CENTRE DE RECHERCHES MATHÉMATIQUES

Le Bulletin du CRM

Publié depuis juin 1990, semestriel
Volume 27, numéro 1, Printemps/Spring 2021

Recent Aisenstadt Chairs
Wieslawa Niziol
(CNRS, IMJ-PRG, Sorbonne Université)
Page 24
Nicolas Bergeron (École Normale Supérieure)
Page 26

SEMESTRE THÉMATIQUE

Probabilités et EDP

Janvier à juillet 2022
January-July 2022

page 6

En bref
At a glance

Le Bulletin du CRM

Volume 27, no 1
Printemps 2021

Le Bulletin du CRM est une lettre d'information à contenu scientifique, faisant le point sur les actualités du Centre de recherches mathématiques (CRM).

ISSN 1492-7659

L'idée de créer le Centre de recherches mathématiques s'est imposée dès 1968. Il est actuellement dirigé par Luc Vinet et a pour objectif de servir de centre national pour la recherche fondamentale en sciences mathématiques et leurs applications. Le CRM compte 13 laboratoires, il regroupe environ 300 membres et plusieurs boursiers postdoctoraux. De plus, le CRM accueille chaque année quantité de chercheurs pour des séjours de moyenne et de longue durée et reçoit un très grand nombre de participants du monde entier dans le cadre de sa programmation thématique, industrielle et multidisciplinaire.

On retrouve partout dans le monde de nombreux chercheurs ayant eu l'occasion de parfaire leur formation en recherche au CRM. Le CRM, en collaboration avec l'ISM, coordonne des cours de cycles supérieurs et joue un rôle prépondérant dans la formation de jeunes chercheurs. Le centre est un lieu privilégié de rencontres où tous les membres bénéficient de nombreux échanges et collaborations scientifiques.

Le CRM tient à remercier ses divers partenaires pour leur appui financier à sa mission : le Conseil de recherches en sciences naturelles et en génie du Canada, le Fonds de recherche du Québec- Nature et technologies, la National Science Foundation, la Fondation Simons, l'Université de Montréal, l'Université du Québec à Montréal, l'Université McGill, l'Université Concordia, l'Université Laval, l'Université d'Ottawa, l'Université de Sherbrooke, le réseau Mitacs, ainsi que les fonds de dotation André Aisenstadt, Serge Bissonnette et Robert Langlands.

Directrice d'édition : Véronique Hussin
Coordination : Josée Leclerc
Zahra Bensaddek
Conception graphique : Pierre Lavallée

Centre de recherches mathématiques
Université de Montréal
C.P. 6128, succ. Centre-ville
Montréal, QC. H3C 3J7
Téléphone : 514 343-7501
Courriel : CRM@CRM.UMontreal.CA

Le Bulletin est disponible à :

http://www.crm.umontreal.ca/docs/docBul_fr.shtml

ABONNEMENT/DÉSABONNEMENT
SUBSCRIBE/UNSUBSCRIBE
Veuillez compléter un bref formulaire à la page web :
Please fill a short form at :
http://crm.math.ca/bulletin/abonnement/

Abonnez-vous à nos pages sur les réseaux sociaux pour garder contact :
CRM_Montreal
Centre de recherches mathématiques
Centre de recherches mathématiques (CRM)
Activites CRM


Luc Vinet

MOT DU DIRECTEUR

MERCI et VIVE le CRM!

C'est la dernière fois que j'écris ce **mot du directeur.** En juillet prochain, Octav Cornea prendra ma relève. Le CRM bénéficiera énormément de son leadership. Je tiens à féliciter Octav de sa nomination et à le remercier chaleureusement de l'altruisme dont il fait preuve en acceptant ces responsabilités.

Ce n'est pas sans un peu de nostalgie que je regarde les quatorze ans que j'ai passés à diriger cet institut formidable qu'est le CRM. Les années 1993-1999 avec la consolidation du financement et les initiatives Réseau de Calcul et de Modélisation Mathématiques (rcm_2), Laboratoires Universitaires Bell, MITACS et la période 2013-2021 qui aura vu le programme Mathématiques de la Planète Terre, le développement de l'UMI/IRL du CNRS, la subvention du programme Simons, la création de nouveaux laboratoires, les célébrations du 50e anniversaire et l'avènement d'***En avant math***. Et surtout, au-delà de tout ça, les mathématiques nouvelles que le CRM a engendrées grâce à tous ses programmes et le réseau d'« anciens » étudiants et de postdocs qui forment une communauté forte et fière de son passage au CRM. On aura ainsi bien célébré la grandeur de l'esprit humain et travaillé à un monde meilleur.

Ce fut un très grand privilège d'avoir pu contribuer au développement du CRM et je suis très reconnaissant de tout ce qu'il m'a apporté surtout sur le plan humain. Une conviction m'habite : si le CRM connaît autant de succès, c'est parce qu'il est porté de manière indéfectible par une communauté très large de personnes engagées et de très grande qualité. Je tiens encore une fois à vous remercier toutes et tous le plus chaleureusement possible : amis, collègues, étudiants et postdocs, personnel administratif, organisateurs, visiteurs, dirigeants universitaires et d'instituts partenaires, personnes attachées aux organismes subventionnaires, membres des gouvernements et j'en oublie. Je voudrais aussi remercier ma femme et mes enfants qui dans l'ombre ont aussi contribué à la vitalité du CRM. Un très grand merci et longue vie au CRM!

THANKS and LONG LIVE THE CRM

It is the last time that I write this **Word from the Director.** *Next July, Octav Cornea will replace me. The CRM will much benefit from his leadership. I wish to congratulate Octav for his appointment and to thank him warmly for the altruism he is demonstrating by accepting these responsibilities.*

It is not without a bit of nostalgia that I look back at the fourteen years that I have spent at the helm of this fantastic institute that the CRM is. The years 1993-1999 with the securing of the funding and the initiatives Network for Computing and Mathematical Modelling (ncm_2), Bell University Labs, MITACS and the period 2013-2021 that saw the Mathematics of the Planet Earth program, the development of the CNRS UMI/IRL, the grant of the Simons Foundation, the creation of new Labs, the celebrations of the 50th anniversary and the advent of ***"En avant math"****. And moreover, beyond that, all the new mathematics that the CRM has generated through its many programs and the "Alumni" network of students and postdocs that now form a strong community that is proud of its unforgettable connection to the CRM. We have in that way celebrated the greatness of the Human spirit and worked towards a better world.*

It has been a huge privilege to be given the chance to contribute to the development of the CRM and I am very grateful for that and for all that the CRM has given me especially at the human level. I am convinced that if the CRM is having so much success, it is because it is solidly supported by a large community of committed and caring individuals of great distinction. Once again, I want to thank you all as warmly as possible: friends, colleagues, students and postdocs, administrative staff, organizers, visitors, academic leaders, members of partner organizations, people associated to funding agencies, members of governments and I am missing many. I also wish to thank my wife and my children, who have, in the background, also contributed to the vitality of the CRM. Once again many thanks and long live the CRM!

Le professeur Octav Cornea nommé prochain directeur du Centre de recherches mathématiques (CRM)

Le professeur Octav Cornea sera le prochain directeur du CRM, à partir du 1er juillet 2021, pour un mandat de quatre ans. Il suivra les traces du professeur Luc Vinet qui occupe ce poste depuis 2013 et qui écrit :

«Je me réjouis beaucoup d'avoir Octav Cornea comme successeur à la barre du CRM. En acceptant ces responsabilités, il fait preuve d'un altruisme qui l'honore. Je suis convaincu que le CRM poursuivra sa glorieuse histoire et excellera plus que jamais sous sa gouverne.»

Professeur au Département de mathématiques et de statistique de l'Université de Montréal depuis 2003, Octav Cornea, a obtenu son doctorat à l'Université de Rochester en 1993 et, en 1994, il est devenu Professeur des Universités à l'Université de Lille 1 où il est resté jusqu'en 2002. Il a été directeur de l'Institut des sciences mathématiques (2006-2009), directeur du Séminaire de Mathématiques Supérieures (2010-2019) et directeur adjoint du Centre de recherches mathématiques (2011-2014). Il travaille en géométrie et topologie, avec des contributions à la topologie algébrique, aux systèmes dynamiques et, ces 20 dernières années, principalement à la topologie symplectique. Il a été boursier Simons (2015-2016), membre de l'Institute for Advanced Study de Princeton (2015-2016), «Research Professor» au Mathematical Science Research Institute de Berkeley (2009) et conférencier invité au Congrès Inaugural de Mathématique des Amériques en 2013.

«Je remercie la communauté mathématique du Québec, et, en particulier, mon prédécesseur Luc Vinet, pour leur appui. C'est une période pleine de défis et de profonde restructuration, mais c'est aussi un âge d'or pour les sciences mathématiques et, ensemble, j'espère que nous allons pouvoir relever les opportunités qui en découlent.»

Octav Cornea

Professor Octav Cornea appointed next director of the Centre de recherches mathématiques (CRM)

Professor Octav Cornea has been appointed the next CRM director, effective July 1, 2021, for a four-year term. He will follow in the footsteps of Professor Luc Vinet who has held this position since 2013 and who writes:

"I am very happy that Octav Cornea will follow me at the helm of the CRM. By accepting these responsibilities, he demonstrates an altruism that honors him. I have no doubt that the CRM will continue its remarkable history and excel more than ever under his leadership."

Professor in the Department of Mathematics and Statistics of the Université de Montréal since 2003, Octav Cornea, obtained his doctorate at the University of Rochester in 1993 and, in 1994, he became Professor at the University of Lille 1, where he remained until 2002. He was director of the Institut des sciences mathématiques (2006-2009), director of the Séminaire de Mathématiques Supérieures (2010-2019) and deputy director of the Centre de recherches mathématiques (2011-2014). He works in geometry and topology, with contributions to algebraic topology, dynamical systems and, over the last twenty years, mainly to symplectic topology. He was a Simons Fellow (2015-2016), member of the Institute for Advanced Study in Princeton (2015-2016), Research Professor at the Mathematical Science Research Institute at Berkeley (2009) and invited speaker at the Inaugural Mathematical Congress of the Americas in 2013.

"I thank the Québec mathematical community, and, in particular, my predecessor Luc Vinet, for their support. It is a challenging time, of profound restructuring, but it is also a golden era for the mathematical sciences and, together, I hope we will be able to make the most of the ensuing opportunities."

Actions sous COVID

Le CRM a eu une année très chargée bien que plusieurs activités aient du être reportées ou modifiées. Grâce à plusieurs initiatives, l'impact du CRM sur la communauté s'avère plus important que jamais. Les contraintes dues à la COVID ont permis d'affiner les méthodes de prestation et de sensibilisation. Elles ont toutefois renforcé l'idée que les interactions en personne que les instituts favorisent sont absolument essentielles. Pour le programme général, certaines activités ont été organisées virtuellement. Par exemple, deux écoles d'été qui devaient se tenir à Vancouver (au PIMS) et à Montréal (au CRM) ont été transformées en OOPS (Online Open Probability School). La conférence Nirenberg en analyse géométrique a également eu lieu virtuellement en septembre. Le 10e atelier de résolution de problèmes de Montréal en mathématiques industrielles et l'atelier régional sur la théorie de Lie se sont aussi tenus en ligne. Plusieurs autres ateliers et écoles du programme général ont été reportés dans un proche avenir. De plus, le CRM a mis en place une nouvelle unité : le groupe CRM en épidémiologie et santé publique et il s'est associé aux autres instituts dans l'initiative Mathematics of COVID-19.

D'un autre côté, le centre de recherches a mis en place le comité équité, diversité et inclusion (EDI). Des efforts ont également été déployés qui ont été couronnés de succès pour permettre aux visiteurs qui étaient à Montréal d'utiliser physiquement les installations. Pour les non-Canadiens, une assistance soutenue a été fournie afin de s'assurer qu'ils obtiennent des visas et des permis de travail et qu'ils soient autorisés à entrer dans le pays. De nombreux laboratoires du CRM offrent des séances de tutorat régulières afin d'atténuer l'isolement des stagiaires. Le programme postdoctoral du CRM a été considérablement élargi (triplé) pour 2021-2022 afin de fournir des possibilités de transition en ces temps où les emplois sont devenus plus rares.

Optimisation, le semestre thématique hiver-printemps 2020 en mathématiques de la prise de décision a été gravement touché par les mesures de confinement dues à la COVID-19 qui ont débuté le 13 mars 2020 : seules 2 des 8 activités prévues ont eu lieu ; une activité a été annulée et cinq ont été reportées à 2021 avec quelques dates à déterminer. Eva Tardos de l'Université Cornell était la conférencière de la Chaire Aisenstadt pour ce programme.

Le CRM a eu la chance de tenir le semestre thématique en théorie des nombres avec un nombre assez important de jeunes chercheurs et de postdocs en résidence. Ces jeunes chercheurs ont passé tout le semestre à Montréal. En collaboration avec les organisateurs et l'Université de Montréal, un plan de mitigation a permis une collaboration intensive en personne. Cela a offert à ces chercheurs une opportunité exceptionnelle en ces temps difficiles, qui s'avèrera déterminante pour leur carrière.

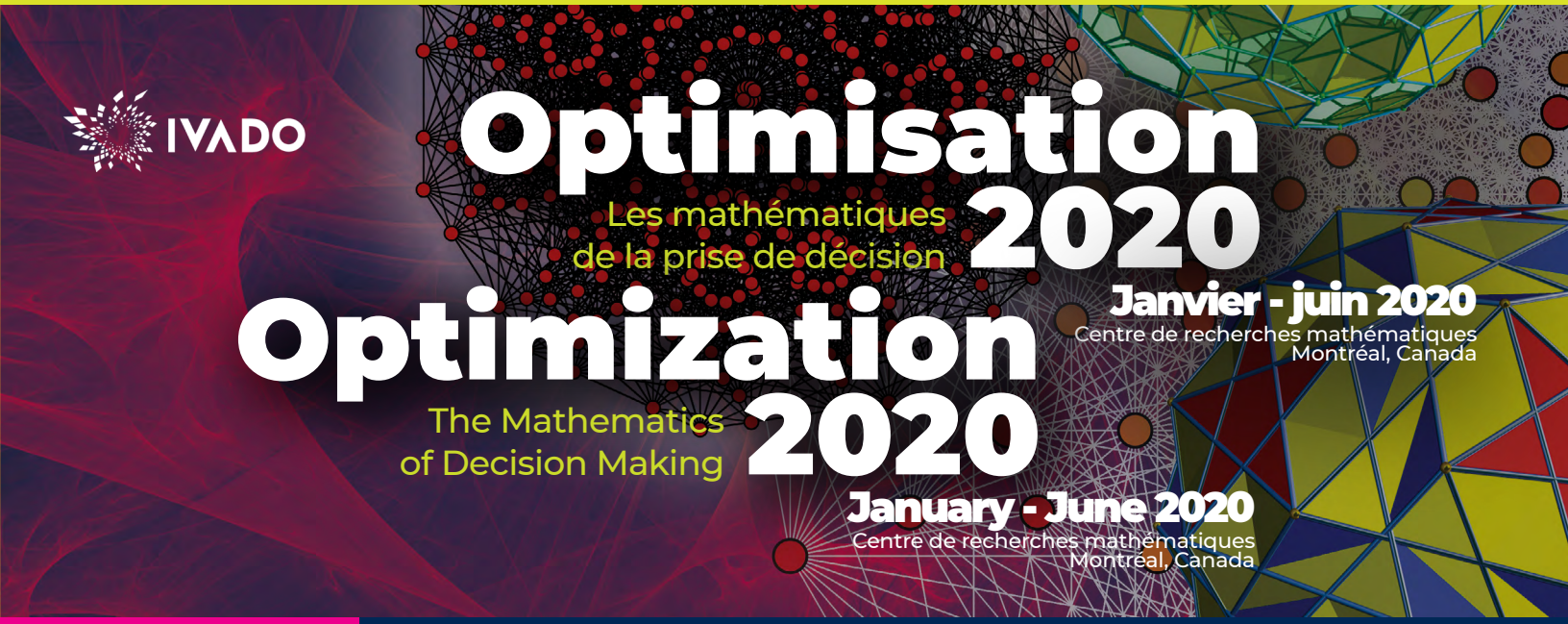
Actions under COVID

The CRM has had a very busy year although many activities have had to be postponed or modified. Through several initiatives, the impact of the CRM on the community is proving to be more significant than ever. The constraints of COVID have allowed for the refinement of delivery and outreach methods. However, they have reinforced the idea that the face-to-face interactions that the institutes foster are absolutely essential. For the overall program, some activities were conducted virtually. For example, two summer schools that were to be held in Vancouver (at PIMS) and Montreal (at CRM) were transformed into the Online Open Probability School (OOPS). The Nirenberg Conference in Geometric Analysis was also held virtually in September. The 10th Montreal Problem Solving Workshop in Industrial Mathematics and the Regional Workshop on Lie Theory were also held online. Several other workshops and schools in the general program have been rescheduled for the near future. In addition, the CRM has established a new unit: the CRM group in Epidemiology and Public Health and has partnered with other institutes in the Mathematics of COVID-19 initiative.

On the other hand, the research center has established the Equity, Diversity and Inclusion (EDI) Committee. Successful efforts were also made to allow visitors who were in Montreal to physically use the facilities. For non-Canadians, continued assistance was provided to ensure that they obtained visas and work permits and were allowed to enter the country. Many CRM laboratories provide regular mentoring sessions to alleviate the isolation of trainees. The CRM postdoctoral program has been significantly expanded (tripled) for 2021-2022 to provide transitional opportunities in these times when jobs have become scarcer.

Optimization 2020 Winter-Spring Thematic Semester in the Mathematics of Decision Making was severely affected by the COVID-19 lockdown measures that started March 13, 2020: Only 2 of the 8 activities planned were held; one activity has been cancelled and five have been postponed to 2021 with some dates to be determined. Eva Tardos of Cornell University was the Aisenstadt Chair lecturer for this program.

The CRM was fortunate to hold the thematic semester in number theory with a fairly large number of young scholars and postdocs in residence. These young researchers spent the entire semester in Montreal. In collaboration with the organizers and the University of Montreal, a mitigation plan allowed for intensive in-person collaboration. This offered these researchers an exceptional opportunity in these difficult times, which will prove to be decisive for their careers.



EN COURS

SUITE DU SEMESTRE À L'AUTOMNE 2021

Les mathématiques de la prise de décision

(suite à l'automne 2021 – following Fall 2021)

Atelier
Optimisation sous incertitude

ORGANISATEURS / ORGANIZERS

Fabian Bastin (Université de Montréal)
Erick Delage (HEC Montréal)
Walter Rei (Université du Québec à Montréal)

Dates mises à jour : 27 septembre-1er octobre 2021
Cet atelier aura lieu en ligne.

L'objectif de cet atelier est de présenter certains des développements les plus récents associés à trois importants champs d'étude: optimisation stochastique combinatoire, méthodes de Monte Carlo, et optimisation robuste.

Workshop
Optimization under uncertainty

Updated dates: September 27-October 1, 2021
This workshop will be held online.

The purpose of this workshop is 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.

Atelier
Comportement des agents dans la théorie des jeux combinatoires

ORGANISATEURS / ORGANIZERS

Margarida Carvalho (Université de Montréal)
Patrice Marcotte (Université de Montréal)
Szilvia Papai (Concordia University)

Dates mises à jour : 16-18 novembre 2021
Cet atelier aura lieu en ligne.

L'atelier a pour but d'étudier les progrès récents portant sur des jeux de grande taille dotés de caractéristiques combinatoires, en mettant l'accent sur l'apprentissage du comportement des joueurs (préférences, fonctions d'utilité), un processus étroitement lié à la science des données et à l'apprentissage automatique. Il est donc naturel que les relations entre ces disciplines et l'optimisation soient au cœur de l'atelier. Les organisateurs souhaitent que les participants, ayant été exposés à des perspectives qui sont généralement abordées par des communautés de recherche distinctes, auront pu élargir leur connaissance d'un domaine en forte émergence.

Workshop
Agents behaviour in combinatorial game theory

Updated dates: November 16-21, 2021
This workshop will be held online.

The aim of the workshop is 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.

Probabilités et équations aux dérivées partielles (EDP)

Probability and partial differential equations (PDE)

Les liens entre la théorie des probabilités, d'un côté, et des équations différentielles et intégrales, de l'autre côté, sont si nombreux et variés qu'il est presque impossible de les présenter de manière exhaustive et unifiée.

Mark Kac, 1951

L'interaction entre les équations différentielles et les probabilités est encore plus féconde aujourd'hui qu'au moment où Mark Kac a écrit les lignes ci-dessus, il y a près de 70 ans. Ce programme thématique est axé sur deux aspects de cette interaction.

