Montréal)

Eric Stubley (Chicago)

Research area: Algebra and number theory

Supervision: Patrick Allen, Henri Darmon, Eyal Goren (McGill)

Ruiran Sun (Johannes Gutenberg)

Research area: Geometry and topology

Supervision: Steven Lu (UQAM), Julien Keller, Peter Russell (McGill)

Anudeep Surendran (QUT)

Research area: Applied mathematics in biosciences and medicine

Supervision: Morgan Craig (Montréal)

CRM-Laval Postdoctoral Fellowships

Ryan Gibara (Concordia)

Research area: Analysis

Supervision: Damir Kinzebulatov

Nishan Mudalige (Guelph)

Research area: Statistics

Supervision: Louis-Paul Rivest

Jiacheng Xia (Chalmers)

Research area: Arithmetic geometry

Supervision: Antonio Lei

CRM-uOttawa Postdoctoral Fellowships

Allan Merino (Lorraine)

Research area: Lie theory

Supervision: Hadi Salmasian

Iraj Yadegari (Sherbrooke)

Research area: Statistics

Supervision: Stacey Smith

CRM-Simons Postdoctoral Fellowships

As part of its partnership with the Centre de recherches mathématiques (CRM) and in response to the COVID-19 crisis, the Simons Foundation created the Simons Bridge for Postdoctoral Fellowships to provide additional funding to institutes to support one-year postdoctoral positions in the mathematical sciences. The CRM was allocated three fellowship positions starting in September 2021 and three positions starting in September 2022.

These twelve-month appointments were awarded to exceptional young researchers who had recently obtained or were expected to obtain a PhD in the mathematical sciences, and allowed the recipients to devote most of their time to research, under the supervision of a professor from one of the CRM member universities.

Clément Berthière (Tours)

Research area: Mathematical physics

Supervision: William Witczak-Krempa (Montréal)

Ruiyuan Chen (Illinois, Urbana-Champaign)

Research area: Mathematical logic and category theory

Supervision: Marcin Sabok, Anush Tserunyan (McGill)

Kevin Church (McGill)

Research area: Applied mathematics

Supervision: Jean-Philippe Lessard (McGill)

Undergraduate Summer Scholarships

Funded by the ISM and the Centre de recherches mathématiques, the Undergraduate Summer Scholarships give undergraduate students the opportunity to acquire research experience in a university or industrial environment while offering early career researchers the chance to gain experience in research supervision. Selected candidates carry out research under the supervision of a postdoctoral fellow, a doctoral student or an assistant professor affiliated with one of the ISM member universities.

2020

Laurent Alsène-Racicot (Montréal)

Supervision: Dmitry Faifman, Jun Zhang and François Lalonde

Project: Théorie de Morse

Selim Amar (McGill)

Supervision: Ibrahim Al Balushi and Gantumur Tsogtgerel

Project: Convergence of Discrete Exterior Calculus

Antoine Brillant (Montréal)

Supervision: Julien Gaboriaud and Luc Vinet

Project: Intrication and chaînes fermioniques

Éléonore Chamberland (Laval)

Supervision: Nicolas Doyen

Project: Étude d'un modèle décrivant l'évolution de la maladie d'Alzheimer

Kevin Constantineau (McGill)

Supervision: Kevin Church and Jean-Philippe Lessard

Project: Braids in the N-body problem

Ludovic d'Anjou-Madore (Montréal)

Supervision: Jean-Philippe Chassé and Octav Cornea

Project: Rudiments de la théorie de l'homotopie par le biais des catégories à modèles

Philippe Drouin (Laval)

Supervision: Pierre-Olivier Parisé and Thomas Ransford

Project: Problèmes de rendez-vous symétriques sur les graphes complets

Marc-Andrew Lavigne (Concordia)

Supervision: Ryan Gibara and Galia Dafni

Project: A functional analysis approach to atomic decomposition and two-star theorems

Tomer Moran (McGill)

Supervision: Fengrui Yang and Pengfei Guan

Project: Regularity estimates for the Monge-Ampere equation

Cunyuan Zhao (McGill)

Supervision: Dmitry Faifman and Dmitry Jakobson

Project: Study of Random Graphs

2021

Julie Alhosh (McGill)

Supervision: Brent Pym

Project: The Galois Action in Deformation Quantization

Rafael Arellano (Laval)

Supervision: Cédric Dion and Hugo Chapdelaine

Project: Théorie algébrique des nombres

Ismaël Bussière (Montréal)

