Canadian Mathematical Society
Société mathématique du Canada

2025 CMS Winter Meeting

PROGRAMME

Réunion d'hiver 2025 de la SMC

December 5-8 | 5 au 8 décembre

Toronto, ON - Toronto Chelsea Hotel

Canadian Mathematical Society
Société mathématique du Canada

Thank you
Merci

To our sponsors | À nos commanditaires

INSTITUT TUTTE INSTITUTE

Centre de la sécurité des télécommunications Canada

Communications Security Establishment Canada

AARMS
Atlantic Association for Research in the Mathematical Sciences

CENTRE DE RECHERCHES MATHÉMATIQUES

FIELDS

Pacific Institute *for the* Mathematical Sciences

Table of contents | Table des matières

CMS Winter Meeting 2025 | Réunion d'hiver de la SMC 2025
Chelsea Hotel, Toronto (ON)

Friday | Vendredi December 5 décembre	Saturday | Samedi December 6 décembre	Sunday | Dimanche December 7 décembre	Monday | Lundi December 8 décembre
8:00 - 19:30 Registration | Inscription	7:30 - 18:00 - Registration | Inscription 8:30 - 16:30 - Poster Session Affiches 10:00 - 16:30 - Exhibits | Expositions	7:30 - 18:00 - Registration | Inscription 10:00 - 16:30 - Exhibits | Expositions	7:30 - 18:00 Registration | Inscription
9:00 – 12:00 CMS Mini-Courses | Mini-cours de la SMC	8:00 – 10:30 Scientific Sessions Sessions Scientifiques	8:00 – 10:30 Scientific Sessions Sessions Scientifiques	8:00 – 10:30 Scientific Sessions Sessions Scientifiques
	10:30 – 11:00 Break | Pause	10:30 – 11:00 Break | Pause	10:30 – 13:30 Break | Pause
12:30 – 16:30 CMS Board of Directors Meeting Réunion du Conseil d'administration de la SMC	11:00 – 12:00 **Prof. Diana Skrzydlo** Education Plenary Lecture Conférence sur l'éducation	11:00 – 12:00 **Dr. Monica Visan** Plenary Lecture Conférence plénière	
13:00 - 16:00 CMS Mini-Courses Mini-cours de la SMC	12:00 - 13:00 **Dr. Louigi Addario-Berry** Plenary Lecture Conférence plénière	12:00 – 13:30 Diversity and Inclusivity Lunchtime Discussion *(Registration Required)* Dîner-discussion sur la diversité et l'inclusion *(inscription obligatoire)*	
	13:00 - 14:00 Break | Pause	13:30 – 14:30 Dr. **Chris Kapulkin** Coxeter-James Prize Lecture Conférence de Prix Coxeter-James	13:30 – 14:30 **Dr. Chi Hoi (Kyle) Yip** Doctoral Prize Lecture Conférence de Prix doctoral
	14:00 – 15:00 **Prof. Barbara and Dr. Brian Forrest** Adrien Pouliot Prize Lecture Conférence de Prix Adrien Pouliot	14:30 – 15:00 Break | Pause	14:30 – 15:00 Break | Pause
16:45 – 18:00 Opening Remarks and Public Lecture | Mot d'ouverture et conférence publique **Dr. Craig Kaplan**	15:00 – 18:00 Scientific Sessions Sessions Scientifiques	15:00 – 18:00 Scientific Sessions Sessions Scientifiques	15:00 – 18:00 Scientific Sessions Sessions Scientifiques
18:00 – 19:00 Welcome Reception Réception	18:00 – 19:00 Friends of Robert Woodrow Reception		
20:00 – 22:00 Student Social | Soirée étudiante	19:00 – 22:00 Reception and Awards Banquet Réception et Banquet de prix		

Mini-Courses

Continuous Quantum Walks *(Promenades quantiques continues)*

Friday, December 5 - 9am to 12pm | Le vendredi 5 décembre - 9h à 12h
Organizer | Organisateur(trice)(s) : Hermie Monterde (Manitoba)
Room | Salle : Windsor

Flipping your Class *(Renverser votre classe)*

Friday, December 5 - 9am to 12pm | Le vendredi 5 décembre - 9 h à 12 h
Organizer | Organisateur(trice)(s) : Diana Skrzydlo (Waterloo)
Room | Salle : Rosetti A

Introduction to Categorical Computing with Catlab *(Introduction à l'informatique catégorielle avec Catlab)*

Friday, December 5 - 1pm to 4pm | Le vendredi 5 décembre - 13 h à 16 h
Organizer(s) | Organisateur(trice)(s) : Xiaoyan Li (Lethbridge) & Nathaniel Osgood (Saskatchewan)
Room | Salle : Rosetti B

Mathematical Programming and Networks *(Programmation mathématique et réseaux)*

Friday, December 5 - 1pm to 4pm | Le vendredi 5 décembre - de 13 h à 16 h
Organizer(s) | Organisateur(trice)(s) : Nathan Grieve (Carleton)
Room | Salle : Stevenson

Beyond First Year: What Maple Can Contribute to Advanced Math Courses *(Au-delà de la première année : ce que Maple peut apporter aux cours de mathématiques avancées)*

Friday, December 5 - 1pm to 4pm | Le vendredi 5 décembre - de 13 h à 16 h
Organizer(s) | Organisateur(trice)(s) : Paulina Chin (Maplesoft)
Room | Salle : Rosetti C

Saturday | Samedi (1/2)

#	ROOM SALLE	SATURDAY | SAMEDI AM	SATURDAY | SAMEDI PM
1	Turner	Combinatorial Algebraic Geometry | Géométrie algébrique combinatoire	
2	James	Commutative Algebra | Algèbre commutative	
3	Churchill Ballroom	Recent Developments in Integrability and Symmetry Theory Développements récents en théorie de l'intégrabilité et de la symétrie	
4	Baker	Topology | Topologie	
5	Seymour	Recent Developments in Complex Analysis and Geometry Développements récents en analyse complexe et géométrie	
6	Stevenson	Mathematical relativity and geometric analysis | Relativité mathématique et analyse géométrique	
7	Windsor	Theory and application of Inverse Problems in mathematical physics Théorie et application des problèmes inverses en physique mathématique	
8	Gerrard	Practical approaches to mentoring undergraduate research projects Approches pratiques pour encadrer des projets de recherche de premier cycle	
9	Rosetti A	Harmonic Analysis & PDE | Analyse harmonique et EDP	
10	Rosetti B	Mathematical Finance | Finance mathématique	
11	Rosetti C	An invitation to low-dimensional topology | Une invitation à la topologie de basse dimension	
12	Wren A	Mathematics of Machine Learning | Mathématiques de l'apprentissage automatique	
13	Wren B	Set theory and its applications | Théorie des ensembles et ses applications	
14	Wren C	Recent progress in convex and discrete geometry | Progrès récents en géométrie convexe et discrète	

Saturday | Samedi (2/2)

#	ROOM SALLE	SATURDAY | SAMEDI AM	SATURDAY | SAMEDI PM
15	Scott A	Progress in differential equations and their applications in mathematical biology Progrès dans le domaine des équations différentielles et leurs applications en biologie mathématique	
16	Scott B	Analytic–Geometric Synergies: Harmonic Analysis and Convexity Synergies analytiques et géométriques : analyse harmonique et convexité	
17	Carlyle A	Algebraic Graph Theory: progress and problems Théorie algébrique des graphes : progrès et problèmes	
18	Carlyle B	Variational Analysis: Theory and Applications | Analyse variationnelle : Théorie et applications	
19	Galsworthy	Probability and PDEs | Probabilité et EDP	
20	Duchesse	Additive combinatorics and applications | Combinatoire additive et applications	
21	Austen	Combinatorial Design Theory | Théorie de la conception combinatoire	
22	Chesterton	Geometric Partial Differential Equations | Équations différentielles partielles géométriques	
23	Whistler	Horizons in Operator Algebras | Horizons dans les algèbres d'opérateurs	

Sunday | Dimanche (1/2)

#	ROOM SALLE	SUNDAY | DIMANCHE AM	SUNDAY | DIMANCHE PM
1	Turner	Combinatorial Algebraic Geometry Géométrie algébrique combinatoire	
2	James	Commutative Algebra | Algèbre commutative	
3	Churchill Ballroom	Gender Equity in the Mathematical Sciences | Égalité des genres dans les sciences mathématiques	
4	Baker	Topology | Topologie	
5	Seymour	Recent Developments in Complex Analysis and Geometry Développements récents en analyse complexe et géométrie	
6	Stevenson	NSERC-CSE Research Communities: Robust, Secure and Safe Artificial Intelligence and Exploratory Analysis of Unstructured Data | Communautés de recherche CRSNG-CSE : Intelligence artificielle robuste, sécurisée et sûre et analyse exploratoire des données non structurées	
7	Windsor	Theory and application of Inverse Problems in mathematical physics Théorie et application des problèmes inverses en physique mathématique	
8	Gerrard		Joy in university math classes La joie dans les cours de maths à l'université
9	Rosetti A	Harmonic Analysis & PDE | Analyse harmonique et EDP	
10	Rosetti B	Mathematical Finance | Finance mathématique	
11	Rosetti C	Number Theory by Early Career Researchers Théorie des nombres par des chercheurs en début de carrière	
12	Wren A	Mathematics of Machine Learning Mathématiques de l'apprentissage automatique	Logic in Canada IV | Logique au Canada IV

Sunday | Dimanche (2/2)

#	ROOM SALLE	SUNDAY | DIMANCHE AM	SUNDAY | DIMANCHE PM
13	Wren B	Set theory and its applications Théorie des ensembles et ses applications	Variational Problems: Trends and Applications Problèmes variationnels : tendances et applications
14	Wren C	Recent progress in convex and discrete geometry | Progrès récents en géométrie convexe et discrète	
15	Scott A	Progress in differential equations and their applications in mathematical biology Progrès dans le domaine des équations différentielles et leurs applications en biologie mathématique	
16	Scott B	Analytic–Geometric Synergies: Harmonic Analysis and Convexity Synergies analytiques et géométriques : analyse harmonique et convexité	
17	Carlyle A	Algebraic Graph Theory: progress and problems Théorie algébrique des graphes : progrès et problèmes	
18	Carlyle B	AI and Mathematical Technologies for Decision Support in Public Health IA et technologies mathématiques pour l'aide à la décision en santé publique	
19	Galsworthy	Probability and PDEs | Probabilité et EDP	
20	Duchesse	Additive combinatorics and applications Combinatoire additive et applications	Geometric Partial Differential Equations Équations différentielles partielles géométriques
21	Austen	Combinatorial Design Theory | Théorie de la conception combinatoire	
22	Chesterton	Student Research Session | Session de recherche étudiante	
23	Whistler	Horizons in Operator Algebras | Horizons dans les algèbres d'opérateurs	

Monday | Lundi (1/1)

#	ROOM SALLE	MONDAY | LUNDI AM	MONDAY | LUNDI PM
1	Baker	Topology | Topologie	
2	Churchill	Practical approaches to mentoring undergraduate research projects Approches pratiques pour encadrer des projets de recherche de premier cycle	
3	Stevenson	AI and Mathematical Technologies for Decision Support in Public Health | IA et technologies mathématiques pour l'aide à la décision en santé publique	
4	Gerrard	Gender Equity in the Mathematical Sciences Égalité des sexes dans les sciences mathématiques	
5	Rosetti A	Harmonic Analysis & PDE | Analyse harmonique et EDP	
6	Rosetti B	Mathematical Finance | Finance mathématique	
7	Rosetti C	Number Theory by Early Career Researchers Théorie des nombres par des chercheurs en début de carrière	
8	Wren A	Logic in Canada IV | Logique au Canada IV	
9	Wren B	New trends in Analysis | Nouvelles tendances en matière d'analyse	
10	Wren C	Quantum Error Correction and Related Topics | Correction d'erreurs quantiques et sujets connexes	

President's Welcome Letter

Dear Participants,

It is my great pleasure to welcome you to Toronto for the 2025 CMS Winter Meeting. We are delighted to gather the mathematical community for several days of exchange, discovery, and collaboration. The next few days offer a rich program of scientific sessions, talks, mini-courses, and discussions designed to spark conversation and collaboration.

The meeting opens on Friday, December 5, with a public lecture by Dr. Craig Kaplan. Our plenary speakers this winter are Prof. Diana Skrzydlo (University of Waterloo), Dr. Louigi Addario-Berry (McGill), and Dr. Monica Visan (UCLA). In addition to these highlights, participants can enjoy a student poster session, prize lectures, and many opportunities to connect with colleagues.

On Saturday evening, we will come together for the banquet to celebrate outstanding contributions to mathematics through the presentation of the Society's awards. This banquet's honourees include Prof. Barbara Forrest and Dr. Brian Forrest (University of Waterloo), recipients of the Adrien Pouliot Award; Dr. Monica Nevins (University of Ottawa), receiving the Graham Wright Award; Dr. Chris Kapulkin (Western University), receiving the Coxeter-James Award; Dr. Chi Koy (Kyle) Yip (Georgia Tech), recipient of the Blair Spearman Doctoral Prize; and Dr. Isabelle Chalendar (Université Gustave Eiffel) and Dr. Jonathan R. Partington (University of Leeds), recipients of the G. de B. Robinson Award. The winners of the student poster session will also be announced and celebrated during the banquet.

This conference would not be possible without the commitment of many individuals. I wish to thank Dr. Lia Bronsard (McMaster University) and Dr. Ilijas Farah (York University), as well as the scientific organizing committee, session organizers, speakers, volunteers, and the CMS staff. I am also grateful for the support of our sponsors: the Tutte Institute, the Atlantic Association for Research in the Mathematical Sciences (AARMS), the Centre de recherches mathématiques (CRM), the Fields Institute, and the Pacific Institute for the Mathematical Sciences (PIMS).

Whether you are here to present your work, reconnect with peers, or discover something new, I hope you find this meeting rewarding and inspiring. And if you're not yet a member of the Canadian Mathematical Society, I encourage you to stop by the registration desk to learn more about how you can get involved with the Society throughout the year.

Best wishes for a productive and enjoyable meeting,

I Binder

Dr. Ilia Binder
President, Canadian Mathematical Society

Bienvenue du Président

Cher/Chères participant(e)s,

C'est avec grand plaisir que je vous souhaite la bienvenue à Toronto pour la réunion d'hiver 2025 de la SMC. Nous sommes heureux de réunir la communauté mathématique pour plusieurs jours d'échanges, de découvertes et de collaboration. Les prochains jours vous offriront un programme riche en sessions scientifiques, conférences, mini-cours et discussions dans le but de susciter les échanges et la collaboration.

La réunion débutera le vendredi 5 décembre par une conférence publique donnée par le Dr Craig Kaplan. Nos conférencier(ère)s plénier(ère)s cet hiver sont la Prof. Diana Skrzydlo (Université de Waterloo), le Dr Louigi Addario-Berry (McGill), et la Dre Monica Visan (UCLA). En plus de ces points saillants, les participant(e)s pourront profiter d'une session d'affiches étudiantes, de conférences de prix et de nombreuses occasions de rencontrer des collègues.

Le samedi soir, nous nous réunirons pour un banquet afin de célébrer les contributions exceptionnelles aux mathématiques par la remise des prix de la Société. Parmi les lauréat(e)s de ce banquet figurent la Prof. Barbara Forrest et le Dr Brian Forrest (Université de Waterloo), récipiendaires du prix Adrien Pouliot ; la Dre Monica Nevins (Université d'Ottawa), récipiendaire du prix Graham Wright ; le Dr Chris Kapulkin (Western University), récipiendaire du prix Coxeter-James ; le Dr Chi Koy (Kyle) Yip (Georgia Tech), lauréat du prix doctoral Blair Spearman ; et la Dre Isabelle Chalendar (Université Gustave Eiffel) et le Dr Jonathan R. Partington (Université de Leeds), lauréats du prix G. de B. Robinson. Les lauréat(e)s de la session d'affiches étudiantes seront également annoncé(e)s et célébré(e)s lors du banquet.

Cette conférence n'aurait pas été possible sans l'engagement de nombreuses personnes. Je tiens à remercier la Dre Lia Bronsard (McMaster University) et le Dr Ilijas Farah (York University), ainsi que le comité scientifique organisateur, les organisateur(trice)s des sessions, les conférencier(ère)s, les bénévoles et le personnel de la SMC. Je suis également reconnaissant du soutien de nos commanditaires : l'Institut Tutte, l'*Atlantic Association for Research in the Mathematical Sciences* (AARMS), le Centre de recherches mathématiques (CRM), l'Institut Fields et le *Pacific Institute for the Mathematical Sciences* (PIMS).

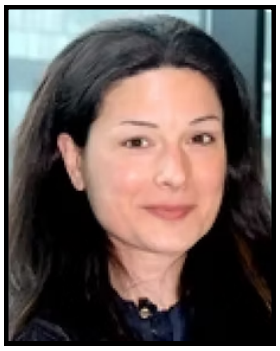
Que vous soyez ici pour présenter vos travaux, renouer avec des collègues ou découvrir quelque chose de nouveau, j'espère que vous trouverez cette réunion enrichissante et inspirante. Et si vous n'êtes pas encore membre de la Société mathématique du Canada, je vous encourage à vous rendre au bureau d'inscription pour en savoir plus sur la façon dont vous pouvez vous impliquer dans la Société tout au long de l'année.

En vous souhaitant une réunion productive et agréable,

I Binder

Dr Ilia Binder
Président, Société mathématique du Canada

The Scientific Organizing Committee
Le Comité scientifique organisateur



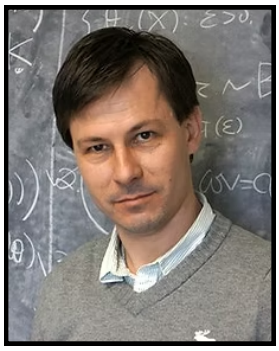
Dr. Andrijana Burazin
University of Toronto, Mississaugua
Education Representative
Représentante de l'éducation

Dr. Patrick Ingram
York University

Dr. Nicholas Kevlahan
McMaster University

Dr. Robert McCann
University of Toronto

Dr. Rahim Moosa
University of Waterloo



Dr. Jean-Christophe Nave
McGill University

Dr. Anush Tserunyan
McGill University

Dr. Aaron Tikuisis
University of Ottawa

Thank you! Merci!

Canadian Mathematical Society
Société mathématique du Canada

2025 Class of Fellows
Cohorte 2025 des Fellows

Congratulations | Félicitations

to the 2025 CMS Class of Fellows
à la cohorte 2025 des Fellows de la SMC

Dr. Adam Clay
University of Manitoba

Dr. Douglas Farenick
University of Regina

Dr. Stephen Kirkland
University of Manitoba

Dr. Rahim Moosa
University of Waterloo

Dr. Jeremy Quastel
University of Toronto

Dr. Renate Scheidler
University of Calgary

Dr. Jie Xiao
Memorial University

2025 Coxeter-James Prize

Dr. Chris Kapulkin (Western University) has been awarded the 2025 Coxeter-James Prize for his outstanding contributions to homotopy theory and its applications across mathematics and computer science.

Dr. Kapulkin earned his Ph.D. from the University of Pittsburgh in 2014 and is now an Associate Professor at Western University. A leading figure in homotopy type theory, he and Dr. Sattler proved Voevodsky's homotopy canonicity conjecture, earning him the 2024 Florence Bucke Science Prize. His research has advanced cubical models of higher categories, discrete homotopy theory, and computational tools for network analysis, influencing fields from geometry to biology.

He has authored nearly 40 papers and received multiple awards, including Western's Distinguished Research Professorship (2022–23) and the Thomas C. Hales Distinguished Research Award (2014).

Beyond research, Dr. Kapulkin serves as an associate editor for the Canadian Journal of Mathematics and the Canadian Mathematical Bulletin, contributes to the CMS EDI Committee, and regularly participates in CMS meetings as a speaker and organizer.

Click here to read the full media release.

Prix Coxeter-James 2025

Le Dr Chris Kapulkin (Université Western) a reçu le prix Coxeter-James 2025 pour ses contributions exceptionnelles à la théorie de l'homotopie et à ses applications en mathématiques et en informatique.

Le Dr Kapulkin a obtenu son doctorat à l'Université de Pittsburgh en 2014 et est aujourd'hui professeur agrégé à l'Université Western. Figure dominante de la théorie des types homotopiques, il a prouvé, avec le Dr Sattler, la conjecture de canonicité homotopique de Voevodsky, ce qui lui a valu le *Florence Bucke Science Prize* 2024. Ses recherches ont fait progresser les modèles cubiques des catégories supérieures, la théorie homotopique discrète et les outils informatiques pour l'analyse des réseaux, influençant des domaines allant de la géométrie à la biologie.

Il est l'auteur de près de 40 articles et a reçu de nombreux prix, dont le *Western's Distinguished Research Professorship* (2022-2023) et le *Thomas C. Hales Distinguished Research Award* (2014).

Au-delà de la recherche, le Dr Kapulkin est rédacteur associé du Journal canadien de mathématiques et du Bulletin canadien de mathématiques, contribue au comité EDI de la SMC et participe régulièrement aux réunions de la SMC en tant que conférencier et organisateur.

Cliquez ici pour lire le communiqué de presse complet.

2025 CMS Blair Spearman Doctoral Prize

Dr. Chi Hoi (Kyle) Yip (Georgia Institute of Technology) has been awarded the 2025 CMS Blair Spearman Doctoral Prize, recognizing outstanding doctoral work by a graduate of a Canadian university.

Dr. Yip earned his Ph.D. in Mathematics from the University of British Columbia (2024) under the supervision of Dr. Greg Martin, Dr. József Solymosi, and Dr. Joshua Zahl. His thesis, Topics in Arithmetic Combinatorics, made major advances on problems such as Sárközy's conjecture, the Paley graph conjecture, and the Erdős similarity problem, using innovative techniques like the Stepanov polynomial method. He also achieved breakthroughs on Diophantine tuples, refining classical results and opening new research directions.

With nearly 45 publications and preprints and 30 invited talks, Dr. Yip has established himself as a prolific young mathematician. His research excellence has been recognized with multiple awards, including two NSERC fellowships and UBC's Graduate Research Award (2023). Since 2024, he has been a Visiting Assistant Professor at Georgia Tech.

Click here to read the full media release.

Prix de doctorat Blair Spearman de la SMC 2025

Le Dr Chi Hoi (Kyle) Yip (Georgia Institute of Technology) a reçu le prix de doctorat Blair Spearman de la SMC 2025, qui récompense les travaux de doctorat exceptionnels d'un diplômé d'une université canadienne.

Le Dr Yip a obtenu son doctorat en mathématiques à l'Université de Colombie-Britannique (2024) sous la supervision des Drs Greg Martin, József Solymosi et Joshua Zahl. Sa thèse, intitulée *Topics in Arithmetic Combinatorics* (Thèmes en combinatoire arithmétique), a permis de réaliser des avancées majeures sur des problèmes tels que la conjecture de Sárközy, la conjecture du graphe de Paley et le problème de similarité d'Erdős, en utilisant des techniques innovantes comme la méthode polynomiale de Stepanov. Il a également réalisé des percées sur les tuples diophantiens, affinant les résultats classiques et ouvrant de nouvelles pistes de recherche.

Avec près de 45 publications et prépublications et 30 conférences invitées, le Dr Yip s'est imposé comme un jeune mathématicien prolifique. L'excellence de ses recherches a été récompensée par de nombreux prix, dont deux bourses du CRSNG et le *UBC's Graduate Research Award* (2023). Depuis 2024, il est professeur adjoint invité à Georgia Tech.

Cliquez ici pour lire le communiqué de presse complet.

2025 Graham Wright Award

Dr. Monica Nevins (University of Ottawa) has received the 2025 Graham Wright Award for Distinguished Service in recognition of her sustained and significant contributions to the Canadian mathematical community and to the CMS.

Dr. Nevins earned her Ph.D. in Mathematics from the Massachusetts Institute of Technology (1998) and has been a Professor at the University of Ottawa since 2000. A leading researcher in representation theory, nilpotent orbits, and mathematical cryptography, she has published over 40 papers, supervised more than 75 students and postdoctoral fellows, and participated in over 80 conferences worldwide.

Her leadership roles include Vice-Dean of Governance and International Relations, Chair of Mathematics and Statistics, and service on committees at both the University of Ottawa and the American Mathematical Society. Within the CMS, she has served as Vice-President, Board Director, Associate Editor, and Scientific Director for major meetings, including the 2021 Online Meeting and 2023 Summer Meeting. A CMS Fellow (2020), Dr. Nevins has also championed equity, teaching, and outreach, inspiring future generations through mentorship and advocacy for women in mathematics.

Click here to read the full media release.

Prix Graham Wright 2025

La Dre Monica Nevins (Université d'Ottawa) a reçu le Prix Graham Wright 2025 pour service méritoire en reconnaissance de ses contributions soutenues et significatives à la communauté mathématique canadienne et à la SMC.

La Dre Nevins a obtenu son doctorat en mathématiques au Massachusetts Institute of Technology (1998) et est professeure à l'Université d'Ottawa depuis 2000. Chercheuse de premier plan dans les domaines de la théorie de la représentation, des orbites nilpotentes et de la cryptographie mathématique, elle a publié plus de 40 articles, supervisé plus de 75 étudiants et boursiers postdoctoraux, et participé à plus de 80 conférences dans le monde entier.

Elle a occupé divers postes de direction, notamment ceux de vice-doyenne de la gouvernance et des relations internationales, de présidente du département de mathématiques et de statistiques, et a siégé à des comités à l'Université d'Ottawa et à l'*American Mathematical Society*. Au sein de la SMC, elle a occupé les fonctions de vice-présidente, de membre du conseil d'administration, de rédactrice associée et de directrice scientifique pour des réunions importantes, notamment la réunion en ligne de 2021 et la réunion d'été de 2023. Fellow de la SMC (2020), la Dre Nevins est également une ardente défenseure de l'équité, de l'enseignement et de la sensibilisation, inspirant les générations futures par son mentorat et son engagement en faveur des femmes dans le domaine des mathématiques.

Cliquez ici pour lire le communiqué de presse complet.

2025 Adrien Pouliot Prize

Prof. Barbara Forrest and Dr. Brian Forrest (University of Waterloo) have been awarded the 2025 Adrien Pouliot Award for their outstanding contributions to mathematics education in Canada.

Prof. Barbara Forrest, recently retired Lecturer in Mathematics, and Dr. Brian Forrest, Professor of Pure Mathematics, are pioneers in online math education and strong advocates for Open Educational Resources (OER). Together, they developed free, high-quality digital calculus materials, including over 600 pages of notes and 150 recorded lectures, now used by thousands of students worldwide. Their innovative approach has transformed teaching and learning by improving accessibility and eliminating textbook barriers.

The Forrests also co-founded the Master of Mathematics for Teachers (MMT) program at Waterloo, which serves over 200 educators annually and has become one of the most successful graduate programs of its kind. Both have received numerous accolades for teaching excellence, including the CMS Excellence in Teaching Award and the University of Waterloo's Distinguished Teacher Award, and Dr. Brian Forrest was named a CMS Fellow in 2021.

Through their vision, collaboration, and dedication, Prof. Barbara Forrest and Dr. Brian Forrest have reshaped mathematics education in Canada, inspiring generations of students and teachers alike.

Click here to read the full media release.

Prix Adrien Pouliot 2025

La Prof. Barbara Forrest et le Dr Brian Forrest (Université de Waterloo) ont reçu le prix Adrien Pouliot 2025 pour leur contribution exceptionnelle à l'enseignement des mathématiques au Canada.

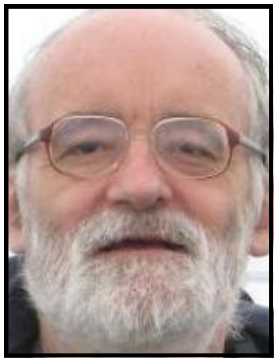
La Prof. Barbara Forrest, récemment retraitée, et le Dr Brian Forrest, professeur de mathématiques pures, sont des pionniers de l'enseignement des mathématiques en ligne et de fervents défenseurs des ressources éducatives libres (REL). Ensemble, ils ont développé du matériel numérique gratuit et de haute qualité sur le calcul différentiel et intégral, comprenant plus de 600 pages de notes et 150 cours enregistrés, désormais utilisés par des milliers d'étudiants à travers le monde. Leur approche innovante a transformé l'enseignement et l'apprentissage en améliorant l'accessibilité et en éliminant les obstacles liés aux manuels scolaires.

Les Forrest ont également cofondé le programme de maîtrise en mathématiques pour les enseignants (MMT) à Waterloo, qui accueille chaque année plus de 200 éducateurs et est devenu l'un des programmes d'études supérieures les plus réussis de ce type. Tous deux ont reçu de nombreuses distinctions pour l'excellence de leur enseignement, notamment le prix d'excellence en enseignement de la SMC et le *Distinguished Teacher Award* de l'université de Waterloo. Le Dr Brian Forrest a été nommé Fellow de la SMC en 2021.

Grâce à leur vision, leur collaboration et leur dévouement, la Prof. Barbara Forrest et le Dr Brian Forrest ont redéfini l'enseignement des mathématiques au Canada, inspirant des générations d'étudiants et d'enseignants.

Cliquez ici pour lire le communiqué de presse complet.

2025 G. de B. Robinson Award



Dr. Isabelle Chalendar (Université Gustave Eiffel) and Dr. Jonathan R. Partington (University of Leeds) have received the 2025 G. de B. Robinson Award for their paper “Phase Retrieval on Circles and Lines” (Canadian Mathematical Bulletin, 67:4 [2024], 927–935).

Their work offers a fresh perspective on the phase retrieval problem, a key question in mathematics and engineering that seeks to reconstruct a signal using only magnitude information. By addressing the most general case (equality conditions on two distinct circles within the disk) the authors provide definitive results and counterexamples that deepen theoretical understanding and broaden the problem’s applicability, including to quantum mechanics and signal processing.

Dr. Chalendar, head of mathematics at Université Gustave Eiffel, is an expert in function theory, complex analysis, and operator theory, and an advocate for gender equity in mathematics. Dr. Partington, Emeritus Professor at the University of Leeds, is a leading researcher in operator theory and control theory and has served as editor of the Journal of the London Mathematical Society.

Click here to read the full media release.

Prix G. de B. Robinson 2025

La Dre Isabelle Chalendar (Université Gustave Eiffel) et le Dr Jonathan R. Partington (Université de Leeds) ont reçu le prix G. de B. Robinson 2025 pour leur article « *Phase Retrieval on Circles and Lines* » (Bulletin mathématique canadien, 67:4 [2024], 927–935).

Leurs travaux offrent une nouvelle perspective sur le problème de la récupération de phase, une question clé en mathématiques et en ingénierie qui vise à reconstruire un signal en utilisant uniquement des informations sur l'amplitude. En abordant le cas le plus général (conditions d'égalité sur deux cercles distincts dans le disque), les auteurs fournissent des résultats définitifs et des contre-exemples qui approfondissent la compréhension théorique et élargissent l'applicabilité du problème, y compris à la mécanique quantique et au traitement du signal.

La Dre Chalendar, directrice du département de mathématiques de l'Université Gustave Eiffel, est une experte en théorie des fonctions, en analyse complexe et en théorie des opérateurs, et une défenseure de l'égalité des sexes en mathématiques. Le Dr Partington, professeur émérite à l'Université de Leeds, est un chercheur de premier plan dans le domaine de la théorie des opérateurs et de la théorie du contrôle, et a été rédacteur en chef du *Journal of the London Mathematical Society*.

Cliquez ici pour lire le communiqué de presse complet.