Le premier objectif est de déterminer dans quelle mesure l'introduction d'aléa dans les EDP (par exemple, par le biais de conditions initiales aléatoires, d'environnements aléatoires ou d'un forçage aléatoire) affecte leur comportement à long terme. Ceci fournit des modèles physiques plus flexibles et réalistes pouvant expliquer une gamme plus large de comportements observés dans les systèmes physiques. De plus, pour certains systèmes, l'aléa est nécessaire pour la construction de modèles d'EDP raisonnables. C'est le cas des problèmes de contrôle stochastiques ou des approximations EDP pour les problèmes d'optimisation impliquant plusieurs agents avec des informations incomplètes ou imparfaites. Le deuxième aspect est la manière dont les probabilités et les EDP sont utilisées pour construire des modèles mathématiques de dynamiques de groupes, et sur l'interaction entre ces modèles. L'expression «dynamique de groupe» peut désigner, par exemple, la migration d'une espèce, la propagation d'un virus ou la propagation d'électrons à travers un milieu non homogène, pour ne citer que quelques exemples. Très souvent, les processus stochastiques peuvent être approximés par des EDP dans la limite de la grande population. Lorsque cela est démontré rigoureusement, cela permet de transmettre des informations entre les deux sujets mathématiques.

Activités du programme thématique

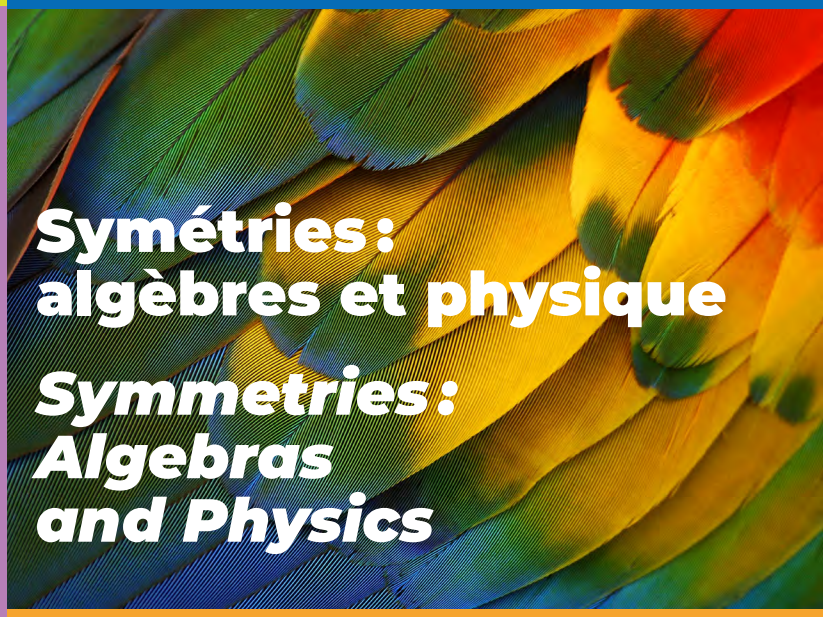
13-27 mars 2022
Atelier : Systèmes de particules et limites hydrodynamiques

10-17 avril 2022
Atelier : Jeux à champ moyen

1-15 mai 2022
Atelier : Systèmes de branchement, équations de réaction-diffusion et modèles de population

16-28 juin 2022
Atelier : Concepts unificateurs dans l'étude des EDP avec Aléa

JUILLET – DÉCEMBRE 2022
JULY – DECEMBER 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

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 focuses on two aspects of this interplay.

The first focus is 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 provides 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 is 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 ugh an inhomogeneous medium, to name a few examples. Very commonly, the stochastic process track the corresponding PDEs in the large-population limit. When this can be proved to hold, it allows for information to be passed between the two mathematical subjects.

Semester Workshops

March 13-27, 2022
Workshop: Interacting Particle Systems and Hydrodynamic Limits

April 10-17, 2022
Workshop: Mean-field games

May 1-15, 2022
Workshop: Branching systems, reaction-diffusion equations and population models

June 16-28, 2022
Workshop: Unifying concepts in PDEs with randomness

Organisateurs / *Organizers*

Louigi Addario-Berry (McGill University)
Jacob Bedrossian (University of Maryland)
Julien Berestycki (University of Oxford)
Paul Chleboun (University of Warwick)
Alessandra Faggionato (University La Sapienza)
Daniel Lacker (Columbia University)
Hubert Lacoin (IMPA)
Claudio Landim (IMPA)
Jessica Lin (McGill University)
Pascal Maillard (Université Paris-Sud)
Jean-Christophe Mourrat (École Normale Supérieure – Paris)
Sarah Penington (University of Bath)
Kavita Ramanan (Brown University)

Ce semestre thématique se concentre sur les progrès récents en algèbre, en théorie des représentations et dans certains domaines de la physique et de l'information quantique. Les fonctions spéciales peuvent intervenir pour faire des liens entre ces sujets.

Ce semestre consistera en six périodes de concentration d'un mois consacrées à la recherche actuelle sur des sujets de pointe; chacun comprendra des ateliers d'une ou deux semaines qui seront précédés d'un certain nombre de mini-cours préparatoires. Bien que chaque période ait sa propre personnalité, il y aura des liens tout au long du semestre qui devraient rendre l'ensemble du programme rigoureux, stimulant et excitant. Le semestre thématique sera lancé par l'organisation au CRM de la conférence internationale parrainée par le SIAM, intitulée « Polynômes orthogonaux, fonctions spéciales et applications (OPSFA) ».

This Thematic Semester focuses on the advances in Algebras, Representation Theory and certain areas of Physics and Quantum Information. Special functions will intervene at times as links between topics. It will consist in six 1-month concentration periods devoted to ongoing research in cutting edge topics; each will involve 1- or 2-week workshops that will be preceded by a number of preparatory mini-courses. While each period will have its own personality, there will be threads throughout the semester which should make the whole program tight, stimulating, and exciting. The thematic semester will be essentially launched by the organization at the CRM of the SIAM sponsored international conference Orthogonal Polynomials, Special Functions and Applications (OPSFA).

Comité organisateur local /
Local organizing committee

Marco Bertola (Concordia University & SISSA)
Véronique Hussin (Université de Montréal)
Yvan Saint-Aubin (Université de Montréal)
Luc Vinet (Université de Montréal)
William Witczak-Krempa (Université de Montréal)

LE CRM EST FIER DE PARTAGER SON ÉNONCÉ
EN MATIÈRE D'ÉQUITÉ, DIVERSITÉ ET INCLUSION

Le CRM, en tant qu'institut dédié à la recherche en sciences mathématiques, veut s'assurer d'offrir à tous les membres de sa communauté mathématique un environnement équitable, diversifié et inclusif. Les effets positifs d'une telle approche sont bien documentés. Dans ce but, le CRM a donc décidé de développer trois axes :

1) ***Viser l'égalité des chances en implantant des pratiques inclusives et équitables, en consultant sa communauté et en adaptant des pratiques en fonction des besoins de tou.te.s;***
2) ***Valoriser la diversité en mettant en valeur et en célébrant les projets des groupes sous-représentés en mathématiques;***
3) ***Faciliter l'accès aux mathématiques pour les groupes sous-représentés.***

Ces trois axes serviront à baliser ses actions futures et à définir ses engagements. Les valeurs associées à l'inclusion et à l'équité font partie des fondements du CRM pour qui l'engagement envers ces principes s'inscrit dans un continuum. Au centre de sa vision, le CRM reconnait l'identité propre de chaque individu. À travers ces différents champs d'action, le CRM veut aussi sensibiliser sa communauté aux impacts des biais inconscients et se positionner afin d'en réduire les conséquences négatives.

Le CRM déploie de telles initiatives afin que diverses voix puissent participer et contribuer de manière équitable à tous les niveaux de son organisation. Le CRM se réjouit de la diversité de ses membres et il encourage l'accès aux activités pour tou.te.s, sans distinction de leurs attributs, par exemple le genre, l'âge, la religion, les situations de handicap, l'appartenance aux Premiers peuples, à un groupe racisé et tout autre groupe.

Le CRM souhaite célébrer et mettre en valeur la diversité de sa communauté et donner le goût des mathématiques au plus grand nombre, c'est-à-dire ouvrir ses portes le plus grand possible!

Pour en savoir plus

Atelier : Les femmes en mathématiques à l'époque de la COVID

Cet événement, qui a eu lieu le 8 mars 2021 à l'occasion de la Journée internationale des femmes, visait à sensibiliser le public aux défis professionnels rencontrés par les femmes mathématiciennes pendant la pandémie. Ce fut également l'occasion de réunir la communauté du CRM pour honorer les réalisations des femmes en mathématiques. Quatre mathématiciennes remarquables ont mis en lumière leurs travaux récents, ainsi que les circonstances inhabituelles auxquelles elles ont dû faire face. Une table ronde informelle a terminé l'événement, avec un accent sur le point de vue des jeunes mathématiciennes. Les quatres mathématiciennes ayant participé aux conférences de cet atelier sont Caroline Colijn, Chikako Mese, Lillian Pierce et Lea Popovic. Ce sont des chercheuses accomplies de renommée internationale. Ce sont également des partenaires, des parents ou des individus en général ayant des besoins humains fondamentaux dont le travail a été affecté par la COVID-19. Les quatre exposés se sont révélés stimulants, passionnants et ont démontré la diversité des domaines et des approches adoptés par ces quatre mathématiciennes.

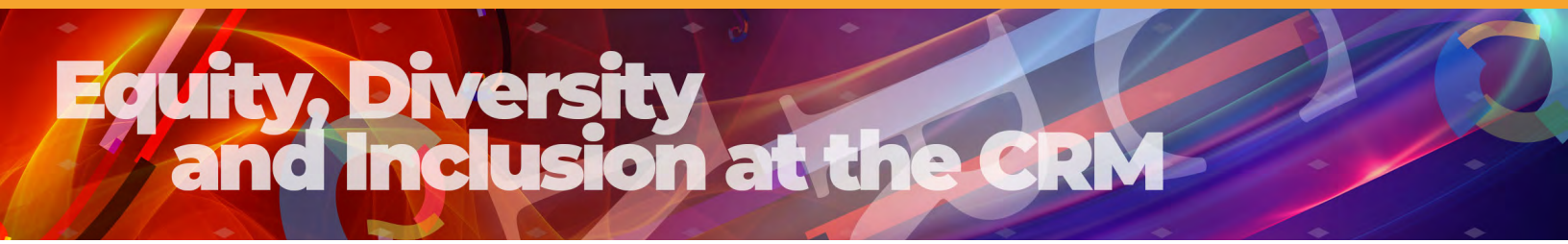
Caroline Colijn est professeure et également titulaire de la chaire de recherche Canada 150 en mathématiques pour l'évolution, infections et la santé publique au département de mathématiques de l'Université Simon Frasier. En tant que dirigeante du groupe de recherches MAGPIE (Mathematics, Genomics and Prediction in Infection and Evolution), les recherches du Dr. Colijn ont été aux premières lignes de l'innovation quant à la réponse à la COVID-19. Sa conférence s'est concentrée sur ces plus récents modèles, leurs prédictions et leur impact sur le domaine de la santé en Colombie britannique et au Canada.

Chikako Mese est professeure à l'Université John Hopkins et membre de la American Mathematical Society pour la cohorte de 2020. Dr. Mese est également la première femme à être professeure titulaire au département de mathématiques de l'Université John Hopkins. Elle est une experte dans la théorie des cartes harmoniques et leurs applications. Sa conférence portait sur le théorème d'uniformisation sur les surfaces d'Aleksandrov, des espaces métriques particuliers. Cette conférence était basée sur son travail en collaboration avec Christine Beiner à l'atelier "*Women in Geometry*" en 2019.

Lillian Pierce est professeure au département de mathématiques à l'Université Duke. Dr. Pierce est une chercheure mondialement connue pour sa contribution importante à la théorie des nombres et à l'analyse harmonique. Sa conférence nous a transportés à travers ses diverses recherches de la dernière année, notamment en superorthogonalité, les opérateurs d'intégrales oscillatoires et bien plus.

Lea Popovic est professeure à l'Université Concordia au département de mathématiques et statistique. Dr. Popovic est une chercheure de haut niveau en probabilité reconnue pour ses contributions à l'analyse des processus stochastiques liés à la biologie de l'évolution, la génétique, la biologie cellulaire et la biologie des systèmes. Sa conférence a mis l'accent sur l'importance d'inclure la dimension stochastique dans les processus cellulaires déjà utilisés tels que les interactions d'ADN et la formation de protéines. Elle a notamment présenté plusieurs résultats dans le langage des dynamiques spatiales stochastiques, en lien avec les équations différentielles partielles.

THE CRM IS PROUD TO SHARE ITS STATEMENT ON
EQUITY, DIVERSITY AND INCLUSION



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

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 underrepresented groups in mathematic.

3) Facilitate access to mathematical knowledge and research for underrepresented groups.

These three axes will serve as guidelines for future actions and commitments. The values associated to 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!

For more information

Workshop: Women in Mathematics during the time of COVID

This event, which was held on March 8, 2021 on International Women's Day, aimed to raise awareness of the career challenges experienced by women mathematicians during the pandemic. It also served as an occasion to bring together the CRM community to honour the achievements of women in mathematics. Four outstanding mathematicians highlighted their recent work, as well as the unusual circumstances that either led to it or challenged it. These talks were followed by an informal panel discussion held in the evening, with a focus on the perspective of junior women mathematicians. These mathematicians that participated in the workshop were Caroline Colijn, Chikako Mese, Lillian Pierce and Lea Popovic. They are internationally recognized accomplished researchers. They are also partners, parents or overall individuals with basic human needs whose work has been affected by COVID-19. All four talks proved to be stimulating, exciting and demonstrated the diversity of fields and approaches taken by these four mathematicians.

Caroline Colijn as Professor and Canada 150 Research Chair in Mathematics for Evolution, Infection and Public Health, Department of Mathematics, Simon Fraser University. Dr. Colijn is internationally known for her research at the interface of mathematics and the epidemiology and evolution of pathogens. As leader of the MAGPIE (Mathematics, Genomics and Prediction in Infection and Evolution), Dr. Corjin research has been at the forefront of Covid pandemic. She gave a fascinating talk on her recent models, their predictions and the impact that they have had on public health in British Columbia and Canada.

Chikako Mese is Professor at the Department of Mathematics, Johns Hopkins University. Fellow of the American Mathematical Society in the 2020 Class, Dr. Chikako Mese was the first female mathematician that became tenured in the Department of Mathematics at Johns Hopkins University. She is an expert in the theory of harmonic maps and applications. Dr. Mese talked on the uniformization theorem on Aleksandrov surfaces which are metric spaces with no differentiability assumptions hence new methods were employed. Her talk was based on joint work with Christine Breiner following a collaboration the two of them started at a "Women in Geometry" workshop of 2019.

Lillian Pierce is Nicholas J. and Theresa M. Leonardy Professor, Department of Mathematics, Duke University. Dr Pierce is a widely recognized researcher, well-known for her outstanding contributions in Number Theory and Harmonic Analysis. Her talk took us on a journey along her interesting research explorations during the past year, that included superorthogonality, oscillatory integral operators, character sums, and much more. She spiced the mathematical content with personal reflections about research conditions during the pandemic and ideas to help mitigating the negative effects on researchers in vulnerable positions.

Lea Popovic is Professor at the Department of Mathematics and Statistics, Concordia University. Dr. Popovic is a senior probabilist who has made outstanding contributions in the analysis of stochastic processes related to evolutionary biology, genetics, cell biology, and systems biology. Her talk motivated the importance of introducing stochasticity into various cellular processes such as DNA interaction and protein formation. She presented several results in the language of stochastic spatial dynamics, with connections to PDEs. She furthermore collected a list of anecdotes from other academic women and articles concerning how the pandemic has disproportionately affected women during this time.

Atelier de résolution de problèmes industriels

Industrial Problem Solving Workshop

L'historique

Depuis 2007, le CRM organise des ateliers de résolution de problèmes industriels. Ces ateliers réunissent des représentants de l'industrie, des chercheurs universitaires, des stagiaires postdoctoraux et des étudiants des cycles supérieurs. Les participants forment des équipes dont chacune analyse un problème fourni par une compagnie ou un organisme public ou parapublic. Les buts principaux de ces ateliers sont de donner à des compagnies ou organismes des outils mathématiques de résolution de problèmes, et de permettre à des chercheurs universitaires en mathématiques appliquées d'examiner des problèmes concrets. Les ateliers organisés par le CRM sont subventionnés par le réseau de centres d'excellence MITACS et le réseau rcm_2, et s'inscrivent dans une tradition canadienne puisque l'institut PIMS et le Fields Institute en organisent eux aussi.

History

Since 2007, the CRM has been organizing industrial problem solving workshops. These workshops bring together industry representatives, university researchers, postdoctoral fellows and graduate students. Participants form teams, each of which analyzes a problem provided by a company or a public or para-public organization. The main goals of these workshops are to provide companies or organizations with mathematical tools for problem solving, and to allow academic researchers in applied mathematics to examine concrete problems.

The workshops organized by the CRM are funded by the MITACS Network of Centres of Excellence and the rcm_2 network, and are part of a Canadian tradition since the PIMS Institute and the Fields Institute also organize them.

Rapport d'activité du 10e atelier en 2020

(du 13 au 27 août)

Cet atelier conjoint du CRM et d'IVADO (Institut de valorisation des données) fut organisé par Odile Marcotte (CRM et GERAD), Nancy Laramée, Jean-Marc Rousseau et Fabrizio Gotti (IVADO), et trois jeunes « professeurs IVADO » : Margarida Carvalho (DIRO, Université de Montréal), Juliana Schulz (HEC Montréal) et Guy Wolf (DMS, Université de Montréal). Le comité organisateur remercie tout particulièrement Fabrizio Gotti, responsable de la logistique de cet atelier virtuel. Notons que l'atelier devait se tenir en mode présentiel, mais que son organisation a dû être modifiée à cause de l'épidémie de Covid-19. Les activités de l'atelier ont donc été réparties sur deux semaines au lieu d'une semaine. Le personnel d'IVADO et Fabrizio Gotti a aidé les équipes à s'organiser de manière virtuelle.

Plus de 80 participants étaient inscrits à l'atelier et quatre problèmes leur furent proposés. Air Canada, Desjardins, Hydro-Québec et l'IATA avaient proposé les problèmes et leurs représentants ont pris une part active aux échanges. Le problème d'Air Canada nécessitait une expertise en traitement de la langue naturelle et fut examiné par une équipe dirigée par Philippe Langlais (DIRO, Université de Montréal). Air Canada désirait une méthode pour classifier les défauts récurrents observés lors de l'entretien de ses aéronefs.

Sébastien Gambs, titulaire d'une chaire de recherche à l'UQAM, coordonna les travaux de l'équipe étudiant le problème de Desjardins, qui portait sur l'anonymisation des données et la création de données synthétiques. En effet, Desjardins veut être en mesure de partager ses données avec des chercheurs ou d'autres groupes sans enfreindre la confidentialité de ses données. Cette entreprise est donc à la recherche de méthodes permettant soit d'anonymiser ses données, soit de créer des données synthétiques ayant des propriétés semblables à celles des véritables données (qui ne peuvent être divulguées).

Le problème soumis par Hydro-Québec concernait la prévision du prix horaire dans le marché d'électricité de l'Ontario. Cette prévision représente un défi pour Hydro-Québec puisqu'une proportion relativement importante de l'électricité de l'Ontario provient de sources renouvelables (énergie éolienne ou solaire). Un professeur de McGill (Yang Yi) et un professeur de Chine (Huaxiong Huang) furent les coordonnateurs pour ce problème. Notons que le professeur Huang a été, pendant de nombreuses années, l'organisateur principal des ateliers de résolution de problèmes de l'Institut Fields.

Comme le problème d'Hydro-Québec, celui de l'IATA requérait une expertise en probabilités et statistique : les travaux de l'équipe étudiant ce dernier problème, qui portait sur la modélisation du risque en transport aérien, furent coordonnés par Denis Larocque (HEC Montréal). Ces travaux menèrent à la publication d'un article (« Functional Kernel Density Estimation: Point and Fourier Approaches to Time Series Anomaly Detection »), dont les auteurs sont Michael R. Lindstrom (UCLA), Hyuntae Jung (IATA) et Denis Larocque. Il est publié dans la revue Entropy : https://www.mdpi.com/1099-4300/22/12/1363. Notons que M. Lindstrom a participé à plusieurs des ateliers de résolution de problèmes du CRM et que sa participation a toujours été exemplaire.

Comme d'habitude, les participants universitaires et industriels de l'atelier se déclarèrent très satisfaits de leur expérience.

Report of the 2020 10th Montreal Workshop

(August 13-27, 2020)

This joint CRM and IVADO workshop *was organized by Odile Marcotte (CRM and GERAD), Nancy Laramée, Jean-Marc Rousseau and Fabrizio Gotti (IVADO), and three young "IVADO professors": Margarida Carvalho (DIRO, Université de Montreal), Juliana Schulz (HEC Montreal) and Guy Wolf (DMS, Université de Montréal). The organizing committee is particularly grateful to Fabrizio Gotti, who was responsible for the logistics of this virtual workshop. Note that the workshop was to be held in face-to-face mode but that its organization had to be modified because of the Covid-19 epidemic. The workshop activities were therefore spread over two weeks instead of one. IVADO staff and Fabrizio Gotti helped the teams organize themselves to work hard but virtually.*

More than 80 participants were registered for the workshop and were given four problems. Air Canada, Desjardins, Hydro-Québec and IATA had proposed these problems and their representatives took an active part in the exchanges. The Air Canada problem required expertise in natural language processing and was examined by a team led by Philippe Langlais (DIRO, Université de Montréal). Air Canada wanted a method to classify recurrent defects observed during the maintenance of its aircraft.