Supervision: Julien Gaboriaud et Luc Vinet

Project: Intrication de fermions libres sur des graphes and q-polynômes de Krawtchouk

Jérôme Côté (Laval)

Supervision: Pierre-Olivier Parisé and Thomas Ransford

Project: Méthode de Cesàro appliquée à l'ensemble de Mandelbrot

Félix Gélinas (UQAM)

Supervision: Gabriel Frieden and Hugh Thomas

Project: Cones and Ping-Pong in Three Dimensions

Xavier Généreux (Montréal)

Supervision: Wanlin Li and Matilde Lalin

Project: The Northcott property for special values of L-functions over function fields

Martin Haddad (Montréal)

Supervision: Md Abdur Razzak and Robert Owen

Project: Fluid Mechanics

Alexander Kroiter (McGill)

Supervision: Mohammad Shirazi and Dmitry Jakobson

Project: Complex Analysis

Camille Larivière (Sherbrooke)

Supervision: Benjamin Blanchette and Thomas Brüstle

Project: Classification des groups simples finis

Sacha Morin (Montréal)

Supervision: Guy Wolf

Project: Machine Learning Models

Jacob Reznikov (McGill)

Supervision: Michael Albanese and Dmitry Jakobson

Project: Conformal covariant operators

Jeremy Schlitt (Concordia)

Supervision: Jake Chinis and Galia Dafni

Project: Applications of Fourier Analysis in Analytic Number Theory

Jean-Philippe Séguin (Laval)

Supervision: Félix Kwok

Project: Méthodes numériques pour le contrôle optimal

Heyang Song (McGill)

Supervision: Mohammed Shirazi and Paul Gauthier

Project: Universal functions of several complex variables with prescribed radial limits almost everywhere

Étienne Soucy (UQAM)

Supervision: Gabriel Frieden and Hugh Thomas

Project: Cones and Ping-Pong in Three Dimensions

Ria Stevens (McGill)

Supervision: Courtney Paquette and Elliot Paquette

Project: Neural Tangent Kernel-Based Loss Modeling of Neural Networks

Other Training Activities

CRM researchers supervise a large number of graduate students. In addition to the summer schools organized or financed by the CRM, the CRM regularly supports various student conferences in mathematics or statistics, including the Seminars on Undergraduate Mathematics in Montreal (SUMM), the Canadian Undergraduate Mathematics Conference (CUMC) and the Canadian Statistics Student Conference (CSSC).

The CRM recently created the Robert Langlands Endowment Fund, which provides funding for activities that promote the use of the French language. These activities include the École Langlands summer school.

The CRM took part in the 2022 edition of 24 heures de science with Frédéric Gourdeau's Grande Conférence. UNESCO's International Mathematics Day, held every year on March 14, is celebrated at the CRM, under the baton of Christiane Rousseau, with various activities around the theme «Mathematics for a Better World» in 2021 and Mathematics for Action: Supporting Science-Based Decision Making in 2022.

Partnerships

The CRM collaborates with many partners, both in and outside Quebec, in order to fulfill its mission of excellence in research and training.

Quebec Partners

The CRM is an inter-university research center made up of six institutional partners: Université de Montréal, Concordia University, Université Laval, McGill University, Université du Québec à Montréal, and Université de Sherbrooke. Its host institution, Université de Montréal, provides the CRM with its office space and an operating grant, and the support of the other partner universities consists mainly of support to the CRM laboratories.

The CRM collaborates actively with the Institut des sciences mathématiques (ISM) on all matters concerning the training of students and postdoctoral fellows, the promotion of mathematics education and research to the general public, and the relationship between universities, colleges, and schools. Other collaborations are those with IVADO, the Network for Computing and Mathematical Modeling (ncm2), and CIRANO. Sponsored by the Ministry of Finance of Québec, and carried out in collaboration with CIRANO, the EnAvantMath! initiative empowers the CRM in its efforts to foster and promote mathematics in Québec, whether in the field of education, of training or in the community.

Canadian Partnerships

At the Canadian level, the CRM is present in the forums where national science policies in the mathematical sciences are discussed, and organizes and supports research activities across the country. A specific budget is set aside each year to encourage the participation of Canadian students in CRM activities. The CRM is the only national institute in the mathematical sciences that operates in the two official languages of Canada.