List of Abbreviations
Liste des abbréviations

AddComb	Additive Combinatorics and Applications Combinatoire additive et applications
AGTPP	Algebraic Graph Theory: progress and problems Théorie algébrique des graphes : progrès et problèmes
AIMath	AI and Mathematical Technologies for Decision Support in Public Health AI and Mathematical Technologies for Decision Support in Public Health
AnGeoSy	Analytic–Geometric Synergies: Harmonic Analysis and Convexity Synergies analytiques et géométriques : analyse harmonique et convexité
apa	Adrien Pouliot Award Prix Adrien-Pouliot
bsdoc	Blair Spearman Doctoral Prize Prix de doctorat Blair Spearman
cjp	Coxeter-James Prize Prix Coxeter-James
ComAlg	Commutative Algebra Algèbre commutative
ComAlgG	Combinatorial Algebraic Geometry Géométrie algébrique combinatoire
ComDThe	Combinatorial Design Theory Théorie de la conception combinatoire
epl	Education Plenary Conférence plénière sur l'éducation
GenEqui	Gender Equity in the Mathematical Sciences Gender Equity in the Mathematical Sciences
GEOpde	Geometric Partial Differential Equations Équations différentielles partielles géométriques
HarPDE	Harmonic Analysis & PDE Analyse harmonique et EDP
HorOpAl	Horizons in Operator Algebras Horizons dans les algèbres d'opérateurs
JOY	Joy in university math classes La joie dans les cours de mathématiques à l'université
LDTop	An invitation to low-dimensional topology Une invitation à la topologie de basse dimension
Logic	Logic in Canada IV Logic in Canada IV
MachLea	Mathematics of Machine Learning Mathématiques de l'apprentissage automatique
MathFin	Mathematical Finance Finance mathématique
NSERC	NSERC-CSE Research Communities: Robust, Secure and Safe Artificial Intelligence and Exploratory Analysis of Unstructured Data Communautés de recherche CRSNG-CSE : Intelligence artificielle robuste, sécurisée et sûre et analyse exploratoire des données non structurées
NTinAna	New trends in Analysis Nouvelles tendances en matière d'analyse
NumTheo	Number Theory by Early Career Researchers Théorie des nombres par des chercheurs en début de carrière
plen	Plenary Sessions Conférences plénières
post	AARMS-CMS Student Poster Session AARMS-CMS Student Poster Session

PrDifEq	Progress in differential equations and their applications in mathematical biology Progrès dans le domaine des équations différentielles et leurs applications en biologie mathématique
ProConG	Recent progress in convex and discrete geometry Progrès récents en géométrie convexe et discrète
PrPDEs	Probability and PDEs Probabilité et EDP
publ	Public Lecture Conférence publique
QuErCor	Quantum Error Correction and Related Topics Correction d'erreurs quantiques et sujets connexes
RDComAn	Recent Developments in Complex Analysis and Geometry Développements récents en analyse complexe et géométrie
RDIntSy	Integrability, Geometry, and Symmetry of Differential Equations Integrability, Geometry, and Symmetry of Differential Equations
RelGeoA	Mathematical Relativity and Geometric Analysis Relativité mathématique et analyse géométrique
ResProj	Practical approaches to mentoring undergraduate research projects Practical approaches to mentoring undergraduate research projects
SetTheA	Set theory and its applications Théorie des ensembles et ses applications
sres	Student Research Session Session de présentations de recherche par les étudiants
TAInver	Theory and application of Inverse Problems in mathematical physics Théorie et application des problèmes inverses en physique mathématique
Topol	Topology Topologie
VarAna	Variational Analysis: Theory and Applications Analyse variationnelle : Théorie et applications
VPTrend	Variational Problems: Trends and Applications Problèmes variationnels : tendances et applications

Schedule for Related Activities
Horaire pour Related Activities

Friday December 5 — vendredi 5 décembre

16:45 - 17:00	Opening and Welcome / Ouverture et bienvenue, Churchill Foyer
18:00 - 19:00	Welcome Reception / Réception de bienvenue, Churchill Foyer
20:00 - 22:00	Student Social / Soirée étudiante, Twilight Café, Dundas location

Saturday December 6 — samedi 6 décembre

10:00 - 11:00	AARMS-CMS Student Poster Session / Session de présentation par affiches pour étudiants AARMS-SMC, Churchill Foyer
10:30 - 11:00	Break / Pause, Churchill Foyer
13:00 - 13:30	Break / Pause, Churchill Foyer
18:00 - 19:00	Friends of Robert Woodrow Reception / Réception des amis de Robert Woodrow, Mountbatten Salon B
19:00 - 22:00	Awards Banquet / Banquet de prix, Mountbatten Salon A

Sunday December 7 — dimanche 7 décembre

10:30 - 11:00	Break / Pause, Churchill Foyer
12:00 - 13:30	EDI/Women in Math Panel Discussion, Gerrard
14:30 - 15:00	Break / Pause, Churchill Foyer

Monday December 8 — lundi 8 décembre

10:30 - 11:00	Break / Pause, Churchill Foyer
14:30 - 15:00	Break / Pause, Churchill Foyer

Schedule
Horaire

Friday December 5	**vendredi 5 décembre**
16:45 - 17:00	Opening and Welcome / Ouverture et bienvenue, ra, Churchill Foyer
17:00 - 18:00	Craig Kaplan (University of Waterloo), *The path to aperiodic monotiles*, publ (p. 42), Churchill Ballroom
18:00 - 19:00	Welcome Reception / Réception de bienvenue, ra, Churchill Foyer
20:00 - 22:00	Student Social / Soirée étudiante, ra, Twilight Café, Dundas location

Saturday December 6 — samedi 6 décembre

8:00 - 8:30 Almut Burchard (University of Toronto), *Strict concavity properties of cross covariograms*, AnGeoSy (p. 67), Scott B

8:00 - 8:30 Ken Davidson (University of Ottawa), *Large Perturbations of Nest Algebras*, HorOpAl (p. 101), Whistler

8:00 - 8:30 Nathan Glatt-Holtz (Indiana University), *On Long Time Accuracy for Stochastic Partial Differential Equations Under Approximation.*, PrPDEs (p. 151), Galsworthy

8:00 - 8:30 Chris Goodrich (UNSW Sydney, Austrailia), *Luxemburg Norm Localisation for Nonlocal Differential Equations with Convolution Coefficients*, PrDifEq (p. 155), Scott A

8:00 - 8:30 Dylan Langharst (Cargnegie Mellon University), *Grünbaum's inequality for probability measures*, ProConG (p. 170), Wren C

8:00 - 8:30 Anne MacKay (Université de Sherbrooke), *Pricing lookback options on quantum computers*, MathFin (p. 121), Rosetti B

8:00 - 8:30 Archishman Saha (University of Ottawa), *Deterministic Behaviour in Stochastic Collective Hamiltonian Systems*, RDIntSy (p. 108), Churchill Ballroom

8:00 - 8:30 Steven Senger (Missouri State University), *Gaps in popular iterated sumset sizes*, AddComb (p. 54), Duchesse

8:00 - 8:30 Doug Stinson (University of Waterloo), *Block designs and protocols for local differential privacy*, ComDThe (p. 82), Austen

8:00 - 8:30 Mahishanka Withanachchi (University of Calgary), *Complex Analytic Methods in One Dimensional Scattering: Harmonic Exponentials, Inner Functions, and Toeplitz Kernels*, TAInver (p. 182), Windsor

8:00 - 8:30 C.M. Michael Wong (University of Ottawa), *Ribbon cobordisms*, LDTop (p. 66), Rosetti C

8:30 - 9:00 Masoomeh Akbari (University of Ottawa), *A Complete Solution to the Generalized HOP with One Round Table*, ComDThe (p. 77), Austen

8:30 - 9:00 Yuri Bakhtin (Courant Institute NYU), *Differentiability of the effective Lagrangian for HJB equations in dynamic random environments*, PrPDEs (p. 150), Galsworthy

8:30 - 9:00 Hans Boden (McMaster), *Splitting the difference in the ribbon-slice conjecture*, LDTop (p. 64), Rosetti C

8:30 - 9:00 Tahir Choulli (University of Alberta), *Pricing formulas for vulnerable claims and death derivatives*, MathFin (p. 117), Rosetti B

8:30 - 9:00 Susan Cooper (University of Manitoba), *Decomposing Star Configuration Ideals*, ComAlg (p. 84), James

8:30 - 9:00 Ryan Gibara (Cape Breton University), *The Neumann problem in metric measure spaces*, AnGeoSy (p. 68), Scott B

8:30 - 9:00 Isaac Gibbs (University of California, Berkeley), *Designing probabilistic predictors for multiple decision makers*, MachLea (p. 130), Wren A

8:30 - 9:00 Alex Iosevich (University of Rochester), *Some parallels between Erdos type problems and exact signal recovery*, ProConG (p. 169), Wren C

8:30 - 9:00 Niky Kamran (McGill University), *Global counterexamples to uniqueness for a Calderón problem with C^k conductivities*, RelGeoA (p. 127), Stevenson

8:30 - 9:00 Ru-Yu Lai (University of Minnesota), *Partial data inverse problems for the nonlinear magnetic Schrodinger equation*, TAInver (p. 181), Windsor

8:30 - 9:00 Jake Levinson (Simon Fraser University), *$\mathbb{A}^1$-degrees of twisted Wronski maps*, ComAlgG (p. 74), Turner

8:30 - 9:00 Chunhua Ou (Memorial University of Newfoundland), *Traveling waves and propagation dynamics of competitive systems in a road-field environment with climate change*, PrDifEq (p. 157), Scott A

8:30 - 9:00 Christopher Schafhauser (University of Nebraska - Lincoln), *KK-rigidity of simple nuclear C*-algebras*, HorOpAl (p. 104), Whistler

8:30 - 9:00 Alireza Sharifi (University of Manitoba), *Integrability and KAM Non–Ergodicity in the Thermostated Hamiltonian Systems*, RDIntSy (p. 108), Churchill Ballroom

8:30 - 9:30 Chris Godsil (University of Waterloo), *Problems in Algebraic Combinatorics II*, AGTPP (p. 58), Carlyle A

8:30 - 9:30 Fernando Xuancheng Shao (University of Kentucky), *Recent developments on the polynomial Szemeredi theorem*, AddComb (p. 54), Duchesse

8:50 - 9:30 Robert Haslhofer (University of Toronto), *Singularities of mean curvature flow in $\mathbb{R}^4$*, GEOpde (p. 91), Chesterton

9:00 - 9:30 Kieran Bhaskara (McMaster University), *h-polynomials and the GVD property of toric ideals of graphs*, ComAlg (p. 83), James

9:00 - 9:30 Paige Bright (MIT), ResProj (p. 147), Gerrard

9:00 - 9:30 Hung-Hsu Chou (University of Pittsburgh), *More is Less: Understanding Compressibility of Neural Networks via Implicit Regularization and Neural Collapse*, MachLea (p. 129), Wren A

9:00 - 9:30 Duncan Dauvergne (University of Toronto), *Characterization of the directed landscape from the KPZ fixed point*, PrPDEs (p. 151), Galsworthy

9:00 - 9:30 Andrew Dean (Lakehead University), *Classification problems concerning real structures and gradings*, HorOpAl (p. 101), Whistler

9:00 - 9:30 Jordan Fazio (Brock University), *Hierarchies of Flow Invariants and Conservation Laws in One-Dimensional Fluids*, RDIntSy (p. 107), Churchill Ballroom

9:00 - 9:30 Frédéric Godin (Concordia University), *Deep Hedging with Options Using the Implied Volatility Surface*, MathFin (p. 119), Rosetti B

9:00 - 9:30 Pavlos Kalantzopoulos (University of Waterloo), *Extremal Convex Bodies in Liakopoulos's Generalized Dual Loomis–Whitney Inequality.*, ProConG (p. 170), Wren C

9:00 - 9:30 Shuxing Li (University of Delaware), *Perfect Sequence Covering Arrays: A Group-Based Approach*, ComDThe (p. 80), Austen

9:00 - 9:30 Duncan McCoy (UQAM), *Calculating the unknotting number (sometimes)*, LDTop (p. 65), Rosetti C

9:00 - 9:30 Viktor Pavlovik, *Accelerated Proximal Gradient Methods in the affine-quadratic case*, VarAna (p. 191), Carlyle B

9:00 - 9:30 Cristian Rios (University of Calgary), *Applications of Alpert wavelets to imaging-based medical diagnosis*, TAInver (p. 182), Windsor

9:00 - 9:30 Scott Rodney (Cape Breton University), *Sobolev Inequalities and the Solvability of Second Order Degenerate Elliptic Equations with rough low order terms*, AnGeoSy (p. 70), Scott B

9:00 - 9:30 Zhisheng Shuai (University of Central Florida, USA), *A Tale of Two Incidence Functions: How Post-Infection Effects Shape Disease Dynamics*, PrDifEq (p. 158), Scott A

9:00 - 9:30 Eric Woolgar (University of Alberta), *Marginally outer trapped surfaces governed by Bakry-Émery Ricci curvature bounds*, RelGeoA (p. 128), Stevenson

9:00 - 9:30 Tianyi Yu (UQAM), *A positive combinatorial formula for the double Edelman–Greene coefficients*, ComAlgG (p. 75), Turner

9:00 - 10:00 Ilia Binder (Toronto), *SLE as critical interface limits: power law rate of convergence*, RDComAn (p. 165), Seymour

9:00 - 10:00 Jorge Cruz Chapital (University of Toronto), SetTheA (p. 174), Wren B

9:30 - 10:00 Alexandru Badescu (University of Calgary), *Option Pricing with Recurrent Variance Dependent Stochastic Discount Factors and Realized Volatility*, MathFin (p. 117), Rosetti B

9:30 - 10:00 Tracey Balehowsky (University of Calgary), *The Inverse Problem of Recovering a Riemannian Metric from Area Data*, RelGeoA (p. 126), Stevenson

9:30 - 10:00 Steve Boyer (UQAM), *Do 3-manifolds with taut foliations have orderable fundamental groups ?*, LDTop (p. 64), Rosetti C

9:30 - 10:00 Kostya Druzhkov (University of Saskatchewan), *Invariant reduction for partial differential equations: Poisson brackets*, RDIntSy (p. 106), Churchill Ballroom

9:30 - 10:00 Peter Gibson (York University), *Inversion of the Miura map on the line*, TAInver (p. 181), Windsor

9:30 - 10:00 Leo Goldmakher (Williams College), *Large subsets are sumsets*, AddComb (p. 53), Duchesse

9:30 - 10:00 Elana Kalashnikov (University of Waterloo), *Tableaux Littlewood—Richardson rules for 2-step flags*, ComAlgG (p. 74), Turner

9:30 - 10:00 Graham Keiper (Università di Cantania), *Symbolic Powers of Toric Ideals*, ComAlg (p. 85), James

9:30 - 10:00 Michael Lamoureux (University of Calgary), *Mathematical visualizations in undergraduate research projects*, ResProj (p. 148), Gerrard

9:30 - 10:00 William Martin (Worcester Polytechnic Institute), *The design strength of P- and Q-polynomial association schemes*, AGTPP (p. 60), Carlyle A

9:30 - 10:00 Rachel Morris (Concordia University), *Regularity guarantees for adversarially robust learning*, MachLea (p. 132), Wren A

9:30 - 10:00 Lam Nguyen (Memorial University of Newfoundland), *Logarithmic Sobolev, Poincaré, and Beckner Inequalities on Hyperbolic Spaces*, ProConG (p. 171), Wren C

9:30 - 10:00	Mihai Nica (University of Guelph), *A probabilist's guide to the Hermite polynomials*, PrPDEs (p. 152), Galsworthy
9:30 - 10:00	Marcu-Antone Orsoni (Université Laval), *On the dimension of observable sets for the heat equation*, AnGeoSy (p. 69), Scott B
9:30 - 10:00	Dolapo Oyetunbi (University of Windsor), *Maximality and symmetry related to the 2-adic ring C*-algebra*, HorOpAl (p. 103), Whistler
9:30 - 10:00	Shambhavi Singh, *Eckstein-Ferris-Pennanen-Robinson duality revisited: paramonotonicity, total Fenchel-Rockafellar duality, and the Chambolle-Pock*, VarAna (p. 191), Carlyle B
9:30 - 10:00	Lin Wang (University of New Brunswick), *Global dynamics of a Filippov SIQR model with delayed control*, PrDifEq (p. 158), Scott A
9:30 - 10:00	Amy Wiebe (University of British Columbia, Okanagan), *Counting transversals in group-based Latin squares*, ComDThe (p. 82), Austen
9:40 - 10:20	Lorenzo Sarnataro (University of Toronto), *The Allen—Cahn equation and free boundary minimal surfaces*, GEOpde (p. 91), Chesterton
10:00 - 11:00	AARMS-CMS Student Poster Session / Session de présentation par affiches pour étudiants AARMS-SMC, ra, Churchill Foyer
10:00 - 10:30	Harshith Alagandala (UWO), *Local Polynomial Convexity at Hyperbolic CR-singularity in* $M^n \subset \mathbb{C}^n$, RDComAn (p. 164), Seymour
10:00 - 10:30	Aleksandr Arakcheev, *On Generalisations of Fejér Monotonicity: Fejér* and Opial Sequences*, VarAna (p. 190), Carlyle B
10:00 - 10:30	Raluca Balan (University of Ottawa), *Recent advances for SPDEs with Lévy noise*, PrPDEs (p. 150), Galsworthy
10:00 - 10:30	Ali Feizmohammadi (University of Toronto), TAInver (p. 181), Windsor
10:00 - 10:30	Remus Floricel (University of Regina), *The spectral* C^**-algebra of a product system*, HorOpAl (p. 101), Whistler
10:00 - 10:30	Nathan Grieve (Carleton University), *Concepts of stability and positivity for big and nef line bundles, divisorial sheaves and divisors on the Zariski Riemann spaces*, ComAlgG (p. 73), Turner
10:00 - 10:30	Paul Hagelstein (Baylor University), *Current developments in the theory of differentiation of integrals*, AnGeoSy (p. 68), Scott B
10:00 - 10:30	Office Hours, LDTop (p. 65), Rosetti C
10:00 - 10:30	Jeff Jauregui (Union College), *Optimizing capacity with nonnegative scalar curvature*, RelGeoA (p. 127), Stevenson
10:00 - 10:30	Yu-Ru Liu (University of Waterloo), *Equidistribution Theorems in Additive Combinatorics*, AddComb (p. 54), Duchesse
10:00 - 10:30	Alex Losevich (University of Rochester), *Research as an integral part of undergraduate curriculum*, ResProj (p. 148), Gerrard
10:00 - 10:30	Trent Marbach (Toronto Metropolitan University), ComDThe (p. 80), Austen
10:00 - 10:30	Alexander Melnikov (University of Alberta), *On Market Completions Approach to Option Pricing and Related Questions*, MathFin (p. 121), Rosetti B
10:00 - 10:30	Hermie Monterde (University of Regina), *Equitable partitions and twin subgraphs*, AGTPP (p. 61), Carlyle A
10:00 - 10:30	Isabella Negrini (University of Toronto), *An Erdős–Rado theorem for perfect trees*, SetTheA (p. 174), Wren B
10:00 - 10:30	Jacek Szmigielski (University of Saskatchewan), *Spinor Camassa-Holm Equations*, RDIntSy (p. 109), Churchill Ballroom
10:00 - 10:30	Jianhong Wu (York University), *An integro-differential equation with spatially varying delay*, PrDifEq (p. 159), Scott A
10:00 - 10:30	Jie Xiao (Memorial University of Newfoundland), C^1*-maximizer of* p*-mean torsion rigidity on convex bodies*, ProConG (p. 172), Wren C
10:00 - 10:30	Yunan Yang (Cornell University), *Training Distribution Optimization in the Space of Probability Measures*, MachLea (p. 133), Wren A
10:00 - 10:30	Shah Rashan Zamir (Tulane University), *On the algebraic properties of the Böröczky configuration*, ComAlg (p. 86), James

10:00 - 11:00	Shohel Ahmed (University of Alberta), *Behaviorally Structured Consumer-Resource Dynamics*, post (p. 195), Churchill Foyer
10:00 - 11:00	Grace D'Agostino (University of Guelph), *Uncertainty Analysis of a River Quality Model*, post (p. 195), Churchill Foyer
10:00 - 11:00	Amaury De Burgos (University of Calgary), *The length of cyclic algebras*, post (p. 195), Churchill Foyer
10:00 - 11:00	Xinwen Ding (University of Toronto), *Walk-on-Interfaces: A Monte Carlo Estimator for Elliptic Interface Problem*, post (p. 196), Churchill Foyer
10:00 - 11:00	Tan Phuong Dong le (University of Waterloo), *Stable Mesh-Free Variational Radial Basis Function Approximation for Elliptic PDEs and Obstacle Problems*, post (p. 196), Churchill Foyer
10:00 - 11:00	Antun Nikola Dvorski (University of Toronto), *A new proof of Baernstein's convolution inequality on the unit circle using geometric flow*, post (p. 196), Churchill Foyer
10:00 - 11:00	Joey Fingold (University of Guelph), *Latent Gaussian Importance Sampling for Thinned Poisson Autoregressions*, post (p. 196), Churchill Foyer
10:00 - 11:00	Shan Gao (University of Alberta), *Outbreak or Not ? A Framework for Detecting Infectious Disease Outbreaks*, post (p. 197), Churchill Foyer
10:00 - 11:00	Cameron Jakub (University of Guelph), *Depth Degeneracy in Neural Networks: Vanishing Angles in Fully Connected ReLU Networks on Initialization*, post (p. 197), Churchill Foyer
10:00 - 11:00	Vinay Joshy (University of Guelph), *Sparse Group Lasso for Variable Selection in Finite Gaussian Mixture Regression Models*, post (p. 197), Churchill Foyer
10:00 - 11:00	Lexy Lawryshyn (University of Guelph), *A Nonlinear ODE Model of Butyrate-Tumour-Immune Cell Dynamics in Colorectal Cancer*, post (p. 198), Churchill Foyer
10:00 - 11:00	Erica Liu (University of Waterloo), *Toric Compactifications and Critical Points at Infinity in Analytic Combinatorics*, post (p. 198), Churchill Foyer
10:00 - 11:00	Rachana Mandal (University of Guelph), *Modelling and Simulation Experiments on Directed Movement of Bacteria in Aqueous Medium with Counter-Diffusive Substrate Uptakes*, post (p. 198), Churchill Foyer
10:00 - 11:00	Arion Okubo (University of Toronto), *Explicit Estimates for the Size of the Markoff mod p Cage*, post (p. 199), Churchill Foyer
10:00 - 11:00	Kenneth Shen (Carleton University Math Enrichment Centre), *Families of rational-sided triangles with the same area and perimeter*, post (p. 199), Churchill Foyer
10:00 - 11:00	John Hunn Smith (University of Waterloo), *Explicit Diagonal Asymptotics of Symmetric Multi-Affine Rational Functions via ACSV*, post (p. 199), Churchill Foyer
10:00 - 11:00	Aiden William James Taylor (University of Calgary), *Wavelet Transforms and Machine Learning Methods for the Classification of Auroral Images*, post (p. 200), Churchill Foyer
10:00 - 11:00	Xuemeng Wang (Simon Fraser University), *Christoffel Adaptive Sampling for Sparse Random Feature Expansions*, post (p. 200), Churchill Foyer
10:30 - 11:00	Break / Pause, ra, Churchill Foyer
11:00 - 12:00	Diana Skrzydlo (University of Waterloo), *Resilient Course Design*, epl (p. 43), Churchill Ballroom
12:00 - 13:00	Louigi Addario-Berry (McGill University), *Heights and diameters of random trees and graphs*, plen (p. 44), Churchill Ballroom
13:00 - 13:30	Break / Pause, ra, Churchill Foyer
14:00 - 15:00	Barbara and Brian Forrest (University of Waterloo), *Teaching, Learning and Assessment in the Age of AI*, apa (p. 45), Churchill Ballroom
15:00 - 15:30	Tatyana Barron (UWO), *Vanishing of Poincare series, revisited*, RDComAn (p. 165), Seymour
15:00 - 15:30	Ivan Booth (Memorial University of Newfoundland), *Black hole evolution and internal structure: constraints from the stability operator*, RelGeoA (p. 126), Stevenson
15:00 - 15:30	Sue Ann Campbell (University of Waterloo), *The Eigenvalue Spectrum of Distributed Delay Differential Equations with Large Mean Delay*, PrDifEq (p. 154), Scott A
15:00 - 15:30	Ernie Croot (Georgia Institute of Technology), *A survey of some results on digits of numbers in different bases related to a problem of R. L. Graham*, AddComb (p. 52), Duchesse
15:00 - 15:30	Ferenc Fodor (University of Szeged), *Central diagonal sections of Gaussian cubes*, AnGeoSy (p. 68), Scott B
15:00 - 15:30	Geneviève Gauthier (HEC Montréal), *Beyond volatility of volatility: Decomposing the informational content of VVIX*, MathFin (p. 119), Rosetti B

15:00 - 15:30 Hazem Hassan (McGill University), *Interaction between directed reading programs and undergraduate research projects*, ResProj (p. 148), Gerrard

15:00 - 15:30 Steve Kirkland (University of Manitoba), *An edge centrality measure based on Kemeny's constant*, AGTPP (p. 59), Carlyle A

15:00 - 15:30 Walaa Moursi, VarAna (p. 191), Carlyle B

15:00 - 15:30 Cameron Musco (University of Massachusetts Amherst), *Structured Matrix Approximation via Matrix-Vector Products*, MachLea (p. 132), Wren A

15:00 - 15:30 Barbara Prinari (University of Buffalo), *Breather interactions in the integrable discrete Manakov system*, RDIntSy (p. 108), Churchill Ballroom

15:00 - 15:30 Jeremy Quastel (University of Toronto), *Integrable PDE in random growth*, PrPDEs (p. 152), Galsworthy

15:00 - 15:30 Kasra Rafi (Toronto), *From Mirzakhani's Volumes to Random Surfaces*, LDTop (p. 65), Rosetti C

15:00 - 15:30 Nick Rozenblyum (University of Toronto), *String topology and the cyclic Deligne conjecture*, Topol (p. 188), Baker

15:00 - 15:30 Eric Sawyer (McMaster University), *A comparison of trilinear testing conditions for the paraboloid Fourier extension and Kakeya conjectures in three dimensions*, HarPDE (p. 97), Rosetti A

15:00 - 15:30 Thomas Sinclair (Purdue University), *Computability of C*-norms*, HorOpAl (p. 104), Whistler

15:00 - 15:30 Karolyn So (Simon Fraser University), *Gröbner Cones for Finite Type Cluster Algebras*, ComAlgG (p. 75), Turner

15:00 - 15:30 Brett Stevens (Carleton University), *Linear and non-linear 1-intersecting pencils of conics*, ComDThe (p. 81), Austen

15:00 - 15:30 Janet Vassilev (University of New Mexico), *Patterns in differential powers of ideals in affine semigroup rings*, ComAlg (p. 86), James

15:00 - 15:30 Bartlomiej Zawalski (Case Western Reserve University), *On flat shadow boundaries from point light sources and the characterization of ellipsoids*, ProConG (p. 172), Wren C

15:00 - 15:40 Freid Tong (University of Toronto), *Calabi-Yau metrics and optimal transportation*, GEOpde (p. 92), Chesterton

15:00 - 16:00 Narmada Varadarajan (University of Toronto), *Circle-squaring with low Borel complexity*, SetTheA (p. 175), Wren B

15:30 - 16:00 Roberto Albesiano (Waterloo), *From division to extension*, RDComAn (p. 164), Seymour

15:30 - 16:00 Daniel Carranza (Johns Hopkins University), *Generalizing the Bousfield-Kan formula*, Topol (p. 184), Baker

15:30 - 16:00 Yu-Ting Chen (University of Victoria), *Martingale description of the two-dimensional stochastic heat equation*, PrPDEs (p. 151), Galsworthy

15:30 - 16:00 Adrian Chitan (University of Western Ontario), *Mentoring Success: Lessons from a Graduate-Undergraduate Model*, ResProj (p. 147), Gerrard

15:30 - 16:00 Graham Cox (Memorial University of Newfoundland), *Black hole mergers and bifurcations of marginally outer trapped surfaces*, RelGeoA (p. 126), Stevenson

15:30 - 16:00 Alena Ernst (Worcester Polytechnic Institute), *Designs in finite general linear groups*, ComDThe (p. 78), Austen

15:30 - 16:00 Yuan Gao, *On the equivalence of c-potentiability and c-path boundedness in the sense of Artstein-Avidan, Sadovsky and Wyczesany.*, VarAna (p. 190), Carlyle B

15:30 - 16:00 Tyrone Ghaswala (Waterloo), *Does the Loch Ness Monster's mapping class group even have a finite-index subgroup ?*, LDTop (p. 65), Rosetti C

15:30 - 16:00 Yifan Jing (Ohio State University), *Measure doubling for small sets in compact Lie groups*, AddComb (p. 54), Duchesse

15:30 - 16:00 Chris Manon (University of Kentucky), ComAlgG (p. 74), Turner

15:30 - 16:00 Emanuela Marangone (University of Manitoba), *Weighted Veronese Rings*, ComAlg (p. 85), James

15:30 - 16:00 Zhuang Niu (University of Wyoming), *$\mathcal{Z}$-absorption and small boundary property*, HorOpAl (p. 103), Whistler

15:30 - 16:00 Alexander Odesski (Brock University), *p-Determinants and monodromy of differential operators*, RDIntSy (p. 108), Churchill Ballroom

15:30 - 16:00 Cristian Rios (University of Calgary), *Characterizations of the Kakeya maximal conjecture in three dimensions*, HarPDE (p. 96), Rosetti A

15:30 - 16:00 Lars Stentoft (Western University), *In estimation, the key is the volatility index, not the returns*, MathFin (p. 123), Rosetti B

15:30 - 16:00 Kateryna Tatarko (University of Waterloo), *Minimizing inradius for a given constraint*, ProConG (p. 171), Wren C

15:30 - 16:00 Alex Townsend (Cornell University), *A Mathematical Guide to Operator Learning*, MachLea (p. 133), Wren A

15:30 - 16:00 Elisabeth Werner (Case Western Reserve University), *Floating bodies for ball-convex bodies*, AnGeoSy (p. 71), Scott B

15:30 - 16:00 Gail Wolkowicz (McMaster University), *A predator-prey model with delay in both the prey and the predator growth terms*, PrDifEq (p. 159), Scott A

15:30 - 16:00 Harmony Zhan (Worcester Polytechnic Institute), *Laziness of quantum walks*, AGTPP (p. 62), Carlyle A

15:50 - 16:30 Yulun Xu (University of Toronto), *viscosity solution to complex Hessian quotient equation.*, GEOpde (p. 92), Chesterton

16:00 - 16:30 Amir Babak Aazami (Clark University), *Normal forms, "almost-Einstein" metrics, and conformal invariants*, RelGeoA (p. 125), Stevenson

16:00 - 16:30 Branimir Cacic (University of New Brunswick), *Revisiting the differential topology of higher-dimensional noncommutative tori*, HorOpAl (p. 101), Whistler

16:00 - 16:30 Francesco Cellarosi (Queen's University), *Stochastic Calculus for the Theta Process*, PrPDEs (p. 150), Galsworthy

16:00 - 16:30 Matt Davison (Western University), *A Real Options Approach to Wildfire Evacuations*, MathFin (p. 118), Rosetti B

16:00 - 16:30 Dmitry Faifman (Université de Montréal), *Tubes and valuations in Lie groups*, AnGeoSy (p. 68), Scott B

16:00 - 16:30 Martin Frankland (University of Regina), *Enriched model categories and the Dold-Kan correspondence*, Topol (p. 185), Baker

16:00 - 16:30 Parker Glynn-Adey (University of Toronto), *Supporting A Departmental Culture of Undergraduate Research*, ResProj (p. 147), Gerrard

16:00 - 16:30 Avi Gupta (Simon Fraser University), *Universal Nonlinear Learning of High-Dimensional Anisotropic Sobolev Functions from Point Samples*, MachLea (p. 130), Wren A

16:00 - 16:30 Kiumars Kaveh (University of Pittsburgh), ComAlgG (p. 74), Turner

16:00 - 16:30 Alice Lacaze-Masmonteil (University of Regina), *On the directed Oberwolfach problem with tables of even lengths and $n \equiv 2 \ (mod\ 4)$ guests*, ComDThe (p. 79), Austen

16:00 - 16:30 Chenkuan Li (Brandon University), *Existence, Uniqueness, and Hyers–Ulam's Stability of the Nonlinear Bagley–Torvik Equation with Functional Initial Conditions*, PrDifEq (p. 156), Scott A

16:00 - 16:30 Hongda Li, *Relaxed Weak Accelerated Proximal Gradient Method: A Unified Framework for Nesterov's Accelerations*, VarAna (p. 191), Carlyle B

16:00 - 16:30 Iresha Madduwe (Dalhousie University), *Reconstruction Conjecture on Homological Invariants of Cameron-Walker Graphs*, ComAlg (p. 85), James

16:00 - 16:30 Mahdieh Gol Bashmani Moghadam (Brock University), *Symmetry Transformation Group Arising from the Laplace–Runge–Lenz Vector*, RDIntSy (p. 107), Churchill Ballroom

16:00 - 16:30 Egon Schulte (Northeastern University), *Bounding the Regularity Radius of Delone Sets*, ProConG (p. 171), Wren C

16:00 - 16:30 Tino Tamon (Clarkson University), *How strong is weak coupling ?*, AGTPP (p. 62), Carlyle A

16:00 - 16:30 Ignacio Uriarte-Tuero (University of Toronto), *Muckenhoupt A_p weights, BMO, distance functions and Hardy-Sobolev inequalities*, HarPDE (p. 97), Rosetti A

16:00 - 16:30 Yvon Verberne (Western), *Grand arcs and the Nielsen-Thurston Classification*, LDTop (p. 66), Rosetti C

16:00 - 17:00 Jashan Bal (University of Waterloo), *Projectivity in topological dynamics*, SetTheA (p. 174), Wren B

16:00 - 17:00 Isabelle Chalendar (Université Gustave Eiffel), RDComAn (p. 165), Seymour

16:00 - 17:00 Stanley Yao Xiao (University of Northern British Columbia), *Primes of the form $f(p, q)$, f quadratic, and applications*, AddComb (p. 55), Duchesse

16:30 - 17:00 Kristine Bauer (University of Calgary), *Differentiability in homotopy theory*, Topol (p. 184), Baker

16:30 - 17:00 Maxime Fortier Bourque (UdeM), *What are the best hyperbolic surfaces ?*, LDTop (p. 64), Rosetti C

16:30 - 17:00 Bjoern Bringmann (Princeton University), *Global well-posedness of the stochastic Abelian-Higgs equations in two dimensions*, PrPDEs (p. 150), Galsworthy

16:30 - 17:00 Ana Čolović (University of Missouri), *Composition of Paraproducts*, HarPDE (p. 94), Rosetti A

16:30 - 17:00 James Hornick (McMaster University), *BIFURCATIONS OF SOLITARY WAVES IN A COUPLED SYSTEM OF LONG AND SHORT WAVES*, RDIntSy (p. 107), Churchill Ballroom

16:30 - 17:00 Nathan Ilten (Simon Fraser University), *Rational Curves in Projective Toric Varieties*, ComAlgG (p. 74), Turner

16:30 - 17:00 Cristian Ivanescu (MacEwan University), *Preservation of the Way-Below Relation Under Tensor Products*, HorOpAl (p. 102), Whistler

16:30 - 17:00 Caleb Jones (Toronto Metropolitan University), *Current Trends in Hypergraph Burning*, ComDThe (p. 79), Austen

16:30 - 17:00 Pavlos Kalantzopoulos (Waterloo University), *A multiversion of real and complex hypercontractivity.*, AnGeoSy (p. 69), Scott B

16:30 - 17:00 Anastasis Kratsios (McMaster University), *Incremental Generation is Necessity and Sufficient for Universality in Flow-Based Modelling*, MachLea (p. 131), Wren A

16:30 - 17:00 Xinzhi Liu (University of Waterloo), *Observer-Based Adaptive Robust Control of Dual-Layer Multiagent Epidemic Models*, PrDifEq (p. 156), Scott A

16:30 - 17:00 Mark Reesor (Wilfrid Laurier University), *Approximating the Money-Weighted Rate of Return*, MathFin (p. 122), Rosetti B

16:30 - 17:00 Tung Tran, *On the boundedness of sequences generated by stochastic gradient and random projection algorithms*, VarAna (p. 192), Carlyle B

16:30 - 17:00 Ryan Ugner (University of California, Berkeley), RelGeoA (p. 128), Stevenson

16:30 - 17:00 John Urschel (Massachusetts Institute of Technology), *Nodal Statistics for Graphs and Matrices*, AGTPP (p. 62), Carlyle A

16:30 - 17:00 Dharm Veer (Dalhousie University), *Binomial ideals associated to polycubes.*, ComAlg (p. 86), James

---

16:40 - 17:20 Kenneth DeMason (McMaster University), *A Strong Form of the Quantitative Wulff Inequality for Crystalline Norms*, GEOpde (p. 91), Chesterton

---

17:00 - 17:30 Patience Ablett (University of Warwick), ComAlgG (p. 72), Turner

17:00 - 17:30 Evans Boadi (University at Buffalo), *Discrete Kutznetsov-Ma breather solutions of the focusing Ablowitz-Ladik equation*, RDIntSy (p. 106), Churchill Ballroom