Sébastien Gambs, a research chair at UQAM, coordinated the work of the team studying Desjardins' problem, which involved data anonymization and the creation of synthetic data. Indeed, Desjardins wants to be able to share its data with researchers or other groups without violating the confidentiality of its data. The company is therefore looking for methods to either anonymize its data or create synthetic data with properties similar to those of real data (which cannot be disclosed).

The problem submitted by Hydro-Québec concerned the forecast of the hourly price in the Ontario electricity market. This forecasting is a challenge for Hydro-Québec since a relatively large proportion of Ontario's electricity comes from renewable sources (wind or solar). A McGill professor (Yang Yi) and a professor from China (Huaxiong Huang) were the coordinators for this problem. Note that Professor Huang was, for many years, the main organizer of the Fields Institute problem solving workshops.

Like the Hydro-Québec problem, the IATA problem required expertise in probability and statistics: the work of the team studying this problem, which dealt with risk modeling in air transport, was coordinated by Denis Larocque (HEC Montréal). This work led to the publication of a paper ("Functional Kernel Density Estimation: Point and Fourier Approaches to Time Series Anomaly Detection"), whose authors are Michael R. Lindstrom (UCLA), Hyuntae Jung (IATA) and Denis Larocque. It is published in the journal Entropy: https://www.mdpi.com/1099-4300/22/12/1363. Note that Dr. Lindstrom has participated in several of the CRM problem-solving workshops and his participation has always been exemplary.

As usual, the academic and industrial participants of the workshop were very satisfied with their experience.

À VENIR

La 11e Édition en août 2021

The 11th edition in August 2021

Pour la onzième édition, les ateliers de résolution de problèmes (ARPI) auront lieu du 23 au 27 aout 2021 et seront organisés conjointement par le Centre de recherches mathématiques (CRM) et l'Institut de valorisation des données (IVADO). Les principaux objectifs de l'atelier sont les suivants:

1) donner aux organisations des outils mathématiques de résolution de problèmes;
2) permettre à des chercheur.e.s et des étudiant.e.s en sciences mathématiques (incluant la science des données, les statistiques, l'optimisation, les mathématiques financières, le traitement de la langue naturelle, etc.) d'examiner des problèmes concrets.

L'ARPI est considéré comme un « incubateur » de collaborations entre les compagnies et les chercheurs universitaires car les travaux effectués pendant l'atelier peuvent aboutir à des projets à moyen et à long terme, grâce à diverses sources de financement.

For the eleventh edition, the workshops (ARPI) will take place from August 23 to 27, 2021 and will be jointly organized by the Centre de recherches mathématiques (CRM) and the Institut de valorisation des données (IVADO). The main objectives of the workshop are to:

1) provide organizations with mathematical tools for problem solving;
2) to allow researchers and students in the mathematical sciences (including data science, statistics, optimization, financial mathematics, natural language processing, etc.) to examine concrete problems.

ARPI is considered an "incubator" for collaborations between companies and academic researchers as the work done during the workshop can lead to medium and long-term projects, thanks to various funding sources.

LE PRIX CRM-FIELDS-PIMS 2021
THE CRM-FIELDS-PIMS 2021 PRIZE

Le prix est décerné à

Andrew Granville

Professeur titulaire, Département de mathématiques et de statistique, Université de Montréal

Le Centre de recherches mathématiques (CRM), le Fields Institute et le Pacific Institute for the Mathematical Sciences (PIMS) sont fiers de décerner le prix CRM-Fields-PIMS 2021 à Andrew Granville, professeur titulaire au Département de mathématiques et de statistique de l'Université de Montréal, pour ses réalisations exceptionnelles en sciences mathématiques. L'influence du professeur Granville se mesure en grande partie par ses importantes contributions à la recherche et au mentorat. Tout aussi essentiels sont son amour pour son sujet, son énergie et sa créativité sans bornes ainsi que son enthousiasme à transmettre la beauté des mathématiques aux autres.

Le large éventail de réalisations du professeur Granville comprend le traitement de questions en géométrie arithmétique, l'approximation diophantienne, les aspects algorithmiques et cryptographiques, ainsi que ses contributions profondes à la théorie analytique des nombres. Communicateur charismatique, il est extrêmement sollicité en tant qu'orateur auprès de publics de niveaux très variés. Le professeur Granville a plus de 160 articles publiés à son actif, dont bon nombre figurent dans les meilleures revues du domaine. Il a également écrit de nombreux manuels et notes de cours, ainsi qu'une pièce de théâtre et un roman graphique largement acclamé qui explore des thèmes mathématiques.

Le professeur Granville a joué un rôle important dans les mathématiques canadiennes depuis l'obtention de son doctorat de l'Université Queens en 1987. En 2002, il s'est joint au Département de mathématiques et de statistique de l'Université de Montréal à titre de titulaire d'une chaire de recherche du Canada. Sa présence a eu un effet stimulant sur la communauté mathématique de Montréal en particulier. La liste des étudiants diplômés et post-doctorants qu'il a formés au cours de sa carrière se lit comme un who's who de la jeune génération d'experts en théorie analytique des nombres, y compris plusieurs mathématiciennes de premier plan.

Dans le cadre de cette reconnaissance, le professeur Granville recevra une récompense pécuniaire et une invitation à présenter une conférence dans chaque institut.

Lauréat 2021 du prix CRM-Fields-PIMS

The prize is awarded to

Andrew Granville

Professor, Department of Mathematics and Statistics, Université de Montréal

The Centre de recherches mathématiques (CRM), the Fields Institute and the Pacific Institute for the Mathematical Sciences (PIMS) are proud to award the CRM-Fields-PIMS 2021 Prize to Andrew Granville, full 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 in large part by his significant research and mentoring contributions. Equally essential are his love of his subject, his boundless energy and creativity, and his enthusiasm for sharing the beauty of mathematics with others.

Professor Granville's wide range of accomplishments include treatments of questions in arithmetic geometry, Diophantine approximation, algorithmic and cryptographic aspects, as well as his profound contributions to analytic number theory. Being a charismatic communicator, he is in great demand as a speaker to audiences of many different levels. Professor Granville has more than 160 published articles, many of which appear in the top journals in the field. He has also written numerous textbooks and lecture notes, as well as a play and a widely acclaimed graphic novel exploring mathematical themes.

Professor Granville has played an important role in Canadian mathematics since receiving his PhD from Queens University in 1987. In 2002, he joined the Department of Mathematics and Statistics at the Université de Montréal as a Canada Research Chair. His presence has had a stimulating effect on the mathematical community of Montreal in particular. The list of graduate students and post-doctoral fellows he has trained over the course of his career reads like a who's who of the younger generation of experts in analytic number theory, including several leading female mathematicians.

As part of this recognition, Professor Granville will receive a monetary award and an invitation to present a lecture at each institute.

2021 CRM-Fields-PIMS Prize Recipient

LE PRIX PRIX CRM-SSC 2020
THE 2020 CRM-SSC PRIZE

Lauréate 2020 du prix CRM-SSC
Erica Moodie
(Université McGill)

La statisticienne et titulaire d'une chaire William Dawson, Erica Moodie, a remporté le Prix CRM-SSC en statistique. Le prix est décerné une fois l'an par le Centre de recherches mathématiques (CRM) et la Société statistique du Canada (SSC). Il souligne le calibre exceptionnel des recherches effectuées par un.e statisticien.ne ayant obtenu son doctorat depuis moins de 15 ans. Erica Moodie a reçu ce prix pour «ses contributions remarquables à la biostatistique, portant entre autres sur l'inférence causale, la médecine de précision et les régimes de traitement dynamique, et pour ses contributions importantes à des problématiques importantes tel le VIH et la santé mentale» (notice du prix).

Pour plus d'infos : http://www.crm.umontreal.ca/prix/prixCRMSSC/prixCRMSSC20_fr.shtml

2020 CRM-SSC Prize Recipient
Erica Moodie
(McGill University)

Erica Moodie, statistician, and William Dawson Scholar has won the CRM-SSC Prize in statistics. This prize is awarded annually by the Centre de recherches mathématiques (CRM) and the Statistical Society of Canada (SSC) in recognition of outstanding research carried out primarily in Canada by a statistician during the first fifteen years after completing a PhD. Erica Moodie has received this prize for "her outstanding contributions to biostatistics, notably in causal inference, precision medicine, and dynamic treatment regimes, and her influential contributions to substantive areas of application such as HIV and mental health" (citation for the award).

For more details: *http://www.crm.umontreal.ca/prix/prixCRMSSC/prixCRMSSC20_an.shtml*

Des nouveaux dans l'équipe du CRM

Flore Lubin est technicienne en bureautique et administration au CRM depuis décembre 2020. Flore a une licence professionnelle en Commerce international de l'Université de Versailles Saint-Quentin-en-Yvelines et de l'ISIPCA. Elle a notamment travaillé dans le domaine des ventes en France et au Japon. En 2017, Flore Lubin arrive au Québec et se joint à l'équipe des ventes et de l'administration chez Axxess International, courtier en douanes et transitaire international, avant de rejoindre l'équipe du CRM où elle offre un soutien administratif aux activités scientifiques.

Flore Lubin sur LinkedIn

Madid Rahani est le nouvel analyste informatique du CRM depuis août 2020. Il est en charge des projets de développement et de la mise à jour des sites web, des applications ainsi que de la base de données. Il est détenteur d'un bac en génie informatique de l'Université Mouloud Mammeri Tizi-Ouzou en Algérie et d'un AEC en développement d'applications mobiles du Collège Ahuntsic.

Madid Rahani sur LinkedIn

YouTube
Centre de recherches mathématiques - CRM

Des séminaires et colloques scientifiques virtuels ont été rapidement organisés.

Le personnel du CRM a animé ces réunions dans les salles Zoom, enregistrées et mises en ligne.

YouTube
Centre de recherches mathématiques - CRM

Virtual scientific seminars and colloquia were swiftly organized.

The CRM staff has been facilitating these meetings in Zoom rooms, recorded and put online.

DES NOUVELLES DE L'INITIATIVE EN AVANT MATH !

UNE INITIATIVE NATIONALE POUR PROMOUVOIR LES MATHÉMATIQUES

Un projet du Centre de recherches mathématiques (CRM) et du Centre interuniversitaire de recherche en analyse des organisations (CIRANO), ensemble, catalyseurs de croissance en sciences mathématiques!

Deux rapports sont déjà parus

- Les déterminants du choix du domaine d'études universitaires. Une revue de la littérature et identification de pistes d'interventions, par Claude Montmarquette
- Les enseignants, leur formation ainsi que les outils mis à leur disposition, par Louise Poirier

Pour les consulter : https://enavantmath.org/

L'appel d'activités sur le terrain « L'avenir est mathématique » 2021-2022 est en cours

Tous les détails : https://enavantmath.org/#projets2021

Les projets retenus de l'appel d'activités sur le terrain « L'avenir est mathématique » 2020-2021 se réalisent :

Douze projets ont été sélectionnés suite à ce premier concours d'activités sur le terrain. Au total, nous avions reçu 43 projets.

Élèves autistes

De l'école à la vie, Commission scolaire de la Capitale

Tous

Community oriented action: ***MATH outreach activities*** (Une action orientée vers la communauté : Activités de sensibilisation MATH), Université Concordia

Primaire

Les maths partout autour de nous, Les Scientifines

Primaire, orthopédagogie

Situations mathématiques à caractère ludique pour intervenir en orthopédagogie, UQAM

Primaire et secondaire

Assurer la pérennité de Math en jeu, Université Laval

Activités mathématiques ludiques gratuites, Université Laval

Primaire et éventuellement, secondaire

Cercle mathématique ludique de l'AQJM et ***Semaine des maths 2020***, Université Laval

Primaire et secondaire (10 à 18 ans)

Les cercles mathématiques du Québec, Institut des sciences mathématiques (ISM)

Primaire et étudiants collégiaux

acceSciences, volet mathématique du projet Pour un Montréal Scientifique, Regroupement des cégeps de Montréal

Secondaire

Déploiement de la ressource pédagogique ***Code tes maths***, Collège de Maisonneuve

Une évasion mathématique, Groupe des responsables en mathématique au secondaire (GRMS)

Collégial et universitaire, éventuellement secondaire

Modéliser et simuler pour comprendre le monde, Université de Montréal

Description des projets retenus sur le site :

https://enavantmath.org/#projets

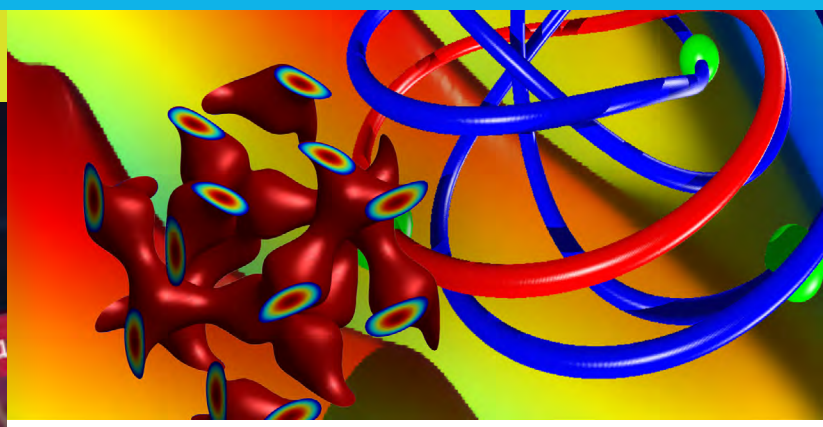
*Le projet **En avant math!** est rendu possible grâce à l'octroi d'une subvention du Ministère des Finances du Québec et est une initiative de deux centres de recherche, le CIRANO et le Centre de recherches mathématiques (CRM).*

LUC VINET
DANS QUÉBEC ÉCONOMIQUE

L'importance des mathématiques et de la numératie au Québec

Dans la plus récente édition du *Québec économique* (volume 9), Luc Vinet, l'actuel directeur du Centre de recherches mathématiques (CRM), fait valoir l'importance de la numératie et de la recherche mathématique pour le Québec. Il met notamment en lumière la portée souvent oubliée des mathématiques dans de multiples domaines, à la fois scientifiques et culturels. Luc Vinet aborde le sujet de la numératie et de ses avantages à l'échelle individuelle. Il présente les applications des mathématiques comme un moyen d'approfondir ses connaissances par l'imposition d'une discipline intellectuelle et d'une structuration du raisonnement dans la résolution de problèmes. Luc Vinet mentionne le fait que les mathématiques sont considérées comme une discipline qui n'est pas accessible à tous et discute l'impact que ce stéréotype peut avoir sur la société québécoise. Par ailleurs, il mentionne l'importance sociétale de la numératie pour le développement des industries au Québec. Il prend exemple d'initiatives développée à l'international pour valoriser la place des mathématiques dans les écoles. Finalement, Luc Vinet appelle à la responsabilité des gouvernements pour accroître le niveau de numératie dans les communautés minoritaires. Deux sujets intimement liés, la numératie et la recherche mathématique, sont discutés. La première est présentée comme l'une des pierres de touche essentielles à la formation et à la culture de nos concitoyens et au développement concurrentiel du Québec. Par la suite, un argumentaire soulignant l'importance économique et générale de la recherche mathématique est offert. Le Québec est fort bien servi à ces deux égards par l'initiative « En avant math! » et le CRM respectivement, et, pour cette raison, ces deux organisations méritent tout le soutien possible pour positionner stratégiquement le Québec.

https://cirano.qc.ca/files/publications/2020LI-01.pdf



CRM-CAMP COLLOQUIUM

A complete proof of the Feigenbaum conjectures

http://www.crm.umontreal.ca/camp-nonlinear/

Le 8 décembre 2020, le CRM CAMP in Nonlinear Analysis a eu la chance d'avoir un exposé de Jean-Pierre Eckmann (Université de Genève), une sommité mondiale en physique mathématique et en systèmes dynamiques.

Depuis le 23 juin 2020, le CRM CAMP rassemble la communauté des chercheurs, dispersés dans le monde, dans le domaine des méthodes de preuve assistées par ordinateur, en particulier, ceux qui travaillent dans les domaines de la théorie des systèmes dynamiques et de l'analyse non linéaire. En plus de la série de conférences hebdomadaires, le programme sert également de mécanisme pour organiser des ateliers, des tutorats et d'autres activités scientifiques. Les chercheurs participants sont dispersés dans le monde entier et il existe un besoin croissant d'un forum régulier de discussion et de diffusion des résultats. Cela est particulièrement important en cette période d'interruption des voyages.

CRM-CAMP COLLOQUIUM:

A complete proof of the Feigenbaum conjectures

http://www.crm.umontreal.ca/camp-nonlineaire/

On December 8 at 10 a.m., the CRM CAMP in Nonlinear Analysis was fortunate to have a presentation by Jean-Pierre Eckmann (University of Geneva), a world authority in mathematical physics and dynamic.

Since June 23, 2020, the CRM CAMP project brings together the community of researchers scattered around the globe in the area of computer-assisted methods of proof, especially those working in the areas of dynamical systems theory and nonlinear analysis. In addition to the weekly lecture series the program also serves as a mechanism for organizing workshops, tutorials, and other scientific activities. Participating researchers are scattered around the globe, and there is a growing need for a regular forum for discussion and dissemination of results. This is especially important in current time of unprecedented travel interruption.

COMMUNICATIONS EFFICACES EN MATHÉMATIQUES APPLIQUÉES

AMÉLIOREZ VOTRE IMPACT, ATTIREZ UN PUBLIC PLUS LARGE

Atelier de Communications efficaces en mathématiques appliquées

Comment avoir un impact plus important auprès d'un plus large public

Le *Centre de recherches mathématiques* organise une série d'ateliers pour aider les mathématiciens.nes appliqués.es à communiquer avec les médias et le public. Ces ateliers en français (4 modules) se déroulerent en mai sur 4 semaines. Cette série de quatre ateliers sera offerte à distance sur une période de quatre semaines, du 3 au 28 mai 2021. Chaque atelier est composé de deux périodes de trois heures chacune étalée sur deux journées consécutives. Les participants ont l'occasion de mettre en pratique leurs connaissances nouvellement acquises par des mises en situation et terminent cette formation dotée d'une meilleure compréhension des enjeux de communication avec des audiences diversifiées.

Les organisateurs sont :

Jacques Bélair (Université de Montréal)

Rebecca Tyson (UBC-Okanagan), présidente-élue de la Société Canadienne de Mathématiques Appliquées et Industrielles (SCMAI, CAIMS en anglais)

Activité soutenue par le CRSNG pour le développement des compétences en communication scientifique.

Atelier en français :
http://www.crm.umontreal.ca/2021/Communications21

Version en anglaise :

English Workshop: https://ecsam.ca/

Le prix John L. Synge 2020 est décerné à Christian Genest

Le professeur Christian Genest (Université McGill) est le 9e récipiendaire du prix John L. Synge, qui lui a été décerné le 15 septembre 2020 par la Société Royale du Canada. Ce prix est attribué à l'occasion pour des recherches exceptionnelles dans le domaine des sciences mathématiques. Genest est le premier statisticien et le second membre du CRM à recevoir cette distinction. Il est un "statisticien de renommée mondiale dont les travaux fondamentaux sur la modélisation des copules, la théorie des valeurs extrêmes et la prise de décision ont conduit à une compréhension transformatrice de l'impact de la dépendance dans l'évaluation du risque. Il a conçu des méthodes d'analyse de données multivariées et d'inférence non paramétrique qui ont permis d'améliorer les pratiques de gestion des risques dans les domaines de l'assurance, de la finance, de l'hydrologie, etc. Ses contributions lui ont valu plusieurs prix, donc un prix de recherche de la Fondation Alexander von Humbolt" (notice du prix).

2020 John L. Synge award is awarded to Christian Genest

Professor Christian Genest (McGill University), is the 9th John L. Synge award recipient. On September 15th, 2020 the Royal Society of Canada gave him the distinction for his outstanding research in mathematical sciences. Christian is the first statistician and the second CRM member to receive this prize. He is a "world-renowned statistician whose seminal work in copula modeling, extreme-value theory, and collaborative decision-making led to a transformative understanding of the impact of dependence in risk assessment. He designed multivariate data analysis and nonparametric inference methods which improved risk management practices in insurance, finance, hydrology and other fields. His contributions have earned him several awards, including a research prize from the Alexander von Humboldt Foundation" (citation for the award).