The CRM coordinates certain activities with the Fields Institute for Research in Mathematical Sciences, the Pacific Institute for the Mathematical Sciences (PIMS), the Atlantic Association for Research in the Mathematical Sciences (AARMS), the Canadian Statistical Sciences Institute (CANSSI), the Banff International Research Station (BIRS), MITACS, the Canadian Mathematical Society (CMS), the Canadian Applied and Industrial Mathematics Society (CAIMS), the Statistical Society of Canada (SSC), and the Canadian Association of Physicists (CAP). The Department of Mathematics and Statistics of the University of Ottawa has been a partner of the CRM since 2003.

FIELDS

PIMS

AARMS
Atlantic Association for Research in the Mathematical Sciences

CANSSI INCASS QUEBEC

BIRS

Mitacs

CMS SMC

CAIMS SCMAI

Société statistique du Canada
Statistical Society of Canada

Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

uOttawa

International Partnerships

The CRM is highly visible on the international scene. The main institutional collaborator of the CRM is the French National Centre for Scientific Research (CNRS), which has an International Research Laboratory (IRL) at the CRM, headed by Olivier Lafitte since 2019. The IRL provides financial support for visits of French researchers to the CRM, and the organization of meetings and workshops. Thanks to an agreement between the CNRS and the Fonds de recherche du Québec (FRQ), support from the FRQ also allows members of the CRM to visit France to collaborate with their French colleagues.

Another important international partner of the CRM is the Simons Foundation, which generously supports the Simons-CRM Scholar-in-Residence Program and supported the CRM-Simons Bridge for Postdoctoral Fellowships in 2021 and 2022.

The Mathematical Sciences Research Institute (MSRI) is a partner of the CRM and contributes to the organization of the Séminaire de mathématiques supérieures (SMS). Other international partners include the the Institut des Hautes Études Scientifiques (IHÉS), the Institut Henri Poincaré (IHP), the ALGANT (Algebra, Geometry and Number Theory) consortium of the Erasmus Mundus network, the Agencia Estatal Consejo Superior de Investigaciones Científicas (Spain), the Czech Technical University in Prague, and the Instituto Nacional de Matematica Pura e Aplicada (IMPA, Brazil).

CRM-CNRS International Research Lab

SIMONS FOUNDATION

2022

Publications

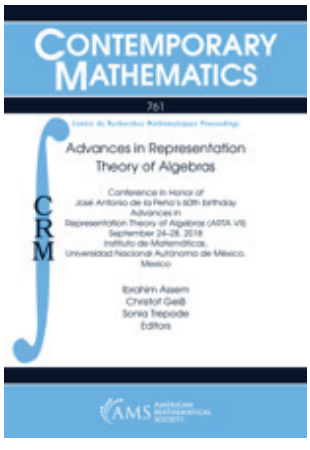
Publications are an essential part of the CRM's contribution to the dissemination of research in the mathematical sciences. Prestigious scientific book publishers, such as the American Mathematical Society and Springer, publish and distribute world-class books edited by the CRM.

Titles published between 2020 and 2022

CRM Proceedings (Contemporary Mathematics, AMS)

Advances in Representation Theory of Algebras

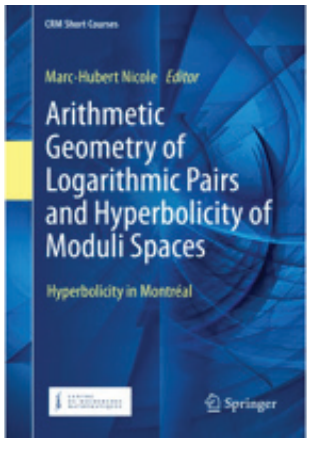
Editors:
Ibrahim Assem, Christof Geiß, Sonia Trepode; CONM/761, 2021



CRM Short Courses (Springer)

Arithmetic Geometry of Logarithmic Pairs and Hyperbolicity of Moduli Spaces: Hyperbolicity in Montréal

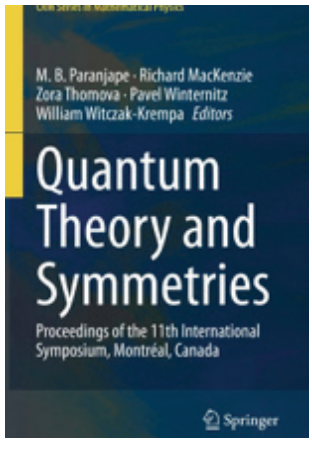
Editor:
Marc-Hubert Nicole; CRMSC, 2021



CRM Series in Mathematical Physics (Springer)

Quantum Theory and Symmetries (Proceedings of the 11th International Symposium, Montreal)

Editors:
M. B. Paranjape, Richard MacKenzie, Zora Thomova, Pavel Winternitz, William Witczak-Krempa; 2021



COMMITTEES

CRM Committees

Governance and scientific committees

The CRM structure consists of a Board of Directors, an Assembly of Members, an International Scientific Advisory Committee, a Local Scientific Committee, a Management Committee, a Committee of Laboratory Directors, and an EDI Committee. Here are the members of these committees in 2020–2022 (except for the directors of the laboratories, already mentioned in a previous section).