17:00 - 17:30 Denys Bulavka (Dalhousie University), *A Hilton-Milner theorem for exterior algebras*, ComAlg (p. 84), James

17:00 - 17:30 Debraj Chakrabarti (Central Michigan), *Restricted type estimates and the Bergman Projection*, RDComAn (p. 165), Seymour

17:00 - 17:30 David Grynkiewicz (University of Memphis), *Towards a Kneser-Pollard Theorem*, AddComb (p. 53), Duchesse

17:00 - 17:30 Nishanth Gudapati (College of the Holy Cross), *Remarks on the s=1 Teukolsky Equation*, RelGeoA (p. 126), Stevenson

17:00 - 17:30 Mohamed Hibat-Allah (University of Waterloo), *Language models for quantum many-body physics*, MachLea (p. 130), Wren A

17:00 - 17:30 Office Hours, LDTop (p. 65), Rosetti C

17:00 - 17:30 Sumin Leem (University of Calgary), *Categorical design for encoding rule-based text*, ComDThe (p. 80), Austen

17:00 - 17:30 Liangbing Luo (York University), *Logarithmic Sobolev inequalities on some infinite-dimensional groups*, AnGeoSy (p. 69), Scott B

17:00 - 17:30 Patrick Melanson (University of Regina), *Pro-Tori and Inductive Limits of Non-Commutative Tori*, HorOpAl (p. 103), Whistler

17:00 - 17:30 Sadra Nejati, VarAna (p. 191), Carlyle B

17:00 - 17:30 Johnna Parenteau (University of Regina), *Determining Distinctness in the Weighted Matching Polynomial*, AGTPP (p. 61), Carlyle A

17:00 - 17:30 Dorette Pronk (Dalhousie University), *A tom Dieck Fundamental Groupoid for Orbifolds*, Topol (p. 188), Baker

17:00 - 17:30	Kristina Stankova (Western University), *Applying ruin theory to retirement savings: A case study*, MathFin (p. 123), Rosetti B
17:00 - 17:30	Dimiter Vassilev (University of New Mexico), *Regularity of solutions to non-local semilinear equations related to Sobolev type embeddings on homogeneous groups*, HarPDE (p. 97), Rosetti A
17:00 - 17:30	Xingfu Zou (Western University), *Dynamics of a nonlocal dispersal population model with annually synchronized emergence of adults*, PrDifEq (p. 160), Scott A
17:00 - 18:00	Bo Peng (McGill University), *Anti-classification results in dynamical systems*, SetTheA (p. 175), Wren B
17:30 - 18:00	Ada Chan (York University), *Type-II matrices*, AGTPP (p. 58), Carlyle A
17:30 - 18:00	Shonda Dueck (University of Winnipeg), *Cyclic partitions of complete hypergraphs and large sets of combinatorial designs*, ComDThe (p. 78), Austen
17:30 - 18:00	Hermann Eberl (University of Guelph), *Travelling Waves in a highly degenerate PDE-ODE coupled model of cellulosic biofilm formation*, PrDifEq (p. 155), Scott A
17:30 - 18:00	Bradd Hart (McMaster University), *Decidedly undecidable results in operator algebras*, HorOpAl (p. 102), Whistler
17:30 - 18:00	Spencer Hill (Queen's University), *Communication Complexity of Exact Sampling under Exponential Cost*, MachLea (p. 131), Wren A
17:30 - 18:00	Jesse Hulse (Manitoba), *A Formula for the Pluricomplex Green Function of the Bidisk*, RDComAn (p. 166), Seymour
17:30 - 18:00	Selvi Kara (Bryn Mawr College), *Algebraic Study of Polarized Neural Ideals*, ComAlg (p. 84), James
17:30 - 18:00	Geunyoung Kim (McMaster University), *Heegaard diagrams for 5-manifolds*, Topol (p. 186), Baker
17:30 - 18:00	Serhii Koval (Memorial University), *Weyl algebras and symmetries of differential equations*, RDIntSy (p. 107), Churchill Ballroom
17:30 - 18:00	Nguyen Lam (Memorial University of Newfoundland), *Sharp Stability of the Second-order Heisenberg Uncertainty Principle*, HarPDE (p. 95), Rosetti A
17:30 - 18:00	Adam Metzler (Wilfrid Laurier University), *Comparing Life-Cycle and Contrarian Investment Strategies*, MathFin (p. 121), Rosetti B
17:30 - 18:00	Andriy Prymak (University of Manitoba), *On asymptotic Lebesgue's universal covering problem*, AnGeoSy (p. 70), Scott B
17:30 - 18:00	Jonathan Tidor (Princeton University), *Uniform sets with few 4APs via colorings*, AddComb (p. 55), Duchesse
18:00 - 19:00	Friends of Robert Woodrow Reception / Réception des amis de Robert Woodrow, ra, Mountbatten Salon B
19:00 - 22:00	Awards Banquet / Banquet de prix, ra, Mountbatten Salon A

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30 Tracey Balehowsky (Calgary), *Transformation Optics and Models of Spatial Topology*, TAInver (p. 180), Windsor

8:00 - 8:30 Santiago Estupiñán (UWaterloo), *A new shifted Littlewood-Richardson rule*, ComAlgG (p. 73), Turner

8:00 - 8:30 Zhenchao Ge (University of Waterloo), *An Additive property for polynomial sequence in function fields*, AddComb (p. 52), Duchesse

8:00 - 8:30 Alptekin Goksan (University of Toronto), *A sharp condition for Békollé-Bonami weights to satisfy the reverse Hölder inequality*, HarPDE (p. 94), Rosetti A

8:00 - 8:30 Matheus Grasselli (McMaster University), *A Tale of Two Regions: A North and South Macroeconomic-Ecological Model*, MathFin (p. 120), Rosetti B

8:00 - 8:30 Donald Kreher (Michigan Technological University), *Factorization of finite groups*, ComDThe (p. 79), Austen

8:00 - 8:30 Arjun Krishnan (University of Rochester), *Field induced phase transition in the polymer model*, PrPDEs (p. 152), Galsworthy

8:00 - 8:30 Jennifer Lawson (University of Calgary), *Incorporating Ecological Data into Models of Population Spread with Different Forms of Dispersal*, PrDifEq (p. 155), Scott A

8:00 - 8:30 Erin Meger (Queen's University), *Expanding Horizons: Applying Lessons from Women's Advocacy to Intersectional Equity*, GenEqui (p. 88), Churchill Ballroom

8:00 - 8:30 Bouchra Nasri (Université de Montréal), *Infectious disease surveillance using deep learning models*, AIMath (p. 49), Churchill A

8:00 - 8:30 Emily Quesada-Herrera (University of Lethbridge), *On the vertical distribution of the zeros of the Riemann zeta-function*, NumTheo (p. 145), Rosetti C

8:00 - 8:30 Opening Remarks, NSERC (p. 137), Stevenson

8:00 - 8:30 Charles Starling (Carleton University), *Uniqueness theorems for combinatorial C*-algebras*, HorOpAl (p. 104), Whistler

8:00 - 8:30 Kate Tretiakova (University of Ottawa), *"But How Do We Know?": Epistemological Trespass in the Math Classroom*, sres (p. 178), Chesterton

8:00 - 8:30 Yvon Verberne (Western University), *Graphs of quasicircles*, Topol (p. 189), Baker

8:00 - 8:30 Denis Vinokurov (Université de Montréal), *Topological Tensor Products, Harmonic Maps, and Spectral Optimization*, AnGeoSy (p. 70), Scott B

8:00 - 9:00 Julian Camilo Cano Ramos (Universidad de Los Andes), *Combinatorics of Ramsey ideals*, SetTheA (p. 175), Wren B

8:30 - 9:00 Spyros Alexakis (University of Toronto), TAInver (p. 180), Windsor

8:30 - 9:00 Steve Butler (Iowa State University), *Cospectral constructions for the q-Laplacian matrix*, AGTPP (p. 57), Carlyle A

8:30 - 9:00 Amanda Chafee (Carleton University), *Hamiltonian Cycles on Coverings*, ComDThe (p. 78), Austen

8:30 - 9:00 Jose Cruz (University of Calgary), *A tale on trascendence and arithmetic equivalence*, NumTheo (p. 142), Rosetti C

8:30 - 9:00 Saeed Ghasemi (Lakehead University), *Preservation of Elementary Equivalence under Tensor Products*, HorOpAl (p. 101), Whistler

8:30 - 9:00 John Healy (Tutte Institute for Mathematics and Computing), *Exploiting distortions in clustering and dimension reduction for unstructured data*, NSERC (p. 136), Stevenson

8:30 - 9:00 Katrina Honigs (Simon Fraser University), *McKay correspondence for reflection groups and derived categories*, ComAlgG (p. 73), Turner

8:30 - 9:00 Alex Iosevich (University of Rochester), *The Fourier ratio, probabilistic method and signal recovery*, AnGeoSy (p. 69), Scott B

8:30 - 9:00 Jaskaran Kaire (University of Manitoba), *Hadwiger's Conjecture for Cap Bodies*, ProConG (p. 170), Wren C

8:30 - 9:00 Christopher Kennedy (Queen's University), *On the analysis of fluid-solid interactions*, PrPDEs (p. 151), Galsworthy

8:30 - 9:00 Rick Lu and Haonan Zhao (University of Toronto), *L-functions and Numerical Computations Concerning Landau-Siegel Zeros*, sres (p. 177), Chesterton

8:30 - 9:00 Junling Ma (University of Victoria), *Detecting the change of the exponential growth rate during an early stage of an epidemic*, AIMath (p. 49), Churchill A

8:30 - 9:00 B. Doug Park (University of Waterloo), *Symplectic geography problem*, Topol (p. 187), Baker

8:30 - 9:00 André Rickes (University of Calgary), *Average population size of single species diffusing in heterogeneous environments*, PrDifEq (p. 157), Scott A

8:30 - 9:00 Alexandre Roch (Université du Québec à Montréal), *Optimal Green Transition for a Firm*, MathFin (p. 122), Rosetti B

8:30 - 9:00 Yurij Salmaniw (Cape Breton University), *Well-posedness of aggregation-diffusion equations and systems with irregular kernels*, HarPDE (p. 96), Rosetti A

8:30 - 9:00 Kyne Santos (Toronto Metropolitan University), *Math In Drag*, GenEqui (p. 89), Churchill Ballroom

8:30 - 9:00 Gregory G. Smith (Queen's University), *Cellular free resolutions for normalizations of toric ideals*, ComAlg (p. 85), James

8:30 - 9:00 Matthew Thorpe (Warwick University), *How Many Labels Do You Need in Semi-Supervised Learning ?*, MachLea (p. 133), Wren A

8:30 - 9:30 Hunter Spink (University of Toronto), *Geometric additive combinatorics via o-minimality*, AddComb (p. 55), Duchesse

---

9:00 - 9:30 Mustafa Avci (Athabasca University), *A viscosity solution approach to the Feynman-Kac formula for a one-dimensional parabolic PDE with variable exponent coefficient*, PrPDEs (p. 149), Galsworthy

9:00 - 9:30 François-Michel Boire (University of Ottawa), *Modeling Systemic House Price Risk*, MathFin (p. 117), Rosetti B

9:00 - 9:30 Jane Breen (Ontario Tech University), *Reinforcement learning for algebraic graph theory: parallelizing Wagner's approach*, AGTPP (p. 57), Carlyle A

9:00 - 9:30 Matt Cartier (University of Pittsburgh), *Computing the Invariant β for Certain Schubert Subvarieties*, ComAlgG (p. 72), Turner

9:00 - 9:30 Amaury De Burgos (University of Calgary), *On the length of cyclic algebras*, sres (p. 176), Chesterton

9:00 - 9:30 Dmitry Faifman (University of Montreal), *Bi-invariant valuations and convolution on Lie groups*, ProConG (p. 169), Wren C

9:00 - 9:30 Joshua Flynn (Massachusetts Institute of Technology), *Higher order boundary operators and trace inequalities on the Siegel domain and complex ball*, HarPDE (p. 94), Rosetti A

9:00 - 9:30 Isaac Harris (Purdue University), *Qualitative Methods Applied to Biharmonic Scattering*, TAInver (p. 181), Windsor

9:00 - 9:30 Dmitry Jacobson (McGill University), *Extremal metrics on graphs*, AnGeoSy (p. 69), Scott B

9:00 - 9:30 Fatemeh Jalalvand (University of Calgary), *Shape of log-unit lattices in D_6 fields*, NumTheo (p. 144), Rosetti C

9:00 - 9:30 William Martin (Worcester Polytechnic Institute), *Hitting all the n-tuples from a distance*, ComDThe (p. 80), Austen

9:00 - 9:30 Duncan McCoy (Universite du Quebec a Montreal), *Cusps of arithmetic hyperbolic manifolds*, Topol (p. 187), Baker

9:00 - 9:30 Sophie Morin (Polytechnique Montreal), *Equivariant machine learning for collision detection of ellipses and related shapes*, MachLea (p. 131), Wren A

9:00 - 9:30 Nathaniel Osgood (University of Saskatchewan), *Social Media-Based Respiratory Disease Surveillance: Multi-Assessor Labelling and Cross-Model Accuracy Assessment*, AIMath (p. 49), Churchill A

9:00 - 9:30 Pierre-Olivier (UQTR), RDComAn (p. 166), Seymour

9:00 - 9:30 Kaleb Ruscitti (University of Waterloo), *Modifying Mapper for Temporal Topic Modelling*, NSERC (p. 137), Stevenson

9:00 - 9:30 Ebrahim Samei (University of Saskatchewan), *Tempered representations on stationary spaces*, HorOpAl (p. 104), Whistler

9:00 - 9:30 Ila Varma (University of Toronto), *Concrete strategies for promoting Gender Equity in your mathematical spaces*, GenEqui (p. 89), Churchill Ballroom

9:00 - 9:30 Jay Yang (Vanderbilt University), *Controlling Homology in Virtual Resolutions of Monomial Ideals*, ComAlg (p. 86), James

9:00 - 9:30 Hilaire Epstein Nonhou Zogo (Queen's University), *Event-Triggered Control for an SIS Epidemic Model*, PrDifEq (p. 159), Scott A

9:00 - 10:00	Ronnie Chen (University of Florida), SetTheA (p. 174), Wren B
9:30 - 10:00	Karoly Bezdek (University of Calgary), *Non-separable arrangements revisited*, ProConG (p. 169), Wren C
9:30 - 10:00	Adrian Chitan (Western University), *Stratification of the half-density quantization of the Jeffrey-Weitsman-Witten invariants*, sres (p. 176), Chesterton
9:30 - 10:00	Octav Cornea (Université de Montréal), *Triangulated persistence categories and symplectic topology*, Topol (p. 185), Baker
9:30 - 10:00	Fauzia Jabeen (Toronto Metropolitan University), *Efficient Method of Estimating Second-Order Sensitivities for Stochastic Discrete Biochemical Systems*, PrPDEs (p. 151), Galsworthy
9:30 - 10:00	William Kellough (Memorial University of Newfoundland), *BIBDs That Almost Have Locally Equitable Colourings*, ComDThe (p. 79), Austen
9:30 - 10:00	Alice Lacaze-Masmonteil (University of Regina), *On the second largest eigenvalue of certain graphs in the perfect matching association scheme*, AGTPP (p. 60), Carlyle A
9:30 - 10:00	Chongming Li (Queen's University), *Uniform Persistence Analysis of the Bacteria Persister Model*, PrDifEq (p. 156), Scott A
9:30 - 10:00	Wenyuan Liao (University of Calgary), *Adjoint Analysis of Seismic Wave Equation and its Applications in Full Waveform Inversion*, TAInver (p. 182), Windsor
9:30 - 10:00	Sullivan MacDonald (University of Toronto), *Progress toward the Krzyz conjecture*, HarPDE (p. 95), Rosetti A
9:30 - 10:00	Hasan Mahmood (Dalhousie University), *Simplicial Resolutions of Powers of Monomial Ideals*, ComAlg (p. 85), James
9:30 - 10:00	Paul McNicholas (McMaster University), *Clustering and Dimension Reduction*, NSERC (p. 136), Stevenson
9:30 - 10:00	Anton Mosunov (Cornell University), *Numbers that are integrally representable by the homogenization of the minimal polynomial of* $\tan(\pi/n)$, AddComb (p. 54), Duchesse
9:30 - 10:00	Paul Péringuey, *Joint distributions of error terms for primes in arithmetic progressions modulo 11*, NumTheo (p. 144), Rosetti C
9:30 - 10:00	Emily Quesada-Herrera (University of Lethbridge), *Math as a neurodivergent trans latina*, GenEqui (p. 89), Churchill Ballroom
9:30 - 10:00	Esha Saha (University of Alberta), *Data-Driven Solutions to Coupled PDEs using Disjoint Priors*, MachLea (p. 132), Wren A
9:30 - 10:00	Sara Stephens (Cornell University), *Strictly Semistable Quasimaps to* $\mathbb{P}^n$, ComAlgG (p. 75), Turner
9:30 - 10:00	Yana Teplitskaya (Paris-Saclay University), *About maximal distance minimizers. Regularity and explicit examples*, AnGeoSy (p. 70), Scott B
9:30 - 10:00	Dan Ursu (York University), *Non-conventional averaging in C*-algebras*, HorOpAl (p. 105), Whistler
9:30 - 10:00	Antony Ware (University of Calgary), *Generative Pricing of Basket Options via Signature-Conditioned Mixture Density Networks*, MathFin (p. 124), Rosetti B
9:30 - 10:00	Woldegebriel Assefa Woldegerima (York University), *Toy Introduction to Epidemiology-Informed Neural Networks (EINNs) with Application*, AIMath (p. 50), Churchill A
9:30 - 10:00	Yunus Zeytuncu (Michigan), *Spectral Theory of the Kohn Laplacian on Quotient Manifoldsv*, RDComAn (p. 167), Seymour
10:00 - 10:30	Félix Baril Boudreau (CICMA & Université du Luxembourg), *Abelian varieties with homotheties*, NumTheo (p. 142), Rosetti C
10:00 - 10:30	John Byrne (University of Delaware), *Nonabelian Sidon sets and extremal problems on digraphs*, AGTPP (p. 57), Carlyle A
10:00 - 10:30	Zack Cramer (University of Waterloo), *Out in the Open: Fostering 2SLGBTQIA+ Inclusion in Mathematics*, GenEqui (p. 88), Churchill Ballroom
10:00 - 10:30	Sanjeena Dang (Carleton University), *Clustering compositional data with a logistic normal multinomial mixture model with an underlying latent factor structure*, NSERC (p. 135), Stevenson
10:00 - 10:30	Blair Davey (Montana State University), *Self-similar sets and Lipschitz curves*, AnGeoSy (p. 68), Scott B
10:00 - 10:30	Sara Faridi (Dalhousie University), *Extremal and D-Extremal ideals and their algebraic properties*, ComAlg (p. 84), James
10:00 - 10:30	Marcel Goh (McGill University), *Block complexity and idempotent Schur multipliers*, AddComb (p. 53), Duchesse

10:00 - 10:30	Christopher Heggerud (University of Manitoba), *Regime shifts in biology and tools to predict them*, PrDifEq (p. 155), Scott A
10:00 - 10:30	Jesse Hulse (University of Manitoba), *The Unified Transform Method: Beyond Circular or Convex Domains*, HarPDE (p. 95), Rosetti A
10:00 - 10:30	Shikhar Jaiswal (University of Toronto), *Understanding The Modality Gap In Multi-Modal Systems*, Mach-Lea (p. 131), Wren A
10:00 - 10:30	Michael Lamoureux (University of Calgary), *Inverse problems in seismic imaging*, TAInver (p. 181), Windsor
10:00 - 10:30	Michael Y. Li (University of Alberta), *Modeling for a purpose: influenza outbreak in a boarding school revisited.*, AIMath (p. 49), Churchill A
10:00 - 10:30	Zaib Un Nisa Memon (Toronto Metropolitan University), *A hybrid method for stochastic simulations of reaction-diffusion epidemic models*, PrPDEs (p. 152), Galsworthy
10:00 - 10:30	Mehdi Moradi (University of Ottawa), *On locally finite-dimensional traces*, HorOpAl (p. 103), Whistler
10:00 - 10:30	Sharon Robins (Carnegie Mellon), *Oda's Conjecture for Smooth Projective Toric Varieties of Lower Picard Rank*, ComAlgG (p. 74), Turner
10:00 - 10:30	Mateja Sajna (University of Ottawa), *From Spouse-Avoiding to Spouse-Loving: Transforming Solutions to the Oberwolfach Problem*, ComDThe (p. 81), Austen
10:00 - 10:30	Andrew Salch (Wayne State University), *Number theory and stable homotopy groups of spheres*, Topol (p. 188), Baker
10:00 - 10:30	Xiaofei Shi (University of Toronto), *The Price of Information*, MathFin (p. 123), Rosetti B
10:00 - 10:30	Lis Vivas (Ohio State), RDComAn (p. 166), Seymour
10:00 - 10:30	Elisabeth Werner (Case Western Reserve University), L_p *relative surface areas*, ProConG (p. 172), Wren C
10:30 - 11:00	Break / Pause, ra, Churchill Foyer
11:00 - 12:00	Monica Visan (University of California, Los Angeles (UCLA)), *Well-posedness and the method of commuting flows*, plen (p. 44), Churchill Ballroom
12:00 - 13:30	EDI/Women in Math Panel Discussion, ra, Gerrard
13:30 - 14:30	Chris Kapulkin (Western University), *Topology, graphs, and data*, cjp (p. 46), Churchill Ballroom
14:30 - 15:00	Break / Pause, ra, Churchill Foyer
15:00 - 15:15	Burcu Karabina (University of Waterloo), *Thinking Dice*, JOY (p. 111), Gerrard
15:00 - 15:30	Gergely Ambrus (University of Szeged, Hungary), *Large signed sums, polarization problems, and projection constants of convex bodies*, ProConG (p. 169), Wren C
15:00 - 15:30	Chris Bauch (University of Waterloo), *Tipping points in epidemiological systems*, AIMath (p. 47), Churchill A
15:00 - 15:30	Li Bo (University of California, San Diego), *Variational Modeling and Analysis of Phase Separation with Elasticity*, VPTrend (p. 193), Wren B
15:00 - 15:30	Peter Danziger (Toronto Metropolitan University), *Packing designs with large block size*, ComDThe (p. 78), Austen
15:00 - 15:30	Zilin Jiang (Arizona State University), *Median eigenvalues of subcubic graphs*, AGTPP (p. 59), Carlyle A
15:00 - 15:30	Huaxin Lin (Shanghai Institute for Mathematics and Interdisciplinary Sciences), *Almost commuting selfadjoint operators and quantum mechanics*, HorOpAl (p. 102), Whistler
15:00 - 15:30	Luka Mernik (Florida Polytechnic University), RDComAn (p. 166), Seymour
15:00 - 15:30	Argam Ohanyan (University of Toronto), *On the geometry of continuously differentiable spacetime metrics*, RelGeoA (p. 127), Windsor
15:00 - 15:30	Gerald Penn (University of Toronto), *Predicting Levenshtein Edit Sequences for Fine-Grained Estimation of Automatic Speech Recognition Error*, NSERC (p. 136), Stevenson
15:00 - 15:30	Martina Rovelli (University of Ottawa), *Towards a complicial set of cobordisms*, Topol (p. 188), Baker
15:00 - 15:30	Alexander Schied (University of Waterloo), *Exploring Roughness in Stochastic Processes: From Weierstrass Bridges to Volatility Estimation*, MathFin (p. 123), Rosetti B
15:00 - 15:30	Jiatong Sun (University of Alberta), *Data-Driven Computation for Periodic Stochastic Differential Equations*, sres (p. 178), Chesterton
15:00 - 15:30	Tianxu Wang (University of Alberta), *Existence and asymptotic stability of a generic Lotka-Volterra system with nonlinear spatially heterogenous cross-diffusion*, PrDifEq (p. 159), Scott A

15:00 - 15:30	Alexia Yavicoli (University of British Columbia), *The Erdős similarity problem for non-small Cantor sets*, HarPDE (p. 98), Rosetti A
15:00 - 15:30	Kyle Yip (Georgia Tech), *Diophantine tuples and Diophantine powersets*, NumTheo (p. 146), Rosetti C
15:00 - 15:50	Spencer Unger (UofT), *Circle squaring with algebraic irrationals and few pieces*, Logic (p. 115), Wren A
15:15 - 15:35	Thomas Kielstra (University of Toronto Scarborough), *Sweet Shots, Sharp Concepts: Teaching Piecewise Derivatives with a Marshmallow Gun*, JOY (p. 112), Gerrard
15:30 - 16:00	Jananan Arulseelan (Iowa State University), HorOpAl (p. 101), Whistler
15:30 - 16:00	Maryam Basiri (Toronto Metropolitan University), *Positive Solutions of Separated Boundary Value Problems*, PrDifEq (p. 154), Scott A
15:30 - 16:00	Ted Bisztriczky (University Calgary), *Construction methods for polytopes*, ProConG (p. 169), Wren C
15:30 - 16:00	Alex Cowan (University of Waterloo), *Murmurations from functional equations*, NumTheo (p. 142), Rosetti C
15:30 - 16:00	Abbas Ghasemi (Toronto Metropolitan University), *From Flow Instability to Airborne Transmission of Respiratory Diseases: A Computational Fluid Dynamics Approach*, AIMath (p. 48), Churchill A
15:30 - 16:00	Cody Hyndman (Concordia University), *Optimal annuitization with labor income under age-dependent force of mortality*, MathFin (p. 120), Rosetti B
15:30 - 16:00	Toryn Qwyllyn Klassen (University of Toronto), *Remembering to Be Fair: Non-Markovian Fairness in Sequential Decision Making*, NSERC (p. 136), Stevenson
15:30 - 16:00	William Menasco (University of Buffalo), *A construction of minimal coherent filling pairs*, Topol (p. 187), Baker
15:30 - 16:00	Yuveshen Mooroogen (University of British Columbia), *A large-scale variant of the Erdos similarity conjecture*, HarPDE (p. 96), Rosetti A
15:30 - 16:00	Joy Morris (University of Lethbridge), *A new measure of EKR-robustness on permutation groups*, AGTPP (p. 61), Carlyle A
15:30 - 16:00	Dariche Nguyen (McMaster University), *Weak anchoring around a colloidal particle*, sres (p. 178), Chesterton
15:30 - 16:00	Kianoosh Shokri (University of Ottawa), *A recursive construction of strength-4 covering arrays using an ovoid in $PG(3,q)$*, ComDThe (p. 81), Austen
15:30 - 16:00	Jack Tisdell (McGill University), *Minimizing asymptotic score in random bullseye darts*, VPTrend (p. 193), Wren B
15:30 - 16:00	James Wheeler (University of Michigan), *Asymptotically Euclidean Solutions of the Constraint Equations with Prescribed Asymptotics*, RelGeoA (p. 128), Windsor
15:30 - 16:30	Dan Coman (Syracuse), *Tian's theorem for Grassmannian embeddings and degeneracy sets of random sections*, RDComAn (p. 166), Seymour
15:35 - 15:55	Parker Glynn-Adey and Samira Goder (University of Toronto Scarborough), *String Stars: A Joyful Ending for a Class*, JOY (p. 111), Gerrard
15:55 - 16:05	Break, JOY (p. 111), Gerrard
16:00 - 16:30	Andrea Burgess (University of New Brunswick- Saint John), *Cyclic circular external difference families*, ComDThe (p. 77), Austen
16:00 - 16:30	Monica Cojocaru (University of Guelph), *Expanding optimization ensemble model methods for forecasting seasonal influenza in the U.S.*, AIMath (p. 48), Churchill A
16:00 - 16:30	Benjamin Cookson (University of Toronto), *Unifying Proportional Fairness in Centroid and Non-Centroid Clustering*, NSERC (p. 135), Stevenson
16:00 - 16:30	Keira Gunn (Mt Royal University), *Some Results in Dynamics of the Positive Characterstic Tori*, NumTheo (p. 143), Rosetti C
16:00 - 16:30	Thanh Huynh (McMaster University), *A numerical approach for local isoperimetric partitions*, sres (p. 177), Chesterton
16:00 - 16:30	Nathan Kershaw (Western University), *Topological data analysis using discrete homology*, Topol (p. 185), Baker
16:00 - 16:30	Hitesh Kumar (Simon Fraser University), *Square Energy: Conjectures and Results*, AGTPP (p. 60), Carlyle A
16:00 - 16:30	Aareyan Manzoor (University of Waterloo), *There is a non-Connes embeddable Equivalence Relation*, HorOpAl (p. 103), Whistler

16:00 - 16:30	Sergii Myroshnychenko (University of the Fraser Valley), *Polytope Reconstruction: floating and illuminating structures*, ProConG (p. 170), Wren C
16:00 - 16:30	Jinniao Qiu (University of Calgary), *Some recent progress on stochastic HJB equations*, MathFin (p. 122), Rosetti B
16:00 - 16:30	Sumaira Rehman (Toronto Metropolitan University), *Initial value problems for nonlinear higher-order fractional differential equations*, PrDifEq (p. 157), Scott A
16:00 - 16:30	Yakov Shlapentokh Rothman (University of Toronto), *Polynomial Decay for the Klein-Gordon Equation on the Schwarzschild Black Hole*, RelGeoA (p. 128), Windsor
16:00 - 16:30	Mathias Stout (McMaster), *Integration in Hensel minimal fields*, Logic (p. 114), Wren A
16:00 - 16:30	Julian Weigt (Abdus Salam International Centre for Theoretical Physics), *Regularity of maximal functions in higher dimensions*, HarPDE (p. 98), Rosetti A
16:00 - 16:30	Tong Zhang (Memorial University of Newfoundland), *Liouville-type theorem for the fractional p-Laplacian inequalties*, VPTrend (p. 194), Wren B
16:05 - 16:15	Christopher Heggerud (University of Manitoba), *The joy of getting stuck in traffic*, JOY (p. 111), Gerrard
16:15 - 16:35	Michael Pawliuk (University of Toronto Mississauga), *Valentine's Day Gallery Walk*, JOY (p. 112), Gerrard
16:30 - 17:00	Shohel Ahmed (University of Alberta), *Modelling Foraging Behavior in Ecological Dynamics*, sres (p. 176), Chesterton
16:30 - 17:00	Ali Alsetri (University of Kentucky), *Burgess-type character sum estimates over generalized arithmetic progressions of rank 2.*, NumTheo (p. 142), Rosetti C
16:30 - 17:00	Benoit Hamelin (Tutte Institute for Mathematics and Computing), *Representation of cyber defense telemetry for exploration tasks*, NSERC (p. 136), Stevenson
16:30 - 17:00	Leo Jimenez (Ohio State), *Pfaffian functions and model theory*, Logic (p. 114), Wren A
16:30 - 17:00	Anastasis Kratsios (McMaster University), *A Neural Black–Scholes Formula*, MathFin (p. 120), Rosetti B
16:30 - 17:00	David Kribs (University of Guelph), *Operator Algebra Perspective on Entanglement-Assisted Quantum Codes*, HorOpAl (p. 102), Whistler
16:30 - 17:00	Xinyang Lu (Lakehead University), VPTrend (p. 193), Wren B
16:30 - 17:00	Mariem Magdy (Perimeter Institute), *Estimates for spinor fields using the space-spinor formalism*, RelGeoA (p. 127), Windsor
16:30 - 17:00	Ángel David Martínez Martínez (CUNEF Universidad), *On the monotonicity of the heat kernel*, HarPDE (p. 96), Rosetti A
16:30 - 17:00	Andy Raich (Arkansas), *Tower multitype and compactness of the dbar-Neumann operator in complex manifolds*, RDComAn (p. 166), Seymour
16:30 - 17:00	Shahriyar Pourakbar Saffar (Memorial University of Newfoundland), *Constructing uniquely 2-colourable 4-cycle decompositions*, ComDThe (p. 80), Austen
16:30 - 17:00	Gustavo Cicchini Santos (Toronto Metropolitan University), *Strictly Positive Solutions of Neumann Boundary Value Problems and Applications to Duffing Type Models*, PrDifEq (p. 157), Scott A
16:30 - 17:00	Mariia Sobchuk (University of Waterloo), *Quantum algorithms for matrix problems*, AGTPP (p. 62), Carlyle A
16:30 - 17:00	Edward Thommes (Sanofi), *Long-range forecasting of seasonal influenza vaccine uptake using web search data*, AIMath (p. 50), Churchill A
16:30 - 17:00	Viktor Vigh (University of Szeged, Hungary), *Circumscribed random spherical disc-polygons via duality*, ProConG (p. 172), Wren C
16:30 - 17:00	C.M. Michael Wong (University of Ottawa), *A profinite tensor product of vector spaces and bimodules*, Topol (p. 189), Baker
16:35 - 16:50	Muhammad Awais (University of Victoria), *Guessing & Graphing Trig. Functions*, JOY (p. 110), Gerrard
16:50 - 17:10	Egan Chernoff (University of Saskatchewan), *The Perplexing Power of Pop Quiz Pageantry*, JOY (p. 111), Gerrard
17:00 - 17:30	Tim Alderson (University of New Brunswick- Saint John), *Maximal Arcs and Maximal-length A^sMDS Codes: Existence and Obstructions*, ComDThe (p. 77), Austen
17:00 - 17:30	Camille Archambault (McGill University), *An Agentic Pipeline Combining GraphRAG and UMAP for Explainable Vulnerability Discovery in Low-Level Code.*, NSERC (p. 134), Stevenson