PRIX CRM-ISM-AMQ

Création du prix CRM-ISM-AMQ pour une publication exceptionnelle

Le prix CRM-ISM-AMQ sera décerné annuellement pour une publication exceptionnelle dans les Annales mathématiques du Québec (AMQ). Ce nouveau prix a été créé en collaboration avec le Centre de recherches mathématiques (CRM), l'Institut des sciences mathématiques (ISM) et l'AMQ. Le prix est décerné à la fin de chaque année civile. Pour être admissible, l'article doit avoir été publié dans l'AMQ au courant de l'année en cours ou de l'année précédente. L'article gagnant sera sélectionné par le comité de rédaction ; aucune mise en nomination ne sera requise. Le prix sera attribué pour la première fois en décembre 2021 à l'un des auteurs des articles parus dans les années 2021 ou 2020.

Pour plus d'informations sur l'AMQ, y compris les directives de soumission, veuillez consulter le site

https://www.springer.com/journal/40316

Creation of the CRM-ISM-AMQ award for an exceptional publication

The CRM-ISM-AMQ Prize will be awarded annually for an outstanding publication in the Annales mathématiques du Québec (AMQ). The new prize has been created in collaboration between the Centre de recherches mathématiques (CRM), the Institut des sciences mathématiques (ISM), and the AMQ. The prize is awarded at the end of each calendar year. To be eligible, the paper must be published in the AMQ during that or the previous year. The winning paper is selected by the Editorial Board; no nominations are required. For the first time, the prize will be awarded in December 2021 to one of the papers published in the years 2021 or 2020.

For further information on the AMQ, including the submission guidelines, please visit

https://www.springer.com/journal/40316

SMS

SÉMINAIRE DE MATHÉMATIQUES SUPÉRIEURES

MICROLOCAL ANALYSIS : THEORY AND APPLICATIONS

ANALYSE MICROLOCALE : THÉORIE ET APPLICATIONS

May 3 - August 13, 2021 /
3 mai - 13 août 2021
Virtual Edition Virtuelle

Plenary speakers/ Conférenciers pléniers

Malabika Pramanik *(University of British Columbia)*
Gabriel Rivière *(Université de Nantes)*
Zeev Rudnick *(Tel Aviv University)*
Johannes Sjöstrand *(Université de Bourgogne)*
John Toth *(McGill University)*
Gunther Uhlmann *(University of Washington)*
Maciej Zworski *(University of California, Berkeley)*

Specialized courses / Cours spécialisés

Semyon Dyatlov *(MIT)*
David Borthwick *(Emory University)*
Allan Greenleaf *(University of Rochester)*
Tobias Weich *(Universität Paderborn)*

Core courses / Cours de base

Kiril Datchev *(Purdue University)*
Asma Hassannezhad *(University of Bristol)*
Hamid Hezari *(University of California, Irvine)*
Mikko Salo *(University of Jyväskylä)*
Melissa Tacy *(University of Auckland)*

Organizers / Organisateurs

Suresh Eswarathasan *(Dalhousie University)*
Dmitry Jakobson *(McGill University)*
Katya Krupchyk *(University of California Irvine)*
Stéphane Nonnenmacher *(Université Paris-Saclay).*

crm.umontreal.ca/sms2021/

CENTRE DE RECHERCHES MATHÉMATIQUES
ISM Institut des sciences mathématiques
PIMS
GEMSTONE
AARMS Atlantic Association for Research in the Mathematical Sciences
FIELDS
MSRI Mathematical Sciences Research Institute
Université de Montréal

UN RENDEZ-VOUS LES VENDREDIS : FRIDAY'S GET TOGETHER:

Colloque des sciences mathématiques du Québec

Québec Mathematical Sciences Colloquium

Organisé par le CRM en collaboration avec l'Institut des sciences mathématiques (ISM), le Colloque des sciences mathématiques du Québec (CSMQ), reprend sa série de colloques en format virtuel! Par ailleurs, les colloques du Laboratoire de statistique se joignent maintenant au CSMQ. Pour recevoir l'invitation Zoom à cette série, veuillez-vous inscrire au http://crm.umontreal.ca/colloque-sciences-mathematiques-quebec/index.html#colloques

Organized by the CRM in collaboration with the Institut des sciences mathématiques (ISM), the Québec Mathematical Sciences Colloquium, resumes its series of seminars in virtual format. In addition, the colloquiums of the Statistics Lab will join the Québec Mathematical Sciences Colloquium. To receive the Zoom invite for this series, please register at http://crm.umontreal.ca/quebec-mathematical-sciences-colloquium/index.html#colloques

Nomination de Manuel Morales à la direction adjointe aux partenariats du CRM

Manuel Morales a été nommé directeur adjoint aux partenariats du CRM en juillet 2020 pour un mandat de deux ans. Manuel Morales est professeur agrégé au Département de mathématiques et de statistique de l'Université de Montréal et scientifique en chef, Intelligence artificielle à la Banque Nationale du Canada depuis 2018. Il est aussi directeur du programme CRSNG-FONCER sur l'apprentissage automatique en finance quantitative et intelligence d'affaires.

Manuel Morales is appointed as Deputy Director of partnerships at the CRM

The Centre de recherches mathématiques and its director Luc Vinet are pleased to announce the appointment of Manuel Morales to the position of Deputy Director of partnerships at the CRM, effective July 13, 2020 for a two-year term. Manuel Morales is an Associate Professor in the Department of Mathematics and Statistics at the Université de Montréal and is also Chief Scientist, Artificial Intelligence at the National Bank since 2018. Moreover, he is also director of the NSERC-CREATE program on Machine Learning in Quantitative Finance and Business Intelligence.

Les Unités mixtes internationales (UMI) du CNRS deviennent des International Research Laboratories (IRL)

L'UMI-CRM (UMI 3457) devient donc l'IRL-CRM. Quelques infos:

Interview avec Olivier Lafitte à l'Institut Galilée au sujet de son travail au sein de l'IRL-CRM

https://galilee.univ-paris13.fr/favoriser-le-developement-de-la-recherche-entre-la-france-et-le-canada/

La présence du CNRS au CRM et au Canada

https://northamerica.cnrs.fr/notre-presence-au-canada/

Les trois unités mixtes internationales (UMI/IRL) du Québec rassemblées autour d'un projet de recherche

Dans le cadre de l'Appel à projets Action 2020 Changement climatique, une initiative interdisciplinaire du CNRS, le projet de recherche porté par le directeur CNRS de l'IRL-CRM Olivier Lafitte, a été sélectionné. Ce projet a obtenu le soutien financier du CNRS à travers les programmes interdisciplinaires de la MITI. Les équipes qui travailleront sur le projet sont : IRL-CRM, UMI-LN2 et UMI-Takuvik.

Parmi les outils CNRS de structuration des partenariats à l'international, on retrouve les IRL (laboratoires de recherche internationaux) qui remplacent les UMI (unités mixtes internationales). Les IRL visent à mettre en lumière des collaborations emblématiques ancrées à l'international et créées à niveau stratégique.

Pour en savoir plus

Quebec's three CNRS International Research Laboratory (UMI/IRL) united around a research project

As part of the Action 2020 Climate Change call for projects, an interdisciplinary CNRS initiative, the research project led by the CNRS director of IRL-CRM Olivier Lafitte, was selected. This project has received financial support from the CNRS through the MITI interdisciplinary programs. The teams that will work on the project are: IRL-CRM, UMI-LN2 and UMI-Takuvik.

Among the CNRS tools for structuring international partnerships are the IRLs (International Research Laboratories), which replace the UMIs (unités mixtes internationales). IRLs aim to highlight emblematic actions decided at a strategic level with a strong local presence.

For more information

Egor Shelukhin reçoit la bourse de recherche Sloan 2021

Le Centre de recherches mathématiques (CRM) tient à féliciter Egor Shelukhin, récipiendaire de la prestigieuse bourse de recherche Sloan 2021 dans la catégorie Mathématiques. Egor Shelukhin est le premier mathématicien issu de l'Université de Montréal à recevoir cette distinction, mais aussi le premier, toutes disciplines confondues, à obtenir la bourse pour l'université depuis 1996. Cette bourse est attribuée aux chercheurs les plus prometteurs d'aujourd'hui dans de multiples disciplines qui comptent les mathématiques, la physique, la chimie ainsi que les neurosciences, les sciences économiques, l'informatique et la biochimie. Egor Shelukhin fait partie des 128 chercheurs à avoir été choisis par la fondation Alfred P. Sloan pour ce prix. Ses accomplissements et son potentiel le placent parmi la prochaine génération de leaders scientifiques au Canada et aux États-Unis.

Egor Shelukhin is 2021 Sloan Research Fellow

The Centre de recherches mathématiques (CRM) would like to congratulate Egor Shelukhin, recipient of the prestigious Sloan Research Fellowship 2021 in the Mathematics category. Egor Shelukhin is the first mathematician from the Université de Montréal to receive this distinction and also the first, across all disciplines, to obtain the fellowship for the university since 1996. This scholarship is awarded to today's most promising researchers in multiple disciplines including mathematics, physics, chemistry as well as neuroscience, economics, computer science and biochemistry. Egor Shelukhin is one of 128 researchers selected by the Alfred P. Sloan Foundation for this award. His accomplishments and potential place him among the next generation of scientific leaders in Canada and the United States.

https://sloan.org/fellowships/2021-Fellows

DES NOUVELLLES DES EXPERTS EN ÉPIDÉMIOLOGIE ET EN SANTÉ PUBLIQUE

Des chercheurs du CRM essentiels aux efforts nationaux de modélisation des maladies infectieuses

Nos chercheurs sont impliqués dans trois des cinq réseaux financés par l'Initiative de modélisation des maladies infectieuses émergentes de l'Agence de la santé publique du Canada et du CRSNG.

Le réseau Mathematics for Public Health **(MfPH)**, dirigé par Kumar Murty, directeur du Fields Institute et professeur à l'Université de Toronto, cherchera à combler le fossé entre la recherche en mathématiques et les enjeux concrets du domaine de la santé publique. Le réseau One Health Modelling Network for Emerging Infections **(OMNI)**, dirigé par Huaiping Zhu de l'Université York et du Centre canadien de modélisation des maladies, permettra de déterminer quels éléments il convient de cibler pour combler les lacunes en matière de données, en effectuant une surveillance accrue ou en recueillant davantage de données. Le réseau Statistical Methods for Managing Emerging Infectious Diseases, dirigé par Patrick Brown de l'Université de Toronto, élaborera des méthodes et des outils qui nous permettront d'obtenir un portrait exact de la nature et de l'étendue de la transmission d'une maladie infectieuse au sein de la population à partir de données réelles obtenues dans le cadre d'enquêtes ou provenant d'organes administratifs.

Les chercheurs du CRM se mobilisent pour faire face aux situations d'urgence et ils travaillent de concert avec de nombreux partenaires pancanadiens grâce à ces octrois. Nos membres feront partie du consortium de recherche polyvalent qui favorisera la mise en commun des efforts nationaux de modélisation des maladies qui aideront à mieux prévoir, prévenir et réagir aux maladies infectieuses émergentes.

Le ministre de l'Innovation, des Sciences et de l'Industrie, François-Philippe Champagne, et la ministre de la Santé Patty Hajdu, ont annoncé un investissement de 10 millions de dollars en financement, dont 2,5 millions de dollars pour le One Health Modeling Network for Emerging Infections (OMNI), un financement de 3 millions de dollars pour Mathematics for Public Health (MfPH), une coalition regroupant les principaux instituts de mathématiques du Canada Fields, PIMS, AARMS et le CRM et Statistical Methods for Managing Emerging Infectious Diseases pour 750 000 $.

Les projets font partie de plusieurs réseaux multidisciplinaires de modélisation des maladies infectieuses financés dans le cadre de l'Initiative de modélisation des maladies infectieuses émergentes, établie grâce à un partenariat entre l'Agence de la santé publique du Canada (ASPC) et le Conseil de recherches en sciences naturelles et en génie du Canada (CRSNG).

Le MfPH vise à appliquer des techniques mathématiques avancées pour aider à atteindre les objectifs de santé publique. Le groupe MfPH est composé de 48 co-chercheurs, 21 établissements canadiens et plus de 20 collaborateurs nationaux et internationaux dans des domaines tels que l'épidémiologie, la modélisation mathématique, les maladies infectieuses et la santé publique. Il mobilisera un réseau national qui utilise des modèles mathématiques et statistiques de pointe pour donner des conseils sur les politiques de santé publique dans le but à long terme de renforcer la préparation aux épidémies futures et d'améliorer la résilience du Canada dans les situations d'urgence.

MfPH sera codirigée par le directeur Fields, Kumar Murty, et le professeur de mathématiques de l'Université York, Jianhong Wu, et comptera parmi ses membres de nombreux leaders dans leurs domaines respectifs, dont Bouchra Nasri de l'École de santé publique de l'UdeM (ESPUM), Patrick A. Leighton de la Faculté de médecine vétérinaire, Jacques Bélair, Arthur Charpentier, Hélène Guérin, Manuel Morales et Luc Vinet du CRM.

Le Réseau OMNI utilisera des connaissances multidisciplinaires sur les liens entre la santé environnementale, animale et humaine pour affiner la modélisation des maladies utilisée pour identifier précocement les pathogènes.

En tant que chercheur principal du projet OMNI, Zhu, professeur au Département de mathématiques et de statistique de la Faculté des sciences de York, réunira 72 co-candidats au projet de 23 universités canadiennes et 49 collaborateurs de 28 organisations nationales et internationales.

On s'attend à ce que les modèles développés à partir de ce nouveau réseau conduisent à l'identification des données critiques et aux lacunes de modélisation. En identifiant les lacunes, le réseau pourra cibler la surveillance et les données et utiliser les données dans la modélisation de la maladie.

Hélène Carabin professeure au Département de pathologie et microbiologie de la Faculté de médecine vétérinaire de l'UdeM est co-directrice de ce réseau. Parmi les autres membres de ce réseau, on compte Bouchra Nasri, Jacques Bélair, Simon de Montigny, Morgan Craig, Patrick A. Leighton, Thomas Poder et Timothée Poisot de l'UdeM.

Le réseau Statistical Methods for Managing Emerging Infectious Diseases, dirigé par Patrick Brown de l'Université de Toronto, élaborera des méthodes et des outils qui nous permettront d'obtenir un portrait exact de la nature et de l'étendue de la transmission d'une maladie infectieuse au sein de la population à partir de données réelles obtenues dans le cadre d'enquêtes ou provenant d'organes administratifs. Le réseau vise à accroitre la capacité du Canada à réagir aux éclosions de maladies infectieuses émergentes.

Ce projet rassemble les meilleurs biostatisticiens au Canada qui travaillent sur les maladies infectieuses et les joint aux épidémiologistes qui développent de nouvelles méthodes de collecte de données pendant la pandémie de COVID-19. Ce groupe développe des méthodes et des outils pour obtenir une image précise de la nature et de l'étendue de la transmission des maladies infectieuses dans la population, en s'appuyant sur des données réelles provenant de sources administratives et d'enquêtes. Trois membres du StatLab du CRM sont impliqués dans ce réseau: Erica E. M. Moodie, Alexandra M. Schmidt et David A. Stephens.

Annonce du gouvernement du Canada

Initiative de modélisation des maladies infectieuses émergentes

Des chercheurs de l'UdeM au cœur de la lutte contre les maladies infectieuses émergentes, UdeMnouvelles, 26 avril 2021

CRM researchers key to national infectious disease modeling efforts

Our researchers are involved in three of the five networks funded by the Emerging Infectious Diseases Modeling Initiative of the Public Health Agency of Canada and NSERC.

The Mathematics for Public Health (MfPH) network, led by Kumar Murty, Director of the Fields Institute and professor at the University of Toronto, will seek to bridge the gap between mathematical research and real public health issues. The One Health Modeling Network for Emerging Infections (OMNI), led by Huaiping Zhu of York University and the Canadian Centre for Disease Modeling, will identify gaps that can be used to prioritize more targeted surveillance or data collection and then use those data to refine models. Statistical Methods for Managing Emerging Infectious Diseases, led by Dr. Patrick Brown at the University of Toronto, will develop methods and tools to get an accurate picture of the nature and extent of infectious disease transmission in the population, relying on real-world data from administrative sources and surveys.

CRM researchers are mobilizing to face emergency situations and they are working in concert with many pan-Canadian partners thanks to these grants. Our members will be part of the multi-purpose research consortium that will foster the pooling of national disease modeling efforts that will help better predict, prevent and respond to emerging infectious diseases.

The Minister of Innovation, Science and Industry, François-Philippe Champagne, and Minister of Health Patty Hajdu, announced an investment of $ 10 million in funding, including $ 2.5 million for the One Health Modeling Network for Emerging Infections (OMNI), funding of $ 3 million for Mathematics for Public Health (MfPH), a coalition of major Canadian mathematical institutes Fields, PIMS, AARMS and the CRM and $750 000 for Statistical Methods for Managing Emerging Infectious Diseases.

The projects are among several multidisciplinary infectious disease modeling networks funded under the Emerging Infectious Diseases Modeling Initiative, established through a partnership between the Public Health Agency of Canada (PHAC) and the Natural Sciences and Engineering Research Council of Canada (NSERC).

The MfPH aims to apply advanced mathematical techniques to help achieve public health objectives. The MfPH group is made up of 48 co-researchers, 21 Canadian institutions and more than 20 national and international collaborators in fields such as epidemiology, mathematical modeling, infectious disease and public health. It will mobilize a national network that uses state-of-the-art mathematical and statistical modelling to advise on public health policy with the long-term goal of boosting future epidemic preparedness and improving Canada›s resilience in emergency situations.

MfPH will be co-led by Fields Director Kumar Murty and York University Mathematics Professor Jianhong Wu, and will count amongst its membership numerous leaders in their respective fields, including Bouchra Nasri from the École de santé publique de l'UdeM (ESPUM), Patrick A. Leighton from the Faculté de médecine vétérinaire, Jacques Bélair, Arthur Charpentier, Hélène Guérin, Manuel Morales and Luc Vinet from the CRM.

The OMNI Network will use multidisciplinary knowledge about the connections between environmental, animal and human health to refine the disease modelling that is used to identify pathogens early.

As principal investigator of the OMNI project, Zhu, professor in the Department of Mathematics and Statistics in York's Faculty of Science, will bring together 72 project co-applicants from 23 Canadian universities and 49 collaborators from 28 national and international organizations.

Models developed from this new network are expected to lead to the identification of critical data and modeling gaps. By identifying gaps, the network will be able to target surveillance and data and use the data in disease modeling.

Hélène Carabin, professor in the Département de pathologie et microbiologie de la Faculté de médecine vétérinaire de l'UdeM, is co-director of this network. Other members of this network include Bouchra Nasri, Jacques Bélair, Simon de Montigny, Morgan Craig, Patrick A. Leighton, Thomas Poder and Timothée Poisot from UdeM.

Statistical Methods for Managing Emerging Infectious Diseases, led by Dr. Patrick Brown at the University of Toronto, will develop methods and tools to get an accurate picture of the nature and extent of infectious disease transmission in the population, relying on real-world data from administrative sources and surveys. They are seeking to augment Canada's capacity to respond to emerging infectious diseases.

This project assembles the top biostatisticians in Canada working on infectious diseases, and joins them with epidemiologists developing novel methods for data collection during the COVID-19 pandemic. This group is developing methods and tools to get an accurate picture of the nature and extent of infectious disease transmission in the population, relying on real-world data from administrative sources and surveys. Three members of the CRM StatLab are involved in this network: Erica E. M. Moodie, Alexandra M. Schmidt and David A. Stephens.