Board of Directors

The Board of Directors comprises

- The Director (ex officio);
- A member of the Management Committee appointed by the Board for a two-year mandate;
- Two regular members appointed by the Assembly for three-year mandates, normally renewable once;
- A Laboratory Director, chosen by the Committee of Laboratory Directors, for a two-year term, normally renewable once;
- The Chair of the International Scientific Advisory Committee;
- A postdoctoral member;
- The Vice-Rector for Research of each of the CRM's six partner universities;
- Additional members appointed by the Board of Directors, with or without voting rights, from all sectors deemed relevant: business, industry, major Canadian or foreign research institutes or centers, and public service.

In 2020-2022, the Board was made up of Marie-Josée Hébert - Chair of the Board of Directors (Vice-Rector, Research, Université de Montréal), Christian Agbobli (Vice-Rector, Research, UQAM), Vincent Aimez (Vice-Rector, Partnerships, Université de Sherbrooke), Benoit Boulet (Associate Vice-Principal, Research, McGill University), Paula Wood-Adams (Vice-President, Research, Concordia University), Serge Desnoyers (Assistant to the Vice-Rector, Research, Université Laval), Frédéric Bouchard (Dean of the Faculty of Arts and Sciences, Université de Montréal), Dusa McDuff (Chair of the International Scientific Committee), Luc Vinet (CRM Director, 2020-2021), Octav Cornea (CRM Director, 2021-2022), Olivier Collin (ISM Director, 2020-2021), Iosif Polterovich (ISM Director, 2021-2022), Véronique Hussin (CRM Deputy Director, 2020-2021), Michael Lau (Laval), Franco Saliola (UQAM).

International Scientific Advisory Committee

The International Scientific Advisory Committee (ISAC) is made up of leading researchers from Canada and abroad. Its members are mathematicians or researchers with close ties to the mathematical sciences. The Committee's main task is to make recommendations and advise the CRM on its general scientific orientation and proposed medium and long term scientific activities.

In 2020-2022, the Committee was chaired by Dusa McDuff (Columbia), and also included Afonso S. Bandeira (ETH Zurich), Lia Bronsard (McMaster), Ruth Charney (Brandeis), Octav Cornea (CRM Director, 2021-2022), Miranda Holmes Cerfon (NYU), Olivier Lafitte (IRL CRM-CNRS Director), Javad Mashreghi (CMS President, Laval), Sylvie Méléard (Polytechnique, Saclay), Robert Pego (Carnegie Mellon), Jeremy Quastel (Toronto), Dana Randall (Georgia Tech), Nicolai Reshetikhin (UC Berkeley), Emmanuel Ullmo (IHES), Michael Ward (UBC) and Luc Vinet (CRM Director, 2020-2021).

Local Scientific Committee

In 2020-2022, the local scientific committee was made up of Rustum Choksi (McGill, 2020-2021), Octav Cornea (CRM Director, 2021-2022), Christian Genest (McGill University, 2021-2022), Alexandre Girouard (Laval, 2020-2021), Niky Kamran (McGill), Matilde Lalìn (Montréal), Hugh Thomas (UQAM, 2020-2021), and Luc Vinet (CRM Director, 2020-2021).

Management Committee

In 2020-2021, this committee was made up of Luc Vinet (CRM Director, Montréal), Véronique Hussin (Deputy Director, Communications and Publications, Montréal), Jean-Philippe Lessard (Deputy Director, Scientific Programs, McGill), Manuel Morales (Deputy Director, Partnerships, Montréal), and Louise Poirier (Deputy Director, Numeracy, Montréal).

In 2021-2022 the members were: Octav Cornea (CRM Director, Montréal), Alexandre Girouard (Deputy Director, Scientific Programs and Publications, Laval), Manuel Morales (Deputy Director, Partnerships, Montréal), and Louise Poirier (Deputy Director, Numeracy, Montréal).