17:00 - 17:30	Mustafa Avci (Athabasca University), *Existence of solutions for a singular double phase variable exponent problem with $(p(\cdot), q(\cdot))-$ Hardy-type potential*, VPTrend (p. 193), Wren B
17:00 - 17:30	Dena Firoozi (University of Toronto), *Ranking Quantilized Mean-Field Games and Early-Stage Venture Investments*, MathFin (p. 118), Rosetti B
17:00 - 17:30	Shan Gao (University of Alberta), *Tipping in Ecological Systems Driven by Periodic Climate Variability*, sres (p. 177), Chesterton
17:00 - 17:30	Ali Hamad (Ottawa), *Bundles of metric structures as left ultrafunctors*, Logic (p. 113), Wren A
17:00 - 17:30	Feodor Kogan (University of Toronto), HorOpAl (p. 102), Whistler
17:00 - 17:30	Juyoung Lee (University of British Columbia), *Variational inequalities for two-parameter averages over tori*, HarPDE (p. 95), Rosetti A
17:00 - 17:30	Nicol Leong (University of Lethbridge), *On some results involving the Riemann zeta function and the Mobius function*, NumTheo (p. 144), Rosetti C
17:00 - 17:30	Leland McInnes (Tutte Institute for Mathematics and Computing), *Persistent Homology in High Dimensions*, Topol (p. 187), Baker
17:00 - 17:30	Shivaram Pragada (Simon Fraser University), *Structure of Eigenvectors of Graphs*, AGTPP (p. 61), Carlyle A
17:00 - 17:30	Carsten Schütt (University of Kiel, Germany), *Expected extremal area of facets of random polytopes*, ProConG (p. 171), Wren C
17:00 - 17:30	Affan Shoukat (University of Regina), *Physics Informed Neural Networks for Fractional Logistic Growth Models*, AIMath (p. 50), Churchill A
17:00 - 17:30	Afroditi Talidou (University of Calgary), *Stability of front-like solutions of the FitzHugh-Nagumo equations on warped cylinders*, PrDifEq (p. 158), Scott A
17:00 - 18:00	Dror Varolin (Stony Brook), RDComAn (p. 166), Seymour
17:10 - 17:20	Break, JOY (p. 110), Gerrard
17:20 - 18:00	Roundtable Discussion, JOY (p. 111), Gerrard
17:30 - 18:00	Steven Ding (McGill University), NSERC (p. 135), Stevenson
17:30 - 18:00	Christine Eagles (Waterloo), *Algebraic independence of solutions to multiple Lotka-Volterra systems*, Logic (p. 113), Wren A
17:30 - 18:00	Nic Fellini (Queen's University), *Non-Wieferich Primes in Number Fields*, NumTheo (p. 143), Rosetti C
17:30 - 18:00	Himanshu Gupta (University of Regina), *Graph Complement and Delta Conjectures: Progress Using Classical Results*, AGTPP (p. 59), Carlyle A
17:30 - 18:00	Alexander Kupers (University of Toronto), *Mapping class groups of exotic tori*, Topol (p. 186), Baker
17:30 - 18:00	Austin Sun (University of Toronto), *The Grassmannian of lines as the space of pencils of binary quantics: towards a GIT-free PGL_2-stratification of $Gr(2, n+1)$*, sres (p. 178), Chesterton
17:30 - 18:00	Aaron Tikuisis (University of Ottawa), *Basic homotopy lemmas via abstract classification*, HorOpAl (p. 105), Whistler
17:30 - 18:00	Vitali Vougalter (University of Toronto), *Existence of stationary solutions for some integro-differential equations with the double scale anomalous diffusion*, PrDifEq (p. 158), Scott A
17:30 - 18:00	Chenjian Wang (University of British Columbia), *Pinned patterns and density theorems in $\mathbb{R}^d$*, HarPDE (p. 98), Rosetti A
17:30 - 18:00	Foivos Xanthos (Toronto Metropolitan University), *Star-Shaped Risk Measures: Representations and Cash-Additive Hulls*, MathFin (p. 124), Rosetti B

Monday December 8 — lundi 8 décembre

8:00 - 8:30 Kristine Bauer, Ozgur Yilmaz and Deanna Needell (PIMS), *Strategies for building inclusivity: lessons from PIMS initiatives*, GenEqui (p. 87), Gerrard

8:00 - 8:30 Adam Clay (University of Manitoba), *Slope detection in knot complements and the L-space conjecture*, Topol (p. 185), Baker

8:00 - 8:30 Homer de Vera (University of Manitoba), *Minimizing Kemeny's constant for partial stochastic matrices with a single specified column*, AGTPP (p. 58), Seymour

8:00 - 8:30 Dmitry Jakobson (McGill University), *Nodal solutions of Yamabe equations and curvature prescription*, NTinAna (p. 138), Wren B

8:00 - 8:30 Isabella Negrini (University of Toronto), *Rigid Cocycles and the p-adic Kudla Program*, NumTheo (p. 144), Rosetti C

8:00 - 8:30 David Saunders (University of Waterloo), *Exploratory Investment-Consumption with Non-Exponential Discounting*, MathFin (p. 122), Rosetti B

8:30 - 9:00 Qi Deng (York University), *A physics-informed learner for decoding societal mobilization in epidemic transmission*, AIMath (p. 48), Stevenson

8:30 - 9:00 Hazem Hassan (McGill University), *p-adic higher Green's functions*, NumTheo (p. 143), Rosetti C

8:30 - 9:00 Sooyeong Kim (University of Guelph), *A Nordhaus–Gaddum Problem for the Spectral Gap of a Graph*, AGTPP (p. 59), Seymour

8:30 - 9:00 Patrick Naylor (McMaster University), *Four-dimensional Murasugi sum*, Topol (p. 187), Baker

8:30 - 9:00 Ilgwon Seo (McMaster), *O-minimality of almost regular multisummable germs*, Logic (p. 114), Wren A

8:30 - 9:00 Shahaboddin Shaabani (University of Toronto), *A view from above on $JN_p((R)^n$*, HarPDE (p. 97), Rosetti A

8:30 - 9:00 Jérôme Vetois (McGill University), *Nonexistence of extremals for the second conformal eigenvalue in low dimensions*, NTinAna (p. 139), Wren B

8:30 - 9:00 Amy Wiebe (UBC Okanagan), *Curbs, Not Tickets: Conference Planning for Equity*, GenEqui (p. 89), Gerrard

8:30 - 9:00 Ting-Kam Leonard Wong (University of Toronto), *Excess growth rate and axiomatic characterizations*, MathFin (p. 124), Rosetti B

9:00 - 9:30 Michael Cavers (University of Toronto Scarborough), *Digraphs with few distinct eigenvalues*, AGTPP (p. 58), Seymour

9:00 - 9:30 Alexander Frei (University of Waterloo), QuErCor (p. 162), Wren C

9:00 - 9:30 Niushan Gao (Toronto Metropolitan University), *On Continuity and Asymptotic Consistency of Measures of Risk and Variability*, MathFin (p. 119), Rosetti B

9:00 - 9:30 Erica Liu (University of Waterloo), *Empowerment in Math Happens Through Doing Math Together*, GenEqui (p. 88), Gerrard

9:00 - 9:30 Jeffrey Marshall-Milne (McMaster University), *An invitation to alternating links and the Greene-Howie Theorem*, Topol (p. 186), Baker

9:00 - 9:30 Carolyn McGregor (Ontario Tech University), AIMath (p. 49), Stevenson

9:00 - 9:30 Gian Cordana Sanjaya (University of Waterloo), *Squarefree density of discriminant of polynomials with restricted coefficients*, NumTheo (p. 145), Rosetti C

9:00 - 9:30 Katja Vassilev (University of Chicago), *One-dimensional wave kinetic theory*, HarPDE (p. 98), Rosetti A

9:30 - 10:00 Steven Boyer (Université du Québec à Montréal), *The L-space conjecture*, Topol (p. 184), Baker

9:30 - 10:00 Almaz Butaev (University of the Fraser Valley), *Minimizing some discrete energy functionals on a regular metric measure space*, HarPDE (p. 94), Rosetti A

9:30 - 10:00 Ningping Cao (National Research Council), *Quantum Error-Corrected Non-Markovian Metrology*, QuErCor (p. 161), Wren C

9:30 - 10:00 Kseniya Garaschuk (University of the Fraser Valley), *Human-centered classrooms*, GenEqui (p. 88), Gerrard

9:30 - 10:00 Robert Haslhofer (University of Toronto), *Free boundary minimal disks in convex balls*, NTinAna (p. 138), Wren B

9:30 - 10:00 Joey Lakerdas-Gayle (Waterloo), *Computability theory of function composition*, Logic (p. 114), Wren A

9:30 - 10:00 Roman Makarov (Wilfrid Laurier University), *Spectral Expansions for Structural Credit Risk Models Incorporating Occupation Area and Occupation Time*, MathFin (p. 121), Rosetti B

9:30 - 10:00	Bobby Miraftab (Carleton University), *When the adjacency matrix of a graph is a product of two adjacency matrices ?*, AGTPP (p. 60), Seymour
9:30 - 10:00	Sicheng Zhao (McMaster University), *Improving Infectious Disease Prevalence Estimation and Parameter Inference Using Number of Tests and Positivity Data*, AIMath (p. 51), Stevenson
9:30 - 10:00	Xiao Zhong (University of Waterloo), *A dynamical Manin–Mumford type question on polynomial endomorphisms of* $\mathbb{A}^2$, NumTheo (p. 146), Rosetti C
10:00 - 10:30	Ryan Alvarado (Amherst College), HarPDE (p. 94), Rosetti A
10:00 - 10:30	Diego Bejarano (York), *Finding Order in Metric Structures*, Logic (p. 113), Wren A
10:00 - 10:30	Guillaume Dauphinais (Xanadu Quantum Technologies), QuErCor (p. 162), Wren C
10:00 - 10:30	Christoph Frei (University of Alberta), *A Doubly Continuous Model for Equilibrium Trading Dynamics*, MathFin (p. 118), Rosetti B
10:00 - 10:30	Tyrone Ghaswala (University of Waterloo), *Mapping class groups admit a unique Polish topology*, Topol (p. 185), Baker
10:00 - 10:30	Malabika Pramanik (UBC and BIRS), *Creating Space: Evolving standards of Gender Equity and Collective Change in the Mathematical Sciences*, GenEqui (p. 89), Gerrard
10:00 - 10:30	Fateme Sajadi (University of Toronto), *A Unified Finiteness Theorem For Curves*, NumTheo (p. 145), Rosetti C
10:00 - 10:30	Bruno Staffa (Rice University), *Density and equidistribution of closed geodesics and stationary geodesic nets*, NTinAna (p. 139), Wren B
10:00 - 10:30	Meri Zaimi (Perimeter Institute for Theoretical Physics), *Finite bivariate Tratnik functions*, AGTPP (p. 62), Seymour
10:30 - 11:00	Break / Pause, ra, Churchill Foyer
13:30 - 14:30	Chi Hoi Yip (Georgia Institute of Technology), *Some inverse problems in arithmetic combinatorics*, bsdoc (p. 45), Churchill Ballroom
14:30 - 15:00	Break / Pause, ra, Churchill Foyer
15:00 - 15:30	Hymn Chan (University of Toronto), *The p-adic Langlands Program and Breuil's Lattice Conjecture*, NumTheo (p. 142), Rosetti C
15:00 - 15:30	Dan Mangoubi (The Hebrew University), *On common roots of Legendre polynomials*, NTinAna (p. 139), Wren B
15:00 - 15:30	Andrew Nemec (University of Texas at Dallas), *Entanglement-Assisted Subspace Codes*, QuErCor (p. 162), Wren C
15:30 - 16:00	Sooyeong Kim (University of Guelph), *Quasiorthogonality of Commutative Algebras and Implications for Quantum Information*, QuErCor (p. 162), Wren C
15:30 - 16:00	Alba Dolores García Ruiz (CUNEF Universidad), *High-Energy Laplace Eigenfunctions on Integrable Billiards*, NTinAna (p. 139), Wren B
15:30 - 16:00	Anton Shakov (Queen's University), *Some Distributional Properties of* 2*-Regular Integer Sequences*, NumTheo (p. 145), Rosetti C
16:00 - 16:30	Sarah Hagen (University of Illinois at Urbana-Champaign), *Quantum Secret Sharing with Three and Four Qubits*, QuErCor (p. 162), Wren C
16:30 - 17:00	Serge Adonsou (University of Guelph), *Unified and Generalized Approach to Entanglement-Assisted Quantum Error Correction*, QuErCor (p. 161), Wren C
16:30 - 17:00	John Toth (McGill University), L^2 *restriction bounds for analytic continuations of quantum ergodic Laplace eigenfunctions.*, NTinAna (p. 139), Wren B
17:00 - 17:30	Francisco Torres de Lizaur (Universidad de Sevilla), *Symmetries of eigenfunctions*, NTinAna (p. 138), Wren B
17:00 - 17:30	Mukesh Taank (University of Guelph), *Generalized Knill–Laflamme theorem for families of isoclinic subspaces*, QuErCor (p. 163), Wren C

Talk List

A

Aazami, Amir Babak, *Normal forms, "almost-Einstein" metrics, and conformal invariants*, RelGeoA (p. 125), Saturday December 6, 16:00 - 16:30, Stevenson

Ablett, Patience, ComAlgG (p. 72), Saturday December 6, 17:00 - 17:30, Turner

Addario-Berry, Louigi, *Heights and diameters of random trees and graphs*, plen (p. 44), Saturday December 6, 12:00 - 13:00, Churchill Ballroom

Adem, Alejandro, Topol (p. 184), Baker

Adonsou, Serge, *Unified and Generalized Approach to Entanglement-Assisted Quantum Error Correction*, QuErCor (p. 161), Monday December 8, 16:30 - 17:00, Wren C

Ahmed, Shohel, *Behaviorally Structured Consumer-Resource Dynamics*, post (p. 195), Saturday December 6, 10:00 - 11:00, Churchill Foyer

Ahmed, Shohel, *Modelling Foraging Behavior in Ecological Dynamics*, sres (p. 176), Sunday December 7, 16:30 - 17:00, Chesterton

Akbari, Masoomeh, *A Complete Solution to the Generalized HOP with One Round Table*, ComDThe (p. 77), Saturday December 6, 8:30 - 9:00, Austen

Alagandala, Harshith, *Local Polynomial Convexity at Hyperbolic CR-singularity in $M^n \subset \mathbb{C}^n$*, RDComAn (p. 164), Saturday December 6, 10:00 - 10:30, Seymour

Albesiano, Roberto, *From division to extension*, RDComAn (p. 164), Saturday December 6, 15:30 - 16:00, Seymour

Alderson, Tim, *Maximal Arcs and Maximal-length A^sMDS Codes: Existence and Obstructions*, ComDThe (p. 77), Sunday December 7, 17:00 - 17:30, Austen

Alexakis, Spyros, TAInver (p. 180), Sunday December 7, 8:30 - 9:00, Windsor

Alsetri, Ali, *Burgess-type character sum estimates over generalized arithmetic progressions of rank 2.*, NumTheo (p. 142), Sunday December 7, 16:30 - 17:00, Rosetti C

Alvarado, Ryan, HarPDE (p. 94), Monday December 8, 10:00 - 10:30, Rosetti A

Ambrus, Gergely, *Large signed sums, polarization problems, and projection constants of convex bodies*, ProConG (p. 169), Sunday December 7, 15:00 - 15:30, Wren C

Anco, Stephen, RDIntSy (p. 106), Churchill Ballroom

Arakcheev, Aleksandr, *On Generalisations of Fejér Monotonicity: Fejér* and Opial Sequences*, VarAna (p. 190), Saturday December 6, 10:00 - 10:30, Carlyle B

Archambault, Camille, *An Agentic Pipeline Combining GraphRAG and UMAP for Explainable Vulnerability Discovery in Low-Level Code.*, NSERC (p. 134), Sunday December 7, 17:00 - 17:30, Stevenson

Arulseelan, Jananan, HorOpAl (p. 101), Sunday December 7, 15:30 - 16:00, Whistler

Avci, Mustafa, *A viscosity solution approach to the Feynman-Kac formula for a one-dimensional parabolic PDE with variable exponent coefficient*, PrPDEs (p. 149), Sunday December 7, 9:00 - 9:30, Galsworthy

Avci, Mustafa, *Existence of solutions for a singular double phase variable exponent problem with $(p(\cdot), q(\cdot))-$ Hardy-type potential*, VPTrend (p. 193), Sunday December 7, 17:00 - 17:30, Wren B

Awais, Muhammad, *Guessing & Graphing Trig. Functions*, JOY (p. 110), Sunday December 7, 16:35 - 16:50, Gerrard

B

Badescu, Alexandru, *Option Pricing with Recurrent Variance Dependent Stochastic Discount Factors and Realized Volatility*, MathFin (p. 117), Saturday December 6, 9:30 - 10:00, Rosetti B

Bakhtin, Yuri, *Differentiability of the effective Lagrangian for HJB equations in dynamic random environments*, PrPDEs (p. 150), Saturday December 6, 8:30 - 9:00, Galsworthy

Bal, Jashan, *Projectivity in topological dynamics*, SetTheA (p. 174), Saturday December 6, 16:00 - 17:00, Wren B

Balan, Raluca, *Recent advances for SPDEs with Lévy noise*, PrPDEs (p. 150), Saturday December 6, 10:00 - 10:30, Galsworthy

Balehowsky, Tracey, *The Inverse Problem of Recovering a Riemannian Metric from Area Data*, RelGeoA (p. 126), Saturday December 6, 9:30 - 10:00, Stevenson

Balehowsky, Tracey, *Transformation Optics and Models of Spatial Topology*, TAInver (p. 180), Sunday December 7, 8:00 - 8:30, Windsor

Barbara & Brian Forrest, *Teaching, Learning and Assessment in the Age of AI*, apa (p. 45), Saturday December 6, 14:00 - 15:00, Churchill Ballroom

C

Č

C

D

E

F

G

H

I

J

K

L

M

Q

R

S

T

U

V

W

X

Y

Z

Public Lecture
Conférence publique

Schedule/Horaire **Room/Salle: Churchill Ballroom**

Friday December 5 **vendredi 5 décembre**

17:00 - 18:00 Craig Kaplan (University of Waterloo), *The path to aperiodic monotiles* (p. 42)

Abstract/Résumé

CRAIG KAPLAN, University of Waterloo
[Friday December 5 / vendredi 5 décembre, 17:00 – Churchill Ballroom]
The path to aperiodic monotiles

An aperiodic monotile is a shape that admits tilings of the plane, but none that have periodic symmetry. The question of whether aperiodic monotiles exist, also known as the "einstein problem", was open until 2023, when a team of amateur and professional mathematicians (including me) proved that a shape called the "hat" is aperiodic. The einstein problem is connected to a number of other deep questions in tiling theory, some of which remain open. I will talk about aperiodic tilings and the discovery of the hat, and about some of the connections between the einstein problem and other problems in tiling theory that I continue to study.

Education Plenary
Conférence plénière sur l'éducation

Schedule/Horaire **Room/Salle: Churchill Ballroom**

Saturday December 6 **samedi 6 décembre**

11:00 - 12:00 Diana Skrzydlo (University of Waterloo), *Resilient Course Design* (p. 43)

Abstract/Résumé

DIANA SKRZYDLO, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 11:00 – Churchill Ballroom]
Resilient Course Design

Teaching today means planning for change, including shifts in student backgrounds, new technologies, evolving accessibility standards, or unexpected disruptions in the world around us. How can we design courses that hold up under these pressures without losing their core purpose ? In this plenary, we'll explore practical strategies for building resilience into both instructional practices and assessment. From flexible structures that support diverse learners to approaches that make courses adaptable to new tools and contexts, we'll look at techniques that help keep learning meaningful and sustainable. Whether you're deeply invested in pedagogy or simply looking for ideas to make your courses run more smoothly, you'll leave with concrete, actionable strategies to strengthen your teaching for whatever comes next.

Plenary Sessions
Conférences plénières

Schedule/Horaire **Room/Salle: Churchill Ballroom**

Saturday December 6 **samedi 6 décembre**

12:00 - 13:00 Louigi Addario-Berry (McGill University), *Heights and diameters of random trees and graphs* (p. 44)

Sunday December 7 **dimanche 7 décembre**

11:00 - 12:00 Monica Visan (University of California, Los Angeles (UCLA)), *Well-posedness and the method of commuting flows* (p. 44)

Abstracts/Résumés

LOUIGI ADDARIO-BERRY, McGill University
[Saturday December 6 / samedi 6 décembre, 12:00 – Churchill Ballroom]
Heights and diameters of random trees and graphs

Fix a finite set S of graphs, and let U be a uniformly random sample from S. We ask the question: what is the statistical behaviour of diam(U), the greatest graph distance between any two vertices in U ? Many variants of this question have been asked, including for branching process trees (starting with the work of Kolmogorov 1938) and regular graphs (starting with the work of Bollobás 1982).

Two natural and very general settings for this question are when S has the form

S_1=T is a rooted tree with vertex set V(G)=1,...,n and vertex degrees $(d_1,...,d_n)$ or S_2=G is a graph with vertex set V(G)=1,...,n and vertex degrees $(d_1,...,d_n)$

We explain how to answer such questions, and to prove tight diameter upper bounds, in both cases. One of the challenges in proving the results for S_2 is that in general we know neither how to approximately enumerate nor to efficiently sample from sets of the form S_2.

Time permitting, I may also discuss diameter lower bounds.

I will also discuss the social and political roles and responsibilities of professional and learned societies.

Based in part on joint works with Serte Donderwinkel, Gabriel Crudele, and Igor Kortchemski.

MONICA VISAN, University of California, Los Angeles (UCLA)
[Sunday December 7 / dimanche 7 décembre, 11:00 – Churchill Ballroom]
Well-posedness and the method of commuting flows

Completely integrable partial differential equations are regularly used as effective models for a wide array of phenomena seen in nonlinear optics, magnetohydrodynamics, Bose-Einstein condensates, and for both surface and internal waves in fluid mechanics. These equations exhibit a wide range of physical behaviors, most notably the elastic interaction of solitary waves and the soliton resolution phenomenon. While these behaviours were first witnessed in the completely integrable settings, they are robust enough to also be observed in non-integrable analogues.

Because of their significance, much effort has been devoted to the development of a complete well-posedness theory for completely integrable models. This is the question of the existence and uniqueness of solutions, as well as the continuous dependence of the solution on the initial data. Surprisingly, unlike their non-integrable cousins, completely integrable PDE have stubbornly resisted such a complete theory. In this talk I will introduce several completely integrable models, outline why they have proven so recalcitrant, and discuss recent breakthroughs on the well-posedness question that employ the method of commuting flows.

Prize Lectures
Conférence des lauréats

Schedule/Horaire — **Room/Salle: Churchill Ballroom**

Saturday December 6 — samedi 6 décembre

14:00 - 15:00 — Barbara and Brian Forrest (University of Waterloo), *Teaching, Learning and Assessment in the Age of AI* (p. 45)

Sunday December 7 — dimanche 7 décembre

13:30 - 14:30 — Chris Kapulkin (Western University), *Topology, graphs, and data* (p. 46)

Monday December 8 — lundi 8 décembre

13:30 - 14:30 — Chi Hoi Yip (Georgia Institute of Technology), *Some inverse problems in arithmetic combinatorics* (p. 45)

Abstract/Résumé

Adrien Pouliot Award
Prix Adrien-Pouliot

BARBARA AND BRIAN FORREST, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 14:00 – Churchill Ballroom]
Teaching, Learning and Assessment in the Age of AI

There is strong evidence to indicate that artificial intelligence will have a profound impact on teaching and learning. During the first part of this presentation, we will briefly outline some ways in which AI tools can be used today to help make our teaching more efficient.

Much of our success in helping students learn mathematics has been due to the assessments that we have designed as learning tools. For these to be effective it has always been imperative that our students were as fully engaged as possible. In the second part of this presentation, we will provide some examples of our favourite questions and discuss how they hold up in the presence of AI tools and what this may mean for the nature and role of assessments in the future.

Blair Spearman Doctoral Prize
Prix de doctorat Blair Spearman

CHI HOI YIP, Georgia Institute of Technology
[Monday December 8 / lundi 8 décembre, 13:30 – Churchill Ballroom]
Some inverse problems in arithmetic combinatorics

In this talk, I will give a gentle introduction to some of my favorite problems in arithmetic combinatorics and highlight some recent progress. In particular, I will discuss:

* A question of Erdős on whether the set of perfect squares can be close to a sumset, and a multiplicative analogue by Hajdu and Sárközy.

* A conjecture of Van Lint and MacWilliams on the characterization of maximum subsets of a finite field of square order such that pairwise differences are all squares (also known as the Erdős-Ko-Rado theorem for Paley graphs), and its generalization.

* Inverse sieve problems (that have been studied by Green–Harper, Helfgott–Venkatesh, Shao, and Walsh), motivated by the inverse Goldbach problem.

Joint work with Ernie Croot and Junzhe Mao.

Coxeter-James Prize
Prix Coxeter-James

CHRIS KAPULKIN, University of Western Ontario
[Sunday December 7 / dimanche 7 décembre, 13:30 – Churchill Ballroom]
Topology, graphs, and data

Discrete homotopy theory is an emerging area of mathematics that applies topological intuitions in discrete settings. It associates (discrete) homotopy and homology groups to graphs that detect combinatorial, rather than topological, "holes." It has found numerous applications, including to matroid theory, hyperplane arrangements, and network analysis.

This talk will be an introduction to discrete homotopy theory, building towards two main contributions. The first is a theoretical result, joint with Daniel Carranza (Compos. Math. 2024), that associates to a graph a topological space whose homotopy and homology groups recover the discrete homotopy and homology groups of the graph. The second, joint with Nathan Kershaw (arXiv:2506.15020), is an application of the foregoing result to data analysis, showing that persistent discrete homology provides an alternative to standard techniques of topological data analysis that is better suited for noisy data.

No background in homotopy theory, combinatorics, or statistics will be assumed.

AI and Mathematical Technologies for Decision Support in Public Health

Org: Qi Deng, **Seyed Moghades** and/et **Jianhong Wu** (York University)

This session unites researchers from mathematics, AI, and public health to explore how cutting-edge technologies and analytics drive advances in disease surveillance, policy design, and equitable health outcomes. Presentations will highlight methodological innovations and applications that inform data-driven decisions in population health.

Schedule/Horaire **Rooms/Salles:** Carlyle B , Stevenson

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Bouchra Nasri (Université de Montréal), *Infectious disease surveillance using deep learning models* (p. 49), Carlyle B
8:30 - 9:00	Junling Ma (University of Victoria), *Detecting the change of the exponential growth rate during an early stage of an epidemic* (p. 49), Carlyle B
9:00 - 9:30	Nathaniel Osgood (University of Saskatchewan), *Social Media-Based Respiratory Disease Surveillance: Multi-Assessor Labelling and Cross-Model Accuracy Assessment* (p. 49), Carlyle B
9:30 - 10:00	Woldegebriel Assefa Woldegerima (York University), *Toy Introduction to Epidemiology-Informed Neural Networks (EINNs) with Application* (p. 50), Carlyle B
10:00 - 10:30	Michael Y. Li (University of Alberta), *Modeling for a purpose: influenza outbreak in a boarding school revisited.* (p. 49), Carlyle B
15:00 - 15:30	Chris Bauch (University of Waterloo), *Tipping points in epidemiological systems* (p. 47), Carlyle B
15:30 - 16:00	Abbas Ghasemi (Toronto Metropolitan University), *From Flow Instability to Airborne Transmission of Respiratory Diseases: A Computational Fluid Dynamics Approach* (p. 48), Carlyle B
16:00 - 16:30	Monica Cojocaru (University of Guelph), *Expanding optimization ensemble model methods for forecasting seasonal influenza in the U.S.* (p. 48), Carlyle B
16:30 - 17:00	Edward Thommes (Sanofi), *Long-range forecasting of seasonal influenza vaccine uptake using web search data* (p. 50), Carlyle B
17:00 - 17:30	Affan Shoukat (University of Regina), *Physics Informed Neural Networks for Fractional Logistic Growth Models* (p. 50), Carlyle B

Monday December 8 — lundi 8 décembre

8:30 - 9:00	Qi Deng (York University), *A physics-informed learner for decoding societal mobilization in epidemic transmission* (p. 48), Stevenson
9:00 - 9:30	Carolyn McGregor (Ontario Tech University) (p. 49), Stevenson
9:30 - 10:00	Sicheng Zhao (McMaster University), *Improving Infectious Disease Prevalence Estimation and Parameter Inference Using Number of Tests and Positivity Data* (p. 51), Stevenson

Abstracts/Résumés

CHRIS BAUCH, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 15:00 – Carlyle B]
Tipping points in epidemiological systems

Dynamical transitions in complex systems continue to garner attention from mathematicians, on account of both their fascinating behaviour as well as their applications to public health. Many of these systems can be characterized as coupled behaviour-disease systems, where there is a two way feedback between some nonlinear transmission dynamics and a nonlinear

human system. A familiar example is the COVID-19 pandemic, where a pandemic wave could drive widespread adoption of infection control measures but, as case incidence dropped, the subsequent relaxation of these measures fostered conditions for the next pandemic wave. In this talk, I will provide an overview of some of my research on mathematical modelling of tipping points in epidemiological systems, including coupled social-epidemiological systems. Methods include dynamical systems models, bifurcation theory, evolutionary game theory, and data-driven dynamical systems approaches assisted by deep learning.

MONICA COJOCARU, University of Guelph

[Sunday December 7 / dimanche 7 décembre, 16:00 – Carlyle B]

Expanding optimization ensemble model methods for forecasting seasonal influenza in the U.S.

Each year, the seasonal influenza epidemic sees significant variability in its evolution. Accurate forecasts of future influenza cases are important for planning public health responses. The United States Centers for Disease Control and Prevention (CDC) has annually organized the FluSight competition to solicit forecasts from teams over forecast horizons (0–3). Using these data, the CDC produces an ensemble forecast of all submitted forecasts. In this paper, we introduce a weight-based ensemble forecasting method to predict laboratory-confirmed influenza hospital admissions for the 2024–2025 season. The method consists of determining optimal weights that are updated week-by-week throughout the FluSight competition to minimize the mean squared error (MSE) of a blend of teams' previous forecasts compared to the truth data. Using these weights over an expanding time window starting at the beginning of the season, we produce our own future forecasts ; we call our method the *expanding window optimization* (EWO). To improve EWO's performance vis-a-vis the CDC ensemble model, we further introduce the *Adjusted-Weights EWO* (Adw-EWO) method. This new forecast is obtained by adding a correction term to the original EWO forecast, controlled by a parameter $\pi \in (0, 1)$. The correction term is computed using only the forecast errors at horizon 0 and is then applied uniformly across all forecast horizons. Our results show that the Adw-EWO method consistently outperforms the EWO across all horizons. Moreover, the Adw-EWO outperforms the CDC ensemble model at horizons 0, 1, and 2, while at horizon 3, the Adw-EWO and the CDC ensemble were roughly comparable.

QI DENG

[Monday December 8 / lundi 8 décembre, 8:30 – Carlyle B]

A physics-informed learner for decoding societal mobilization in epidemic transmission

Epidemic dynamics depend not only on contact-driven transmission but also on when individuals become mobilized into the effective susceptible pool. We formalize this process with the susceptibility mobilization function (SMF), a single time-resolved curve learned directly from case data. Using a physics-informed, covariate-free neural learner embedded in an extended SIR framework, we estimate SMFs for 210 COVID-19 waves across 30 Chinese provinces from 2020 to 2022. Despite substantial geographic and variant heterogeneity, SMFs exhibit consistent morphological structure that can be summarized using functional principal components. A hierarchical Bayesian alignment model links these morphological modes to societal-context domains such as mobility, population structure, urban form, and economic capacity, and reveals strong period sensitivity. During Delta waves, high-context settings displayed later and broader mobilization. Translating morphology into intervention guidance, we identify a robust principle: advancing actions slightly before the SMF peak reduces epidemic size more reliably than increasing intervention strength later. We also develop a two-axis provincial scorecard that separates current performance (SRS) from longitudinal progress (LPI), allowing fairer comparison across structurally diverse settings. By transforming diverse social determinants into an interpretable temporal function, the SMF provides a generalizable methodological tool for analyzing context-driven transmission and supporting adaptive epidemic response.

ABBAS GHASEMI, Toronto Metropolitan University (TMU)

[Sunday December 7 / dimanche 7 décembre, 15:30 – Carlyle B]

From Flow Instability to Airborne Transmission of Respiratory Diseases: A Computational Fluid Dynamics Approach

Mathematical modeling and computational fluid dynamics (CFD) play an essential role in advancing our understanding of

complex flow phenomena such as shear-layer instability, vortex dynamics, and the emergence of chaotic flow behaviour. Among a wide range of engineering and environmental systems, these phenomena often arise in the airborne transmission of respiratory pathogens, governing their spatio-temporal dispersion. Because they frequently occur at high Reynolds numbers and involve strong nonlinear interactions between exhaled droplets, fluid inertia, viscosity, and turbulence, analytical solutions are rarely possible. Mathematical modelling, therefore, provides the theoretical framework needed to describe these instabilities, while CFD simulations offer a powerful tool for resolving the detailed spatial and temporal evolution of the flowfield. From exhalation jets to the wakes formed behind walking individuals, shear layer instabilities (e.g., Kelvin–Helmholtz instability) are responsible for the formation, growth, and breakdown of coherent vortical structures, consequently governing the pathogen dispersion. Integrating mathematical modelling with modern CFD techniques—such as large eddy simulation (LES), direct numerical simulation (DNS) enables us to sufficiently resolve the length/time-scales emerging in the turbulence energy cascade and ultimately extract the vortex dynamics and chaotic flow structures critical to the dispersion of infectious pathogens.

MICHAEL Y. LI, Univeristy of Alberta
[Sunday December 7 / dimanche 7 décembre, 10:00 – Carlyle B]
Modeling for a purpose: influenza outbreak in a boarding school revisited.

Assessment of models should depend on the modeling objectives. Models that incorporate more realistic mechanisms are more suitable for providing insights. To produce reliable and accurate predictions and inform public health decision making, parsimoneous models are more appropriate and the modeling needs to respect the data. Most of all, model calibration results should be validated by data that is independent of the calibration data, before scenario analysis is make to inform policy. As a case study, we revisit the classical example of a 1978 influenza outbreak in a boarding school in England. We demonstrate that a parsimonious SIR model with data informed time-dependent parameters can produce both accurate fitting to the time series data and validation by the final size of the epidemic. Furthermore, modeling results also provide evidence of the likely epidemic control measures implemented at the school.

JUNLING MA, University of Victoria
[Sunday December 7 / dimanche 7 décembre, 8:30 – Carlyle B]
Detecting the change of the exponential growth rate during an early stage of an epidemic

The exponential growth rate is a key indicator of transmission intensity during the early stages of an epidemic and is closely linked to the basic reproduction number through the serial interval. Changes in control measures, transmission patterns, or the emergence of new variants can alter this rate, making rapid and reliable detection of such shifts essential for informing public health responses. We first derive proper likelihood functions and then employ a hidden Markov model (HMM) to robustly estimate the exponential growth rate. Based on the model, we develop new statistical tools for real-time detection of changes in this rate. We retrospectively apply our framework to the early phase of the COVID-19 pandemic in BC, Canada, demonstrating both the effectiveness and the limitations of our approach.

CAROLYN MCGREGOR, Ontario Tech University
[Monday December 8 / lundi 8 décembre, 9:00 – Carlyle B]

BOUCHRA NASRI, Université de Montréal
[Sunday December 7 / dimanche 7 décembre, 8:00 – Carlyle B]
Infectious disease surveillance using deep learning models

Social media data has become widely used to monitor infectious diseases. This presentation will showcase case studies of social media data related to COVID-19 and Lyme disease, demonstrating the utility of such data in predicting cases and other disease-related characteristics.