Government of Canada announcement

Emerging Infectious Diseases Modelling Initiative

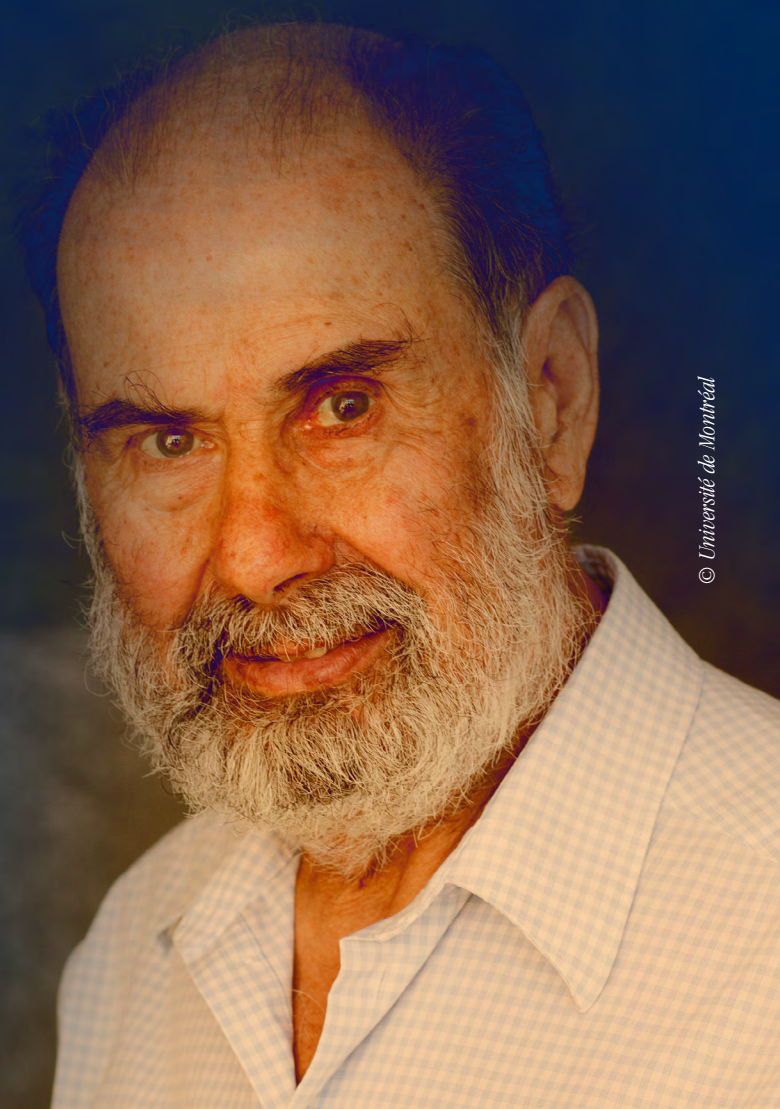
Des chercheurs de l'UdeM au cœur de la lutte contre les maladies infectieuses émergentes,
UdeMnouvelles, April 26, 2021

Pavel Winternitz est décédé le 13 février 2021 à Montréal. Le CRM perd un de ses pionniers. Le professeur Winternitz a eu une longue et fructueuse carrière d'abord comme chercheur au CRM, puis en tant que professeur au Département de mathématiques et de statistique de l'Université de Montréal où il a grandement contribué au développement de la physique mathématique. Avec une passion peu commune pour la recherche, il poursuivait toujours très activement ses travaux au sein du laboratoire de physique mathématique du CRM. Sa gentillesse et son amitié nous manqueront beaucoup.

Pavel Winternitz

1936-2021

Pavel Winternitz died on February 13, 2021 in Montréal. Professor Winternitz had a long and successful career, first as a researcher at the Centre de recherches mathématiques (CRM), then as a professor in the Université de Montréal's Department of Mathematics and Statistics (DMS) where he greatly contributed to the development of mathematical physics. Last June, he was named Professor Emeritus. The CRM loses one of its pioneers and the DMS one of its most distinguished faculty member. After a 47-year career at UdeM, he retired in December 2019 without ceasing his research and student supervision activities. His scientific impact is considerable. His kindness and friendship will be greatly missed. Pavel Winternitz completed a master's degree at the University of Leningrad and then a PhD in Dubna with Ya. A. Smorodinsky. As young researcher Winternitz arrived at the CRM in 1972, just four years after it was created in 1968. He made his mark there with his colleague Jiri Patera in the following years. Indeed, he developed an impressive network of international collaborators, many of whom spent scientific stays at the CRM. Thanks to the dynamism of his team, Montréal is recognized as a pole of excellence for research in mathematical physics. In 1984, he joined UdeM's DMS as a full professor. He pursued an exceptional career combining research and teaching at all levels. Pavel Winternitz was an outstanding researcher in the study of integrable systems and the classification of symmetries in differential equations describing phenomena in physics. He is recognized as an international leader in this field. Many of his works are considered as building blocks for new subfields or new theories, some of which now bear his name. He has also been extraordinarily prolific. Among his publications, nearly 300 articles and 125 conference proceedings have appeared in peer-reviewed journals. Pavel Winternitz's research excellence has earned him several important awards and honours. The most recent was awarded in 2018 in Prague when he received the prestigious Wigner Medal for outstanding contributions to physics through group theory. Pavel Winternitz has made major contributions to mathematical physics at the UdeM's DMS, the CRM, the Université de Montréal, in Canada and around the world. He will be remembered.



© Université de Montréal

Quelques témoignages
Some testimonies

« *Pavel was a wonderful person, a great scientist and an influential person who inspired many scientists all around the world. We cannot express how sad we are to hear his passing. From the first moment that I met with him in Italy at 2004 until recently, he was not only my mentor as a scientist but also together with Milada they became part of our family. The unforgettable moments that we shared both scientifically and socially will always live in our minds. It will always be a great honour for me to have a chance to work with him. We will miss him very much... Our deepest condolences to Milada, to the family and to all who know him.* »

Ismet Yurdusen
(an earlier postdoc of Pavel Winternitz from Turkey)

Sema Yurdusen, Ada Selin Yurdusen
(wife and daughter)

« *The CRM has lost one of its founding lights, a source of inspiration and encouragement to successive generations of students, young researchers and appreciative colleagues. Pavel Winternitz already had a respected reputation as a leading advocate of group theoretical methods in physics when he came to the CRM, as one of its first permanent researcher, shortly after its creation and continued his long and productive career there over the following half century. He made many significant contributions to the development of mathematical physics and helped enhance the reputation of the CRM worldwide, and its recognition as a major center for basic research. With an enduring passion, he continued actively pursuing his research work at the CRM's mathematical physics laboratory, while supervising many students and postdoctoral fellows, several of whom who went on to make their own subsequent marks.*

The range of his interests and skills were very wide, encompassing a cultural and human scope of unique breadth and depth. His kindness, humanity and generosity were greatly appreciated by all who knew him, and there were very many who benefited from his encouragement and support. To me, personally, he was both a mentor and a cherished friend. He will be sorely missed by us all. »

John Harnad
(Director, CRM's Mathematical Physics Lab)

« Je suis très triste d'apprendre la disparition de Pavel. Je n'oublierai jamais sa gaieté, sa gentillesse et son dynamisme. Je lui suis très reconnaissant de m'avoir invité plusieurs fois au CRM dès le début de ma carrière scientifique. Pavel a profondément marqué la physique mathématique. »

Jean-Pierre Françoise
(Professeur Sorbonne-Université)

« *I've just found out from your website that Professor Winternitz has passed away. Please accept my sincere condolences. He was a really good person and an outstanding scientist.* »

Alexander Zhalij
(post-doc CRM 2002-2004)

« *It was with great sorrow to learn about the passing of prof. Pavel Winternitz. We all lost a remarkable scientist and renaissance man whose collaborations spanned the world. I lost my advisor, mentor, and collaborator, whom I met in 1992, and who led me through my Ph.D. studies and offered advice throughout my career. Pavel and his wife Milada became friends to me and my husband, and we loved to join them for long dinners or shorter lunches. We will never forget times spent discussing science and world events or spending time outdoors skiing and canoeing with him. Our condolences to his wife Milada, his sons Peter and Michael and their families.* »

Zora Thomova
and Martin Thoma
(SUNY Polytechnic Institute)

« *I collaborated with Pavel for more than 35 years. We met either in Montreal or in Rome for long periods every year and got to know each other with the respective families very well. Even in last year in the period of Covid-19 I was in contact with him by phone every week to follow his unfortunately declining health and his will to continue working up to the end. He was a good friend for me and for my family. We spent happy times walking with my wife Irene and Milada in the Laurentians or swimming in the cost of Puglia. His death is a great loss for me and for my family. He will be unforgettable in my memory.* »

Decio Levi
(Università degli Studi Roma Tre)

« *I am deeply grieved to hear the unexpected passing of Professor Winternitz. Please accept my sincerest condolences on this sad event. My thoughts are with you all at this most difficult time. I pray from the bottom of my heart that his soul may rest in peace.* »

Hideaki Ujino
(Division of Natural Sciences and Mathematics National Institute of Technology, Gunma College)

« *Nous perdons un grand ami qui aura fait beaucoup pour nous, pour le CRM et pour la science à Montréal. La médaille Wigner et même son éméritat dernièrement lui auront fait bien plaisir. Gardons parmi tant d'autres souvenirs ces moments de réjouissance qui ont reconnu sa passion pour la recherche et un homme de grande envergure.* »

Luc Vinet
(Directeur, CRM)

2020-2021 AISENSTADT CHAIR

Wieslawa Niziol

(CNRS, IMJ-PRG, Sorbonne Université)

Biography

Wieslawa Niziol is a world leader in Arithmetic Algebraic Geometry, mostly known for her work in p-Adic Hodge Theory. She is the author of a series of influential works on p-adic cohomology theories and their applications to arithmetic and automorphic forms, notably to the emerging p-adic Langlands program. She was an invited speaker in the Number Theory section of the 2006 International Congress of Mathematicians.

Report on Lectures

(Adrian Iovita, Concordia University)

Professor Niziol was the Aisenstadt chairholder for the Special Semester on Cohomology in Arithmetic at the CRM in the Fall of 2020. Typically, the Aisenstadt chairs are integrated in the special semester activity but this time, due to the closure of the Canadian borders for scientific activities, the Aisenstadt chairs stayed in Paris and delivered their well attended lectures remotely. Professor Niziol's talks were given on November 30, December 1 and 2, with the title ***Hodge Theory of p-adic Analytic Spaces****.*

Professor Niziol's talks centered around the idea of comparison isomorphisms between various cohomology theories for p-adic analytic spaces and presented results of a long-standing collaboration with G. Dospinescu and P. Colmez. To set the context of her work, let us fix a smooth, proper scheme X over a number field. By choosing an embedding of the number field in the complex numbers, we may attach to X a complex analytic space X^{an} and as such, for every integer $i \geq 0$ there are, on the one hand singular cohomology groups $\mathrm{H}^i(X^{\mathrm{an}}, \mathbb{C})$ which are finitely generated complex vector spaces obtained by triangulating $X(\mathbb{C})$. On the other hand we have de Rham cohomology groups, $\mathrm{H}_{\mathrm{dR}}(X^{\mathrm{an}})$, which are also finite dimensional complex vector spaces obtained in terms of the holomorphic differential forms on X^{an}. Integration of differential forms along homology cycles defines canonical isomorphisms of complex vector spaces $\mathrm{H}^i(X^{\mathrm{an}}, \mathbb{C}) \cong \mathrm{H}^i_{\mathrm{dR}}(X^{\mathrm{an}})$ for every $i \geq 0$. These isomorphisms, called comparison isomor-

phisms, enrich the structures of the underlying cohomology groups: the singular cohomology groups come with canonical and functorial $\mathbb{Q}$-lattice structures (the subspaces $\mathrm{H}^i(X^{\mathrm{an}},\mathbb{Q}) \subset \mathrm{H}^i(X^{\mathrm{an}},\mathbb{C})$), while the de Rham cohomology groups have canonical gradings coming from the Hodge decomposition of harmonic differential forms. Together, via the comparison isomorphisms these endow the cohomology groups with a ***Hodge structure****.*

Since we have started with a scheme over a number field, so let us now choose a prime integer $p > 0$, a prime of our number field over p and let K denote its completion relative to this prime ideal. Base-changing the scheme X to K yields a smooth, proper scheme X_K. Like their counterparts over $\mathbb{C}$, schemes over a p-adic field are equipped with a plethora of cohomology theories: most notably, the p-adic étale cohomology, the pro-étale cohomology, the algebraic de Rham cohomology, and, depending on the reduction type of X_K, crystalline cohomology or Hyodo-Kato cohomology of its special fiber. In 1966 Grothendieck predicted that there should be comparison isomorphisms connecting these cohomology groups. Work of many people (J.-M. Fontaine, G. Faltings, K. Kato, O. Hyodo, T. Tsuji) during the ensuing half century led to the definition of p-adic period rings and the comparison isomorphisms, of which the most general has the form:

$$\mathrm{H}^i(X^{\mathrm{et}}_{\overline{K}},\mathbb{Q}_p) \otimes_{\mathbb{Q}_p} B_{\mathrm{dR}} \cong \mathrm{H}^i_{\mathrm{dR}}(X_K) \otimes_K B_{\mathrm{dR}}$$

where $\overline{K}$ is an algebraic closure of K and B_{dR} is Fontaine's p-adic de Rham period field. These isomorphisms satisfy various functoriality properties, which lead, as in the complex case to p-adic Hodge structures.

Over K there are also p-adic analytic spaces (rigid analytic spaces or adic analytic spaces) and the full panoply of cohomology theories listed above for schemes can be constructed for them as well. Examples of such analytic spaces are: the p-adic analytic space associated to schemes (for example X_K^{an}), Drinfeld's p-adic upper half plane, Drinfeld's p-adic symmetric spaces, the finite coverings of Drinfeld's p-adic symmetric spaces, Rapoport-Zink period domains etc.

After earlier timid attempts to study comparison isomorphisms for p-adic analytic spaces, P. Scholze announced in 2012 the de Rham comparison isomorphism for proper p-adic analytic spaces. He introduced as new tools the theory of perfectoid spaces and the pro-étale topology to replace Faltings' topology used previously.

In her Aisendtadt talks, Wieslawa Niziol announced various results related to comparison isomorphisms for p-adic analytic spaces. Her first talk opened with several illuminating examples, in which she calculated the p-adic étale and pro-étale cohomology of an open disk (in $\mathbb{P}^1$), of an open annulus and of an analytic curve. These calculations are done in terms of ***Banach-Colmez****-spaces, an important new ingredient introduced in such calculations. The second talk discussed various properties of Drinfeld's upper half plane over K, which is simply $\mathbb{P}^1_K \backslash \mathbb{P}^1(K)$. The main result announced is the calculation of the p-adic étale cohomology of Drinfeld's upper half plane, and of its coverings, as representations of the Galois group and $\mathbf{GL}_2(K)$, and the various applications of this result to the p-adic Local Langlands Conjecture.*

Finally the third lecture discussed what the speaker called "general comparison isomorphisms" for p-adic analytic spaces which are smooth, dagger varieties over a finite extension of $\mathbb{Q}_p$. For such varieties they describe the pro-étale cohomology of the variety in terms of a bicartesian diagram containing, apart from the pro-étale cohomology, the Hyodo-Kato cohomology, the de Rham cohomology and the Hodge cohomology of the variety.

The Aisenstadt lectures of Wieslawa Niziol were attended by an enthusiastic and committed audience, and were an excellent complement to the three graduate courses organized as part of the Special Semester, as well as the last workshop of the semester devoted to the p-adic theory of families of automorphic representations with a special focus on higher Hida and Coleman theory. It also gave the organizers of the Special Semester the opportunity to organize a working seminar at the CRM devoted to a discussion of the content of the Aisenstadt lectures.

2019-2020 AISENSTADT CHAIR

Nicolas Bergeron

(École Normale Supérieure)

Biography

Nicolas Bergeron is a French mathematician. He works in *the Département de Mathématiques et Applications at the École normale supérieure (ENS) in Paris, of which he is the current director. He obtained his doctorate at ENS Lyon in 2000 under the supervision of Jean-Pierre Otal with a thesis entitled Geodesic cycles in hyperbolic varieties. He did his postdoctoral studies in Zurich and Neuchâtel. In 2001, he became Research Fellow at the Université de Paris Sud, where he completed his accreditation in 2005 (On cohomology and the spectrum of locally symmetrical varieties) and in 2005 at the École normale supérieure de Paris. Several of his publications show an interest in the Oulipo: reference to Tentative d'épuisement d'un lieu parisien, by Georges Perec, article devoted to Jacques Roubaud.*

Report on Lectures

(by Peter Xu, McGill University)

Professor Bergeron was the Aisenstadt Chairholder for *the Fall 2020 thematic semester on "Number Theory: Cohomology and Arithmetic". He gave an Aisenstadt lecture on October 16, followed by a series of five lectures on the same theme throughout the week of October 19–23 at the workshop on "Arithmetic quotients of locally symmetric spaces and their cohomology".*

The Aisenstadt lecture was titled "Trigonometric functions and modular symbols" and served as an accessible introduction to the workshop talks, as well as an exposition of Professor Bergeron's research suitable for a general mathematical audience. He began by recalling classical work of Eisenstein on the addition formula for the cotangent function

$$\cos x \cot y - \cot x \cot(x+y) - \cot(x+y)\cot y = 1 \tag{0.1}$$

The main portion of the lecture was then dedicated to explaining how this and similar relations can be viewed conceptually as arising from the existence of a certain trigonometric-valued modular symbol which he constructs explicitly. This modular symbol is a concrete way of under-

standing an underlying symmetry for the group $GL_2(\mathbb{Z})$ in the products of trigonometric functions implicated in (0.1). At the end of the talk, Professor Bergeron gave an overview of how this construction is a particular example of a broader class of "Eisenstein cocycles" which he and his collaborators are studying. These cocycles realize $GL_N(\mathbb{Z})$ -symmetries underlying N-fold products of certain special functions, which can be either affine, trigonometric (as above), or elliptic. The three kinds of cocycles are related to areas of mathematics ranging from topology to geometry to arithmetic; in particular, the trigonometric and especially the elliptic cocycles have deep ties to number theory which remain not fully elucidated.

Professor Bergeron's five-lecture series in the workshop the following week was dedicated to fleshing out certain aspects of the study of these cocycles. The first lecture started by recalling the above trichotomy of cocycles along with the general cohomological formalism common to their constructions. He followed by showing the vanishing, due to Sullivan of certain topological characteristic classes for torus bundles; this fact plays an important role in the elliptic and trigonometric cases. Changing tacks, the remainder of the lecture was on constructing the general Eisenstein cocycle in the affine case as an explicit differential form, using en route important geometric work of Brieskorn and Orlik-Solomon on the complements of hyperplane arrangements.

The second lecture began with a continued study of the affine Eisenstein cocycle. The construction given in the first lecture can be performed with two similar but slightly divergent methods (involving different choices of auxiliary hyperplanes), and a key result is that they give the same cohomology class, as one makes it easier to check certain formal properties and the other can be related to a generalization of modular symbols. Returning now to the topological constructions on torus bundles, he uses Sullivan's lemma and some cohomological machinery to obtain "Eisenstein classes" on torus bundles which then can be leveraged into the desired Eisenstein cocycles via a geometric trick of excising hypersurfaces analogous to the affine case.

The entire third lecture was devoted to setting up the analytic study of the Eisenstein classes used above, finding explicit differential forms serving as the de Rham representatives for characteristic classes on the torus bundles over symmetric spaces via the Mathai-Quillen formalism. Certain transforms of these forms, when averaged and normalized via the technique of regularized theta series, play a pivotal role in the elliptic and trigonometric cases.

The fourth lecture elaborated on the relationship between the affine cocycle and generalized modular symbols. In particular, Professor Bergeron shows how integrating the second version of the affine cocycle along geodesic simplices on the "boundary" of a symmetric space yields the values of a modular symbol corresponding to the affine Eisenstein cocycle. The fifth and final lecture extended this to the trigonometric and elliptic cases, developing the theta series from the third lecture into full representatives of Eisenstein classes. Such representatives essentially coincide with (a certain subset of) the Eisenstein series which figure prominently in modern number theory, and hence are of the highest importance in arithmetic applications. These explicit differential forms can finally be leveraged to obtain modular symbols in much the same way as the affine one via integration on geodesic simplices on the "boundary".

Professor Bergeron's series of lectures fit very well into the themes of the workshop; all talks featured some version of the Eisenstein classes/cocycles in a starring role, and in fact some gave arithmetic applications thereof or alternate constructions of the same structures. Many students and researchers attended the workshop virtually and asked several interesting questions. Those who were present onsite in Montreal had small in-person discussions at the CRM after the lectures, helping give insight into the topics. We were very happy to have Professor Bergeron come speak and share his rich research interests with us.

2020 AISENSTADT CHAIR RECIPIENT

Eva Tardos
(Cornell University)

Biography

Éva Tardos received her Dipl.Math. in 1981, and her Ph.D. 1984, from Eötvös University, Budapest, Hungary. She joined Cornell in 1989 and was Chair of the Department of Computer Science 2006-2010. She has been elected to the National Academy of Engineering, 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, Packard Fellowship, the Gödel Prize, Dantzig Prize, and the Fulkerson Prize. She was editor editor-in-Chief of SIAM Journal of Computing 2004-2009 and is currently editor-in-Chief of the Journal of the ACM, and editor of some other journals including the Theory of Computing, and Combinatorica. On November 11, 2019, she was also named the Cornell Information Science Associate Dean for Diversity and Inclusion, this position is an extension of the roles Professor Tardos has been playing in leading Cornell's initiatives.

Report of lecture

(Sriram Sankaranarayanan,
École Polytechnique de Montréal)

On Friday, January 17th, CRM had the pleasure to invite Dr Eva Tardos from Cornell University to deliver the first Aisenstadt Chair lecture for the thematic semester on The Mathematics of Decision Making. The talk connected the long-standing questions posed by economics (on Game Theory) with modern tools to make the best use of data (i.e., learning) and was aptly titled «Learning in Games».

Eva started her talk, with the well-known example of Tragedy of the Commons where the collective actions of rational and selfish players harm the well-being of every player in the system. As a real-life application for this problem, the speaker talked about routing games, i.e., games where cars would like to go from one point to another, and the time of travel increases with congestion in any segment of the road. Now each player might want to behave selfishly to minimize their travel time, this can potentially harm everybody by increasing the congestion in key segments of the road. It was also made clear that while we typically talk about "cars" and "roads", these results immediately generalize for settings like internet networks where data packets (instead of cars) move from one location to another.