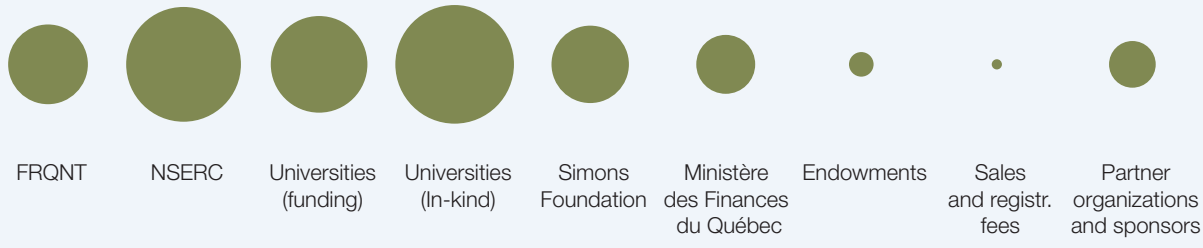
Equity, Diversity and Inclusion Committee

This committee began work in 2020. These members participated in committee deliberations during 2020-2022: Alexandre Girouard (Chair, Laval), Rosalie Bélanger-Rioux (McGill), Broderick Causley (McGill), Rustum Choksi (McGill), Ryan Gibara (Concordia), Véronique Hussin (Montréal), Matilde Lalín (Montréal), Josée Leclerc (CRM), and Alina Stancu (Concordia).

The CRM in Numbers

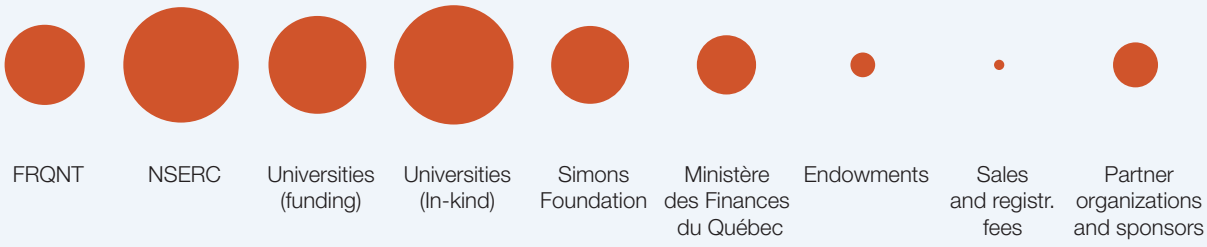
Sources of funding in 2020-2021 in thousands of $

FRQNT	**$ 610**
NSERC	**$ 1,264**
Universities (funding)	**$ 896**
Universities (In-kind)	**$ 1,350**
Simons Foundation	**$ 575**
Ministère des Finances du Québec	**$ 333**
Endowments	**$ 58**
Sales and registr. fees	**$ 10**
Partner organizations and sponsors	**$ 209**
	$ 5,305



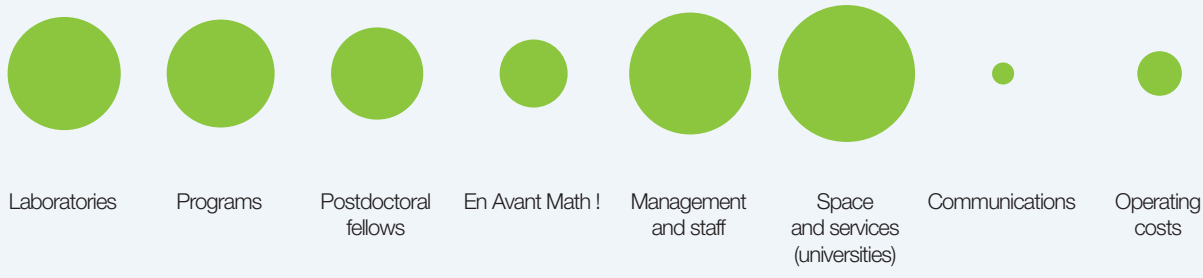
Sources of funding in 2021-2022 in thousands of $

FRQNT	**$ 610**
NSERC	**$ 1,264**
Universities (funding)	**$ 908**
Universities (In-kind)	**$ 1,350**
Simons Foundation	**$ 575**
Ministère des Finances du Québec	**$ 333**
Endowments	**$ 58**
Sales and registr. fees	**$ 10**
Partner organizations and sponsors	**$ 192**
	$ 5,301