NATHANIEL OSGOOD, University of Saskatchewan
[Sunday December 7 / dimanche 7 décembre, 9:00 – Carlyle B]
Social Media-Based Respiratory Disease Surveillance: Multi-Assessor Labelling and Cross-Model Accuracy Assessment

Timely health surveillance reporting is of foremost importance within the context of respiratory infection outbreaks. Traditional public health surveillance is often marred by reporting delays and low ascertainment rates. Recognizing the surveillance potential of Twitter reports of health symptoms, our Computational Epidemiology and Public Health Informatics Laboratory collected a repository of hundreds of millions of Canadian tweets during 2016-2022.

As a central part of their COVID-19 pandemic work under contract with SHA, PHAC, and FNIHB, the applicants employed Particle Filtering and PMCMC of compartmental models with diverse empirical data for regular reporting and projections. That work further investigated the potential for augmenting such data with time series gathered from tweets automatically classified as plausible COVID-19 or Influenza cases. Substantially expanding on the results shared in Tian et al. 2025, we describe here an end-to-end project using multi-assessor tweet labeling, training and testing of language embedding with 24 diverse machine learning models while navigating class imbalances, and comparisons of model accuracy across multiple accuracy measures. 16 models and model variants were assessed for accuracy in identifying tweets reporting plausible COVID-19 cases, with an additional 8 models being assessed for classifying plausible influenza cases. Models were compared using recall, F1, area under the ROC Curve and accuracy. Among models, transformer-based tweets performed most favourably, followed by an ensemble method involving a diverse set of classical techniques. In closing, we discuss our efforts to shift data collection platforms, and to augment our methods to detect spread of health disinformation via sheaf-based deep learning.

AFFAN SHOUKAT, University of Regina
[Sunday December 7 / dimanche 7 décembre, 17:00 – Carlyle B]
Physics Informed Neural Networks for Fractional Logistic Growth Models

We present fractional physics-informed neural networks (fPINNs) for solving generalized logistic growth models governed by the Atangana-Baleanu fractional derivative and proportional delay. By combining automatic differentiation with numerical quadrature for the nonlocal Mittag-Leffler kernel, fPINNs can accurately captures memory-dependent and time-lagged dynamics. We show an application in epidemiology, where fPINNs can be used to infer hidden growth rates and memory effects from limited time-series data of infectious disease outbreaks.

EDWARD THOMMES, Sanofi/University of Guelph
[Sunday December 7 / dimanche 7 décembre, 16:30 – Carlyle B]
Long-range forecasting of seasonal influenza vaccine uptake using web search data

The population-level burden of an influenza season depends strongly on the proportion of people vaccinated beforehand. Being able to predict whether a given season is on track to have low, high or average uptake would provide a critical piece of highly actionable intelligence for all stakeholders involved: Governments, public health authorities, healthcare providers, vaccines manufacturers, and not least, the population itself. In particular, sufficiently early advance warning provides the opportunity for interventions—such as increased investment in awareness programs—to proactively boost participation and avert a projected shortfall. We present an ensemble forecast model which utilizes a panel of Google web search queries to make meaningful predictions about US national-level total seasonal vaccine uptake as early as the beginning of the year in which the season begins.

FUNDING AND DISCLOSURES: This work was supported by an NSERC Alliance grant co-funded by Sanofi. ET is an employee of Sanofi and may hold shares and/or stock options

WOLDEGEBRIEL ASSEFA WOLDEGERIMA, York University
[Sunday December 7 / dimanche 7 décembre, 9:30 – Carlyle B]
Toy Introduction to Epidemiology-Informed Neural Networks (EINNs) with Application

The integration of mechanistic modeling and machine learning has the potential to revolutionize the way we understand complex biological systems. Particularly, the development of Informed Neural Networks (INNs), a class of hybrid models that embed domain-specific knowledge, such as differential equations, into the neural network architecture, has attracted many researchers recently. Epidemiology-Informed Neural Networks (EINNs) incorporate domain-specific knowledge from disease dynamics (e.g., differential equation models, compartmental models like SIR, vector-host interactions, etc.) into their architecture, loss functions, or training process. The loss function that is minimized during training is the combined loss of the data and the DE residuals. This method helps to improve learning, prediction accuracy, interpretability, and parameter estimation, particularly in scenarios where data is sparse or noisy. In this talk, I will quickly introduce the foundations of EINNs. I will then present some results from our study that we trained an EINN on synthetic data derived from an SI-SIR model designed for Avian influenza and show the model's accuracy in predicting extinction and persistence conditions. In the method, a twelve-layer hidden model was constructed with sixty-four neurons per layer, and the ReLU activation function was used. The network is trained to predict the time evolution of five state variables for birds and humans over $50,000$ epochs. The overall loss is minimized to 0.000006, characterized by a combination of data and physics losses, enabling the EINN to follow the differential equations describing the disease progression.

SICHENG ZHAO, McMaster University

[Monday December 8 / lundi 8 décembre, 9:30 – Carlyle B]

Improving Infectious Disease Prevalence Estimation and Parameter Inference Using Number of Tests and Positivity Data

Prevalence of infection is a critical variable for modeling infectious dynamics and public health decision-making. However, estimating true prevalence from surveillance data remains challenging. Here we discuss three novel attempts to model testing mechanism using the beta-distribution, hazard rates and odds ratios respectively. These methods aim to link prevalence with the number of tests, test positivity, and some test characteristics at each data point in a robust, flexible, and theoretically justified manner. We further present a data-fitting framework based on the odds ratio approach and demonstrate its performance using simulated datasets as a proof of concept.

Additive Combinatorics and Applications
Combinatoire additive et applications

Org: Chi Hoi (Kyle) Yip (Georgia Institute of Technology) and/et **Yifan Jing** (Ohio State University)

This session will focus on recent developments in additive combinatorics, as well its rich applications in areas such as discrete geometry, group theory, harmonic analysis, and number theory. This session aims to bring researchers with a common interest in additive combinatorics to showcase recent advancements and inspire new directions.

Cette session portera sur les développements récents en combinatoire additive, ainsi que sur ses nombreuses applications dans des domaines tels que la géométrie discrète, la théorie des groupes, l'analyse harmonique et la théorie des nombres. Cette session vise à réunir des chercheur(euse)s partageant un intérêt commun pour la combinatoire additive afin de présenter les avancées récentes et d'inspirer de nouvelles orientations.

Schedule/Horaire **Room/Salle: Duchesse**

Saturday December 6 **samedi 6 décembre**

8:00 - 8:30	Steven Senger (Missouri State University), *Gaps in popular iterated sumset sizes* (p. 54)
8:30 - 9:30	Fernando Xuancheng Shao (University of Kentucky), *Recent developments on the polynomial Szemeredi theorem* (p. 54)
9:30 - 10:00	Leo Goldmakher (Williams College), *Large subsets are sumsets* (p. 53)
10:00 - 10:30	Yu-Ru Liu (University of Waterloo), *Equidistribution Theorems in Additive Combinatorics* (p. 54)
15:00 - 15:30	Ernie Croot (Georgia Institute of Technology), *A survey of some results on digits of numbers in different bases related to a problem of R. L. Graham* (p. 52)
15:30 - 16:00	Yifan Jing (Ohio State University), *Measure doubling for small sets in compact Lie groups* (p. 54)
16:00 - 17:00	Stanley Yao Xiao (University of Northern British Columbia), *Primes of the form $f(p,q)$, f quadratic, and applications* (p. 55)
17:00 - 17:30	David Grynkiewicz (University of Memphis), *Towards a Kneser-Pollard Theorem* (p. 53)
17:30 - 18:00	Jonathan Tidor (Princeton University), *Uniform sets with few 4APs via colorings* (p. 55)

Sunday December 7 **dimanche 7 décembre**

8:00 - 8:30	Zhenchao Ge (University of Waterloo), *An Additive property for polynomial sequence in function fields* (p. 52)
8:30 - 9:30	Hunter Spink (University of Toronto), *Geometric additive combinatorics via o-minimality* (p. 55)
9:30 - 10:00	Anton Mosunov (Cornell University), *Numbers that are integrally representable by the homogenization of the minimal polynomial of $\tan(\pi/n)$* (p. 54)
10:00 - 10:30	Marcel Goh (McGill University), *Block complexity and idempotent Schur multipliers* (p. 53)

Abstracts/Résumés

ERNIE CROOT, Georgia Institution of Technology
[Saturday December 6 / samedi 6 décembre, 15:00 – Duchesse]
A survey of some results on digits of numbers in different bases related to a problem of R. L. Graham

In this talk I'll survey some results related to R. L. Graham's problem about whether there exist infinitely many integers n such that $\gcd(\binom{2n}{n}, 105) = 1$, including some results due to myself and collaborators.

Additive Combinatorics and Applications
Combinatoire additive et applications

ZHENCHAO GE, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 8:00 – Duchesse]
An Additive property for polynomial sequence in function fields

Ruzsa established optimal lower bounds for the natural density $\underline{d}(A+P_k)$ in terms of $\underline{d}(A)$, where $A \subseteq \mathbb{N}$ is a set of small density and P_k denotes the set of kth powers of primes. In this talk, we will introduce a function field analogue of this result. Let $\mathbb{F}$ be a finite field. We show that any weighted polynomial sequence in $\mathbb{F}[t]$ admitting three broad hypotheses satisfies an analogue of Ruzsa's inequality. As a corollary, the inequality holds for degree-k polynomial sequences ($\mathrm{char}(\mathbb{F}) \nmid k$) over irreducible elements. Notably, our the result extends to the case when the polynomial degree exceeds the characteristic.

MARCEL GOH, McGill University
[Sunday December 7 / dimanche 7 décembre, 10:00 – Duchesse]
Block complexity and idempotent Schur multipliers

We call a matrix blocky if, up to row and column permutations, it can be obtained from an identity matrix by repeatedly applying one of the following operations: duplicating a row, duplicating a column, or adding a zero row or column. Blocky matrices are precisely the boolean matrices that are contractive when considered as Schur multipliers. It is conjectured that any boolean matrix with Schur multiplier norm at most γ is expressible as a signed sum

$$A = \sum_{i=1}^{L} \pm B_i$$

for some blocky matrices B_i, where L depends only on γ. This conjecture is an analogue of Green and Sanders's quantitative version of Cohen's idempotent theorem. In this paper, we prove bounds on L that are polylogarithmic in the dimension of A. Concretely, if A is an $n \times n$ matrix, we show that one may take $L = 2^{O(\gamma^7)} \log(n)^2$.

LEO GOLDMAKHER, Williams College and Carnegie Mellon University
[Saturday December 6 / samedi 6 décembre, 9:30 – Duchesse]
Large subsets are sumsets

Large subsets of $[n]$ can be expressed in the form $A+B$ with A, B sets of cardinality at least 2. How large must a subset be to guarantee such an additive decomposition ? We show that any subset larger than $(n - \log n)$ must admit such a decomposition. This is nearly optimal: for each n we construct an indecomposable subset of $[n]$ of size larger than $(n - 4\log n)$. We conclude with a discussion of higher-dimensional analogues of this question. This is joint work with a number of former participants in the SMALL summer REU program at Williams College.

DAVID GRYNKIEWICZ, University of Memphis
[Saturday December 6 / samedi 6 décembre, 17:00 – Duchesse]
Towards a Kneser-Pollard Theorem

Let $A, B \subset G$ be finite, nonempty subsets of an abelian group G. For $t \geq 1$, the t-popular sumset $A +_t B$ denotes all $x \in G$ having t distinct tuples $(a_1, b_1), \ldots, (a_t, b_t) \in A \times B$ with $x = a_1 + b_1 = \ldots = a_t + b_t$. When $t = 1$, Kneser's Theorem says

$$|A +_1 B| \geq |A| + |B| - |H|,$$

where $H = \{x \in G : \ x + A + B = A + B\} \leq G$ is the stabilizer of $A + B$. When $|G| = p$ is prime, Pollard's Theorem says

$$\sum_{i=1}^{t} |A +_i B| \geq t \min\{p, |A| + |B| - t\}.$$

When $|G| = p$ and $t = 1$, both results coincide. It is an open question to give a Kneser-type generalization of Pollard's Theorem to a general abelian group G. The best partial result is a theorem that describes the structure of A and B when

$$\sum_{i=1}^{t} |A +_i B| < t|A| + t|B| - (2t^2 - 3t + 2),$$

showing there must exist $A' \subseteq A$ and $B' \subseteq B$ with $|A \setminus A'| + |B \setminus B'| \leq t - 1$, $A' +_t B = A' + B' = A +_t B$, and

$$\sum_{i=1}^{t} |A +_i B| \geq t(|A| + |B| - |H|),$$

where H is the stabilizer of $A' + B' = A +_t B$. These conclusions, combined with classical sumset results, imply a strong structural description of A and B. However, the term $2t^2 - 3t + 2$ is too large for this result to encompass a full generalization of both Kneser and Pollard's Theorems, which would require a result valid using t^2 rather than $2t^2 - 3t + 2$. Here we achieve progress by improving the main quadratic term in the bound from $2t^2$ to $\frac{4}{3}t^2$. Joint work with Runze Wang.

YIFAN JING, Ohio State Univerisity
[Saturday December 6 / samedi 6 décembre, 15:30 – Duchesse]
Measure doubling for small sets in compact Lie groups

A central problem in additive combinatorics is to understand how the size of a sumset (or product set) compares to the size of the original set, and to describe the underlying structure when this "doubling" is small. In this talk, I will survey some classical results in the area and discuss recent developments in the setting of compact Lie groups, based on joint work with Chieu-Minh Tran and Simon Machado.

YU-RU LIU, U. of Waterloo
[Saturday December 6 / samedi 6 décembre, 10:00 – Duchesse]
Equidistribution Theorems in Additive Combinatorics

We establish a function-field analogue of Weyl's equidistribution theorem for polynomial sequences and explore its applications to problems in additive combinatorics. This is joint work with Jérémy Champagne, Thái Hoàng Lê and Trevor Wooley.

ANTON MOSUNOV, Cornell University
[Sunday December 7 / dimanche 7 décembre, 9:30 – Duchesse]
Numbers that are integrally representable by the homogenization of the minimal polynomial of $\tan(\pi/n)$

Let $F(x, y)$ denote a binary form with integer coefficients of degree $d > 2$ and non-zero discriminant. Let $R_F(Z)$ denote the number of all integers $\leq Z$ that are integrally representable by F. In 2019, Stewart and Xiao proved that there exists a positive constant C, which depends only on F, such that $R_F(Z) \sim CZ^{2/d}$. For every integer $n > 2$, we estimate the constant C for $t_n(x, y)$, the homogenization of the minimal polynomial of $\tan(\pi/n)$.

STEVEN SENGER, Missouri State University
[Saturday December 6 / samedi 6 décembre, 8:00 – Duchesse]
Gaps in popular iterated sumset sizes

We discuss the triangular gaps observed experimentally by Mel Nathanson and later by Kevin O'Bryant in the most popular sizes of the h-fold iterated sumset, hA, when A is a randomly chosen four-element subset of the first q natural numbers, for q much larger than h.

FERNANDO XUANCHENG SHAO, University of Kentucky
[Saturday December 6 / samedi 6 décembre, 8:30 – Duchesse]
Recent developments on the polynomial Szemeredi theorem

As a special case of the celebrated theorem of Bergelson and Leibman (the polynomial Szemeredi theorem), any positive density subset of the integers must contain a polynomial progression of the form $x, x+y, x+y^2$ with y nonzero. In the last five years since the pioneering work of Peluse and Prendiville, there have been numerous developments on the quantitative aspects of such results. I will give a brief overview of these recent developments, before describing a two-dimensional version and a "popular" version of the polynomial Szemeredi theorem for the pattern $x, x+y, x+y^2$. The talk includes joint works with Sarah Peluse, Sean Prendiville, and Mengdi Wang.

HUNTER SPINK, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 8:30 – Duchesse]
Geometric additive combinatorics via o-minimality

In this talk I will introduce (gently!) o-minimality as a tool for doing additive combinatorics in geometric settings, based on joint work with Jacob Fox and Matthew Kwan.

As an application, if we remove all line segments contained in a "nice" subset $M \subset \mathbb{R}^n$ (e.g. $M = \{e^{2x^2 - e^{log(xyz)log(x+yz)}}/3x - x^{x-y} <= 6\} \subset \mathbb{R}^3$), then the probability that a randomly signed sum of nonzero vectors $\sum \epsilon_i v_i$ lies in M is $n^{-\frac{1}{2}+o(1)}$, essentially matching the $O(n^{-1/2})$ bound from classical Littlewood–Offord theory for M a single point.

JONATHAN TIDOR, Princeton University
[Saturday December 6 / samedi 6 décembre, 17:30 – Duchesse]
Uniform sets with few 4APs via colorings

A well-known question of Ruzsa asks if there exist Fourier-uniform sets with very few 4-term arithmetic progressions: do there exist Fourier-uniform subsets of $\mathbb{Z}/N\mathbb{Z}$ with density α and 4AP-density $\alpha^{\omega(1)}$? I will discuss a surprising connection between this problem and one in arithmetic Ramsey theory. We show that one could construct such sets given a coloring of $\{1, 2, \ldots, N\}$ with $N^{o(1)}$ colors that avoids symmetrically colored 4APs. We say that a 4AP is symmetrically colored if its first and last term receive the same color and its middle two terms receive the same color.

Based on joint work with Mingyang Deng and Yufei Zhao.

STANLEY YAO XIAO, UNBC
[Saturday December 6 / samedi 6 décembre, 16:00 – Duchesse]
Primes of the form $f(p,q)$, f quadratic, and applications

We capitalize on the breakthrough result of Green and Sawhney proving the infinitude of primes of the form $p^2 + nq^2$, where $n \equiv 0, 4 \pmod 6$ is a fixed positive integer and p, q are prime variables to arbitrary binary quadratic forms satisfying the obvious non-degeneracy conditions. Notably, our result covers irreducible indefinite binary quadratic forms. This has applications to counting elliptic curves admitting a rational isogeny of prime degree, ordered by conductor.

Algebraic Graph Theory: progress and problems
Théorie algébrique des graphes : progrès et problèmes

Org: Homer De Vera (University of Manitoba), **Chris Godsil** (University of Waterloo) and/et **Hermie Monterde** (University of Regina)

We bring together experts on algebraic graph theory to present the most recent advances and discuss open problems in the area. This session will focus on graph spectra, eigenvectors and symmetries of graphs, and applications to quantum information on graphs. We hope that this session disseminates new ideas and inspire future collaborations.

Nous réunissons des experts en théorie algébrique des graphes afin de présenter les avancées les plus récentes et de discuter des problèmes ouverts dans ce domaine. Cette session portera sur les spectres des graphes, les vecteurs propres et les symétries des graphes, ainsi que sur les applications à l'information quantique sur les graphes. Nous espérons que cette session permettra de diffuser de nouvelles idées et d'inspirer de futures collaborations.

Schedule/Horaire **Rooms/Salles: Carlyle A, Seymour**

Saturday December 6 — samedi 6 décembre

8:30 - 9:30	Chris Godsil (University of Waterloo), *Problems in Algebraic Combinatorics II* (p. 58), Carlyle A
9:30 - 10:00	William Martin (Worcester Polytechnic Institute), *The design strength of P- and Q-polynomial association schemes* (p. 60), Carlyle A
10:00 - 10:30	Hermie Monterde (University of Regina), *Equitable partitions and twin subgraphs* (p. 61), Carlyle A
15:00 - 15:30	Steve Kirkland (University of Manitoba), *An edge centrality measure based on Kemeny's constant* (p. 59), Carlyle A
15:30 - 16:00	Harmony Zhan (Worcester Polytechnic Institute), *Laziness of quantum walks* (p. 62), Carlyle A
16:00 - 16:30	Tino Tamon (Clarkson University), *How strong is weak coupling ?* (p. 62), Carlyle A
16:30 - 17:00	John Urschel (Massachusetts Institute of Technology), *Nodal Statistics for Graphs and Matrices* (p. 62), Carlyle A
17:00 - 17:30	Johnna Parenteau (University of Regina), *Determining Distinctness in the Weighted Matching Polynomial* (p. 61), Carlyle A
17:30 - 18:00	Ada Chan (York University), *Type-II matrices* (p. 58), Carlyle A

Sunday December 7 — dimanche 7 décembre

8:30 - 9:00	Steve Butler (Iowa State University), *Cospectral constructions for the q-Laplacian matrix* (p. 57), Carlyle A
9:00 - 9:30	Jane Breen (Ontario Tech University), *Reinforcement learning for algebraic graph theory: parallelizing Wagner's approach* (p. 57), Carlyle A
9:30 - 10:00	Alice Lacaze-Masmonteil (University of Regina), *On the second largest eigenvalue of certain graphs in the perfect matching association scheme* (p. 60), Carlyle A
10:00 - 10:30	John Byrne (University of Delaware), *Nonabelian Sidon sets and extremal problems on digraphs* (p. 57), Carlyle A
15:00 - 15:30	Zilin Jiang (Arizona State University), *Median eigenvalues of subcubic graphs* (p. 59), Carlyle A
15:30 - 16:00	Joy Morris (University of Lethbridge), *A new measure of EKR-robustness on permutation groups* (p. 61), Carlyle A
16:00 - 16:30	Hitesh Kumar (Simon Fraser University), *Square Energy: Conjectures and Results* (p. 60), Carlyle A
16:30 - 17:00	Mariia Sobchuk (University of Waterloo), *Quantum algorithms for matrix problems* (p. 62), Carlyle A
17:00 - 17:30	Shivaram Pragada (Simon Fraser University), *Structure of Eigenvectors of Graphs* (p. 61), Carlyle A
17:30 - 18:00	Himanshu Gupta (University of Regina), *Graph Complement and Delta Conjectures: Progress Using Classical Results* (p. 59), Carlyle A

Monday December 8 — lundi 8 décembre

Algebraic Graph Theory: progress and problems
Théorie algébrique des graphes : progrès et problèmes

8:00 - 8:30	Homer de Vera (University of Manitoba), *Minimizing Kemeny's constant for partial stochastic matrices with a single specified column* (p. 58), Seymour
8:30 - 9:00	Sooyeong Kim (University of Guelph), *A Nordhaus–Gaddum Problem for the Spectral Gap of a Graph* (p. 59), Seymour
9:00 - 9:30	Michael Cavers (University of Toronto Scarborough), *Digraphs with few distinct eigenvalues* (p. 58), Seymour
9:30 - 10:00	Bobby Miraftab (Carleton University), *When the adjacency matrix of a graph is a product of two adjacency matrices ?* (p. 60), Seymour
10:00 - 10:30	Meri Zaimi (Perimeter Institute for Theoretical Physics), *Finite bivariate Tratnik functions* (p. 62), Seymour

Abstracts/Résumés

JANE BREEN, Ontario Tech University

[Sunday December 7 / dimanche 7 décembre, 9:00 – Carlyle A]

Reinforcement learning for algebraic graph theory: parallelizing Wagner's approach

In a recent paper by Wagner (see [1]), it was shown that using reinforcement learning with a cross-entropy approach, one can efficiently find or construct counterexamples to conjectured bounds in algebraic graph theory. This method was re-implemented in [2], and used to disprove several published conjectures in spectral graph theory. In this talk, I will discuss these algorithms and some applications, along with some adaptations to these approaches which may improve speed and efficiency.

This is joint work with Alix Bouffard.

[1] Adam Zsolt Wagner (2021). Constructions in combinatorics via neural networks. *arXiv:2104.14516*

[2] Mohammad Ghebleh, Salem Al-Yakoob, Ali Kanso, Dragan Stevanovic (2024). Reinforcement learning for graph theory, I. Reimplementation of Wagner's approach. *arXiv:2403.18429*

STEVE BUTLER, Iowa State University

[Sunday December 7 / dimanche 7 décembre, 8:30 – Carlyle A]

Cospectral constructions for the q-Laplacian matrix

Given a graph we consider the q-Laplacian matrix described as $qD + A$ where D is the diagonal matrix of degrees and A is the adjacency matrix. By proper selection of q we recover well known matrices ($q = 0$ is the adjacency ; $q = 1$ is the signless Laplacian ; $q = -1$ is, up to sign, the Laplacian).

It is known that there are graphs which are cospectral (same multiset of eigenvalues) for the q-Laplacian for arbitrary choice of q (any regular cospectral pair suffices, but regularity is not needed). The goal of this talk is to highlight some pair of graphs which are cospectral for the q-Laplacian for only some specific values of q and we show there are infinitely many values of which have a cospectral pair. One of our tools we will use is some generalization of Godsil-McKay switching.

JOHN BYRNE, University of Delaware

[Sunday December 7 / dimanche 7 décembre, 10:00 – Carlyle A]

Nonabelian Sidon sets and extremal problems on digraphs

An S_k-set is a subset of a group whose k-tuples have distinct products. We give explicit constructions of large S_k-sets in the groups $\mathrm{Sym}(n)$ and $\mathrm{Alt}(n)$ and of large S_2-sets in $\mathrm{Sym}(n) \times \mathrm{Sym}(n)$ and $\mathrm{Alt}(n) \times \mathrm{Alt}(n)$, as well as some probabilistic

constructions for 'nice' groups. We show that if k is even and Γ has a normal abelian subgroup with bounded index then any S_k-set has size at most $(1-\varepsilon)|\Gamma|^{1/k}$. The S_k-sets are related to the following graph-theoretic problem: determine the largest possible minimum outdegree in a directed graph with no subgraph in $\{C_{2,2},\ldots,C_{k,k}\}$, where $C_{\ell,\ell}$ is the orientation of $C_{2\ell}$ with two maximal directed ℓ-paths. Contrasting with undirected cycles, the extremal minimum outdegree for $\{C_{2,2},\ldots,C_{k,k}\}$ is much smaller than that for any $C_{\ell,\ell}$. We count the directed Hamilton cycles in one of our constructions to improve the upper bound for a problem on Hamilton paths posed by Cohen, Fachini, and Körner. Joint work with Michael Tait.

MICHAEL CAVERS, University of Toronto Scarborough
[Monday December 8 / lundi 8 décembre, 9:00 – Seymour]
Digraphs with few distinct eigenvalues

Graphs with few adjacency eigenvalues have been well studied. This presentation concerns the analogous problem for digraphs (with loops permitted) whose adjacency matrices have few distinct eigenvalues. A spectral characterization is given for the strongly connected digraphs that have exactly two distinct eigenvalues and further structural results are presented.

This is joint work with Bobby Miraftab.

ADA CHAN, York University
[Saturday December 6 / samedi 6 décembre, 17:30 – Carlyle A]
Type-II matrices

An $n \times n$ complex matrix W is a *type-II* matrix if, for $i,j = 1,\ldots,n$,

$$\sum_{k=1}^{n} \frac{W_{ik}}{W_{jk}} = n\delta_{ij}.$$

Important examples of type-II matrices include spin models and complex Hadamard matrices. From each type-II matrix, Nomura's construction gives a formally dual pair of association schemes. This talk gives a brief overview of the rich theory of type-II matrices with connections to association schemes, spin models, and some recent work on quantum symmetry of graphs.

HOMER DE VERA, University of Manitoba
[Monday December 8 / lundi 8 décembre, 8:00 – Seymour]
Minimizing Kemeny's constant for partial stochastic matrices with a single specified column

Given a finite, discrete-time, time-homogeneous Markov chain on n states with an irreducible transition matrix T, we may compute Kemeny's constant $\mathcal{K}(T)$ in terms of the eigenvalues of T. Kemeny's constant on such matrices may be interpreted in terms of the expected number of steps to get from a random initial state to a random destination state, and hence, may be viewed as average travel time on a network when the states of the Markov chain are viewed as vertices on a graph. We similarly define $\mathcal{K}(T)$ in terms of eigenvalues of a stochastic matrix T having a single essential class, an extension of irreducible stochastic matrices. Suppose we have a partial stochastic matrix where some entries are specified and the rest are unspecified, how do we choose values for the unspecified entries so that the resulting stochastic matrix has a single essential class and $\mathcal{K}(T)$ is minimized ? Steve Kirkland solved this question for partial stochastic matrices where the only specified entries are the diagonal entries and where the only specified entries are in a single row. In this talk, we present our results for the case where the only specified entries are in a single column. This is a work in progress with Prof. Kirkland.

CHRIS GODSIL, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 8:30 – Carlyle A]
Problems in Algebraic Combinatorics II

Algebraic Graph Theory: progress and problems
Théorie algébrique des graphes : progrès et problèmes

Over 30 years ago I wrote a paper "Problems in Algebraic Combinatorics" (Elec. J. Comb.). I will report on successful resolution of three of these, lack of progress on others, and add some new ones.

HIMANSHU GUPTA, University of Regina
[Sunday December 7 / dimanche 7 décembre, 17:30 – Carlyle A]
Graph Complement and Delta Conjectures: Progress Using Classical Results

Two major open problems in inverse eigenvalue problems for graphs concern the maximum nullity of matrices associated with graphs. Let G be a graph of order n and minimum degree δ. The first asks whether the sum of maximum nullities of G and its complement is lower bounded by $n-2$. The second asks whether the maximum nullity of G is lower bounded by δ. They are called the graph complement conjecture and the delta conjecture, respectively. In this talk, I present progress on both conjectures using classical results of Mader from 1972 and Lovasz, Saks, and Schrijver from 1989. This work is in collaboration with Francesco Barioli, Shaun M. Fallat, and Zhongshan Li.

ZILIN JIANG, Arizona State University
[Sunday December 7 / dimanche 7 décembre, 15:00 – Carlyle A]
Median eigenvalues of subcubic graphs

We present a resolution to conjectures by Fowler, Pisanski, and Mohar regarding the median eigenvalues of subcubic (chemical) graphs. Specifically, we prove that the median eigenvalues of every connected graph with maximum degree at most three, except for the Heawood graph, lie within the interval [-1, 1]. This result has significant implications in mathematical chemistry, particularly in the analysis of molecular orbital models, and extends prior work on bipartite chemical graphs.

SOOYEONG KIM, University of Guelph
[Monday December 8 / lundi 8 décembre, 8:30 – Seymour]
A Nordhaus–Gaddum Problem for the Spectral Gap of a Graph

We study how quickly a random walk on a graph mixes by examining the spectral gap of its transition probability matrix. For any graph G on n vertices and its complement $\overline{G}$, we prove that

$$\max\{\mathrm{gap}(G),\, \mathrm{gap}(\overline{G})\} = \Omega(1/n).$$

When both the minimum and maximum degrees of G are $\Omega(n)$, this maximum spectral gap improves to $\Theta(1)$. We also establish lower bounds of order $\Omega(1/n)$ when the maximum degree is $n - O(1)$, or when G is the join of two graphs.

In contrast, we construct families of connected graphs whose complements are also connected for which

$$\max\{\mathrm{gap}(G),\, \mathrm{gap}(\overline{G})\} = O(n^{-3/4}).$$

These results illustrate how complementary graph structures constrain spectral-gap behaviour.

STEVE KIRKLAND, University of Manitoba
[Saturday December 6 / samedi 6 décembre, 15:00 – Carlyle A]
An edge centrality measure based on Kemeny's constant

Given a connected graph G, Kemeny's constant $\kappa(G)$ is a parameter associated with the random walk on G that measures how easily the random walker circulates through the vertices of G. We consider a measure of edge centrality $c(\bullet)$ that is based on Kemeny's constant. In the special case that e is a cut edge of G whose deletion yields the disconnected graph $G_1 \cup G_2$, it turns out that $c(e) = \kappa(G) - \kappa(\widehat{G}_1) - \kappa(\widehat{G}_2)$, where $\widehat{G}_1$ (resp. $\widehat{G}_2$) is formed from G_1 (resp. G_2) by adding a loop at the vertex incident with e.

When G is a tree, we produce a formula for $c(e)$ that is completely combinatorial. That formula yields attainable upper and lower bounds on $c(e)$ for trees, and facilitates an analysis of the behaviour of $c(e)$ when a branch of the tree is moved.

Joint work in progress with Max Wiebe.

HITESH KUMAR, Simon Fraser University

[Sunday December 7 / dimanche 7 décembre, 16:00 – Carlyle A]

Square Energy: Conjectures and Results

For an n-vertex graph G with adjacency eigenvalues $\lambda_1 \geq \cdots \geq \lambda_n$, the *positive square energy* $s^+(G)$ and *negative square energy* $s^-(G)$ are defined as follows:

$$s^+(G) = \sum_{\lambda_i > 0} \lambda_i^2, \quad s^-(G) = \sum_{\lambda_i < 0} \lambda_i^2.$$

In recent years, interesting results have been proved about the square energy of graphs, exciting generalizations have been made, but many questions remain open. In this talk, the speaker will present the state of the art on these parameters. Based on joint work with several authors: Saieed Akbari, Bojan Mohar, Shivaramakrishna Pragada, and Shengtong Zhang.

ALICE LACAZE-MASMONTEIL, University of Regina

[Sunday December 7 / dimanche 7 décembre, 9:30 – Carlyle A]

On the second largest eigenvalue of certain graphs in the perfect matching association scheme

Defined as the difference between its two largest eigenvalues, the spectral gap of a graph plays an important role on our understanding of its connectivity as observed by Godsil and Royle (2001). Since computing the largest eigenvalue of a graph is generally not too difficult, the crux to understanding the spectral gap of a graph is to compute its second largest eigenvalue. In this talk, we will consider the spectral gap of certain graphs in the perfect matching association scheme. Since these graphs are part of the same association scheme, they have the same eigenspaces. These eigenspaces correspond to irreducible representations of the symmetric group and thus, one could use these irreducible representations to compute the eigenvalues of each graph. In practice, such computations are difficult to perform which makes it difficult to find the eigenspace that realizes the second largest eigenvalue. The focus of my talk will be to identify this eigenspace for selected graphs in the scheme. This is joint work with Himanshu Gupta, Allen Herman, Roghayeh (Mitra) Maleki, and Karen Meagher.

WILLIAM MARTIN, Worcester Polytechnic Institute

[Saturday December 6 / samedi 6 décembre, 9:30 – Carlyle A]

The design strength of P- and Q-polynomial association schemes

Let Γ be a Q-polynomial distance-regular graph on vertex set X and let $E_0, E_1, \ldots, E_d$ be a Q-polynomial ordering of the primitive idempotents of its Bose-Mesner algebra. If E_1 has rank m, then $\frac{|X|}{x} E_1$ is the Gram matrix of a spherical code in $\mathbb{R}^m$ and this is a spherical t-design for some $t \geq 2$. In this talk, we investigate the relationship between t and the Krein parameters of the association scheme. In particular, we prove that, for $m > 2$, we have $t \leq 5$. This resolves a conjecture I made in 2013. This is work in progress with Jesse Lansdown (Galway), Akihiro Munemasa (Tohoku), Sho Suda (NDA Japan) and Hajime Tanaka (Tohoku).