Going back to the tragedy of commons, she defined the price of anarchy as the ratio of the maximum total cost for all players when the players non-cooperatively compete as rational agents to the total cost obtained when the agents behave in a coordinated fashion to minimize the total cost. The price of anarchy can be proven to be small in certain special games with strong assumptions, but more realistic games have a large price of anarchy.

In the current topic of interest, Dr Tardos considered repeated gameplay, and in such a game, a consistently good strategy is unlikely to exist for players. Should they exist, then it is only likely that the players consistently play that strategy and remain optimal. With this relaxation, the professor motivated the concept of «no-regret learning» which is, that the learned (time-varying) strategy profile for any player performs better than any (time-invariant) fixed action for that player.

No-regret learning is a hard target to achieve too but still serves to be useful. With that motivation, she presented a result that the (time-variant) strategy obtained by learning has a cost not greater than the cost of any fixed action scaled by $(1+\varepsilon)$ added to $\log(d)/\varepsilon$ where d is the number of strategies that the player has.

Then the professor motivated the concept of smooth games, where the cost of unilateral deviation from one strategy to another can be bounded in terms of the social costs of both the strategies. Finally, she showed that under the assumption of smooth games and even in a dynamic environment, an adaptive learner's regret can be bounded. She also shows that the price of anarchy in such a setting is small.

Then she showed real-life examples of how learning provided better social incentive, in the context of online advertisement auctions.

Finally she concluded the talk saying that the results serve as strong motivation to show the importance of adaptive learning in games and that they are generally better than the Nash equilibrium.

2020 CRM-FIELDS-PIMS PRIZE LAUREATE

Catherine Sulem
(University of Toronto)

Biographie

Catherine Sulem, F.R.S.C. et professeure de mathématiques à l'Université de Toronto a reçu le prix CRM-Fields-PIMS pour ses réalisations exceptionnelles en sciences mathématiques. La professeure Sulem est la deuxième femme à recevoir le prix depuis sa création en 1994.

« C'est un grand honneur pour moi de recevoir le prix 2020 CRM-Fields-PIMS », a déclaré la professeure Sulem, après avoir été informée de son prix. « J'ai participé à de nombreux programmes formidables aux instituts et je les remercie de leur soutien à l'ensemble de la communauté mathématique canadienne. Je suis également reconnaissante envers mes collaborateurs, qui ont joué un rôle essentiel dans mes recherches. Je les remercie tous pour leur inspiration et leur amitié. »

La professeure Sulem est reconnue pour ses contributions nombreuses et influentes à l'étude des équations aux dérivées partielles non linéaires. Ses résultats approfondis sur l'équation de Schrödinger non linéaire ont résolu plusieurs questions qui avaient résisté à l'analyse pendant des années. Notamment, son travail est au coeur de la compréhension des singularités autofocalisées de cette équation. Son analyse des vagues d'eau a introduit de nouvelles idées probabilistes puissantes dans ce domaine. Celles-ci et d'autres réalisations révolutionnaires avaient aussi été reconnues par son élection comme Fellow de la Société royale du Canada et de l'American Mathematical Society. Puis, elle a remporté le prix Krieger-Nelson de la Société mathématique du Canada et elle a été choisie par l'Association for Women in Mathematics (AWM) et la Society for Industrial and Applied Mathematics (SIAM) en tant que conférencière Sonia Kovalevsky en 2019. Elle a également reçu la bourse de recherche Killam du Conseil des Arts du Canada.

Reports on Lectures

(by Olivier Lafitte, IRL-CRM et Université Paris 13)

Catherine Sulem is an extremely prolific mathematician, who had outstanding contributions to a wide range of problems in Evolution equations, from water waves (which was the theme of her first conference for the Award of this CRM-Fields-PIMS prize) to more General problems in Fluid Mechanics, as well as what is at the origin of this, that is kinetic equations. Her wide range of subjects include Nonlinear Schrödinger equations as well. She has devised answers to a large number of very important questions (among them on the behavior of solutions of fluid mechanics problems, on solitons, or on the turbulence phenomena) to subjects at the frontier between mathematics, physics, and mathematical physics. She did all her research using a very broad spectrum of mathematical sciences. What is particularly impressive is that this field dates back, as she showed us, to more than three centuries (333 years according to the first reference in her conference: I. Newton, Principia) of natural sciences and mathematics, including renowned scientists (as the Bernoulli family, d'Alembert, Euler, Lagrange, Navier, Helmholtz, Kelvin, Russell, Airy, Boussinesq, Rayleigh, Korteweg de Vries, to mention only scientists of the XVIIth, XVIIIth and XIXth century she presented in her talk).

Water waves:
Domain occupied by the fluid:

$$\Omega(t) = \{(x, y) \in \mathbb{R}^{d+1}, -h < y < \eta(x, t)\} \quad (1)$$

where $y=\eta(x,t)$ is called the free surface question

2020 CRM-FIELDS-PIMS PRIZE LAUREATE (SUITE)

The fluid is incompressible, irrotational, with a no-slip boundary condition at the bottom, a kinematic condition at the free surface, a dynamical boundary condition on the free surface;

The velocity u, the pressure p, the density ρ and the elevation of the free surface η satisfy:

$$\begin{cases} \nabla.\vec{u} = 0, \\ \nabla \wedge \vec{u} = 0\,, \\ \vec{u}.e_{d+1}(x,-h,t) = 0\,, \\ \eta_t + \eta_x \vec{u}_x = \vec{u}.e_{d+1}, y = \eta(x,t), \\ \partial_t \vec{u} + \vec{u}.\nabla\vec{u} + \nabla p = \rho\vec{g}, \end{cases} \quad (2)$$

which yields

$$\begin{cases} \vec{u} = \nabla\phi, \Omega(t), \\ \nabla\phi = 0, \Omega(t), \\ \partial_y\phi(x,-h,t) = 0\,, \\ \eta_t + \eta_x.\partial_x\phi = \partial_y\phi, y = \eta(x,t)\,, \\ \partial_t\phi + \frac{1}{2}|\nabla\phi|^2 + g\eta = 0, y = \eta(x,t). \end{cases} \quad (3)$$

This system is an Hamiltonian system in the appropriate coordinates:

$$H(t) = K(t) + P(t) = \frac{1}{2}\int_{\Omega(t)} \frac{1}{2}|\nabla\phi|^2 dxdy + \frac{1}{2}\int_{\mathbb{R}^d} g\eta^2 dx. \quad (4)$$

The kinetic energy is expressed using the Dirichlet to Neumann operator on the free surface for the Laplacian, which yields the relation

$$\begin{aligned} &(\partial_y - \eta(x).\partial_x)\phi(x,\eta(x,t)) \\ &= G(\eta)(\phi(x,\eta(x,t))) := G(\eta)(\xi(x,t)), \end{aligned} \quad (5)$$

through

$$K(t) = \frac{1}{2}\int_{\mathbb{R}^d} \xi G(\eta)\xi dx.$$

The Hamiltonian is

$$H(\xi,\eta) := \xi G(\eta)\xi + g\eta^2.$$

And the Hamiltonian system is

$$\begin{cases} \partial_t\eta = \partial_\xi H = G(\eta)\xi \\ \partial_t\xi = -\partial_\eta H = -g\eta - \frac{1}{2}|\partial_x\xi|^2 - \frac{G(\eta)\xi + \partial_x\eta\partial_x\xi}{1+|\partial_x\eta|^2}\,. \end{cases}$$

In a third part of her talk, she describes some asymptotic regimes of interest, such as the

- *Small amplitude solution*

$$\eta(x,t) = A\cos(kx - \omega(k)t), \omega(k) = \sqrt{gk\tanh kh}\,.$$

With the shallow water assumption (kh small), she shows an illuminating example where the velocity of the waves (such as tsunamis) is $c = \sqrt{gh}$, which is equivalent to the speed of a commercial airplane.

When the amplitude a is small with respect to the depth h, and the depth is itself small with respect to the wavelength

$$\epsilon = \epsilon := \frac{a}{h} = (\frac{h}{\lambda})^2 := \delta^2 \quad (6)$$

(small amplitude long waves), she shows that the system is well approximated by the Korteveg-de Vries equation (in suitable variables)

$$\partial_\tau\eta + \partial^3_{\xi^3}\eta + \eta\partial_x\eta = 0. \quad (7)$$

- *The long time and large distance dynamics, where A is slowly varying, the model exhibits the nonlinear Schrödinger equation.*
- *Under the shallow water and large amplitude hypotheses, one obtains the Saint-Venant system of equations, where she does not restrict to fixed bottoms, but also to rough, varying bottoms ([3]).*

After this really broad presentation of many models useful in water waves, in a fourth part of her talk, she concentrates on internal waves in stratified fluids. These internal waves, occurring very often because the density is stratified in the fluids (hence departing from the Euler model that was the basis of the previous systems and physical situations presented in her talk), are large amplitude, long wavelength, nonlinear waves, propagating over large distances. Mathematical results confirm and predicts actual observations, as Catherine convinced her audience through photographs (from the space shuttle), graphs, ... It gives her the occasion to describe the fundamentals of modeling a phenomenon: identify the physically relevant regime, analyze and interpret the oscillations, and illustrate all phenomena by numerical simulations.

After describing the model for the media (air and water), the internal wave is solution of the KdV equation, and she shows the expression of the soliton, which is explicit:

$$r(X,\tau) = -\frac{3u_0}{a}\mathrm{sech}^2\left(\frac{\sqrt{u_0}}{2}(Xu_0t)\right), \qquad (8)$$

and describes rogue waves (or, as Luc Vinet recalled when introducing Pr Sulem's conference "vagues scélérates" in French). The soliton is a depression wave as it can be seen through $r < 0$.

The associated equation for the amplitude of the surface wave w *is a Schrödinger equation on the real line* $(-\infty, +\infty)$*, of potential* r*, negative,*

$$-\delta^2 \partial_{y^2}^2 w + rw = Ew.$$

In the semiclassical limit $\delta \to 0$*, the bound states* ψ_j *are eigenvectors (of norm 1 in* $L^2(\mathbb{R})$*, localized in the well* $r < 0$*), associated to eigenvalues* E_j *(there is a finite though large number of them) close to the minimum of the function* r*, and Pr Sulem ends her talk with the following proposition on the Fourier transform of* ψ_j *(denoted by* S_j*).*

Proposition 1 *There exists* $\delta_0 > 0, C > 0$ *such that, for all*

$$\delta < \delta_0, \text{ and all } k \in (0, \delta\sqrt{|r(0)| - E_j})$$

$$|S_j(k)| \geq C\left(\frac{\delta}{j}\right)^{\frac{1}{4}}.$$

This proposition, she demonstrates, induces that "Wave energy from the sea surface is trapped by the bound states during the internal wave passage, which gives rise to the phenomenon of rip".

In addition, when studying plane waves interacting with ψ_j *in the Schrödinger equation, one observes that,*

$$w(y) \simeq e^{-i\frac{\sqrt{\lambda}}{\delta}y} + be^{i\frac{\sqrt{\lambda}}{\delta}y} \text{ near } -\infty \qquad (9)$$

and $w(y) \simeq ce^{i\frac{\sqrt{\lambda}}{\delta}y}$ *near* $+\infty$*,* b *is the reflection coefficient,* c *is the transmission coefficient, and one proves that* $b = -1 + O(\sqrt{\lambda}), c = O(\sqrt{\lambda})$*, hence very little of the surface sea state is transmitted, hence a mill pond effect (very calm sea).*

The second conference of Catherine on the next evening (November 25th, 2020) dealt with mathematically inspiring links with other fields in nonlinear PDEs that she could relate to water waves, such as Non Linear Schrödinger equation ([6]) and KdV (already mentioned in the first conference, for which she recalled results of existence and uniqueness in Sobolev spaces [4]) but also on more general integrable systems, for which the use of a scattering map (a natural feature of waves, [5]) proves to be a powerful tool. She also used spectral theory of self-adjoint operators ([1]), scale invariance phenomena, precise existence results (linked with works of J. Colliander for example). Her presentation included soliton resolution, long time behavior of solutions ([2]), problems of orbital stability, to name a few, broadening the horizon of all people who listened this day and, I am sure, also future listeners.

References

[1] Craig, Walter; Gazeau, Maxime; Lacave, Christophe; Sulem, Catherine Bloch theory and spectral gaps for linearized water waves. SIAM J. Math. Anal. 50 (2018), no. 5, 5477–5501.

[2] Liu, Jiaqi; Perry, Peter A.; Sulem, Catherine Long-time behavior of solutions to the derivative nonlinear Schrödinger equation for soliton-free initial data. Ann. Inst. H. Poincaré Anal. Non Linéaire 35 (2018), no.1, 217–265.

[3] Craig, Walter; Lannes, David; Sulem, Catherine Water waves over a rough bottom in the shallow water regime. Ann. Inst. H. Poincaré Anal. Non Linéaire 29 (2012), no. 2, 233–259.

[4] Sidi, A.; Sulem, C.; Sulem, P.-L. On the long-time behavior of a generalized KdV equation. Acta Appl. Math. 7 (1986), no. 1, 35–47.

[5] Pelinovsky, Dmitry E.; Sulem, Catherine Eigenfunctions and eigenvalues for a scalar Riemann-Hilbert problem associated to inverse scattering. Comm. Math. Phys. 208 (2000), no. 3, 713–760.

[6] Colliander, J.; Simpson, G.; Sulem, C. Numerical simulations of the energy-supercritical nonlinear Schrödinger equation. J. Hyperbolic Differ. Equ. 7 (2010), no. 2, 279–296.

2020 AISENSTADT PRIZE IN MATHEMATICS RECIPIENT
LAURÉAT DU PRIX ANDRÉ-AISENSTADT 2020

Egor Shelukhin
(Université de Montréal)


Egor Shelukhin

Biography

Egor Shelukhin *is a mathematician currently working as an Assistant Professor in the Department of Mathematics and Statistics at the Université de Montréal. He obtained his PhD in 2012 at Tel Aviv University under the supervision of Leonid Polterovich. Shelukhin then was a CRM-ISM Postdoctoral Research Fellow in Mathematics at the Centre de recherches mathématiques (CRM) from 2012 to 2014. He then spent the Spring semester of 2014 in 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 Advances Study, Princeton. His work is centered around Symplectic Topology, Contact Topology and Geometric Analysis.*

Summary of Research (by Egor Shelukhin, Université de Montréal)

The field of symplectic topology, which has its origins in classical mechanics, and in particular in the work of Henri Poincaré on the three-body problem, has been revitalized in the late 70s and early 80s by the appearance of variational methods, and methods of non-linear partial differential equations, notably following the work of Gromov on the notion of pseudo-holomorphic curves. Inspired by the work of Donaldson, and continued by Floer, Fukaya, Hofer, and many others, this approach is in its source related to various aspects of geometry and topology, as well as modern physics. One may say that methods of string theory are applied to prove new results in classical mechanics!

My research mainly focuses on the study of the group Ham of Hamiltonian diffeomorphisms, which are natural transformations of a symplectic manifold that correspond to the motions of classical mechanics. I mainly study three interconnected aspects of this infinite-dimensional group: its geometric properties, including Hofer's geometry, its algebraic properties, and the dynamical properties of its elements. The last aspect is of course the subject of Hamiltonian dynamics, the area closest to the pioneering work of Poincaré.

In the 60s, Arnol'd has conjectured, roughly speaking, that Hamiltonian diffeomorphisms should possess more fixed points than required for purely topological reasons. Floer's approach to Arnol'd's conjecture, now known as Floer theory, combines the variational approach of Rabinowitz and Conley-Zehnder with Gromov's theory of pseudo-holomorphic curves. In particular, it considers fixed points as critical points of a functional on a suitable loop space of the symplectic manifold and studies gradient trajectories between them. In doing so, this theory admits a natural "filtered" enhancement obtained by looking at different intervals of values for the functional.

In the work [10] joint with Leonid Polterovich (see also [9, 7]), we have observed that filtered Floer homology fits surprisingly well with a theory developed in a completely different subject, topological data analysis, originating in the applied sciences. As a result, we used notions such as persistence modules and barcodes to obtain new results on Hofer's geometry. We showed in particular that in certain natural settings there are Hamiltonian diffeomorphisms that are arbitrarily far, in the metric sense, from being autonomous: that is belonging to a one-parametric subgroup or, more intuitively, corresponding to the evolution of a closed system in classical mechanics.

An apparently unrelated subject, that of topological restrictions on the fixed points sets of finite groups of symmetry, was introduced by P. A. Smith in the 1930s with later contributions of Floyd, Borel, and others. A key result of this theory is that, as measured by the basic topological invariants, the fixed point set of a finite group action cannot be more topologically rich than the total space. (More precisely, the dimension of the homology group of the fixed points set is at most that of the total space, provided that the group has p^k elements for a prime p and homology is taken with coefficients in the field $\mathbb{F}_p$ with p elements.) One notable classical application of Smith theory, due to Thom, is to the topology of real algebraic varieties.

Recent years saw novel extensions of Smith theory to the realm of Floer theory, with applications primarily to low-dimensional topology. It has entered higher-dimensional symplectic topology in the works of Hendricks, Seidel, and Smith. In a breakthrough work [11], Seidel has constructed a remarkable operation in Floer theory coming from families of symmetric Riemann surfaces. It allows to relate the Floer theory of a symplectomorphism ϕ to that of its iteration ϕ^2 by a Smithtype inequality, coming from a natural symmetry on the set of fixed points of ϕ^2 provided by ϕ. This symmetry corresponds to rotating loops by a "half-turn", and has also made an appearance in [10]. In my recent work [12, 13] I have further developed Seidel's approach, combining it with the theory of barcodes, and explored its implications to Hamiltonian dynamics. In particular, this has led to a proof [12] of the well-known Hofer-Zehnder conjecture for a class of symplectic manifolds including the complex projective spaces: if a Hamiltonian diffeomorphism has more fixed points, suitably counted, than the total Betti number of the manifold (this is the lower bound provided by classical Floer theory), then it must have infinitely many periodic points. This conjecture is similar in flavor to the Conley conjecture, stating that there is a large class of manifolds where every Hamiltonian diffeomorphism has infinitely many periodic points (see [5, 4, 6]). It gives new information on Hamiltonian dynamics in cases where the Conley conjecture fails. It is also a higher-dimensional generalization of a celebrated result of Franks [2] for the two-sphere.

Coming back in a full circle, it has become apparent that the new Smith theory in filtered Floer homology provides additional information on finite group actions in symplectic topology. In a joint work [1] with my student Marcelo S. Atallah, we use these methods combined with studying quantum Steenrod operations, introduced by Fukaya [3] and Wilkins[14], to provide an answer to an open question of McDuff-Salamon [8, Problem 24] regarding finite subgroups of the group of Hamiltonian diffeomorphisms. In particular we prove that for a natural class of manifolds initially considered by Floer, the existence of finite order Hamiltonian diffeomorphisms implies that through each point of the manifold there passes a pseudo-holomorphic sphere. We also obtain a new symplectic analogue of a classical result of Newman from 1931: there is a small ball around the identity in Hofer's metric that contains no finite subgroup of Ham. Finally, we prove new topological properties of such maps, by combining our methods with classical Smith theory, which was initially developed to study finite group actions.