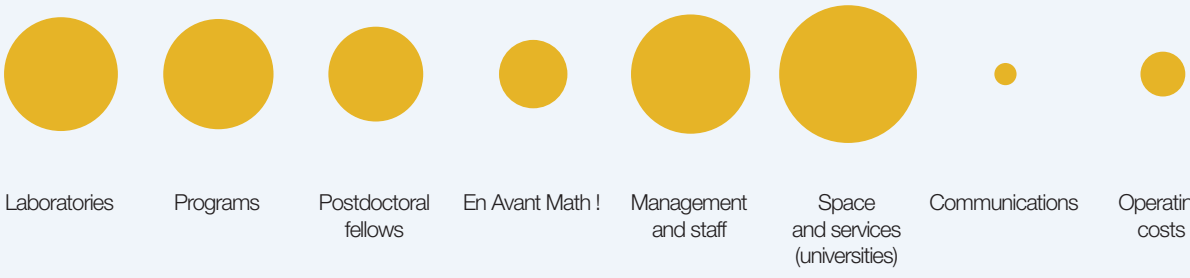
Use of sources in 2020-2021 in thousands of $

Laboratories	$ 922
Programs	$ 839
Postdoctoral fellows	$ 612
En Avant Math !	$ 333
Management and staff	$ 1,070
Space and services (universities)	$ 1,350
Communications	$ 35
Operating costs	$ 143
	$5,305

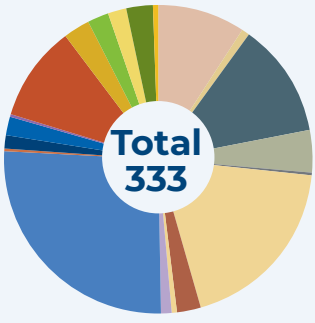


Use of sources in 2021-2022 in thousands of $

Laboratories	$ 922
Programs	$ 865
Postdoctoral fellows	$ 640
En Avant Math !	$ 333
Management and staff	$ 1,012
Space and services (universities)	$ 1,350
Communications	$ 35
Operating costs	$ 143
	$ 5,301

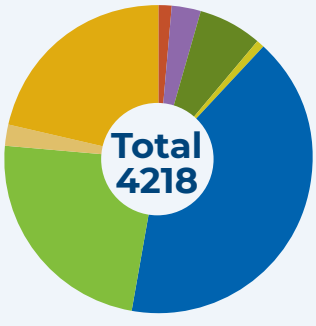


Affiliation of regular and associate members (researchers) of the CRM and its laboratories, 2020-2022



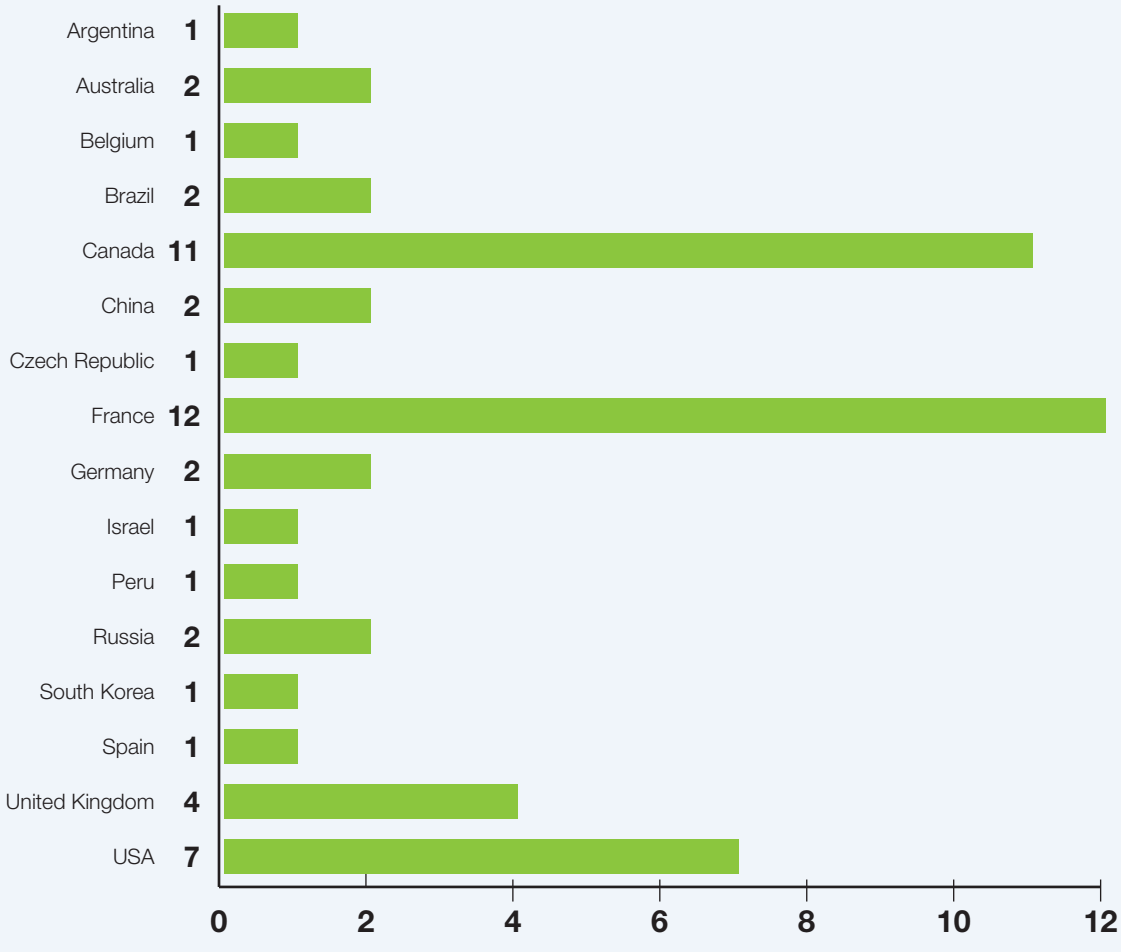
Université Laval	30
Université du Québec à Trois-Rivières	3
Université du Québec à Montréal	40
Université de Sherbrooke	14
Université de Montréal	1
Université de Montréal	63
Université d'Ottawa	9
Queen's University	1
Québec, Cégeps	4
McGill University	87
INRS	1
HEC Montréal	5
École Polytechnique de Montréal	6
École de technologie supérieure	1
Concordia University	33
Other, France	10
Other, Europe	7
Other, USA	6
Other, Canada	10
Other (World)	2