BOBBY MIRAFTAB, Carleton University

[Monday December 8 / lundi 8 décembre, 9:30 – Seymour]

When the adjacency matrix of a graph is a product of two adjacency matrices?

A graph G is factorizable via the matrix product if the adjacency matrix of G can be written as the product of two adjacency matrices. In this talk, we define the matrix product of two graphs, both algebraically and combinatorially, and identify families

of simple graphs whose adjacency matrices admit such factorizations. We also show how spectral methods help characterize factorizable graphs.

HERMIE MONTERDE, University of Regina
[Saturday December 6 / samedi 6 décembre, 10:00 – Carlyle A]
Equitable partitions and twin subgraphs

In this talk, we prove a fundamental result about equitable partitions on weighted graphs with twin subgraphs, and use this result to construct graphs with pair and plus state transfer. In particular, for $\tau \in \{\frac{\pi}{2}, \frac{\pi}{\sqrt{2}}\}$, we show that almost all connected planar graphs admit pair state transfer at time τ, and almost all connected planar graphs can be assigned a single negative edge weight resulting in plus state transfer, or perfect state transfer between a plus state and a pair state, at time τ. Using a result of Schwenk, analogous results will also be shown to hold for trees. This is joint work with Chris Godsil, Steve Kirkland, Sarojini Mohapatra, and Hiranmoy Pal.

JOY MORRIS, University of Lethbridge
[Sunday December 7 / dimanche 7 décembre, 15:30 – Carlyle A]
A new measure of EKR-robustness on permutation groups

One of many questions that arises naturally out of extensions of the Erdős-Ko-Rado Theorem, is the question of how many edges must be removed from a graph before the independence number increases. We study a variation on this question. The derangement graph of a permutation group is the Cayley graph on that group, whose connection set consists of all of the derangements in the group. Since we are dealing with Cayley graphs, rather than considering all subgraphs that can be produced by removing edges, we instead consider only subgraphs that are still Cayley graphs on the original group: that is, that can be produced by removing inverse-closed sets of elements (derangements) from the original connection set.

This is joint work with Karen Gunderson, Karen Meagher, Venkata Raghu Tej Pantangi, and Mahsa N. Shirazi.

JOHNNA PARENTEAU, University of Regina
[Saturday December 6 / samedi 6 décembre, 17:00 – Carlyle A]
Determining Distinctness in the Weighted Matching Polynomial

It is well known that the roots of any weighted matching polynomial of a graph with a Hamilton path are distinct, real numbers that enjoy a strict interlacing property with respect to the end-points of the Hamilton path. In this talk, we generalize this notion to establish a new class of graphs called SRSI_w graphs. These graphs have simple roots where the roots of a vertex-deleted subgraph strictly interlace the roots of the graph. In this talk, we characterize all SRSI_w graphs and provide a construction using a simple graph expansion operation.

SHIVARAM PRAGADA, Simon Fraser University
[Sunday December 7 / dimanche 7 décembre, 17:00 – Carlyle A]
Structure of Eigenvectors of Graphs

Let G be a graph on n vertices with characteristic polynomial $\varphi_G(\lambda)$. A graph is said to be *Irreducible* if the characteristic polynomial of its adjacency matrix is irreducible. For every irreducible graph G, we show that each eigenvector of its adjacency matrix has pairwise distinct, non-zero entries.

More generally, consider a graph G whose characteristic polynomial factors over $\mathbb{Q}$ as

$$\varphi_G(\lambda) = p_1(\lambda) \cdots p_k(\lambda),$$

where the polynomials $p_i(\lambda)$ are distinct irreducible factors. For any eigenvalue θ with minimal polynomial $p_j(\lambda)$, we prove a structure theorem of eigenspaces corresponding each polynomial $p_j(\lambda)$. We derive a lower bound on the number of distinct entries that must appear in every eigenvector corresponding to θ.

It is conjectured that almost all graphs have irreducible characteristic polynomials, this has recently been confirmed under the assumption of the Extended Riemann Hypothesis. We pose new structural questions about irreducible graphs and present preliminary progress toward understanding their eigenvectors and spectral properties.

MARIIA SOBCHUK, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 16:30 – Carlyle A]
Quantum algorithms for matrix problems

I will give an overview of recent progress in the area of quantum algorithms for matrix inversion with applications to solving certain kinds of differential equations.

TINO TAMON, Clarkson University
[Saturday December 6 / samedi 6 décembre, 16:00 – Carlyle A]
How strong is weak coupling ?

Imagine a scenario (due to Bose) where Alice and Bob wish to send quantum bits to each other using a continuous-time quantum walk over a given graph which they view as a quantum channel. Against better judgment, they decide to attach weak edges (much like antennas) to the graph. We prove that this strategy works in creating high-fidelity quantum state transfer between them (under modest assumptions). As an added twist, this protocol is immune to localization.

This is joint work with Alastair Kay.

JOHN URSCHEL, MIT
[Saturday December 6 / samedi 6 décembre, 16:30 – Carlyle A]
Nodal Statistics for Graphs and Matrices

The study of discrete nodal statistics, that is, data regarding the zeros of Laplacian eigenvectors, provides insight into structural properties of graphs and matrices, and draws strong parallels with classical results in analysis for Laplacian eigenfunctions. In this talk, we will give an overview of the field, covering key results on nodal sets for graphs and their connection to known results and open problems in the continuous setting. In addition, we will discuss some recent progress towards a more complete understanding of the extremal properties of the nodal statistics of a matrix.

MERI ZAIMI, Perimeter Institute for Theoretical Physics
[Monday December 8 / lundi 8 décembre, 10:00 – Seymour]
Finite bivariate Tratnik functions

In the context of algebraic combinatorics, P- and Q-polynomial association schemes are important objects which are closely related to distance-regular graphs. The polynomials appearing in these structures are classified by Leonard's theorem, and they belong to the discrete part of the (q-)Askey scheme. Moreover, the Terwilliger algebra of these schemes has been studied, and there are connections to the theory of Leonard pairs. In the recent years, progress has been made to extend these concepts to the case where the polynomials involved are multivariate. However, a classification analogous to Leonard's theorem is lacking in the mutlivariate case. With the purpose of progressing in that direction, I will discuss work concerning certain finite families of bivariate functions, said of Tratnik type, which are expressed as an intricate product of univariate polynomials of the (q-)Askey scheme. The goal is to classify such functions which satisfy some generalized bispectral properties, that is, two recurrence relations and two (q-)difference equations of certain types.

Algebraic Graph Theory: progress and problems
Théorie algébrique des graphes : progrès et problèmes

HARMONY ZHAN, Worcester Polytechnic Institute
[Saturday December 6 / samedi 6 décembre, 15:30 – Carlyle A]
Laziness of quantum walks

The trace of the average mixing matrix measures the laziness of a quantum walk: the larger trace, the more likely that the walker stays at home in the long run. We will explore the combinatorial aspects of this graph invariant, and identify the laziest walkers in some families of graphs. This is joint work with Amulya Mohan, Christino Tamon and Yichi Xu.

An invitation to low-dimensional topology
Une invitation à la topologie de basse dimension

Org: Adam Clay (University of Manitoba) and/et **Patrick Naylor** (McMaster University)

The purpose of this session is for researchers to motivate and introduce the question(s) driving current research and recent progress in their area of specialization. Questions that can be understood by a broad audience in low-dimensional topology, and which have the potential to lead to new collaborations across sub-disciplines within the field, are particularly welcome.

L'objectif de cette session est de permettre aux chercheur(euse)s de présenter et de susciter l'intérêt pour les questions qui motivent leurs recherches actuelles et les progrès récents dans leur domaine de spécialisation. Les questions qui peuvent être comprises par un large public dans le domaine de la topologie de basse dimension et qui sont susceptibles de déboucher sur de nouvelles collaborations entre les sous-disciplines de ce domaine sont particulièrement bienvenues.

Schedule/Horaire **Room/Salle: Rosetti C**

Saturday December 6 **samedi 6 décembre**

8:00 - 8:30	C.M. Michael Wong (University of Ottawa), *Ribbon cobordisms* (p. 66)
8:30 - 9:00	Hans Boden (McMaster), *Splitting the difference in the ribbon-slice conjecture* (p. 64)
9:00 - 9:30	Duncan McCoy (UQAM), *Calculating the unknotting number (sometimes)* (p. 65)
9:30 - 10:00	Steve Boyer (UQAM), *Do 3-manifolds with taut foliations have orderable fundamental groups ?* (p. 64)
10:00 - 10:30	Office Hours (p. 65)
15:00 - 15:30	Kasra Rafi (Toronto), *From Mirzakhani's Volumes to Random Surfaces* (p. 65)
15:30 - 16:00	Tyrone Ghaswala (Waterloo), *Does the Loch Ness Monster's mapping class group even have a finite-index subgroup ?* (p. 65)
16:00 - 16:30	Yvon Verberne (Western), *Grand arcs and the Nielsen-Thurston Classification* (p. 66)
16:30 - 17:00	Maxime Fortier Bourque (UdeM), *What are the best hyperbolic surfaces ?* (p. 64)
17:00 - 17:30	Office Hours (p. 65)

Abstracts/Résumés

HANS BODEN, McMaster University
[Saturday December 6 / samedi 6 décembre, 8:30 – Rosetti C]
Splitting the difference in the ribbon-slice conjecture

Some time ago, Ralph Fox asked whether every slice knot is ribbon. This innocent question morphed into the ribbon-slice conjecture, despite the fact no one seems to believe it is true. I will discuss two ways to divide Fox's question into two open problems using (a) virtual knots (b) ribbon 2-knots. This approach has been an effective method for converting an intractable problem into several intractable problems.

MAXIME FORTIER BOURQUE, Université de Montréal
[Saturday December 6 / samedi 6 décembre, 16:30 – Rosetti C]
What are the best hyperbolic surfaces ?

I will survey some extremal problems on moduli spaces that ask which hyperbolic surfaces maximize or minimize various geometric invariants. Examples include the size of the isometry group, the diameter, the length and number of shortest closed geodesics, and the value and multiplicity of the first positive eigenvalue of the Laplacian.

An invitation to low-dimensional topology
Une invitation à la topologie de basse dimension

STEVE BOYER, UQAM
[Saturday December 6 / samedi 6 décembre, 9:30 – Rosetti C]
Do 3-manifolds with taut foliations have orderable fundamental groups ?

The L-space conjecture contends, in part, that if a closed, orientable 3-manifold admits a taut foliation then its fundamental admits a left-invariant total order (i.e. it is left-orderable). Though known in many cases, the contention remains widely open. In this talk I will survey what is known about this problem and describe some recent work with Cameron McA. Gordon, Ying Hu, and Duncan McCoy which shows the connection between foliations and left-orders contended by the L-space conjecture is not as direct as might have been hoped.

TYRONE GHASWALA, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 15:30 – Rosetti C]
Does the Loch Ness Monster's mapping class group even have a finite-index subgroup ?

The study of mapping class groups of infinite-type surfaces (so called big mapping class groups) has enjoyed a surge of interest in the past decade or so. Remarkably, the seemingly innocent question in the title of this talk remains stubbornly unresolved.

I will motivate the question, introducing the relevant results from the study of infinite-type surfaces, with the aim of convincing you it's a compelling question ! I will not assume familiarity with big mapping class groups.

I have thought about the question on and off for the past few years, and I invite, with open arms, any ideas anyone may have !

OFFICE HOURS,
[Saturday December 6 / samedi 6 décembre, 10:00 – Rosetti C]

OFFICE HOURS,
[Saturday December 6 / samedi 6 décembre, 17:00 – Rosetti C]

DUNCAN MCCOY, UQAM
[Saturday December 6 / samedi 6 décembre, 9:00 – Rosetti C]
Calculating the unknotting number (sometimes)

The unknotting number is simultaneously one of the simplest classical knot invariants to define and one of the most challenging to compute. This intractability stems from the fact that typically one has no idea which diagrams admit a collection of crossing changes realizing the unknotting number for a given knot. I will discuss some (mostly false) conjectures concerning the behaviour of the unknotting number as well as a smattering of positive results.

KASRA RAFI, University of Toronto
[Saturday December 6 / samedi 6 décembre, 15:00 – Rosetti C]
From Mirzakhani's Volumes to Random Surfaces

We will explore what it means to choose a random geometric surface, using natural probability measures on moduli space, and describe some of the limiting geometric phenomena that emerge for high genus surfaces. In this setting, many geometric features stabilize as the genus tends to infinity and, somewhat paradoxically, become easier to describe and compute, for example the distribution of short geodesics and the geometry of a typical neighborhood of a random point. This perspective was initiated by Mirzakhani, who used Weil-Petersson volume to define a natural notion of a random hyperbolic surface and to

calculate expected values of various geometric quantities. I will explain these ideas and then discuss analogous questions and results for flat surfaces, highlighting connections between geometry, dynamics and low-dimensional topology.

YVON VERBERNE, The University of Western Ontario
[Saturday December 6 / samedi 6 décembre, 16:00 – Rosetti C]
Grand arcs and the Nielsen-Thurston Classification

The Nielsen-Thurston classification tells us that the elements in the mapping class group of a finite type surface are either finite order, reducible, or pseudo-Anosov. We discuss this classification and how to obtain a similar classification theorem when one considers the action of the mapping class group on a combinatorial complex. In the case of infinite type surfaces, the question of what a classification type theorem for elements in the mapping class group would be is open. In this talk, we will discuss what a generalization of a pseudo-Anosov mapping class may be in the context of the action of the mapping class group on a combinatorial complex, and open problems which surround this approach.

C.M. MICHAEL WONG, University of Ottawa
[Saturday December 6 / samedi 6 décembre, 8:00 – Rosetti C]
Ribbon cobordisms

The Slice–Ribbon Conjecture states that, given a smooth concordance (a smooth cobordism that is a cylinder) between a knot and the unknot, one can always find a Morse function on it with only index-0 and index-1, but no index-2, critical points. That it is not obviously false is one of the reasons that 4-dimensional topology is so strange. In this talk, I will briefly survey the history of this conjecture and explain some progress in the past few years as well as some connections to contact topology.

Analytic–Geometric Synergies: Harmonic Analysis and Convexity
Synergies analytiques et géométriques : analyse harmonique et convexité

Org: Almaz Butaev (University of the Fraser Valley), **Galia Dafni** (Concordia University) and/et **Serhii Myroshnychenko** (University of the Fraser Valley)

Harmonic analysis and convex geometry are two areas of mathematics with deep historical connections and a growing number of modern interactions. Techniques from Fourier analysis have proven to be indispensable in addressing fundamental problems in convex and discrete geometry, such as volume inequalities, characterizations of special convex bodies, and stability questions. Conversely, geometric insights often inspire new analytic methods and results.

L'analyse harmonique et la géométrie convexe sont deux domaines des mathématiques qui ont des liens historiques profonds et qui font l'objet d'un nombre croissant d'interactions modernes. Les techniques issues de l'analyse de Fourier se sont révélées indispensables pour traiter des problèmes fondamentaux de la géométrie convexe et discrète, tels que les inégalités de volume, les caractérisations de corps convexes spéciaux et les questions de stabilité. À l'inverse, les connaissances géométriques inspirent souvent de nouvelles méthodes et de nouveaux résultats analytiques.

Schedule/Horaire **Room/Salle: Scott B**

Saturday December 6 — samedi 6 décembre

8:00 - 8:30	Almut Burchard (University of Toronto), *Strict concavity properties of cross covariograms* (p. 67)
8:30 - 9:00	Ryan Gibara (Cape Breton University), *The Neumann problem in metric measure spaces* (p. 68)
9:00 - 9:30	Scott Rodney (Cape Breton University), *Sobolev Inequalities and the Solvability of Second Order Degenerate Elliptic Equations with rough low order terms* (p. 70)
9:30 - 10:00	Marcu-Antone Orsoni (Université Laval), *On the dimension of observable sets for the heat equation* (p. 69)
10:00 - 10:30	Paul Hagelstein (Baylor University), *Current developments in the theory of differentiation of integrals* (p. 68)
15:00 - 15:30	Ferenc Fodor (University of Szeged), *Central diagonal sections of Gaussian cubes* (p. 68)
15:30 - 16:00	Elisabeth Werner (Case Western Reserve University), *Floating bodies for ball-convex bodies* (p. 71)
16:00 - 16:30	Dmitry Faifman (Université de Montréal), *Tubes and valuations in Lie groups* (p. 68)
16:30 - 17:00	Pavlos Kalantzopoulos (Waterloo University), *A multiversion of real and complex hypercontractivity.* (p. 69)
17:00 - 17:30	Liangbing Luo (York University), *Logarithmic Sobolev inequalities on some infinite-dimensional groups* (p. 69)
17:30 - 18:00	Andriy Prymak (University of Manitoba), *On asymptotic Lebesgue's universal covering problem* (p. 70)

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Denis Vinokurov (Université de Montréal), *Topological Tensor Products, Harmonic Maps, and Spectral Optimization* (p. 70)
8:30 - 9:00	Alex Iosevich (University of Rochester), *The Fourier ratio, probabilistic method and signal recovery* (p. 69)
9:00 - 9:30	Dmitry Jacobson (McGill University), *Extremal metrics on graphs* (p. 69)
9:30 - 10:00	Yana Teplitskaya (Paris-Saclay University), *About maximal distance minimizers. Regularity and explicit examples* (p. 70)
10:00 - 10:30	Blair Davey (Montana State University), *Self-similar sets and Lipschitz curves* (p. 68)

Abstracts/Résumés

Analytic–Geometric Synergies: Harmonic Analysis and Convexity
Synergies analytiques et géométriques : analyse harmonique et convexité

ALMUT BURCHARD, University of Toronto
[Saturday December 6 / samedi 6 décembre, 8:00 – Scott B]
Strict concavity properties of cross covariograms

The cross covariogram of two convex bodies K, L is the volume of the intersection of K with v+L, as a function of the translation vector v. This function is known to be log concave ; here I will present precise conditions for *strict* log concavity. (Joint work with Gabriele Bianchi and Lawrence Lin)

BLAIR DAVEY, Montana State University
[Sunday December 7 / dimanche 7 décembre, 10:00 – Scott B]
Self-similar sets and Lipschitz curves

If E is a purely unrectifiable 1-set in the plane, then the intersection of E with any Lipschitz graph has zero 1-dimensional Hausdorff measure. This leads to a natural question: Given a purely unrectifiable 1-set, can we find a Lipschitz curve for which the intersection with E is non-trivial in some dimension less than 1 ? Going further, how close to 1 can we get ? We discuss the answer to this question for self-similar sets. This talk covers joint work with Silvia Ghinassi and Bobby Wilson.

DMITRY FAIFMAN, Université de Montréal
[Saturday December 6 / samedi 6 décembre, 16:00 – Scott B]
Tubes and valuations in Lie groups

Evaluating the volume of metric tubes around submanifolds traces back to Weyl's famous resolution of Hotelling's problem in Euclidean space. Further results were obtained by A. Gray and others, particularly in rank one symmetric spaces. We consider a Lie group equipped with a bi-invariant Riemmanian (or more generally, Finslerian) metric. Utilizing Alesker's theory of valuations on smooth manifolds, in particular the convolution of valuations on compact Lie groups introduced by Alesker and Bernig, and borrowing tools and ideas from deformation theory, we give an explicit power series for the volume of a tube around a submanifold. Based on a joint work with A. Bernig and J. Kotrbaty.

FERENC FODOR, University of Szeged, Hungary
[Saturday December 6 / samedi 6 décembre, 15:00 – Scott B]
Central diagonal sections of Gaussian cubes

We consider Gaussian-type probability measures in the standard n-dimensional cube and study the induced measure of hyperplane sections through the origin and orthogonal to a main diagonal. Using a formula proved by König and Koldobsky (2013), we investigate the asymptotic behaviour of the measure of sections as n tends to infinity. Joint work with Bernardo Gonzalez Merino (University of Murcia, Spain).

RYAN GIBARA, Cape Breton University
[Saturday December 6 / samedi 6 décembre, 8:30 – Scott B]
The Neumann problem in metric measure spaces

In this talk, we will discuss progress on the study of the Neumann problem for the p-Laplacian in the context of a doubling metric measure space supporting a p-Poincaré inequality. The focus will be on recent joint work with Luca Capogna, Rikka Korte, and Nageswari Shanmugalingam, where we establish Hölder regularity of the weak solutions with an exponent that is sharp with respect to the hypotheses we require from the Neumann data.

Analytic–Geometric Synergies: Harmonic Analysis and Convexity
Synergies analytiques et géométriques : analyse harmonique et convexité

PAUL HAGELSTEIN, Baylor University
[Saturday December 6 / samedi 6 décembre, 10:00 – Scott B]
Current developments in the theory of differentiation of integrals

We will provide an overview of current developments in the theory of differentiation of integrals. Particular emphasis will be placed on a recent result, extending prior work of Bateman and Katz, that provides a condition on directional maximal operators on $\mathbb{R}^2$ sufficient to ensure that they are unbounded on $L^p(\mathbb{R}^2)$ for $1 \leq p < \infty$. This recent work is joint with Blanca Radillo-Murguia and Alex Stokolos.

ALEX IOSEVICH, University of Rochester
[Sunday December 7 / dimanche 7 décembre, 8:30 – Scott B]
The Fourier ratio, probabilistic method and signal recovery

We are going to discuss the ratio of the L1 to L2 norms of the Fourier transform in a variety of different contexts as a proxy for the complexity of a signal. We are going to see that if the Fourier ratio is small, the signal can be well-approximated by a trigonometric polynomial of a low degree. Applications to signal recovery and connections with restriction theory of the Fourier transform will be discussed.

DMITRY JACOBSON, McGill
[Sunday December 7 / dimanche 7 décembre, 9:00 – Scott B]
Extremal metrics on graphs

We review several old and new results about extremal metrics for various graph functionals.

PAVLOS KALANTZOPOULOS, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 16:30 – Scott B]
A multiversion of real and complex hypercontractivity.

We establish a multiversion of real and complex Gaussian hypercontractivity. Our result generalizes Nelson's hypercontractivity in the real setting and the works of Beckner, Weissler, Janson, and Epperson in the complex setting to several functions. The proof relies on heat semigroup methods, where we construct an interpolation map that connects the inequality at the endpoints. As a consequence, we derive sharp multiversion of the Hausdorff-Young inequality and the log-Sobolev inequality. This is joint work with Paata Ivanisvili.

LIANGBING LUO, Queen's University
[Saturday December 6 / samedi 6 décembre, 17:00 – Scott B]
Logarithmic Sobolev inequalities on some infinite-dimensional groups

The logarithmic Sobolev inequality has been first introduced and studied by L. Gross on a Euclidean space, and since then it found many applications. In particular, many existing results concern the question on how the constant in the logarithmic Sobolev inequality depends on the geometry of the underlying space. As for many of such infinite-dimensional groups curvature bounds (or classical Bakry-Emery estimates) are not available, we use different techniques. Examples are provided.

MARCU-ANTONE ORSONI, Université Laval
[Saturday December 6 / samedi 6 décembre, 9:30 – Scott B]
On the dimension of observable sets for the heat equation

Let Ω be a bounded C^1 domain in $\mathbb{R}^n$. If $\omega \subset \Omega$ is an open set, it is today well-known that the heat equation is null-controllable (or equivalently observable) from ω. In this talk, I will show that this result still holds when ω is any measurable set with Hausdorff dimension strictly greater than $n-1$. Even if this observability result is sharp with respect to the scale of Hausdorff dimension, we will see how to construct observable sets with codimension greater than 1 and how they are related to nodal sets of Laplace eigenfunctions. Joint work with A.W. Green, K. Le Balc'h and J. Martin.

ANDRIY PRYMAK, University of Manitoba
[Saturday December 6 / samedi 6 décembre, 17:30 – Scott B]
On asymptotic Lebesgue's universal covering problem

A classical theorem of Jung states that any set of diameter 1 in an n-dimensional Euclidean space is contained in a ball J_n of radius $\sqrt{\frac{n}{2n+2}}$; in other words, J_n is a universal cover in $\mathbb{E}^n$.

Lebesgue's universal covering problem, posed in 1914, asks for the convex set of smallest area that serves as a universal cover in the plane ($n=2$). We show that in high dimensions, Jung's ball J_n is asymptotically optimal with respect to volume: for any universal cover $U \subset \mathbb{E}^n$,

$$\mathrm{Vol}(U) \geq (1-o(1))^n \mathrm{Vol}(J_n).$$

Joint work with A. Arman, A. Bondarenko and D. Radchenko.

SCOTT RODNEY, Cape Breton University
[Saturday December 6 / samedi 6 décembre, 9:00 – Scott B]
Sobolev Inequalities and the Solvability of Second Order Degenerate Elliptic Equations with rough low order terms

In this talk I will present joint work with D. Cruz-Uribe, Y. Zeren, S. Cetin, and F. Dal concerning the existence of weak solutions to linear degenerate elliptic PDEs with rough low order terms of the form

$$-\frac{1}{v}\mathrm{Div}\,(Q\nabla u) + HRu + S'Gu + Fu = f + T'g$$

where Q=Q(x) may have vanishing eigenvalues, R, S, and T are first order vector fields, and the coefficients H, G, F are measurable functions in a function space related to the gain in a given Sobolev Inequality. The results are presented in the context of a matrix weighted Sobolev inequality with gain on an Orlicz Scale. Following this and time permitting, I will present some ideas on the production of matrix weighted Sobolev inequalities in joint work with D. Cruz-Uribe and F. Dal.

YANA TEPLITSKAYA, Paris-Saclay University
[Sunday December 7 / dimanche 7 décembre, 9:30 – Scott B]
About maximal distance minimizers. Regularity and explicit examples

Consider a compact set $M \subset \mathbb{R}^d$ and $l > 0$. A maximal distance minimizer problem is to find a connected compact set Σ of the length (that is, one-dimensional Hausdorff measure $\mathcal{H}^1$) at most l that minimizes

$$\max_{y \in M} \mathsf{dist}(y, \Sigma),$$

where $dist$ stands for the Euclidean distance. In this talk, I will survey known results on maximal distance minimizers, including explicit examples (such as a circle, a rectangle, and a minimizer with an infinite number of corner points), as well as the regularity of their local structure (a finite number of branching points in the plane and at most three tangent rays at any point of a minimizer in any dimension). I will also discuss several open problems in this area.

Analytic–Geometric Synergies: Harmonic Analysis and Convexity
Synergies analytiques et géométriques : analyse harmonique et convexité

DENIS VINOKUROV, Université de Montréal

[Sunday December 7 / dimanche 7 décembre, 8:00 – Scott B]

Topological Tensor Products, Harmonic Maps, and Spectral Optimization

In the classical scalar setting, the Rellich–Kondrachov theorem provides compact Sobolev embeddings that are central to many arguments in analysis. This compactness fails for Sobolev maps with values in infinite-dimensional targets, such as Hilbert spaces, and standard direct methods break down.

I will explain how techniques from the theory of topological tensor products allow one to recover a useful compactness framework for certain classes of variational integrals for vector-valued functions. As a key example, we consider Dirichlet-type energies whose critical points are harmonic maps into the infinite-dimensional Hilbert sphere. Their energy densities also arise as critical points of a Laplace eigenvalue optimization problem. We address both the existence of such optimal densities and the regularity of the associated harmonic maps.

ELISABETH WERNER

[Saturday December 6 / samedi 6 décembre, 15:30 – Scott B]

Floating bodies for ball-convex bodies

Abstract: We define floating bodies in the class of n-dimensional ball-convex bodies. A right derivative of volume of these floating bodies leads to a surface area measure for ball-convex bodies which we call relative surface area. We show that this quantity is a rigid motion invariant, upper semi continuous valuation.

Joint work with C. Schuett and D. Yalikun.

Combinatorial Algebraic Geometry
Géométrie algébrique combinatoire

Org: **Megumi Harada**, **Brett Nasserden** and/et **Alexandre Zotine** (McMaster University)

Combinatorial Algebraic Geometry is a subfield of algebraic geometry which studies the many families of algebraic varieties arising in commutative algebra, representation theory, mathematical physics, and other fields, which have an explicit combinatorial structure. Toric varieties and Schubert varieties are traditionally the most prominent examples. However, many other spaces, such as the moduli space of curves and the Hilbert scheme of points, lie within this conceptual framework.

La géométrie algébrique combinatoire est un sous-domaine de la géométrie algébrique qui étudie les nombreuses familles de variétés algébriques apparaissant en algèbre commutative, en théorie de la représentation, en physique mathématique et dans d'autres domaines, qui ont une structure combinatoire explicite. Les variétés toriques et les variétés de Schubert en sont traditionnellement les exemples les plus connus. Cependant, de nombreux autres espaces, tels que l'espace de moduli des courbes et le schéma de Hilbert des points, s'inscrivent dans ce cadre conceptuel.

Schedule/Horaire — Room/Salle: Turner

Saturday December 6 — samedi 6 décembre

8:30 - 9:00	Jake Levinson (Simon Fraser University), *$\mathbb{A}^1$-degrees of twisted Wronski maps* (p. 74)
9:00 - 9:30	Tianyi Yu (UQAM), *A positive combinatorial formula for the double Edelman–Greene coefficients* (p. 75)
9:30 - 10:00	Elana Kalashnikov (University of Waterloo), *Tableaux Littlewood—Richardson rules for 2-step flags* (p. 74)
10:00 - 10:30	Nathan Grieve (Carleton University), *Concepts of stability and positivity for big and nef line bundles, divisorial sheaves and divisors on the Zariski Riemann spaces* (p. 73)
15:00 - 15:30	Karolyn So (Simon Fraser University), *Gröbner Cones for Finite Type Cluster Algebras* (p. 75)
15:30 - 16:00	Chris Manon (University of Kentucky) (p. 74)
16:00 - 16:30	Kiumars Kaveh (University of Pittsburgh) (p. 74)
16:30 - 17:00	Nathan Ilten (Simon Fraser University), *Rational Curves in Projective Toric Varieties* (p. 74)
17:00 - 17:30	Patience Ablett (University of Warwick) (p. 72)

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Santiago Estupiñán (UWaterloo), *A new shifted Littlewood-Richardson rule* (p. 73)
8:30 - 9:00	Katrina Honigs (Simon Fraser University), *McKay correspondence for reflection groups and derived categories* (p. 73)
9:00 - 9:30	Matt Cartier (University of Pittsburgh), *Computing the Invariant β for Certain Schubert Subvarieties* (p. 72)
9:30 - 10:00	Sara Stephens (Cornell University), *Strictly Semistable Quasimaps to $\mathbb{P}^n$* (p. 75)
10:00 - 10:30	Sharon Robins (Carnegie Mellon), *Oda's Conjecture for Smooth Projective Toric Varieties of Lower Picard Rank* (p. 74)

Abstracts/Résumés

PATIENCE ABLETT, University of Warwick
[Saturday December 6 / samedi 6 décembre, 17:00 – Turner]

Combinatorial Algebraic Geometry
Géométrie algébrique combinatoire

MATT CARTIER, University of Pittsburgh
[Sunday December 7 / dimanche 7 décembre, 9:00 – Turner]
Computing the Invariant β for Certain Schubert Subvarieties

This talk concerns an invariant $\beta_Y(L)$ attached to a triple (X, Y, L), where X is an irreducible projective variety, $Y \subset X$ is a proper subscheme, and L is a big or ample line bundle on X. This invariant has arisen independently in several works, where it has been used to obtain new results in Diophantine geometry and mathematical physics. We will focus on the case where $X = \mathbb{G}(k, n)$, $L = O_X(1)$, and $Y \subset X$ a Schubert subvariety. We develop a method which, under suitable hypotheses, allows us to compute $\beta_Y(L)$ for any such Schubert subvariety Y. As a final result, using a different argument, we obtain a concise explicit formula for $\beta_Y(L)$ when Y is a special type of Schubert subvariety that we call a maximal rectangle Schubert subvariety (MR Schubert subvariety).

SANTIAGO ESTUPIÑÁN, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 8:00 – Turner]
A new shifted Littlewood-Richardson rule

As Littlewood-Richardson rules compute linear representation theory of symmetric groups, shifted Littlewood-Richardson rules compute analogous projective representation theory of symmetric groups. The first shifted Littlewood-Richardson rule is due to Stembridge (1989), building on a natural generalization by Sagan and Worley (1979/1984) of the jeu de taquin algorithm to shifted Young tableaux. We give a new shifted Littlewood-Richardson rule that requires consideration of fewer tableaux than Stembridge's rule and is provably faster on a family of structure coefficients. Our rule derives from applying old ideas of Lascoux and Schützenberger (1981) to the study of Haiman's mixed insertion (1989) and Serrano's shifted plactic monoid (2010).(Joint work with Oliver Pechenik.)

NATHAN GRIEVE, Carleton U./NTU/UQAM/U. Waterloo
[Saturday December 6 / samedi 6 décembre, 10:00 – Turner]
Concepts of stability and positivity for big and nef line bundles, divisorial sheaves and divisors on the Zariski Riemann spaces

A key feature of the Neron-Severi spaces of divisor classes on the Zariski Riemann spaces is the absence of an ample cone. This highlights the question of defining K-stability invariants and measures of positivity for big and nef classes on projective varieties. The purpose of this talk is to report on recent progress in this direction. Some emphasis will be placed on my recent results about slope K-stability for big and nef divisors. Time permitting, I will report on my additional very recently obtained results which are in the general direction of the Riemann-Roch problem for birational divisors. For instance, this includes construction of Newton-Okounkov bodies for birational divisors and a concept of Kodaria-Iitaka dimension for fractional b-generalized log varieties.

KATRINA HONIGS, Simon Fraser University
[Sunday December 7 / dimanche 7 décembre, 8:30 – Turner]
McKay correspondence for reflection groups and derived categories

The classical McKay correspondence shows that there is a bijection between irreducible representations of finite subgroups G of $\mathrm{SL}(2, \mathbb{C})$ and the exceptional divisors of the minimal resolution of the singularity $\mathbb{C}^2/G$. This is a very elegant correspondence, but it's not at all obvious how to extend these ideas to other finite groups.