References

[1] *Marcelo Atallah and Egor Shelukhin. Hamiltonian no-torsion. Preprint, arXiv:2008.11758, 2020.*

[2] *John Franks. Geodesics on S^2 and periodic points of annulus homeomorphisms.* ***Invent.*** *Math., 108(2):403–418, 1992.*

[3] *Kenji Fukaya. Morse homotopy, A^∞, and Floer homologies. In* ***Proceedings of GARC Workshop on Geometry and Topology '93 (Seoul, 1993)****, volume 18 of* ***Lecture Notes Ser****., pages 1–102. Seoul Nat. Univ., Seoul, 1993.*

[4] *Viktor L. Ginzburg. The Conley conjecture.* ***Ann. of Math.****, 172:1127–1180, 2010.*

[5] *Viktor L. Ginzburg and Başak Z. Gürel. Conley conjecture revisited.* ***Int. Math. Res. Not. IMRN****, (3):761–798, 2019.*

[6] *Nancy Hingston. Subharmonic solutions of Hamiltonian equations on tori.* ***Ann. of Math.*** *(2), 170(2):529–560, 2009.*

[7] *Asaf Kislev and Egor Shelukhin. Bounds on spectral norms and barcodes.* ***Geom. Topol., to appear.*** *Available at arXiv:1810.09865, 2018.*

[8] *Dusa McDuff and Dietmar Salamon. I****ntroduction to symplectic topology.*** *Oxford Graduate Texts in Mathematics. Oxford University Press, Oxford, third edition, 2017.*

[9] *L. Polterovich, E. Shelukhin, and V. Stojisavljevic. Persistence modules with operators in Morse and Floer theory.* ***Mosc. Math. J.****, 17(4):757–786, 2017.*

[10] *Leonid Polterovich and Egor Shelukhin. Autonomous Hamiltonian flows, Hofer's geometry and persistence modules.* ***Selecta Math.*** *(N.S.), 22(1):227–296, 2016.*

[11] *Paul Seidel. The equivariant pair-of-pants product in fixed point Floer cohomology.* ***Geom. Funct. Anal.****, 25(3):942–1007, 2015.*

[12] *Egor Shelukhin. On the Hofer-Zehnder conjecture. Preprint, arXiv:1905.04769, 2019.*

[13] *Egor Shelukhin and Jingyu Zhao. The $\mathbb{Z}/p\mathbb{Z}$ product-isomorphism in fixed point Floer homology. J.* ***Symplectic Geom., to appear.*** *Available at arXiv:1905.03666.*

[14] *Nicholas Wilkins. A construction of the quantum Steenrod squares and their algebraic relations.* ***Geom. Topol****., 24:885–970, 2020.*

2020 AISENSTADT PRIZE IN MATHEMATICS RECIPIENT
LAURÉAT DU PRIX ANDRÉ-AISENSTADT 2020

Robert Haslhofer
(University of Toronto)


Robert Haslhofer

Biography

Robert Haslhofer *is a mathematician currently working as an Assistant Professor in the Department of Mathematics at the University of Toronto. He obtained his PhD in 2012 at the Swiss Federal Institute of Technology in Zurich. Haslhofer then was a Courant Instructor at the Courant Institute of Mathematical Sciences. Since 2015, he has been working as an Assistant Professor at the University of Toronto. 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 NSERC Discovery Grant and a Sloan Research Fellowship.*

Summary of Research (by Robert Haslhofer, University of Toronto)

A family of surfaces moves by mean curvature flow if the velocity at each point is given by the mean curvature vector. Mean curvature flow first arose in material science as a model of evolving interfaces and has been extensively studied over the last 40 years.

Curve shortening flow. *To gain intuition, we first consider the case of evolving curves. Recall that if γ is a curve in the plane, then its second derivative with respect to arc length s gives the curvature vector* **k**. *Now, given any closed embedded curve as initial condition we can evolve it in time by curve shortening flow,*

$$\delta_t \gamma(p,t) = \mathbf{k}(p,t). \tag{1}$$

A short computation yields that the total length of the curve satisfies

$$\dot{L}(t) = -\int_{\gamma_t} |\mathbf{k}|^2 ds. \tag{2}$$

This shows that the curve shortening flow is the gradient flow of the length functional, i.e., the most efficient way to decrease the length of curves. From the PDE perspective, equation (1) can be viewed as a geometric version of the heat equation. Motivated by the physical intuition of heat diffusion one thus hopes that the curve shortening flow deforms any initial curve towards an optimal homogeneous limit. This process indeed works amazingly well:

Theorem 1 *(Grayson [1]).* ***The curve shortening flow starting at any closed embedded curve in the plane converges to a round point****.*

Here, the conclusion means that the curve shrinks to a point, and after dilating to unit size converges to a round circle. In particular, Grayson's theorem shows that a curve spiralling around many times always unwinds itself quicker than it shrinks; for a nice illustration look at https://www.youtube.com/watch?v=wHfpacPLHIA

Mean curvature flow. *We now consider surfaces M in $\mathbb{R}^3$. Recall that at any point $x \in M$ the mean curvature* **H** *is a vector normal to the surface whose length is given by the sum of the principal curvatures. Now, given any closed embedded initial surface we can evolve it in time by mean curvature flow,*

$$\delta_t x = \mathbf{H}(x,t). \tag{3}$$

Generalizing (2), we have

$$\dot{A}(t) = \int_{M_t} |\mathbf{H}|^2 dA, \tag{4}$$

i.e. the mean curvature flow is the gradient flow of the area functional. Moreover, since the mean curvature can be expressed as a nonlinear Laplacian of the position vector, the mean curvature flow can be viewed as geometric version of the heat equation. The subject was kicked off by the following classical result:

Theorem 2 *(Huisken [2]).* ***The mean curvature flow starting at any convex closed embedded surface $M \subset \mathbb{R}^3$ converges to a round point.***

On the other hand, if the initial surface is not convex then the flow typically encounters singularities.

Example *(neck-pinch singularity).* ***If the initial surface looks like a dumbbell, then the neck pinches off, and the surface gets broken up into two components****.*

A related example is the degenerate neck-pinch, where one starts with an asymmetric dumbbell whose geometry is fine-tuned such that the smaller sphere pulls itself through the neck exactly at the same moment as the neck pinches off. Most of the research since Huisken's classical result has focussed on analyzing the formation of singularities and developing methods to continue the flow through them. Indeed, getting a hold of singularities is crucial for most striking applications in topology, geometry, and physics, see e.g. [3, 4, 5, 6].

Blowup analysis. *To study singularities one looks at them under the microscope. To describe this properly, let $\mathcal{M} = \{M_t\}$ be a mean curvature flow of surfaces. Given a space-time point $X_0 = (x_0, t_0)$ and scaling factors $\lambda_i \to \infty$ one considers the sequence of flows that is obtained from $\mathcal{M}$ by shifting X_0 to the origin and parabolically dilating by λ_i. This gives rise to the notion of a tangent flow at X_0:*

$$\hat{\mathcal{M}}_{X_0} := \lim_{i\to\infty} \mathcal{D}_{\lambda_i}(\mathcal{M} - X_0). \tag{5}$$

Roughly speaking, every tangent flow is either (i) a round shrinking cylinder

$$\hat{\mathcal{M}}_{X_0} = \{S^1(\sqrt{-2t})\mathbb{R}\}_{t<0} \tag{6}$$

or (ii) a self-similarly shrinking asymptotically conical surface. In case (i) we say the flow has a neck-singularity, and in case (ii) a conical singularity. It has been known since the 90s that mean curvature flow through conical singularities is nonunique:

Example *(non-uniqueness).* ***Mean curvature flow of surfaces can form conical singularities and evolve out of them in many different ways.***

This has been shown theoretically [7] and experimentally [8]. On the other hand, it has been conjectured in the 90s [9], that mean curvature flow through cylindrical singularities is unique, and that every cylindrical singularity has a mean-convex neighborhood. We will describe our solution of these conjectures in the following subsection.

Flow through neck singularities. *In [11, 12], joint with Choi-Hershkovits and Choi-Hershkovits-White, we proved the mean-convex neighborhood conjecture.*

Theorem 3 *(mean-convex neighborhoods).* ***If $\mathcal{M} = \{M_t\}$ has a neck-singularity at X_0 then there exists a space-time neighborhood of X_0 in which the flow moves in one direction.***

Combined with an earlier result by Hershkovits-White [10], this allowed us to confirm the uniqueness conjecture for mean curvature flow through neck-singularities.

Theorem 4 *(uniqueness).* ***Mean curvature flow through neck-singularities is unique.***

Together with a result of Brendle [13], we also made progress towards the two-sphere conjecture.

Theorem 5 *(flow of two-spheres).* ***Assuming Ilmanen's multiplicity one conjecture, mean curvature flow of embedded two-spheres is well-posed.***

The major difficulty in tackling the mean-convex neighborhood conjecture is that tangent flows only partially capture singularities. To fully capture singularities, one needs to understand all limit flows

$$\mathcal{M}^\infty = \lim_{i\to\infty} \mathcal{D}_{\lambda_i}(\mathcal{M} - X_i), \tag{7}$$

where now X_i is allowed to vary (e.g., to capture a degenerate neck pinch, one wants to choose X_i that follow the tip). A prior one only knows that any suitable limit flow $\mathcal{M}^\infty$ near a neck singularity is an ancient asymptotically cylindrical flow, namely an ancient, unit-regular, cyclic, integral Brakke flow whose tangent flow at $-\infty$ is a round shrinking cylinder. We classified all such flows.

Theorem 6 *(classification).* ***Any ancient asymptotically cylindrical flow is either a round shrinking cylinder, a translating bowl soliton, or an ancient oval.***

Figure 1

We note that the classification theorem quickly implies the mean-convex neighborhood theorem via a short argument by contradiction. Our classification builds on recent breakthroughs by Angenent-Daskalopoulos-Sesum [14] and Brendle-Choi [15]. However, we assume neither convexity nor self-similarity, something which has never been accomplished before for any geometric flow. This is crucial for our proof of the mean-convex neighborhood conjecture and uniqueness conjecture. Let us conclude with a sentence about potential topological and geometric applications. A full resolution of the two-sphere conjecture would yield a mean curvature proof of the Smale conjecture that $\mathrm{Diff}(S^3) \sim O(4)$ and would also be very helpful to attack the Lusternik-Schnirelman conjecture that the three-sphere equipped with any Riemannian metric contains at least four minimal embedded two-spheres.

References

[1] M. Grayson. The heat equation shrinks embedded plane curves to round points, J. **Differential Geom.**, 26(2):285–314, 1987.

[2] G. Huisken. Flow by mean curvature of convex surfaces into spheres. J. **Differential Geom.**, 20(1):237–266, 1984.

[3] G. Huisken, C. Sinestrari. Mean curvature flow with surgeries of two-convex hypersurfaces. **Invent. Math.**, 175:137–221, 2009.

[4] R. Buzano, R. Haslhofer, O. Hershkovits. The moduli space of two-convex embedded spheres. J. **Differential Geom.** (to appear).

[5] R. Haslhofer, D. Ketover. Minimal 2-spheres in 3-spheres. **Duke Math. J.**, 168(10):1929–1975, 2019.

[6] G. Huisken, T. Ilmanen. The Inverse Mean Curvature Flow and the Riemannian Penrose Inequality. J. **Differential Geom.**,59(3):353–437, 2001.

[7] S. Angenent, D. Chopp, T. Ilmanen. A computed example of nonuniqueness of mean curvature flow in $\mathbb{R}^3$. **Comm. PDE**, 20:1937–1958, 1995.

[8] W. Ristenpart, et al. Non-coalescence of oppositely charged drops. **Nature**, 461:377–380, 2009.

[9] B. White. Evolution of curves and surfaces by mean curvature. **Proceedings of the ICM**, Beijing I:525–538, 2002.

[10] O. Hershkovits, B. White. Non-fattening of mean curvature flow at singularities of mean convex type. **Comm. Pure. Appl. Math.** 73(3):558–580, 2020.

[11] K. Choi, R. Haslhofer, O. Hershkovits. Ancient low entropy flows, mean convex neighborhoods, and uniqueness. **preprint**, 2018.

[12] K. Choi, R. Haslhofer, O. Hershkovits, B. White. Ancient asymptotically cylindrical flows and applications. **preprint**, 2019.

[13] S. Brendle. Embedded self-similar shrinkers of genus 0. **Ann. of Math.** 183(2):715–728, 2016.

[14] S. Angenent, P. Daskalopoulos, N. Sesum. Uniqueness of two-convex closed ancient solutions to the mean curvature flow. **Ann. of Math.** 192(2):353–436, 2020.

[15] S. Brendle, K. Choi Uniqueness of convex ancient solutions to mean curvature flow in $\mathbb{R}^3$ **Invent. Math.** 217:35–76, 2019.

GRANDES CONFÉRENCES PUBLIQUES DU CRM

FRANÇOIS BERGERON
(UNIVERSITÉ DU QUÉBEC À MONTRÉAL)

JIM 2021

Bach et les mathématiques de la Fugue

http://www.crm.umontreal.ca/2021/BergeronF21

Le 17 février 2021, François Bergeron (Université du Québec à Montréal) a donné une vidéoconférence intitulée 'Bach et les mathématiques de la Fugue' au sujet du rôle joué par les transformations et les symétries en mathématiques dans diverses domaines artistiques. François Bergeron y propose une tournée dans l'univers de ces notions, qui se termine sur l'exploitation des mathématiques dans l'Art de Fugue de Bach. François Bergeron est connu au sein de la communauté mathématique internationale pour ses nombreuses contributions à la recherche en combinatoire et sur les algèbres et leurs représentations. Il est également connu pour ses multiples interventions sur diverses scènes, qui l'ont notamment amené à donner plusieurs conférences dans les cégeps, mais aussi aux émissions Découvertes et Les Années Lumières, et bien d'autres.

Accès direct à sa conférence :
https://youtu.be/lgdSqSPsXcw

Bach et les mathématiques de la Fugue

http://www.crm.umontreal.ca/2021/BergeronF21

On February 17, 2021, François Bergeron (Université du Québec à Montréal) gave a videoconference entitled 'Bach and the Mathematics of Fugue'. This lecture looks at the role played by transformations and symmetries in mathematics in various artistic fields. François Bergeron proposed a tour through the universe of these notions, which ended with the exploitation of mathematics in Bach's Art of Fugue. François Bergeron is known in the international mathematical community for his numerous contributions to research in combinatorics and algebra and their representations. He is also known for his various interventions on various stages, which have notably led him to give many lectures in CEGEPs, but also to the programs Découvertes and Les Années Lumières, and many others.

Direct access to his conference:
https://youtu.be/lgdSqSPsXcw

Le 12 mars 2021, le Centre de recherches mathématiques (CRM) a organisé une soirée dans le cadre de la Journée internationale des mathématiques de l'UNESCO. En adoptant la thématique 2021 de cette grande célébration internationale « Les mathématiques pour un monde meilleur », le CRM vient souligner l'impact des sciences mathématiques pour faire face aux défis dans des domaines tels que l'intelligence artificielle, les modèles de prédiction, les changements climatiques, les dépistages, le partage équitable ainsi que pour améliorer la qualité de vie de bien des façons inattendues grâce aux connaissances combinées des scientifiques qui y travaillent. Le CRM a réuni des conférenciers-organisateurs hors pair qui explorent chacun à leur manière le thème de cette année. La soirée était animée par Frédéric Gourdeau (Université Laval) et l'ensemble des célébrations incluait trois conférences données par Yvan Saint-Aubin, Christian Genest et Christiane Rousseau respectivement.

Yvan Saint-Aubin, a présenté une conférence intitulée **« Un modèle simple de pandémie »**. Il y a abordé différents outils mathématiques utilisés par les diverses agences de santé publique pour prendre des décisions ayant un impact énorme sur nos vies. Il s'est notamment intéressé aux concepts de taux de reproduction de base et d'immunité de groupe. Deux modèles ont été présentés, le premier illustrant la croissance exponentielle du début d'une épidémie et le classique modèle SIR sur lequel on comprend les concepts de taux de reproduction de base et d'immunité de groupe.

Christian Genest a présenté une conférence intitulée **« Dépistage par groupe »**. Dans celle-ci, il a proposé des pistes pour accroître l'efficacité de la campagne de dépistage tout en économisant les ressources en procédant à des tests sur des mélanges de prélèvements plutôt que sur des échantillons individuels. Cette stratégie, qui fait notamment appel à la théorie des codes correcteurs d'erreurs de Reed-Solomon, est déjà employée avec succès dans certains pays. La conférence a montré les économies potentielles selon la prévalence de la maladie et la stratégie utilisée.

Christiane Rousseau a présenté une conférence intitulée **« Partage équitable »**. Celle-ci portait sur la théorie de partage équitable dont les applications sont nombreuses comme, par exemple, la répartition des actifs d'une compagnie en faillite ou des biens d'un couple après un divorce. Christiane Rousseau a notamment siégé au comité exécutif de l'Union Mathématique Internationale pour laquelle elle a piloté le dossier qui, en novembre 2019, a mené l'UNESCO à proclamer le 14 mars Journée internationale des mathématiques.

https://youtube.com/playlist?list=PLHaWeIntAtAJlZB9VY-C8dQiuC_HnAFAur

DANS LE CADRE DE LA 15E ÉDITION DES 24 HEURES DE SCIENCE
DU CENTRE DE RECHERCHES MATHÉMATIQUES

Harnessing Math to Demystify Tipping Points

Vendredi 7 mai 2021 /
Friday May 7, 2021
19h / 7:00 pm

Mary Lou Zeeman

Bowdoin College, USA

Biography

Mary Lou Zeeman is the Wells Johnson Professor at Bowdoin College in the US. Her research is in 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 Mathematics Climate Research Network (MCRN). She is very involved in the popularisation of science for sustainable development issues.

*Whatever your talents, and whatever your passions, you can use them to help our planet. This is especially true if you enjoy math. In this talk, we'll explore the mathematics of "tipping points" — **dramatic moments when a system suddenly shifts from one state to another** — and see how it can help us to make decisions for a better world.*

crm.umontreal.ca/2021/science24heures2021/

SEMESTRE THÉMATIQUE

Théorie des nombres – Comohologie en arithmétique, automne 2020

Number Theory – Cohomology in Arithmetic, Fall 2020

The Number Theory Thematic Semester on Cohomology in Arithmetic was held in a hybrid format: Three workshops (2 virtual and one hybrid) and two Aisenstadt Chair lectures took place, with a fourth workshop that has been deferred to Fall 2021. The Aisenstadt Chair lecturers were Wieslawa Niziol (CNRS & Sorbonne) and Nicolas Bergeron (ENS Paris). Importantly, the CRM has been able to welcome 13 young scholars (postdoctoral researchers), including 5 women, within its walls for stays ranging from 4 to 12 months. They have been working in a safe bubble within the framework of a mitigation plan approved by the Université de Montréal. They interacted with a number of prominent local number theorists. Working seminars were held in hybrid mode with participants dispersed in several countries. The program also included three graduate courses.

Higher Coleman Theory and Applications Workshop

(Atelier Théorie de Coleman supérieure et applications)

as part of Thematic Semester:
Number Theory – Cohomology in Arithmetic

December 7-11, 2020

Organisers:

Daniel Barrera Salazar (Universidad de Santiago de Chile)
Mladen Dimitrov (Université de Lille)
Adrian Iovita (Concordia University)
Giovanni Rosso (Concordia University)

Activity Summary:

The fourth workshop "Higher Coleman Theory and Applications", which we organized in the framework of the Special Semester "Cohomology in Arithmetic" at the CRM, Fall 2020, benefited from the experience of the organization of the other three workshops (of which one, more precisely the second, was postponed but the others happened at the dates announced).

Already before the third workshop it was clear that: a) there had to be a "live component of it", b) it would be beneficial, even necessary, to concentrate the workshop in one theme and its applications. Therefore the third workshop functioned as follows: it had 2-3 one-hour online (zoom) talks and a live discussion in the afternoons, daily, during the week of the workshop. This increased the participation of the 25-30 local postdoctoral fellows and graduate students who attended regularly, participated in the discussions and, according to their own evaluations, learned a lot from the workshop.

The fourth workshop was therefore re-structured and concentrated around the theme, very much in fashion, of Higher Coleman Theory and its applications. We secured the participation of the main Mathematicians involved in this research theme (G. Boxer, V. Pilloni, F. Andreatta, D. Loeffler, S. Zerbes, J. E. Rodriguez) and we organized cycles of lectures in the style of a Winter school. We were planning to position the activity as a superspreader event for creating interest in Higher Coleman Theory, and the speakers largely succeeded in transmitting to the audience their infectious enthusiasm for the subject. At the same time, we incorporated the Aisenstadt lectures of Wieslawa Niziol (CNRS Paris) into the workshop (they happened during the week-end before the start of the workshop).

In view of the fact that both the topic of Niziol's talks and that of the workshop were quite technical and in order to maximize the benefit for the local participants, more than a month before the start of the workshop we organized lectures reviewing the background needed in order for our participants to be able to follow the lectures and participate in the discussions. The review lectures were given by local experts, they were available only for the local participants and were very well attended.

Regional Lie Theory Conference

October 2-3, 2020

Organizers:

Michael Lau *(Université Laval)*
Erhard Neher *(University of Ottawa)*


Michael Lau


Erhard Neher

The conference was held remotely using Zoom, with excellent support provided by Virginie Leduc and the CRM staff. It featured six one-hour presentations by top researchers in the field :

- **Evgeny Feigin**
  (HSE University Moscow)
  Veronese embeddings, arc schemes and global Demazure modules
- **Yvan Saint-Aubin**
  (Université de Montréal)
  The structure of the periodic spin chain XXZ seen as a module over the affine Temperley-Lieb algebra
- **Thomas Creutzig**
  (University of Alberta)
  VOAs — From representation theory to physics
- **Martina Lanini**
  (Universita di Roma Tor Vergata)
  Torus actions on cyclic quiver Grassmannians
- **Georgia Benkart**
  (University of Wisconsin-Madison)
  Fusion Rules
- **Alex Weekes**
  (University of British Columbia)
  Coulomb branches and Yangians

A total of 59 mathematicians registered for the conference and participated from 16 countries on 6 continents. Registration was mandatory, but free. All lectures were recorded and made publicly available on the CRM YouTube channel. The presentations were uniformly superb, providing a window into a wide variety of current work in the field, and were delivered by researchers at various stages of academic life, from postdocs to emeritus professors, with no technical difficulties whatsoever.

To understand the conference, it is important to know its history, which is a concrete example of how Covid-19 has profoundly changed the nature of scientific exchanges within a single year.