Geographical origin of participants in thematic programs, workshops, conferences and schools, 2020-2022

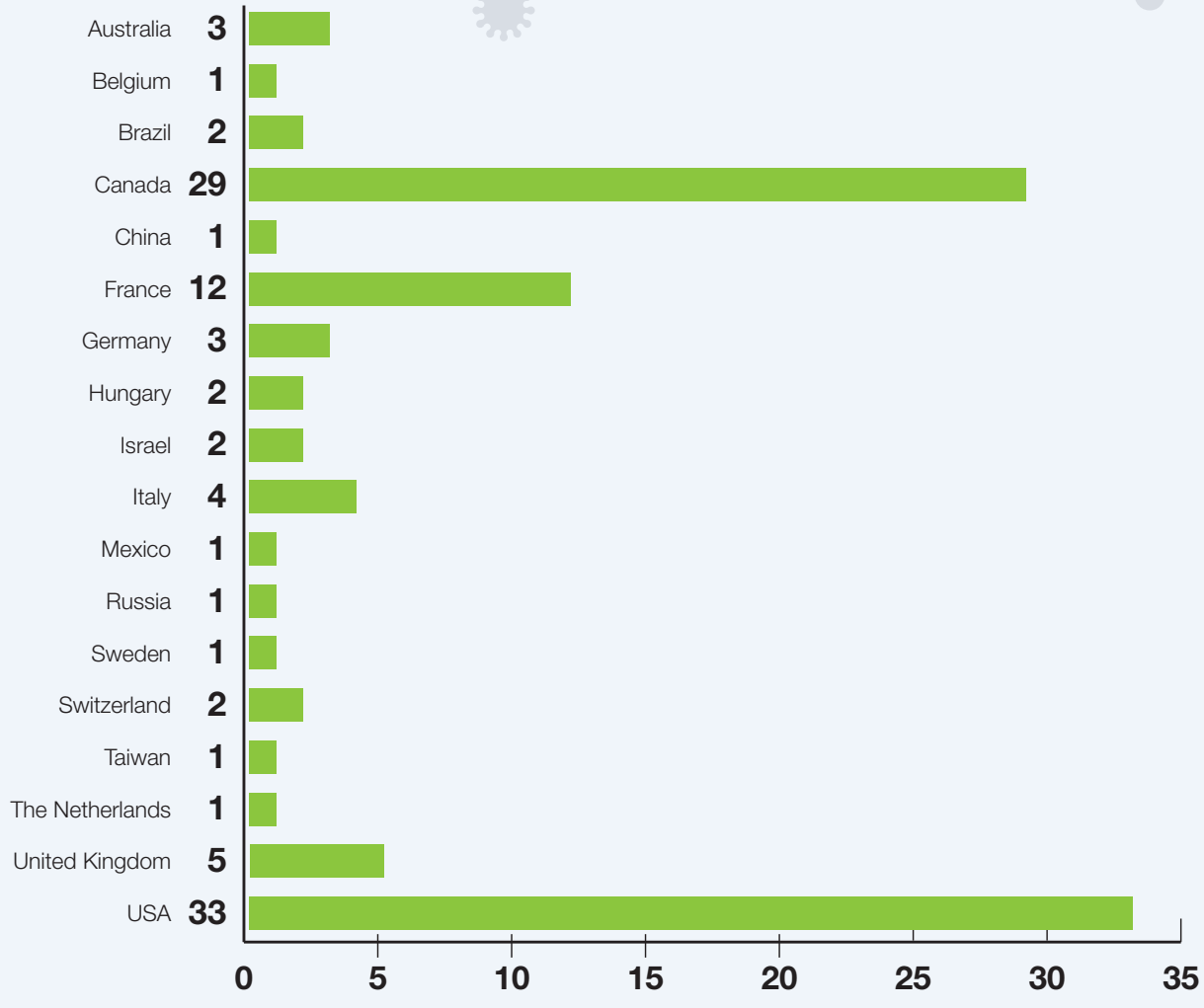


Africa	52
Americas (other)	129
Asia	286
Austtralia and N.Z.	26
Canada	1729
Europe	996
Middle East	87
USA	913

Number of visiting researchers (minimum one-month stay), 2020-2022 (51)



Number of postdoctoral researchers by country of PhD, 2020-2022 (104)



CRM Executive and Staff

Executive

Luc Vinet Université de Montréal	Director *(until June 30, 2021)*
Octav Cornea Université de Montréal	Director *(from July 1, 2021)*
Louise Poirier Université de Montréal	Deputy Director – Numeracy initiative
Jean-Philippe Lessard McGill University	Deputy Director – Scientific programs *(until June 30, 2021)*
Véronique Hussin Université de Montréal	Deputy Director – Publications and communications *(until August 31, 2021)*
Manuel Morales Université de Montréal	Deputy Director – Partnerships *(until December 31, 2021)*
Alexandre Girouard Université Laval	Deputy Director – Scientific programs and publications *(from July 1, 2021)*
Andrew Granville Université de Montréal	Special Advisor – Strategy *(from July 1, 2021)*
Odile Marcotte Université du Québec à Montréal	Special Advisor – Partnerships *(from February 1, 2022)*
Benoit Durand-Jodoin	Deputy Director – Administration *(from February 1, 2022)*

Administration & Research Support

Vincent Masciotra	Head of administration *(until January 31, 2022)*
Hernando Naranjo	Financial officer *(until Matrch 18, 2022)*
Diane Brûlé-de Filippis	Administrative technician
Rhode Sénide Ménard	Administrative technician *(from June 2, 2021)*