Kapranov and Vasserot, and then, later, Bridgeland, King and Reid showed this correspondence can be recast and extended as an equivalence of derived categories of coherent sheaves. When this framework is extended to finite subgroups of $\mathrm{GL}(2, \mathbb{C})$ generated by reflections, the equivalence of categories becomes a semiorthogonal decomposition whose components are, conjecturally, in bijection with irreducible representations of G. This correspondence has been verified in recent work of Potter and

of Capellan for a particular embedding of the dihedral groups D_n in $\mathrm{GL}(2,\mathbb{C})$. I will discuss recent joint work verifying this decomposition in further cases.

NATHAN ILTEN, Simon Fraser University
[Saturday December 6 / samedi 6 décembre, 16:30 – Turner]
Rational Curves in Projective Toric Varieties

I will discuss joint work with Jake Levinson in which we study embedded rational curves in projective toric varieties from a combinatorial perspective. We show that any degree d rational curve in a toric variety can be constructed from a special affine-linear map called a degree d Cayley structure. We characterize when the curves coming from a degree d Cayley structure are smooth and have degree d. We then use this to establish a bijection between the set of irreducible components of the Hilbert scheme whose general element is a smooth degree d curve, and so-called maximal smooth Cayley structures.

ELANA KALASHNIKOV, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 9:30 – Turner]
Tableaux Littlewood—Richardson rules for 2-step flags

The Abelian/non-Abelian correspondence gives rise to a natural basis for the cohomology of flag varieties, which - except for Grassmannians - is distinct from the Schubert basis. I will describe this basis and its multiplication rules, and explain how to relate it to the Schubert basis for two-step flag varieties. I will then explain how this leads to new tableaux Littlewood–Richardson rules for many products of Schubert classes. This is joint work (separately) with Wei Gu and Linda Chen.

KIUMARS KAVEH, University of Pittsburgh
[Saturday December 6 / samedi 6 décembre, 16:00 – Turner]

JAKE LEVINSON, Université de Montréal
[Saturday December 6 / samedi 6 décembre, 8:30 – Turner]
$\mathbb{A}^1$-degrees of twisted Wronski maps

In $\mathbb{A}^1$-enumerative geometry, the $\mathbb{A}^1$-degree of a finite map of varieties is given by counting points in a general fiber, weighted by, for each point, the class of its Jacobian determinant considered up to squares. This gives a sum in the Grothendieck-Witt ring of the base field, generalizing both the complex degree (absolute count of points in the fiber) and real topological degree (points weighted by the signs of their Jacobians) to arbitrary fields.

I will present some forthcoming work with Thomas Brazelton, in which we compute $\mathbb{A}^1$-degrees of Wronski maps with twisted real structures. Wronski maps arise in Schubert calculus and moduli of curves and have rich enumerative properties over both R and C ; they measure ramification points of linear series on $\mathbb{P}^1$. By varying whether the ramification points are real or complex conjugate pairs, we vary the real structure of a Wronski-type family over $\overline{M_{0,n}}$. We describe how its $\mathbb{A}^1$-degree changes as the real structure is twisted.

CHRIS MANON, University of Kentucky
[Saturday December 6 / samedi 6 décembre, 15:30 – Turner]

SHARON ROBINS, Carnegie Mellon University
[Sunday December 7 / dimanche 7 décembre, 10:00 – Turner]
Oda's Conjecture for Smooth Projective Toric Varieties of Lower Picard Rank

Oda's conjecture predicts the surjectivity of certain multiplication maps between linear systems on smooth projective toric varieties. Equivalently, it asserts a strong integer decomposition property for Minkowski sums of pairs of lattice polytopes. A key consequence of this surjectivity is that the smooth projective toric variety associated to the smooth polytope P is projectively normal with respect to all embeddings defined by the dilations of P. In this talk, I will survey known results on when the conjecture holds and present aspects of my work on this problem for toric varieties of lower Picard rank.

KAROLYN SO, Simon Fraser University
[Saturday December 6 / samedi 6 décembre, 15:00 – Turner]
Gröbner Cones for Finite Type Cluster Algebras

Cluster algebras are a class of commutative algebras defined by a combinatorial iterative method. Consequently, many properties of cluster algebras may be studied through combinatorial tools. In the case of finite cluster type, the cluster algebra $\mathcal{A}$ is canonically a quotient of a polynomial ring by an ideal $I_{\mathcal{A}}$. By work of Ilten, Nájera-Chávez, and Treffinger, there exists a term order such that the initial ideal of $I_{\mathcal{A}}$ is the ideal generated by products of incompatible cluster variables. We study the Gröbner cone $\mathcal{C}_{\mathcal{A}}$ corresponding to this initial ideal. In joint work with Ilten, we construct distinguished elements of $\mathcal{C}_{\mathcal{A}}$ using compatibility degrees, and give explicit descriptions of the rays and lineality spaces of $\mathcal{C}_{\mathcal{A}}$ in terms of combinatorial models for cluster algebras of types A_n, B_n, C_n, D_n with a special choice of frozen variables, and in the case of no frozen variables. In this talk, I will discuss the main results in types A_n, B_n, and C_n.

SARA STEPHENS, Cornell University
[Sunday December 7 / dimanche 7 décembre, 9:30 – Turner]
Strictly Semistable Quasimaps to $\mathbb{P}^n$

One important moduli stack in enumerative geometry is that of ϵ-stable quasimaps, introduced by Ciocan-Fontanine, Kim, and Maulik for a broad class of GIT quotients. Varying the parameter ϵ yields a wall and chamber structure, giving rise to a family of intermediate Deligne-Mumford stacks that interpolate between the moduli of stable quasimaps and Kontsevich's stable maps. In this talk, I will describe an intrinsic perspective on the resulting wall-crossing phenomena via algebraic stacks, employing the framework of infinite-dimensional geometric invariant theory developed by Halpern-Leistner and collaborators. We construct an algebraic stack encoding an ϵ-stable quasimap wall crossing in the case where the semistable locus of the target is $\mathbb{P}^n$, and analyze necessary and sufficient filling conditions for this stack to admit a good moduli space.

TIANYI YU, LACIM
[Saturday December 6 / samedi 6 décembre, 9:00 – Turner]
A positive combinatorial formula for the double Edelman–Greene coefficients

Lam, Lee, and Shimozono introduced the double Stanley symmetric functions to study the equivariant geometry of the affine Grassmannian. They showed that the double Edelman–Greene coefficients, the double Schur expansion coefficients of these functions, are Graham-positive. This positivity was later refined by Anderson. They further asked for an explicit combinatorial formula that manifests this positivity directly. We provide the first such formula, built from two combinatorial models: bumpless pipedreams and increasing chains in the Bruhat order. The key ingredients of our proof are a connection between these two models and a symmetry of increasing chains recently discovered by Sottile and Yu. This is a joint work with Jack Chen-An Chou.

Combinatorial Design Theory
Théorie de la conception combinatoire

Org: Alice Lacaze-Masmonteil (University of Regina), **David Pike** (Memorial University of Newfoundland) and/et **Doug Stinson** (University of Waterloo)

In the 18th century, several seemingly innocuous scheduling problems were proposed, often in the form of a puzzle. These problems were ultimately solved using tools and theoretical approaches that now lie in what is known as combinatorial design theory. Since then, this area of mathematics has seen tremendous growth in the diversity of designs, constructions, and applications that it encompasses. The purpose of this session is to showcase recent results in topics such as classical designs, cycle systems, graph decompositions, Latin squares and other aspects of design theory.

Au XVIIIe siècle, plusieurs problèmes de planification apparemment anodins ont été proposés, souvent sous la forme d'énigmes. Ces problèmes ont finalement été résolus à l'aide d'outils et d'approches théoriques qui relèvent aujourd'hui de ce que l'on appelle la théorie combinatoire de la conception. Depuis lors, ce domaine des mathématiques a connu une croissance considérable en termes de diversité des conceptions, des constructions et des applications qu'il englobe. L'objectif de cette session est de présenter les résultats récents dans des domaines tels que les conceptions classiques, les systèmes cycliques, les décompositions de graphes, les carrés latins et d'autres aspects de la théorie de la conception.

Schedule/Horaire **Room/Salle: Austen**

Saturday December 6 — samedi 6 décembre

8:00 - 8:30	Doug Stinson (University of Waterloo), *Block designs and protocols for local differential privacy* (p. 82)
8:30 - 9:00	Masoomeh Akbari (University of Ottawa), *A Complete Solution to the Generalized HOP with One Round Table* (p. 77)
9:00 - 9:30	Shuxing Li (University of Delaware), *Perfect Sequence Covering Arrays: A Group-Based Approach* (p. 80)
9:30 - 10:00	Amy Wiebe (University of British Columbia, Okanagan), *Counting transversals in group-based Latin squares* (p. 82)
10:00 - 10:30	Trent Marbach (Toronto Metropolitan University) (p. 80)
15:00 - 15:30	Brett Stevens (Carleton University), *Linear and non-linear 1-intersecting pencils of conics* (p. 81)
15:30 - 16:00	Alena Ernst (Worcester Polytechnic Institute), *Designs in finite general linear groups* (p. 78)
16:00 - 16:30	Alice Lacaze-Masmonteil (University of Regina), *On the directed Oberwolfach problem with tables of even lengths and $n \equiv 2 \ (mod\ 4)$ guests* (p. 79)
16:30 - 17:00	Caleb Jones (Toronto Metropolitan University), *Current Trends in Hypergraph Burning* (p. 79)
17:00 - 17:30	Sumin Leem (University of Calgary), *Categorical design for encoding rule-based text* (p. 80)
17:30 - 18:00	Shonda Dueck (University of Winnipeg), *Cyclic partitions of complete hypergraphs and large sets of combinatorial designs* (p. 78)

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Donald Kreher (Michigan Technological University), *Factorization of finite groups* (p. 79)
8:30 - 9:00	Amanda Chafee (Carleton University), *Hamiltonian Cycles on Coverings* (p. 78)
9:00 - 9:30	William Martin (Worcester Polytechnic Institute), *Hitting all the n-tuples from a distance* (p. 80)
9:30 - 10:00	William Kellough (Memorial University of Newfoundland), *BIBDs That Almost Have Locally Equitable Colourings* (p. 79)
10:00 - 10:30	Mateja Sajna (University of Ottawa), *From Spouse-Avoiding to Spouse-Loving: Transforming Solutions to the Oberwolfach Problem* (p. 81)
15:00 - 15:30	Peter Danziger (Toronto Metropolitan University), *Packing designs with large block size* (p. 78)
15:30 - 16:00	Kianoosh Shokri (University of Ottawa), *A recursive construction of strength-4 covering arrays using an ovoid in $PG(3, q)$* (p. 81)
16:00 - 16:30	Andrea Burgess (University of New Brunswick- Saint John), *Cyclic circular external difference families* (p. 77)

Combinatorial Design Theory
Théorie de la conception combinatoire

16:30 - 17:00	Shahriyar Pourakbar Saffar (Memorial University of Newfoundland), *Constructing uniquely 2-colourable 4-cycle decompositions* (p. 80)
17:00 - 17:30	Tim Alderson (University of New Brunswick- Saint John), *Maximal Arcs and Maximal-length A^{s}MDS Codes: Existence and Obstructions* (p. 77)

Abstracts/Résumés

MASOOMEH AKBARI, University of Ottawa
[Saturday December 6 / samedi 6 décembre, 8:30 – Austen]
A Complete Solution to the Generalized HOP with One Round Table

The Honeymoon Oberwolfach Problem (HOP), introduced by Šajna, is a recent variant of the classic Oberwolfach Problem. This problem asks whether it is possible to seat $2m_1 + 2m_2 + \cdots + 2m_t = 2n$ participants, consisting of n newlywed couples, at t round tables of sizes $2m_1, 2m_2, \ldots, 2m_t$ for $2n - 2$ successive nights, so that each participant sits next to their spouse every night and next to every other participant exactly once. This problem is denoted by $\mathrm{HOP}(2m_1, 2m_2, \ldots, 2m_t)$. Jerade, Lepine, and Šajna have studied the HOP and resolved several important cases.

We generalized the HOP by allowing tables of size two, relaxing the previous restriction that tables must have a minimum size of four. In the generalized HOP, we aim to seat the $2n$ participants at s tables of size 2 and t round tables of sizes $2m_1, 2m_2, \ldots, 2m_t$, where $2n = 2s + 2m_1 + 2m_2 + \cdots + 2m_t$ and $m_i \geq 2$, while preserving the adjacency conditions of the HOP. We denote this problem by $\mathrm{HOP}(2^{\langle s \rangle}, 2m_1, \ldots, 2m_t)$.

In this talk, we present a general approach to this problem and provide a solution to the generalized HOP with one round table, showing that the necessary condition for $\mathrm{HOP}(2^{\langle s \rangle}, 2m)$ to have a solution is also sufficient.

TIM ALDERSON, University of New Brunswick, Saint John
[Sunday December 7 / dimanche 7 décembre, 17:00 – Austen]
Maximal Arcs and Maximal-length A^{s}MDS Codes: Existence and Obstructions

We investigate the existence of linear codes whose parameters meet the maximum possible length for a given Singleton defect $s \geq 1$—so-called A^{s}MDS codes. We survey known existence results for maximal-length A^{s}MDS codes in small dimensions, highlighting dimensions 2 and 3, including the Barlotti condition that $s+2$ divides q. For higher-dimensional projective spaces maximal codes do not exist when $s > q$, while constructions exist for special cases such as $s = q - 1$ and $s = q - 2$ when $k \leq 4$.

Long A^{s}MDS codes are necessarily projective and dual to AMDS codes, and we develop arithmetic conditions that restrict the possible existence of such codes. The talk concludes with a summary of bounded values of $\kappa(s, q)$ - the maximum dimension for which there (may) exist maximal-length A^{s}MDS codes and provide (and perhaps settle) conjectures.

ANDREA BURGESS, University of New Brunswick Saint John
[Sunday December 7 / dimanche 7 décembre, 16:00 – Austen]
Cyclic circular external difference families

A $(v, m, \ell, 1)$-*Circular External Difference Family (CEDF)* is an m-sequence $(A_1, \ldots, A_m)$ of ℓ-subsets of an additive group G of order v such that the multiset of all differences $a - a'$, with $(a, a') \in A_{i+1 \pmod m} \times A_i$ for some $i \in \mathbb{Z}_m$, is equal to $G \setminus \{0\}$. When $G = \mathbb{Z}_v$, we speak of a *cyclic CEDF*. CEDFs are a variation of External Difference Families, and have been recently introduced as a tool to construct non-malleable threshold schemes.

Necessarily, if a $(v, m, \ell, 1)$-CEDF exists, then $v = m\ell^2 + 1$. It is known that an $(m\ell^2 + 1, m, \ell, 1)$-CEDF over the cyclic group exists whenever the number of subsets m is even, while there cannot exist a cyclic CEDF for m and ℓ both odd. In this talk, we consider the existence of cyclic CEDFs in the case that m is odd and ℓ is even. In particular, we construct a cyclic $(m\ell^2 + 1, m, \ell, 1)$-CEDF for any odd $m > 1$ when $\ell = 2$, and for any even $\ell \geq 2$ when $m = 3$.

This is joint work with Francesca Merola and Tommaso Traetta.

AMANDA CHAFEE, Carleton University
[Sunday December 7 / dimanche 7 décembre, 8:30 – Austen]
Hamiltonian Cycles on Coverings

A covering design is a v-set V and a list B of b blocks of size k where every pair from V must occur in at least one block. A 1-block intersection graph (1-BIG) is a graph $G = (B, E)$, where $b \in B$ and $(b, b') \in E$ if $|b \cap b'| = 1$ for $b, b' \in B$. This talk will go over what independence sets look like in a 1-BIG based on coverings with $k = 3$. We prove that optimal $k = 3$ coverings $v \equiv 5 \pmod 3$ have a Hamiltonian cycle and show why this proof fails for even v.

PETER DANZIGER, Toronto Metropolitan University
[Sunday December 7 / dimanche 7 décembre, 15:00 – Austen]
Packing designs with large block size

Given positive integers v, k, t and λ with $v \geq k \geq t$, a packing design $\mathsf{PD}_\lambda(v, k, t)$ is a pair $(V, \mathcal{B})$, where V is a v-set and $\mathcal{B}$ is a collection of k-subsets of V such that each t-subset of V appears in at most λ elements of $\mathcal{B}$. When $\lambda = 1$, a $\mathsf{PD}_1(v, k, t)$ is equivalent to a binary code with length v, minimum distance $2(k - t + 1)$ and constant weight k. The maximum size of a $\mathsf{PD}_\lambda(v, k, t)$ is called the packing number, denoted $\mathsf{PDN}_\lambda(v, k, t)$.

We consider packing designs with k large relative to v. In this case, we extend the second Johnson bound to arbitrary λ and show that this bound is tight. Specifically, we prove that for a positive integer n, $\mathsf{PDN}_\lambda(v, k, t) = n$ whenever $nk - (t-1)\binom{n}{\lambda+1} \leq \lambda v < (n+1)k - (t-1)\binom{n+1}{\lambda+1}$. For fixed t and λ, this determines the value of $\mathsf{PDN}_\lambda(v, k, t)$ when k is large with respect to v. We also extend this result to directed packings, by showing that if no point appears in more than three blocks, then the blocks of a $\mathsf{PD}_2(v, k, 2)$ can be directed so that no ordered pair occurs more than once.

Joint work with Andrea Burgess, Daniel Horsley and Muhammad Tariq Javed

---

SHONDA DUECK, University of Winnipeg
[Saturday December 6 / samedi 6 décembre, 17:30 – Austen]
Cyclic partitions of complete hypergraphs and large sets of combinatorial designs

We consider cyclic partitions of the complete k-uniform hypergraph on a finite set V, and their relationship to combinatorial designs. A *t-complementary k-hypergraph* is a k-uniform hypergraph with vertex set V and edge set E for which there exists a permutation $\theta \in Sym(V)$ such that the sets $E, E^\theta, E^{\theta^2}, \ldots, E^{\theta^{t-1}}$ partition the set of all k-element subsets of V. Such a permutation θ is called a *(t, k)-complementing permutation*. The t-complementary k-hypergraphs are a natural generalization of the almost self-complementary graphs, since the associated (t, k)-complementing permutation θ decomposes the complete k-uniform hypergraph into t isomorphic k-hypergraphs, which are permuted cyclically by θ. When these t-complementary k-hypergraphs in the decomposition are also *regular*, then they form a large set of t isomorphic combinatorial designs. We will look at some algebraic constructions for large sets of combinatorial designs that arise from these cyclic decompositions, including one which generalizes the well know Paley graph construction.

ALENA ERNST, Worcester Polytechnic Institute
[Saturday December 6 / samedi 6 décembre, 15:30 – Austen]
Designs in finite general linear groups

Combinatorial Design Theory
Théorie de la conception combinatoire

In his monumental Thesis in 1973, Delsarte introduced so-called T-designs, which generalise classical combinatorial designs by using a purely algebraic definition. In fact, a combinatorial design is equal to a T-design in the Johnson association scheme. Despite their purely algebraic definition, in the literature many T-designs have nice combinatorial characterisations. This confirms Delsarte's insight that this is indeed a general phenomenon, in his own words: "[...] T-designs will often have interesting properties." In this talk, we elaborate on this insight and discuss results on T-designs in finite general linear groups $\mathrm{GL}(n, q)$. These designs turn out to be subsets acting transitively on flag-like structures, which are common generalisations of t-dimensional subspaces of $\mathbb{F}_q^n$ and bases of t-dimensional subspaces of $\mathbb{F}_q^n$. These results can be interpreted as q-analogues of corresponding results for the symmetric group. This is joint work with Kai-Uwe Schmidt.

CALEB JONES, Toronto Metropolitan University
[Saturday December 6 / samedi 6 décembre, 16:30 – Austen]
Current Trends in Hypergraph Burning

Hypergraph burning is a relatively new model for the spread of influence throughout a complex network. We introduce the concept of a cover sequence in a hypergraph, and use it to analyze the "lazy hypergraph burning" model. In particular, we show that a lazy burning set and a cover sequence are equal and opposite concepts, and hence obtain a new characterization of lazy hypergraph burning. Using this new methodology, we improve several of the best known bounds on the lazy burning number of a hypergraph. Finally, we make use of a common dual construction to solve lazy hypergraph burning for all 2-regular hypergraphs.

WILLIAM KELLOUGH, Memorial University of Newfoundland
[Sunday December 7 / dimanche 7 décembre, 9:30 – Austen]
BIBDs That Almost Have Locally Equitable Colourings

In this talk, we analyze ℓ-colourings of (v, k, λ)-BIBDs where within each block, one colour is absent and the rest appear $\frac{k}{\ell-1}$ times. We give necessary conditions for such colourings to exist. We show how Hadamard matrices, affine planes, and twin prime powers can be used to construct such coloured BIBDs.

DONALD KREHER, Michigan Technological University
[Sunday December 7 / dimanche 7 décembre, 8:00 – Austen]
Factorization of finite groups

Let $(G, \cdot)$ be a finite multiplicative group with identity e. For $A, B \subseteq G$, define

$$AB = \{gh \colon g \in A, h \in B\}$$

and note that AB is a multi-set. We say that (A, B) is a (λ, μ)-*factorization of* G if in the product AB each non-identity element appears λ times and the identity occurs μ times. In the group ring $\mathbb{Z}[G]$ we write

$$AB = \lambda(|G| - e) + \mu e$$

Given a subset $A \subseteq G$, if $B \subseteq G$ satisfies this group ring equation, then we say that B is a (λ, μ)-mate of A. A λ-mate with $\mu = 0$ and is simply called a λ-mate and if $\lambda = 1$ and $\mu = 0$, then it is called a mate.

A $(1, 0)$-factorization of G is called a a near-factorization of G and is where my story begins. However a $(1, 1)$-factorization AB of G when neither A nor B are subgroups of G has perhaps received the most attention by investigators and will likely be where my story will end. Between these two events we have explored factorizations when $\lambda > 1$.

If there is a (λ, μ)-factorization (A, B) of G, with $\lambda \neq \mu$, then there is an explicit formula for B in terms of A. This leads to a direct method for computing a (λ, μ)-mates when they exist. Surprisingly it appears that it is more efficient to compute (λ, μ)-mates using sophisticated backtracking tools.

ALICE LACAZE-MASMONTEIL, University of Regina
[Saturday December 6 / samedi 6 décembre, 16:00 – Austen]
On the directed Oberwolfach problem with tables of even lengths and $n \equiv 2 \ (mod\ 4)$ guests

A $(\vec{C}_{m_1}, \vec{C}_{m_2}, \ldots, \vec{C}_{m_t})$-factor of a directed graph G is a spanning subdigraph of G comprised of t disjoint directed cycles of lengths $m_1, m_2, \ldots, m_t$, where $m_i \geqslant 2$. In this talk, we will be constructing a decomposition of the complete symmetric digraph K^*_{2n} into $(\vec{C}_{m_1}, \vec{C}_{m_2}, \ldots, \vec{C}_{m_t})$-factors when $m_1 + m_2 + \cdots + m_t = 2n$, $t \geqslant 3$, and n is odd. The existence of this decomposition implies a complete solution to the directed Oberwolfach problem with t tables of even lengths and $2n$ guests such that n is odd. This is joint work with Andrea Burgess and Peter Danziger.

SUMIN LEEM, University of Calgary
[Saturday December 6 / samedi 6 décembre, 17:00 – Austen]
Categorical design for encoding rule-based text

Rule-based documents such as building codes contain intricate cross-references and logical conditions that can be organized into a mathematical structure. In this talk, we present a category-theoretic model for representing such texts. We begin by representing their reference network as a knowledge graph and then formalize the logical relations using ologs (ontology logs), a category-theoretic construction introduced by David Spivak. Within this setting, conjunctions and disjunctions correspond to pullbacks (limits) and pushouts (colimits), allowing logical composition to be expressed diagrammatically. This model provides a rigorous basis for rule logic and supports downstream integration with satisfiability modulo theories (SMT) solvers and large language models for automated reasoning tasks.

SHUXING LI, University of Delaware
[Saturday December 6 / samedi 6 décembre, 9:00 – Austen]
Perfect Sequence Covering Arrays: A Group-Based Approach

Consider a set P of permutations of $[n] = \{1, 2, \ldots, n\}$, viewed as a set of ordered n-tuples. Assume that every ordered k-subsequence of distinct elements from $[n]$ appears exactly λ times across the permutations in P. What is the minimum possible size of P? This natural question connects to directed t-designs, perfect deletion-correction codes, k-rankwise independent families of permutations, and a recent resurgence motivated by the introduction of perfect sequence covering arrays by Raphael Yuster. This talk presents resent progress on this problem, with an emphasis on a common group-based structure observed in certain perfect sequence covering arrays identified through sophisticated computer search.

This talk is based on joint work with Jonathan Jedwab and Jingzhou Na (Simon Fraser University).

TRENT MARBACH, Toronto Metropolitan University
[Saturday December 6 / samedi 6 décembre, 10:00 – Austen]

WILLIAM MARTIN, Worcester Polytechnic Institute
[Sunday December 7 / dimanche 7 décembre, 9:00 – Austen]
Hitting all the n-tuples from a distance

For given integers $n, q \geq 2$, we seek the smallest size of a set S of q-ary n-tuples with the property that every q-ary n-tuple differs from some member of S in every coordinate. This is equivalent to computing the total domination number of a certain graph, namely the graph having $\mathbb{Z}_q^n$ as its vertex set and two vertices joined by an edge whenever they are at maximum Hamming distance n. This talk is based on joint work with Sam Adriaensen (VUB), Ferdinand Ihringer (SUSTech), and Ralihe Villagran (WPI).

SHAHRIYAR POURAKBAR SAFFAR, Memorial University of Newfoundland
[Sunday December 7 / dimanche 7 décembre, 16:30 – Austen]
Constructing uniquely 2-colourable 4-cycle decompositions

A cycle system of order n is a decomposition of the edges of the complete graph K_n into cycles of a fixed length. A cycle system is said to be k-colourable if we can assign k colours to its vertices so that no cycle is monochromatic. If a cycle system is k-colourable but not $(k-1)$-colourable, it is called k-chromatic. A k-colourable cycle system is uniquely k-colourable if its colouring is unique up to the permutation of colour classes.

The study of colouring cycle systems has been explored in various settings. In particular, Horsley and Pike have examined the existence of k-chromatic m-cycle systems for any integers $m > 2$ and $k > 1$. While Forbes has investigated 3-cycle systems with unique 3-colourability, the existence of uniquely k-colourable m-cycle systems in general remains an open problem.

In this talk, we mainly focus on the construction of an infinite family of uniquely 2-colourable 4-cycle systems and also a uniquely 2-colourable 4-cycle decomposition of $K_n - I$, for infinitely many integers $n \geq 2$. These constructions contribute to the broader study of uniquely colourable cycle systems and open new directions for future research.

MATEJA SAJNA, University of Ottawa
[Sunday December 7 / dimanche 7 décembre, 10:00 – Austen]
From Spouse-Avoiding to Spouse-Loving: Transforming Solutions to the Oberwolfach Problem

The Oberwolfach problem $OP(F)$, for a 2-factor F of K_n, asks whether there exists a 2-factorization of K_n (if n is odd) or $K_n - I$ (if n is even) where each 2-factor is isomorphic to F. Here, I denotes any 1-factor of K_n. For even n, the problem OP(F) may also be denoted OP$^-(F)$, and has been nicknamed the spouse-avoiding variant. Similarly, the spouse-loving variant is denoted OP$^+(F)$ and asks for a 2-factorization of $K_n + I$ (the complete graph with the edges of a 1-factor I duplicated, rather than deleted) in which each 2-factor is isomorphic to F. To date, many more infinite families of cases of OP and OP$^-$ have been solved than of OP$^+(F)$. In this talk, we show how certain solutions to OP$^-$ can be used to construct solutions to OP$^+(F)$; in particular, when the number of odd cycles in F is not too large. Our technique of *setups* also allows us to completely solve the two-table OP$^+$; that is, OP$^+(F)$ where F has exactly two components.

This is joint work with Maruša Lekše.

KIANOOSH SHOKRI, University of Ottawa
[Sunday December 7 / dimanche 7 décembre, 15:30 – Austen]
A recursive construction of strength-4 covering arrays using an ovoid in $PG(3,q)$

A strength-t covering array $\mathrm{CA}(N;t,k,v)$, is an $N \times k$ array over a v-set such that in any t-set of columns, each t-tuple occurs at least once in a row. We employ an ovoid (maximum-sized k-cap with $k = q^2+1$) in $PG(3,q)$ and its plane sections, called Möbius planes, to build new strength-4 covering arrays. For odd q, we identify three truncated Möbius planes such that for any choice of circles from each plane, their intersection size is at most three. From this, we construct a strength-4 covering array $\mathrm{CA}(3q^4-2;4,\frac{q^2+1}{2},q)$. By extending one of these truncated Möbius planes to a full one and applying a recursive construction, we further obtain a $\mathrm{CA}(3q^4+(q-2)(2q^3-q);4,q^2+1,q)$. For $q \geq 11$, these covering arrays improve the size of the best-known covering arrays with the same parameters.

This is joint work with Lucia Moura and Brett Stevens.

BRETT STEVENS, Carleton University
[Saturday December 6 / samedi 6 décembre, 15:00 – Austen]
Linear and non-linear 1-intersecting pencils of conics

In a Desarguesian projective plane of odd order, the sets of conics through three points, tangent to three lines, and in which

a fixed triangle is self-polar all form a bundle of conics ; the circumscribed, inscribed and self-polar bundles respectively. The pencil of conics in the first and third that contain a fixed point are a linearly parameterized pencil. The corresponding pencil in the second is non-linearly parameterized. Let ϕ and χ be two non-degenerate conics which intersect at a single point and are not tangent there. The bundles described show they appear together in exactly one linear pencil and together in a non-linear pencil. The linear pencil can be embedded in two different bundles and the non-linear pencil in at least one. We prove that a similar result holds in projective planes of even order. We discuss the stabilizer subgroups of these pencils.

DOUG STINSON, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 8:00 – Austen]
Block designs and protocols for local differential privacy

There has been considerable recent interest in using block designs in the design of protocols for local differential privacy. The goal is to provide privacy for people reporting possibly sensitive data while still enabling an underlying probability distribution to be accurately estimated. The basic idea goes back to the "randomized response" method proposed by Warner in 1965, where each participant reports a correct yes-no response with some prespecified probability $\theta > 1/2$ and an incorrect response with probability $1 - \theta$. In this talk, I will review recent research by a variety of authors that employs BIBDs as a randomization mechanism when data having multiple possible values is being aggregated. This research is joint work with Maura Paterson.

AMY WIEBE, University of British Columbia Okanagan
[Saturday December 6 / samedi 6 décembre, 9:30 – Austen]
Counting transversals in group-based Latin squares

Finding the exact number of transversals in a Latin square is a long-studied and difficult problem. Even in the simple setting of the Cayley table of the group $\mathbb{Z}_n$, estimating the number of transversals theoretically is a challenge. For groups of order $n \leq 16$ and cyclic groups of order $n \leq 21$, Shieh et. al [2000] enumerated transversals computationally. Further study by McKay, McLeod, and Wanless [2006] revealed many interesting patterns in these transversal counts. Notably, they ask whether the Cayley table of every 2-group of order n has a number of transversals divisible by 2^{n-1}. In this talk, we introduce a "contract-and-lift" method for approaching this question.

This is joint work with Jim Davis and Jonathan Jedwab.

Commutative Algebra
Algèbre commutative

Org: Giulia Gaggero (McMaster University), **Mahrud Sayrafi** (Fields/McMaster University) and/et **Adam Van Tuyl** (McMaster University)

Not only does commutative algebra contribute to the algebraic side of algebraic geometry, commutative algebra has connections to areas such combinatorics, approximation theory, algebraic statistics, coding theory, and physics, among others. The goal of this session is to bring together Canadian mathematicians and colleagues from around the world to discuss recent progress in commutative algebra.

Non seulement l'algèbre commutative contribue à l'aspect algébrique de la géométrie algébrique, mais elle est également liée à des domaines tels que la combinatoire, la théorie de l'approximation, les statistiques algébriques, la théorie du codage et la physique, entre autres. L'objectif de cette session est de réunir des mathématicien(ne)s canadien(ne)s et leurs collègues du monde entier afin de discuter des progrès récents en algèbre commutative.

Schedule/Horaire **Room/Salle: James**

Saturday December 6 / samedi 6 décembre

8:30 - 9:00	Susan Cooper (University of Manitoba), *Decomposing Star Configuration Ideals* (p. 84)
9:00 - 9:30	Kieran Bhaskara (McMaster University), *h-polynomials and the GVD property of toric ideals of graphs* (p. 83)
9:30 - 10:00	Graham Keiper (Università di Cantania), *Symbolic Powers of Toric Ideals* (p. 85)
10:00 - 10:30	Shah Rashan Zamir (Tulane University), *On the algebraic properties of the Böröczky configuration* (p. 86)
15:00 - 15:30	Janet Vassilev (University of New Mexico), *Patterns in differential powers of ideals in affine semigroup rings* (p. 86)
15:30 - 16:00	Emanuela Marangone (University of Manitoba), *Weighted Veronese Rings* (p. 85)
16:00 - 16:30	Iresha Madduwe (Dalhousie University), *Reconstruction Conjecture on Homological Invariants of Cameron-Walker Graphs* (p. 85)
16:30 - 17:00	Dharm Veer (Dalhousie University), *Binomial ideals associated to polycubes.* (p. 86)
17:00 - 17:30	Denys Bulavka (Dalhousie University), *A Hilton-Milner theorem for exterior algebras* (p. 84)
17:30 - 18:00	Selvi Kara (Bryn Mawr College), *Algebraic Study of Polarized Neural Ideals* (p. 84)

Sunday December 7 / dimanche 7 décembre

8:30 - 9:00	Gregory G. Smith (Queen's University), *Cellular free resolutions for normalizations of toric ideals* (p. 85)
9:00 - 9:30	Jay Yang (Vanderbilt University), *Controlling Homology in Virtual Resolutions of Monomial Ideals* (p. 86)
9:30 - 10:00	Hasan Mahmood (Dalhousie University), *Simplicial Resolutions of Powers of Monomial Ideals* (p. 85)
10:00 - 10:30	Sara Faridi (Dalhousie University), *Extremal and D-Extremal ideals and their algebraic properties* (p. 84)

Abstracts/Résumés

KIERAN BHASKARA, McMaster University
[Saturday December 6 / samedi 6 décembre, 9:00 – James]
h-polynomials and the GVD property of toric ideals of graphs

Abstract: Geometrically vertex decomposable (GVD) ideals form a class of ideals that generalize the Stanley-Reisner ideals of vertex decomposable simplicial complexes. It has been shown that some special families of toric ideals of graphs are GVD, but a complete characterization remains unknown. At the same time, several studies have investigated the algebraic invariants of

toric ideals of graphs. One such invariant, the h-polynomial, has been explicitly described for only a small number of graph classes. In this talk, we describe a new family of graphs whose toric ideals are GVD. We then illustrate how the GVD property allows us to compute an explicit formula for the h-polynomials of this family. This talk is based on joint work with Higashitani and Shibu Deepthi, and separate joint work with Van Tuyl and Zotine.