Planning for the conference began with informal discussions between the organizers on the sidelines of another conference in mid-2019, long before the pandemic struck. The organizers wanted to develop a forum for researchers interested in Lie theory and based in regions of Québec and Ontario adjacent to Montréal. The strategic location and resources of the CRM made it the ideal venue. The conferences were scheduled to take place on Saturdays during the term, so as not to interfere with teaching and allow same-day travel by ground transportation to and from Montréal (no hotel). The original plan was to hold such one-day conferences once a term, starting in Winter 2020. Each conference would have its own theme. For the March 2020 conference this was to be mathematical physics related to Lie theory; for the October 2020 conference the theme was combinatorial aspects of Lie theory.

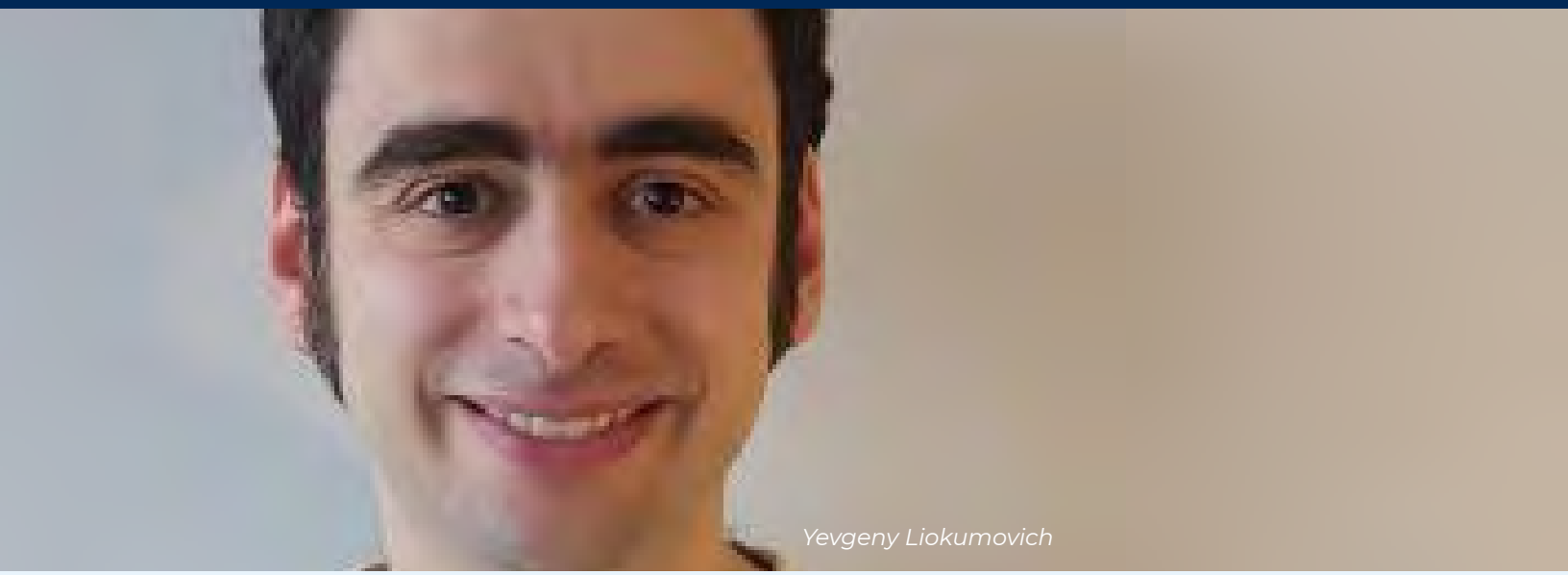
But the coronavirus had other plans. The first conference was scheduled for March 21, 2020. On March 11, the World Health Organization declared a global pandemic; on March 13, the government of Québec summarily closed universities to most teaching activities. After much debate and discussion with invited speakers, the decision was taken on March 16 to cancel the March 21 conference. By then, it was too late to organize a credible on-line meeting for March 21. Neither the organizers nor the speakers had any prior experience with on-line talks, a scenario difficult to imagine from today's perspective. It is amusing to reread our emails from 11 months ago, in which we question what is Zoom and operate under the assumption that restrictions would "only be in place for a couple weeks". In March 2020, we were convinced that the October conference would take place as scheduled, with everyone sitting together in the CRM's auditorium. It was thus natural to postpone the March meeting and combine it to organize a 2-day event in October 2020. We are very grateful to Luc Vinet and the CRM administration for supporting this unforeseen change.

But the pandemic dragged on. All organizers and speakers soon gained Zoom experience. In July 2020, we decided to move the October meeting from an in-person conference to a Zoom event, "just to be on the safe side", because it was still not certain (in July 2020) that an in-person meeting could take place in October 2020. Going on-line also had the distinct advantage that we could invite two young international stars, Feigin (Moscow) and Lanini (Rome), whose presence could not otherwise be funded.

Looking back, our original plan for a series of regional conferences has been overrun by the effects of the pandemic on scientific life. Mathematicians have now adapted to attending specialized online seminars, featuring speakers from all over the world. While the new globalization and democratization of knowledge-sharing is certainly laudable, we feel that important aspects of scientific interaction and communication are being lost in the on-line revolution, and we hope that there will still be an important place for regional scientific community-building in post-pandemic times.

2020 CRM Nirenberg Lectures in Geometric Analysis

http://www.crm.umontreal.ca/2020/Nirenberg-Liokumovich-Song2020



Yevgeny Liokumovich

Yevgeny Liokumovich

University of Toronto
September 18 & 21, 2020

The 2020 CRM Nirenberg Lectures in Geometric Analysis were unusual in a number of ways. Originally planned for March, they had to be rescheduled due to the pandemic and eventually held over Zoom in September. The 2020 edition of the Nirenberg lectures featured, for the first time, two speakers: Yegeny Liokumovich (University of Toronto) and Antoine Song (University of California, Berkeley). The unifying theme of the series was minimal surface theory, and both speakers reported on their recent breakthrough contributions to the subject.

The first two lectures were delivered by Professor Liokumovich. He received his Ph.D. in 2015 at the University of Toronto under the supervision of A. Nabutovsky and R. Rotman. After a postdoc at MIT and 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 the Weyl law for the volume spectrum in a recent joint work with F.C. Marques and the 2015 CRM Nirenberg lecturer A. Neves.

The first lecture entitled "Measuring size and complexity of Riemannian manifolds" was aimed at a general mathematical audience. It addressed the following question: given a Riemannian manifold, how hard is it to slice it into pieces of smaller dimension? More specifically, what can be said about the volume, diameter and topological complexity of the slices? These questions give rise to the notion of width of a manifold, which in turn is connected to the theory of minimal surfaces. The talk was based on the joint works of the speaker with A. Nabutovsky, R. Rotman and B. Lishak, with G.R. Chambers, and with D. Ketover and A. Song.

The 2020 Nirenberg lectures were attended over Zoom by a total of 159 participants, both local and international, including many graduate students and postdocs.

Organizers:

Pengfei Guan (McGill University)
Dmitry Jakobson (McGill University)
Iosif Polterovich (Université de Montréal)
Alina Stancu (Concordia University)

Antoine Song

Antoine Song

University of California, Berkeley

September 23 & 25, 2020

The second talk was entitled "Minimal surfaces and quantitative topology". The speaker presented the main ideas of the recent proof of Gromov's conjecture for the asymptotics of the volume spectrum - which is referred to as "Weyl law" in analogy to the corresponding result for the Laplace spectrum. The talk was based on joint works with F.C. Marques and A. Neves, and with L. Guth.

The next two lectures were delivered by Antoine Song. He received his Ph.D. in 2019 from Princeton University under the supervision of F.C. Marques. Professor Song 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.

In the first lecture entitled "Complexities of minimal hypersurfaces", Antoine Song has also used the analogy between the minimal surface theory and spectral theory. He considered embedded minimal surfaces in 3-manifolds constructed with the help of min-max theory as geometric analogues of Laplace eigenfunctions. New quantitative estimates of their complexity, measured in terms of area, genus and Morse index, were presented during the talk.

The second lecture of Professor Song was aimed at a general mathematical audience. It was entitled "Abundance of minimal hypersurfaces" and was devoted to the proof of the celebrated conjecture of S.T. Yau that any closed Riemannian 3-manifold contains infinitely many minimal surfaces. The argument used an ingenious blend of ideas from analysis, geometric measure theory and topology. This talk was partially based on a joint work of the speaker with F.C. Marques and A. Neves.

APPEL À PROPOSITIONS
CALL FOR PROPOSALS

ACTIVITÉS SCIENTIFIQUES – SCIENTIFIC ACTIVITIES

Le CRM fait **appel à des propositions** concernant des activités scientifiques de haut niveau en sciences mathématiques. La priorité est donnée au soutien d'activités de grande qualité scientifique qui présentent de nouvelles directions de recherche pour la communauté du CRM. Deux volets sont couverts :

Les programmes thématiques sont d'une durée allant de quatre mois à un an, ils peuvent comprendre des ateliers, des conférences, des mini-cours ou des écoles et inclure des séjours prolongés de chercheurs visiteurs au CRM. Les laboratoires scientifiques peuvent participer à l'organisation et au financement de ces programmes;

Le programme général consiste en des activités de courte durée qui ne sont pas associées à un programme thématique. Les activités peuvent être des ateliers, conférences, groupes de recherche, ainsi que des activités de formation telles que les écoles ou les mini-cours soutenus par des chercheurs invités.

Calendrier

Programmes thématiques

Nous sollicitons des lettres d'intention en vue des programmes thématiques qui se tiendront à partir de 2024. Les lettres d'intention devraient être transmises au plus tard les **15 mars et 15 septembre** de chaque année à l'adresse projets@crm.umontreal.ca.

Pour faire l'objet d'un financement, l'activité doit être réalisée **au moins neuf mois après la date limite de soumission des propositions complètes.**

Les propositions sont examinées par le Comité scientifique international et le Comité de direction du CRM. Si le programme est accepté, les membres du comité organisateur pourront compter sur le soutien du personnel du CRM.

Programme général

Les propositions qui requièrent **plus de 5000$** de financement du CRM sont examinées par le Comité scientifique international. Les lettres d'intention devraient être transmises au plus tard les **15 mars et 15 septembre** de chaque année à l'adresse projets@crm.umontreal.ca.

Par ailleurs, les propositions qui requièrent **au plus 5000$** de financement du CRM sont examinées par le Comité de direction du CRM. Les dates limites pour ces propositions sont les **1er février, 1er juin et 1er octobre** de chaque année. Elles doivent être soumises à l'adresse projets@crm.umontreal.ca.

Dans tous les cas, pour faire l'objet d'un financement, l'activité doit être réalisée **au moins neuf mois après la date limite de soumission.**

Conditions

Toutes les activités doivent être d'un intérêt scientifique manifeste et s'arrimer aux domaines de recherche du CRM. Ceci doit être explicité dans la proposition.

Le CRM est fier de souscrire à la politique sur l'adaptation à la diversité culturelle de l'Université de Montréal et s'engage à prendre en compte la diversité et les barrières systémiques et individuelles à l'accès (par exemple, liées à l'origine ethnique, au genre, à un handicap) lors de l'élaboration de sa programmation. Il s'engage, notamment, à surveiller le ratio de genre tant pour les organisateurs que pour les participants dès le stade de la soumission d'une proposition et à demander aux proposants les moyens qu'ils ont pris pour augmenter la diversité dans leur projet.

Généralement, le CRM ne finance pas les évènements qui se répètent. Il est donc peu probable que les conférences récurrentes reçoivent un appui.

Lignes directrices de présentation

Des modèles de proposition (en format .tex et .docx) sont disponibles sur le site web du CRM depuis la page ***«Appel à propositions»***.

Les personnes qui souhaitent proposer un **programme thématique** sont encouragées à contacter, à l'adresse projets@crm.umontreal.ca, le directeur du CRM ou le directeur adjoint aux programmes scientifiques afin de discuter de leur proposition avant de rédiger leur lettre d'intention. Cette dernière doit inclure l'information suivante :

- une proposition complète avec titre ;
- le C.V. de chacun des membres du comité organisateur ;
- une description scientifique de l'évènement, incluant les principales activités de recherche et de formation ;
- une liste provisoire des principaux participants invités et leur rôle éventuel dans le cadre du programme, y compris une proposition de titulaires pour la chaire Aisenstadt ;
- une proposition de calendrier des activités.

Une proposition d'activités dans le cadre du **programme général** doit présenter un argument convaincant concernant la qualité scientifique de l'évènement et sa probabilité de succès. Elle doit comprendre les documents suivants :

- une proposition complète avec titre ;
- le C.V. de chacun des membres du comité organisateur.

The CRM invites proposals for high-level scientific activities in the mathematical sciences. When choosing the scientific programming, the priority is the support of activities of top scientific quality and which introduce new research directions to the CRM community.

Thematic programs

They typically have a duration of between four months and one year. They may include workshops, conferences, short courses or schools, extended stays by visiting researchers to the CRM. The scientific laboratories sometimes participate in the organization and financing of these programs.

General program

The CRM also supports shorter activities not associated with a thematic program. These include workshops, conferences, research in groups, and training activities such as schools or short courses by visiting scholars.

Timeframe

Thematic programs

We are currently inviting letters of intent for thematic programs to take place starting 2024.

*They should be received by **March 15 and September 15** of each year at the address proposals@crm.umontreal.ca.*

Proposals are reviewed by the International Scientific

Advisory Committee and by the CRM Executive Committee. If the program is accepted, the members of the organizing committee can count on the full support of CRM personnel.

General program

Proposals requesting ***over $5000*** *in CRM funding are reviewed by the International Scientific Advisory Committee, which convenes twice annually. For such proposals, the deadlines are* ***March 15 and September 15 of each year****.*

Otherwise, proposals requesting ***at most $5000*** *in CRM funding are reviewed by the CRM's management committee. For such proposals, the deadlines are* ***February 1st, June 1st and October 1st of each year.***

In both cases, to be considered for funding, the activity must occur at least nine months after the submission deadline.

Requirements

All activities should be of clear scientific interest and relevance to the research areas of the CRM. The case for this should be explicitly made in the proposal.

The CRM is proud to subscribe to the Université de Montréal's policy on adapting to cultural diversity and is committed to taking into account the diversity and the systemic and individual barriers to access (for example, related to ethnicity, gender, disability) when developing its programming. It undertakes, in particular, to monitor the gender ratio both for the organizers and for the participants at the proposal submission stage and to ask the proposers for the means they have taken to increase diversity in their project.

The CRM typically does not fund repeat events. Thus, recurring conferences are unlikely to be offered support.

Submission Guidelines

Proposal templates (as .tex and .docx files) are available on the CRM website from the page Call for Proposals.

Thematic programs

Letters of intent for thematic program proposals should include the following information:

- *A complete proposal with title.*
- *CVs for all members of the organizing committee.*
- *A scientific description of the event, including the major research and training activities.*
- *A tentative list of the principal invited participants and their proposed role within the thematic program, including proposal for holders of the Aisenstadt Chair.*
- *A proposed timeline of activities.*

Individuals interested in proposing a thematic program are encouraged to contact the CRM director or the CRM deputy director for scientific programs to discuss their proposal prior to preparing a letter of intent at the address proposals@crm.umontreal.ca.

General program

Proposals for activities as part of the general scientific program should include the following documents:

- *A complete proposal with title.*
- *CVs for all members of the organizing committee.*

Proposals should make a convincing case of the high scientific value of the event and its probability of success. They must be submitted to proposals@crm.umontreal.ca

Programme de chercheurs Simons – CRM

Appel à propositions

Le Centre de recherches mathématiques (CRM) poursuit son appel à propositions. Le programme est financé grâce à l'appui généreux de la Simons Foundation et s'adresse à deux catégories de chercheurs exceptionnels en mathématiques et domaines connexes: les chercheurs juniors (ayant obtenu leur doctorat il y a moins de 10 ans) et les chercheurs séniors.

Dans le cadre de ce programme, les chercheurs sont invités à séjourner au CRM pour une période minimale d'un mois, que ce soit dans le cadre des programmes thématiques ou encore pour participer à des activités de recherche collaborative organisées par les laboratoires du CRM.

Le CRM est fier de souscrire à la politique sur l'adaptation à la diversité culturelle de l'Université de Montréal et s'engage à prendre en compte la diversité et les barrières systémiques et individuelles à l'accès (par exemple, liées à l'origine ethnique, au genre, à un handicap) lors de la sélection des chercheurs invités.

Les propositions sont examinées par le Comité scientifique international quatre fois par année après les dates limites de dépôt des candidatures soit les 10 janvier, 1er avril, 1er juillet et 1er octobre.

Veuillez consulter le lien

http://www.crm.math.ca/simonsfoundation/simonsfoundation_fr.shtml

afin d'obtenir l'information complète concernant le programme et la façon de présenter une candidature.

Simons–CRM Scholar-in-Residence Program

Call for Proposals

The Centre de recherches mathématiques (CRM) continues its call for proposals. The program is funded with the generous support of the Simons Foundation. It is directed towards exceptional researchers in mathematics and related areas at both the junior (less then 10 years since Ph.D.) and senior levels.

The researchers are invited for one month stays or more. The visits could be either associated to a thematic program or collaborative research activities involving the CRM laboratories.

The CRM is proud to subscribe to the Université de Montréal's policy on adapting to cultural diversity and is committed to taking into account the diversity and the systemic and individual barriers to access (for example, related to ethnic origin, gender, disability) when selecting visiting researchers.

The proposals are considered by the International Scientific Advisory Committee four times a year, after the deadlines for application, that is January 10th, April 1st, July 1st, and October 1st.

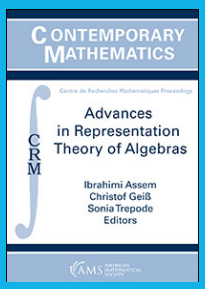
You will find all the information related to this program and how to apply on the link

http://www.crm.math.ca/simonsfoundation/simonsfoundation_en.shtml

NEW CRM PUBLICATIONS

Publié en 2021

CRM Proceedings (in Contemporary Mathematics, AMS)



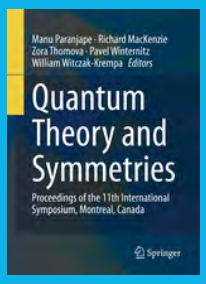
Advances in Representation Theory of Algebras (ARTA VII), UNAM, Mexico, September 2018.

Éditeurs : Ibrahim Assem, Christof Geiss, Sonia Trepode, CONM/761, 2021.

https://bookstore.ams.org/conm-761/

À paraître en 2021

CRM Series in Mathematical Physics (Springer)

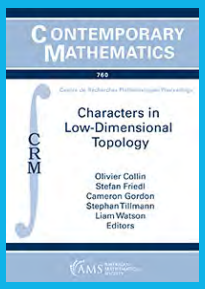


Proceedings of the international conference on Quantum Theory and Symmetries, Montreal 2019.
Éditeurs : M. Paranjape, R. Mackensie, Z. Thomova, P. Winternitz., W. Witczak-Krempa

https://www.springer.com/gp/book/9783030557768

Publié en 2020

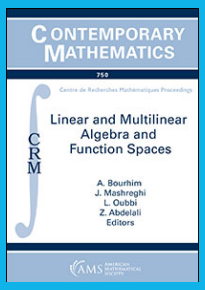
CRM Proceedings (in Contemporary Mathematics, AMS)



Characters in low-dimensional topology in honour of Steve Boyer, UQAM, Montréal, June 2018.

Éditeurs: Stephan Tillmann, Olivier Collin, Stefan Friedl, Cameron Gordon, Liam Watson CONM/760, 2020

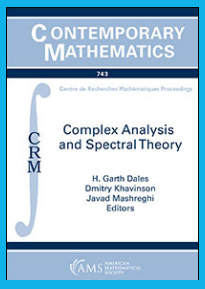
https://bookstore.ams.org/conm-760/



International Conference on Algebra and Related Topics: Part 2: Linear and multilinear algebra, Function spaces and related topics, Rabat, Maroc, July 2018.

Éditeurs: J. Mashreghi, A. Bourhim, Z. El Abidine Abdelali, L. Oubbi, CONM/750, 2020.

https://bookstore.ams.org/conm-750/

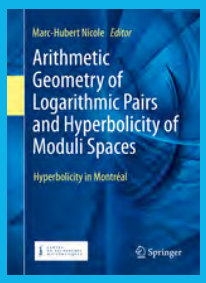


Complex analysis and spectral theory, in celebration of Thomas J. Ransford's 60th birthday, Université Laval, May 2018.

Éditeurs: J. Mashreghi, G. Dales, D. Khavinson, CONM/743, 2020.

https://bookstore.ams.org/conm-743/

CRM Series in Mathematical Physics (Springer)



Arithmetic Geometry of Logarithmic Pairs and Hyperbolicity of Moduli Spaces. Hyperbolicity in Montréal.
Éditeur: Marc-Hubert Nicole, 2020.

https://www.springer.com/gp/book/9783030498634