Fatou Diouf	Administrative coordinator *(from January 1, 2022)*
Liliane Antoinette	Secretarial assistant

Scientific Events

Virginie Leduc	Scientific activities coordinator
Guillermo Martinez-Zalce	Administrative coordinator
Sakina Benhima	Administrative coordinator
Chantal Thibodeau	Administrative technician *(until September 14, 2020)*
Flore Lubin	Administrative technician *(from December 1, 2020)*

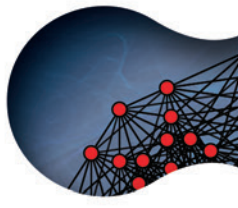
Communications & Publications

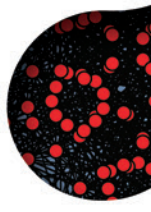
Josée Leclerc	Principal coordinator *(until July 24, 2021)*
Vincent Masciotra	Principal coordinator *(from February 1, 2022)*

IT Systems

Ricardo Briceno	IT Advisor
Madid Rahani	Computer analyst *(from August 17, 2020)*

The CRM thanks the following organizations whose support makes the center's programs and activities possible: NSERC (Natural Sciences and Engineering Research Council of Canada), FRQNT (Fonds de recherche du Québec - Nature et technologies), the Simons Foundation, the Quebec Ministry of Finance, and the NSF (National Science Foundation). The CRM also receives strong support from its host institution, Université de Montréal, and its partner universities: Concordia University, Université Laval, McGill University, Université du Québec à Montréal and Université de Sherbrooke. In addition, endowment funds have been established thanks to the generosity of André Aisenstadt, Robert Langlands, Serge Bissonnette and Jacques Courtois.





CENTRE
DE RECHERCHES
MATHÉMATIQUES

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