DENYS BULAVKA, Dalhousie University
[Saturday December 6 / samedi 6 décembre, 17:00 – James]
A Hilton-Milner theorem for exterior algebras

A set family F is pairwise-intersecting if every pair of its members intersect. In 1960, Erdős, Ko, and Rado gave an upper-bound on the size of a pairwise-intersecting family of k-sets coming from a ground set of size n. Moreover, they characterized the families achieving the upper-bound. These are families whose members all share exactly one element, so called trivial families. Later, Hilton and Milner provided the next best upper-bound for pairwise-intersecting families that are not trivial.

There are several generalizations of the above results. We will focus on the case when the set family is replaced with a subspace of the exterior algebra. In this scenario intersection is replaced with the wedge product, being pairwise-intersecting with self-annihilating and being trivial with being annihilated by a 1-form. Scott and Wilmer, and Woodroofe gave an upper-bound on the dimension of self-annihilating subspaces of the exterior algebra. In the current work we show that the better upper-bound coming from Hilton and Milner's theorem holds for non-trivial self-annihilating subspaces.

This is a joint work with Francesca Gandini and Russ Woodroofe.

SUSAN COOPER, University of Manitoba
[Saturday December 6 / samedi 6 décembre, 8:30 – James]
Decomposing Star Configuration Ideals

Geometrically vertex decomposable ideals have a recursive structure that allows one to study the original ideal by investigating two related ideals, each of which is in one less variable. This underlying structure can be exploited to study important invariants of the ideal. Examples of ideals that are geometrically vertex decomposable include Schubert determinantal ideals and toric ideals of bipartite graphs. In this talk, we determine when the defining ideal of a star configuration in projective space is geometrically vertex decomposable. This is joint work with E. Guardo, E. Marangone, and A. Van Tuyl.

SARA FARIDI, Dalhousie University
[Sunday December 7 / dimanche 7 décembre, 10:00 – James]
Extremal and D-Extremal ideals and their algebraic properties

Extremal ideals are square-free monomial ideals which model or bound the algebraic properties of all square-free monomial ideals and their powers. A refinement of this concept is the notion of D-extremal ideals, which also takes into account the divisibility relations between the generators of the ideals. This talk will be an overview of of what extremal ideals and what kinds of questions can be answered by them.

SELVI KARA, Bryn Mawr College
[Saturday December 6 / samedi 6 décembre, 17:30 – James]
Algebraic Study of Polarized Neural Ideals

Neural codes, collections of binary strings representing the firing patterns of neurons, can be studied algebraically through their associated neural ideals. These ideals encode receptive field relationships among neurons in a stimulus space. However, neural ideals are not necessarily monomial (not even homogeneous) and do not yield standard graded invariants. We study their polarization, yielding squarefree monomial ideals that preserve combinatorial structure. Focusing on these polar neural ideals, we compute and bound their graded Betti numbers, projective dimensions, and regularity. In particular, we prove an

upper bound on projective dimension for polar neural ideals on n neurons and classify when this bound is attained. This is joint work with Ellie Lew.

GRAHAM KEIPER, The University of Catania
[Saturday December 6 / samedi 6 décembre, 9:30 – James]
Symbolic Powers of Toric Ideals

This talk will discuss some recent joint work with Giuseppe Favacchio relating to symbolic powers of toric ideals. We will go over the necessary background on toric ideals as well as symbolic powers. We will then discuss two new results useful in the computation of symbolic powers of toric ideals. The first result will involve a novel method of computing the symbolic powers of toric ideals via tensors and the second result will show how the symbolic powers of toric ideals can be computed in terms of a particular saturation.

IRESHA MADDUWE, Dalhousie University
[Saturday December 6 / samedi 6 décembre, 16:00 – James]
Reconstruction Conjecture on Homological Invariants of Cameron-Walker Graphs

We show that key homological invariants of edge ideals of Cameron Walker graphs, such as regularity, and depth can be reconstructed from its vertex deleted subgraphs. In addition, we discuss the reconstruction of the top-degree Betti numbers of these edge ideals. Furthermore, we speak on the reconstruction of the lattice points of the edge ideals of Cameron Walker graphs such as $(\text{reg}(R/I), \deg \text{h}(R/I))$ and $(\text{depth}(R/I), \dim(R/I))$ using the lattice points of their vertex-deleted subgraphs.

HASAN MAHMOOD, Dalhousie University
[Sunday December 7 / dimanche 7 décembre, 9:30 – James]
Simplicial Resolutions of Powers of Monomial Ideals

Given a monomial ideal I minimally generated by q monomials, we construct a simplicial complex $\mathbb{M}_q^2$ that supports a free resolution of the square I^2. We also define a natural subcomplex $\mathbb{M}^2(I)$, depending on the specific generators of I, that likewise supports a resolution of I^2. Our framework yields new bounds on the projective dimension of second powers of monomial ideals and provides sharper bounds for the Betti numbers of I^2 compared to those obtained from the Taylor resolution.

Furthermore, we introduce permutation ideal $\mathcal{T}_q$, generated by q monomials, and prove that for any monomial ideal I with q generators, $\beta(I^2) \leq \beta(\mathcal{T}_q^2)$. We also show that the simplicial complex $\mathbb{M}_q^2$ supports the minimal resolution of $\mathcal{T}_q^2$, and that $\mathbb{M}_q^2$ in fact coincides with the Scarf complex of $\mathcal{T}_q^2$. Finally, we present analogous constructions and results for third and higher powers of general monomial ideals. This is joint work with Susan Cooper and Sara Faridi, with additional related work in progress with Sara Faridi and Chau Trung.

EMANUELA MARANGONE, University of Manitoba
[Saturday December 6 / samedi 6 décembre, 15:30 – James]
Weighted Veronese Rings

For a standard-graded polynomial ring R, the d-Veronese subring is generated as a k-algebra by degree d monomials, is Koszul, and its defining ideal is quadratic, binomial, and determinantal. In this talk, I will discuss what happens when we start instead with a non-standard graded polynomial ring.

In joint work with A. Seceleanu, L. Fiorindo, B. Chase, T. de Holleben, S. Singh, T. Nguyen, S. Bisui, we show that in the two-variable case, these weighted Veronese rings preserve many of these properties: they are Cohen–Macaulay, Koszul, and have a determinantal presentation. Moreover, their Hilbert function and Betti numbers depend only on the number and degrees of the generators. In contrast, in three or more variables, these properties no longer hold in general.

Commutative Algebra
Algèbre commutative

GREGORY G. SMITH, Queen's University
[Sunday December 7 / dimanche 7 décembre, 8:30 – James]
Cellular free resolutions for normalizations of toric ideals

The theory of cellular resolutions provides a concrete way to construct free resolutions of monomial ideals by relating them to cell complexes. While Bayer–Sturmfels formulate an analogue for binomial ideals, this theory is less fully developed. In this talk, we will expand the framework for cellular free resolutions and give explicit free resolutions for the normalization of a toric ideal. This is based on joint work with Christine Berkesch, Lauren Cranton Heller, and Jay Yang.

JANET VASSILEV, University of New Mexico
[Saturday December 6 / samedi 6 décembre, 15:00 – James]
Patterns in differential powers of ideals in affine semigroup rings

Let R be a two-dimensional normal affine semigroup ring, one of whose facets lies on the x-axis, the other lying within the first quadrant. We will discuss how the slope of the second facet determines patterns for the differential powers of ideals whose radical is the canonical ideal.

DHARM VEER, Dalhousie University
[Saturday December 6 / samedi 6 décembre, 16:30 – James]
Binomial ideals associated to polycubes.

A unit cube in $\mathbb{R}^3$ is a set of the form $\{(x,y,z) \in \mathbb{R}^3 : a \leq x \leq a+1,\ b \leq y \leq b+1,\ c \leq z \leq c+1\}$, where $(a,b,c) \in \mathbb{N}^3$.

In this talk, we associate a binomial ideal to a collection of unit cubes. We discuss the algebraic invariants of this ideal when the collection of cells forms a polycube. For a certain class of polycubes, we prove that the associated quotient ring is Koszul, and we characterize when this quotient ring is Cohen–Macaulay by studying its initial ideal.

JAY YANG, Vanderbilt University
[Sunday December 7 / dimanche 7 décembre, 9:00 – James]
Controlling Homology in Virtual Resolutions of Monomial Ideals

Virtual Resolutions are certain complexes of free modules over the Cox ring of a toric variety. These complexes are exactly those that sheafify to a free resolution of sheaves. However, a virtual resolution may have homology in higher homological degrees. In recent work, I describe a construction of labeled cell complexes describing virtual resolutions with higher homology and how a simple subdivision operation on the cell complex can often yield a virtual resolution of the same module without higher homology.

SHAH RASHAN ZAMIR, Tulane University
[Saturday December 6 / samedi 6 décembre, 10:00 – James]
On the algebraic properties of the Böröczky configuration

The Böröczky configuration of lines and (multiple) points exhibits extremal behavior in commutative algebra and combinatorics. Examples of this appear in the context of the containment problem for ordinary and symbolic powers of ideals and the proof of the Dirac-Motzkin conjecture by Green and Tao. This paper studies the algebraic properties of Böröczky configurations of arbitrary size. Our results compute the Waldschmit constant of the defining ideal of these configurations. Moreover, we use the weighted projective plane P(1,2,3) to give an upper bound for the degree of the minimal generators of their ideal. Finally, this construction is applied to an elliptic curve in the projective plane to give a new counterexample to the aforementioned containment problem.

Gender Equity in the Mathematical Sciences

Org: Keira Gunn (Mount Royal University), **Yu-Ru Liu** (University of Waterloo) and/et **Hermie Monterde** (University of Regina)

Equity, Diversity, and Inclusion (EDI) have become integral to the framework of Canadian higher education. In this session, we offer a more nuanced approach to gender equity - the act of promoting fairness, impartiality and justice amongst all people regardless of gender. We gather leading advocates in the mathematical sciences to present effective strategies for gender equity and discuss initiatives that were successful in promoting the work of people with historically underrepresented genders (including, but not limited to, women, transgender individuals, nonbinary people, gender non-traditional folks, etc). We also welcome talks about the current discourse on gender diversity and the intersectionality of gender with other aspects of one's identity (such as race, class, cultural background, etc.).

Schedule/Horaire **Rooms/Salles: Churchill Ballroom, Gerrard**

Sunday December 7 **dimanche 7 décembre**

8:00 - 8:30	Erin Meger (Queen's University), *Expanding Horizons: Applying Lessons from Women's Advocacy to Intersectional Equity* (p. 88), Churchill Ballroom
8:30 - 9:00	Kyne Santos (Toronto Metropolitan University), *Math In Drag* (p. 89), Churchill Ballroom
9:00 - 9:30	Ila Varma (University of Toronto), *Concrete strategies for promoting Gender Equity in your mathematical spaces* (p. 89), Churchill Ballroom
9:30 - 10:00	Emily Quesada-Herrera (University of Lethbridge), *Math as a neurodivergent trans latina* (p. 89), Churchill Ballroom
10:00 - 10:30	Zack Cramer (University of Waterloo), *Out in the Open: Fostering 2SLGBTQIA+ Inclusion in Mathematics* (p. 88), Churchill Ballroom

Monday December 8 **lundi 8 décembre**

8:00 - 8:30	Kristine Bauer, Ozgur Yilmaz and Deanna Needell (PIMS), *Strategies for building inclusivity: lessons from PIMS initiatives* (p. 87), Gerrard
8:30 - 9:00	Amy Wiebe (UBC Okanagan), *Curbs, Not Tickets: Conference Planning for Equity* (p. 89), Gerrard
9:00 - 9:30	Erica Liu (University of Waterloo), *Empowerment in Math Happens Through Doing Math Together* (p. 88), Gerrard
9:30 - 10:00	Kseniya Garaschuk (University of the Fraser Valley), *Human-centered classrooms* (p. 88), Gerrard
10:00 - 10:30	Malabika Pramanik (UBC and BIRS), *Creating Space: Evolving standards of Gender Equity and Collective Change in the Mathematical Sciences* (p. 89), Gerrard

Abstracts/Résumés

KRISTINE BAUER, OZGUR YILMAZ AND DEANNA NEEDELL, Pacific Institute for the Mathematical Sciences
[Monday December 8 / lundi 8 décembre, 8:00 – Gerrard]
Strategies for building inclusivity: lessons from PIMS initiatives

The mathematical sciences aspire to be an inclusive discipline, yet underrepresentation across many dimensions of diversity remains a persistent challenge. Achieving greater diversity is essential: a wide range of perspectives has been shown to strengthen problem-solving, enrich research directions, and improve the resilience of scientific communities. While many factors contribute to persistent inequities, this talk will focus on two areas where concrete progress is possible: reducing bias in the review of research proposals and fostering programs that actively support participation from underrepresented groups. The discussion

will draw on our experience directing initiatives at the Pacific Institute for the Mathematical Sciences (PIMS), highlighting both successful strategies and ongoing challenges in building a more inclusive mathematical community.

ZACK CRAMER, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 10:00 – Churchill Ballroom]
Out in the Open: Fostering 2SLGBTQIA+ Inclusion in Mathematics

We all teach 2SLGBTQIA+ students, whether we know it or not. Yet undergraduate mathematics classrooms often remain silent on issues of gender and sexual diversity. In this talk, I argue that visible, intentional acts of openness and support can meaningfully shift that dynamic. Whether it's being proudly visible as a 2SLGBTQIA+ ally or speaking openly about one's own identity, even small gestures can help create a classroom where students feel safer and more seen.

As a gay math professor, I'll share what it was like to come out to my students and the unexpected ways it transformed our learning environment. I'll offer practical strategies for instructors, regardless of their identity, to create more inclusive and affirming learning spaces for 2SLGBTQIA+ students. Together, we'll consider what it means to create a math classroom where all students feel safe to be themselves.

KSENIYA GARASCHUK
[Monday December 8 / lundi 8 décembre, 9:30 – Gerrard]
Human-centered classrooms

In this talk, we explore ways in which EDI can meaningfully inhabit the teaching of mathematics, not as an add-on but rather as part of the discipline. We discuss the influence of values, identities and lived experiences in the classroom, along with the role of flexibility and representation in supporting meaningful learning. We use mathematical examples to illustrate how rigorous content can be culturally and humanly situated.

ERICA LIU, University of Waterloo
[Monday December 8 / lundi 8 décembre, 9:00 – Gerrard]
Empowerment in Math Happens Through Doing Math Together

When people hear Women in Math, their first thought is often gender equity — but WiM is not only about gender ; it is fundamentally about mathematics. Our mission has always been to build a community where research, collaboration, and inclusion reinforce one another.

This philosophy shapes the initiatives we lead: the Ontario Graduate Mathematics Conference, the Directed Reading/Research Program, and the Dean's Distinguished Lecture Series. These programs invite students to propose projects, write research plans, and explore topics ranging from number theory to life contingencies. They are not simply outreach events — they are opportunities for students to think, write, present, and discover mathematics in meaningful, rigorous ways.

People sometimes ask why WiM organizes research events for such a broad audience. Yu-Ru always responds: Why not ?

Gender equity in mathematics isn't about drawing boundaries — it's about opening doors, creating equitable intellectual spaces. Empowerment in mathematics doesn't just happen through discussion — it happens through doing math together.

ERIN MEGER, Queen's University
[Sunday December 7 / dimanche 7 décembre, 8:00 – Churchill Ballroom]
Expanding Horizons: Applying Lessons from Women's Advocacy to Intersectional Equity

Equity efforts in the mathematical sciences have long focused on supporting women, and these initiatives have produced meaningful progress. While many patches have been applied to the "leaky pipeline" for women, it is clear that significant leaks persist for other communities. When we examine the experiences of Indigenous scholars, Black students, queer mathematicians,

and others from equity-deserving groups, the causes and consequences of these leaks shift depending on the intersections of gender, race, culture, and systemic barriers ; the leaky pipeline needs solutions as diverse as the communities it impacts.

This talk explores how lessons learned from gender-focused initiatives can inform a more intersectional approach to equity. I highlight how Indigenous knowledge systems can inform our understanding of assessment, and how Black student perspectives reveal gaps in gender-only frameworks. I will also provide concrete, actionable strategies for classrooms and research labs that create conditions where all students no matter their intersectional identities can thrive.

MALABIKA PRAMANIK, UBC & BIRS
[Monday December 8 / lundi 8 décembre, 10:00 – Gerrard]
Creating Space: Evolving standards of Gender Equity and Collective Change in the Mathematical Sciences

Gender equity requires more than representation. It calls for sustained change in how our community defines excellence, opportunity, and belonging. Drawing on experiences from the Banff International Research Station (BIRS) and other national and international initiatives, this talk reflects on the evolving standards of gender equity and the ways they intersect with race, geography, and institutional culture. I will discuss lessons learned from the last five years of BIRS experience, the limits of traditional EDI metrics, and the importance of intentional mentorship, transparency, and accountability in shaping inclusive research spaces.

EMILY QUESADA-HERRERA, University of Lethbridge
[Sunday December 7 / dimanche 7 décembre, 9:30 – Churchill Ballroom]
Math as a neurodivergent trans latina

Reflections on gender, community, intersectionality and identity

---

KYNE SANTOS, Toronto Metropolitan University
[Sunday December 7 / dimanche 7 décembre, 8:30 – Churchill Ballroom]
Math In Drag

I will share my experiences engaging underrepresented groups by doing math outreach on social media as a drag queen. In particular, I'll share my personal journey as an math student with a diverse range of interests and intersectional identities, and what I see as the commonalities between math and gender identity.

ILA VARMA, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 9:00 – Churchill Ballroom]
Concrete strategies for promoting Gender Equity in your mathematical spaces

I will discuss some of the concrete strategies I have used for promoting Gender Equity in the mathematical spaces I am a part of. I will also discuss the pushback one might encounter with promoting such strategies, anything I've learned about getting around them, and time permitting, open up the discussion to the audience to add onto the list of concrete strategies. The goal of this talk is to leave audience members with doable and immediate next steps that can be improved upon year after year.

AMY WIEBE, University of British Columbia Okanagan
[Monday December 8 / lundi 8 décembre, 8:30 – Gerrard]
Curbs, Not Tickets: Conference Planning for Equity

While there has been great improvement over the years in attempts to have more diverse representation in conference plenaries and session speakers, there are many other aspects of conference planning that contribute to an inclusive environment that are

often neglected. In this talk, we highlight some questions for organizers to consider, and discuss specific conference examples where appropriate, when trying to plan more equitable conferences. We emphasize a *proactive* approach to equity concerns rather than a *reactive* one.

Geometric Partial Differential Equations
Équations différentielles partielles géométriques

Org: Siyuan Lu and/et **Yi-Lin Tsai** (McMaster University)

This session may include, but is not limited to, the following topics: minimal submanifolds, nonlinear differential equations on manifolds, conformal geometry, complex structures and Kahler geometry, and applications to general relativity.

Cette session peut inclure, sans s'y limiter, les thèmes suivants : sous-variétés minimales, équations différentielles non linéaires sur les variétés, géométrie conforme, structures complexes et géométrie de Kahler, et applications à la relativité générale.

Schedule/Horaire **Room/Salle: Chesterton**

Saturday December 6 **samedi 6 décembre**

8:50 - 9:30	Robert Haslhofer (University of Toronto), *Singularities of mean curvature flow in $\mathbb{R}^4$* (p. 91)
9:40 - 10:20	Lorenzo Sarnataro (University of Toronto), *The Allen—Cahn equation and free boundary minimal surfaces* (p. 91)
15:00 - 15:40	Freid Tong (University of Toronto), *Calabi-Yau metrics and optimal transportation* (p. 92)
15:50 - 16:30	Yulun Xu (University of Toronto), *viscosity solution to complex Hessian quotient equation.* (p. 92)
16:40 - 17:20	Kenneth DeMason (McMaster University), *A Strong Form of the Quantitative Wulff Inequality for Crystalline Norms* (p. 91)

Abstracts/Résumés

KENNETH DEMASON, McMaster University
[Saturday December 6 / samedi 6 décembre, 16:40]
A Strong Form of the Quantitative Wulff Inequality for Crystalline Norms

The anisotropic perimeter is a natural functional appearing in the mathematical framework for determining equilibrium states of crystals in media. As with the usual isotropic perimeter there is an analogous anisotropic isoperimetric inequality, known as the Wulff inequality, where minimizers of the volume constrained anisotropic perimeter problem, known as Wulff shapes, are characterized. In view of statistical mechanics, almost-minimizers are the most likely observable states; as such their identification is just as important as that of the absolute minimizers. In this talk we will explore a recent result by the speaker which proves quantitative control on almost-minimizers in an H^1 sense when the Wulff shape is a polytope, an upgrade from the previous L^1 control via the so-called Fraenkel asymmetry.

ROBERT HASLHOFER, University of Toronto
[Saturday December 6 / samedi 6 décembre, 8:50]
Singularities of mean curvature flow in $\mathbb{R}^4$

I will first survey the theory of mean curvature flow through singularities in $\mathbb{R}^3$. Then, I will discuss our recent classification of all noncollapsed singularities in $\mathbb{R}^4$. This is joint work with Kyeongsu Choi.

LORENZO SARNATARO, University of Toronto
[Saturday December 6 / samedi 6 décembre, 9:40]
The Allen—Cahn equation and free boundary minimal surfaces

In recent years, the combined work of Guaraco, Hutchinson, Tonegawa, and Wickramasekera has established a min-max construction of minimal hypersurfaces in closed Riemannian manifolds, based on the analysis of singular limits of sequences of

solutions of the Allen—Cahn equation, a semi-linear elliptic equation arising in the theory of phase transitions. In this talk, I will describe some recent boundary regularity results for such limit-interfaces, which provide the first step towards an Allen—Cahn min-max construction of free boundary minimal hypersurfaces in Riemannian manifolds with boundary. This is based on joint works with Akashdeep Dey, Wenkui Du, Martin Li, and Davide Parise.

FREID TONG, University of Toronto
[Saturday December 6 / samedi 6 décembre, 15:00]
Calabi-Yau metrics and optimal transportation

Many recent works in Kahler geometry have revealed a close relationship with the theory of optimal transport. In this talk, we will discuss some recent developments in the regularity theory for optimal transport maps and its relationship to questions in Kahler geometry. Based on joint works with T. Collins and S.-T. Yau.

YULUN XU, University of Toronto
[Saturday December 6 / samedi 6 décembre, 15:50]
viscosity solution to complex Hessian quotient equation.

We prove the existence of viscosity solutions to complex Hessian equations on compact Hermitian manifolds, assuming the existence of a strict subsolution in the viscosity sense. The results cover the complex Hessian quotient equations. This generalizes our previous results, where the equation must satisfy a determinant domination condition. This is a joint work with Prof. Jingrui Cheng.

Harmonic Analysis & PDE
Analyse harmonique et EDP

Org: Galia Dafni (Concordia University), **Ryan Gibara** (Cape Breton University) and/et **Scott Rodney** (Cape Breton University)

This session will bring together junior and senior researchers in harmonic analysis and the analysis of PDEs. Topics explored will include functions spaces defined by mean oscillation, degenerate PDEs, weighted inequalities, sparse techniques, geometric methods, and more. The mix of specialities of the intended participants/audience will foster the fruitful exchange of ideas and possible cross-field collaborations.

Cette session réunira des chercheur(euse)s juniors et seniors spécialisé(e)s dans l'analyse harmonique et l'analyse des EDP. Les thèmes abordés comprendront les espaces de fonctions définis par l'oscillation moyenne, les EDP dégénérées, les inégalités pondérées, les techniques clairsemées, les méthodes géométriques, etc. La diversité des spécialités des participant(e)s/du public visé favorisera un échange d'idées fructueux et d'éventuelles collaborations interdisciplinaires.

Schedule/Horaire **Room/Salle: Rosetti A**

Saturday December 6 — samedi 6 décembre

15:00 - 15:30	Eric Sawyer (McMaster University), *A comparison of trilinear testing conditions for the paraboloid Fourier extension and Kakeya conjectures in three dimensions* (p. 97)
15:30 - 16:00	Cristian Rios (University of Calgary), *Characterizations of the Kakeya maximal conjecture in three dimensions* (p. 96)
16:00 - 16:30	Ignacio Uriarte-Tuero (University of Toronto), *Muckenhoupt A_p weights, BMO, distance functions and Hardy-Sobolev inequalities* (p. 97)
16:30 - 17:00	Ana Čolović (University of Missouri), *Composition of Paraproducts* (p. 94)
17:00 - 17:30	Dimiter Vassilev (University of New Mexico), *Regularity of solutions to non-local semilinear equations related to Sobolev type embeddings on homogeneous groups* (p. 97)
17:30 - 18:00	Nguyen Lam (Memorial University of Newfoundland), *Sharp Stability of the Second-order Heisenberg Uncertainty Principle* (p. 95)

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Alptekin Goksan (University of Toronto), *A sharp condition for Békollé-Bonami weights to satisfy the reverse Hölder inequality* (p. 94)
8:30 - 9:00	Yurij Salmaniw (Cape Breton University), *Well-posedness of aggregation-diffusion equations and systems with irregular kernels* (p. 96)
9:00 - 9:30	Joshua Flynn (Massachusetts Institute of Technology), *Higher order boundary operators and trace inequalities on the Siegel domain and complex ball* (p. 94)
9:30 - 10:00	Sullivan MacDonald (University of Toronto), *Progress toward the Krzyz conjecture* (p. 95)
10:00 - 10:30	Jesse Hulse (University of Manitoba), *The Unified Transform Method: Beyond Circular or Convex Domains* (p. 95)
15:00 - 15:30	Alexia Yavicoli (University of British Columbia), *The Erdős similarity problem for non-small Cantor sets* (p. 98)
15:30 - 16:00	Yuveshen Mooroogen (University of British Columbia), *A large-scale variant of the Erdos similarity conjecture* (p. 96)
16:00 - 16:30	Julian Weigt (Abdus Salam International Centre for Theoretical Physics), *Regularity of maximal functions in higher dimensions* (p. 98)
16:30 - 17:00	Ángel David Martínez Martínez (CUNEF Universidad), *On the monotonicity of the heat kernel* (p. 96)
17:00 - 17:30	Juyoung Lee (University of British Columbia), *Variational inequalities for two-parameter averages over tori* (p. 95)

17:30 - 18:00	Chenjian Wang (University of British Columbia), *Pinned patterns and density theorems in* $\mathbb{R}^d$ (p. 98)

Monday December 8 lundi 8 décembre

8:30 - 9:00	Shahaboddin Shaabani (University of Toronto), *A view from above on* $JN_p((R)^n$ (p. 97)
9:00 - 9:30	Katja Vassilev (University of Chicago), *One-dimensional wave kinetic theory* (p. 98)
9:30 - 10:00	Almaz Butaev (University of the Fraser Valley), *Minimizing some discrete energy functionals on a regular metric measure space* (p. 94)
10:00 - 10:30	Ryan Alvarado (Amherst College) (p. 94)

Abstracts/Résumés

RYAN ALVARADO, Amherst College
[Monday December 8 / lundi 8 décembre, 10:00 – Rosetti A]

ALMAZ BUTAEV, University of the Fraser Valley
[Monday December 8 / lundi 8 décembre, 9:30 – Rosetti A]
Minimizing some discrete energy functionals on a regular metric measure space

We will discuss a construction of discrete Dirichlet forms on Newtonian functions $N^{1,2}$ comparable to the upper gradient energy. Studying the Γ-limit of these Dirichlet forms we will talk about a boundary value problem associated with this limit. This is joint work with N. Shanmugalingam and L. Luo

ANA ČOLOVIĆ, University of Missouri
[Saturday December 6 / samedi 6 décembre, 16:30 – Rosetti A]
Composition of Paraproducts

On the real line, we can decompose a product of two functions in $L^2(\mathbb{R})$ in the following way:

$$bf = \Pi_b(f) + \Pi_b^*(f) + \Pi_f(b),$$

where Π_b is the dyadic paraproduct. In 2013, Pott, Reguera, Sawyer and Wick classified the boundedness of compositons of paraproduct operators $\Pi_b\Pi_d^*$, $\Pi_b^*\Pi_d$, for different functions b and d, along with compositions of paraproducts with the dyadic martingales, in terms of joint conditions on the symbols b and d. We classify the remaining $\Pi_b\Pi_d$ operator.

JOSHUA FLYNN, MIT
[Sunday December 7 / dimanche 7 décembre, 9:00 – Rosetti A]
Higher order boundary operators and trace inequalities on the Siegel domain and complex ball

We introduce conformally covariant boundary operators defined on the Heisenberg group and CR sphere, the boundaries of the Siegel domain and complex ball, respectively. We then establish for the Siegel domain and complex ball all associated higher order extension theorems of Caffarelli-Silvestre type and all higher order CR Sobolev trace inequalities.

Harmonic Analysis & PDE
Analyse harmonique et EDP

ALPTEKIN GOKSAN, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 8:00 – Rosetti A]
A sharp condition for Békollé-Bonami weights to satisfy the reverse Hölder inequality

Békollé-Bonami B_p weights are the unit disc analogue of Muckenhoupt A_p weights and characterize L^p boundedness of the Bergman projection. It is well-known that A_p weights satisfy a reverse Hölder inequality, which brings with it a number of desirable properties such as self-improvement. On the other hand, B_p weights do not in general satisfy the reverse Hölder inequality, and this makes them harder to work with. Aleman, Pott and Reguera recently identified a condition under which B_p weights satisfy the reverse Hölder inequality. This condition requires that the weight be "almost constant" on the top halves of Carleson squares.

In this talk, we prove that being almost constant on top halves is a sharp condition for B_p weights to satisfy the reverse Hölder inequality. Moreover, we investigate the relationships between twelve conditions (including B_p and reverse Hölder) for weights on the unit disc. These conditions are known to be equivalent for weights on $\mathbb{R}^n$ (and are called A_∞ conditions in that case) and were recently studied by Duoandikoetxea, Martín-Reyes and Ombrosi in a more general context. We complete all missing implications and counterexamples between these twelve conditions, both for weights which are almost constant on top halves and for arbitrary weights on the unit disc.

JESSE HULSE, University of Manitoba
[Sunday December 7 / dimanche 7 décembre, 10:00 – Rosetti A]
The Unified Transform Method: Beyond Circular or Convex Domains

A new transform-based technique that generalizes the Unified Transform Method is developed as a novel way to compute fluid flows and numerically solve boundary value problems for holomorphic functions and solutions to Laplacian. This work uses the Szegő kernel to extend previously developed transform pairs to bounded simply connected Lipschitz domains. Time permitting, two applications will be discussed.

NGUYEN LAM, Memorial University of Newfoundland
[Saturday December 6 / samedi 6 décembre, 17:30 – Rosetti A]
Sharp Stability of the Second-order Heisenberg Uncertainty Principle

In this talk, we present sharp stability estimates for the second-order Heisenberg Uncertainty Principle. We derive explicit lower and upper bounds for the associated sharp stability constants and determine their exact asymptotic limits as the dimension N tends to infinity. This is joint work with Anh Do, Guozhen Lu, and Lingxiao Zhang.

JUYOUNG LEE, Universitiy of British Columbia
[Sunday December 7 / dimanche 7 décembre, 17:00 – Rosetti A]
Variational inequalities for two-parameter averages over tori

Variational inequalities have been extensively studied in various branches of mathematics. In particular, variational inequalities for averaging operators provide valuable insights into the pointwise convergence properties of averages. While maximal averaging operators offer similar results, variational inequalities yield more refined and powerful information regarding the behavior of averages. In this talk, we focus on a variational inequality for a two-parameter averaging operator. Indeed, a well-defined formulation of variational inequalities for two-parameter averages has not yet been established. We introduce a precise definition for two-parameter averages over tori and present a sharp boundedness result.

SULLIVAN MACDONALD, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 9:30 – Rosetti A]
Progress toward the Krzyz conjecture

The Krzyz conjecture is a long-standing open problem in complex analysis. Despite initially appearing simpler than related problems which have since been solved, such as the Bieberbach conjecture (now de Branges' Theorem), it remains open. If D is the unit disc and $\mathcal{B}^* = \{f \in \mathrm{Hol}(D) \mid 0 < |f| \leq 1 \text{ in } D\}$, it states that (1) $\sup_{f\in\mathcal{B}^*} |f^{(n)}(0)|/n! = 2/e$ for any $n \in \mathbb{N}$, and (2) the supremum is attained only by functions of the form $e^{i\theta} f_0(e^{i\eta} z)$, where $\theta, \eta \in \mathbb{R}$ and $f_0(z) = \exp((z^n-1)/(z^n+1))$.

In this talk we present recent work on the conjecture. Using techniques from classical harmonic analysis, we find new constraints on the singular inner functions which attain the supremum. It has long been known that extremal functions in $\mathcal{B}^*$ for the nth coefficient exist and are of the form

$$f(z) = \exp\left(\sum_{j=1}^{N} \lambda_j \frac{e^{i\theta_j} z - 1}{e^{i\theta_j} z + 1}\right)$$

for $N \leq n$, positive $\lambda_1, \ldots, \lambda_N$, and distinct $\theta_1, \ldots, \theta_N \in [0, 2\pi)$. Using oscillatory integral methods, we show that $N \geq c\,n$ for a universal constant $c > 0$. This marks modest progress toward proving the expected $N = n$. Various other new properties of extremal functions and their consequences will also be discussed.

Furthermore, we will report on progress related to other aspects of the conjecture.

ÁNGEL DAVID MARTÍNEZ MARTÍNEZ, CUNEF Universidad
[Sunday December 7 / dimanche 7 décembre, 16:30 – Rosetti A]
On the monotonicity of the heat kernel

We will revisit a number of results about the monotonicity of the heat kernel on manifolds and their relation with well-known spectral inequalities. Based in joint work with Almut Burchard.

YUVESHEN MOOROOGEN, University of British Columbia
[Sunday December 7 / dimanche 7 décembre, 15:30 – Rosetti A]
A large-scale variant of the Erdos similarity conjecture

Consider a sequence of real numbers increasing to infinity. How large can a subset of the real line be before it is forced to contain some affine image of that sequence? This question fits into a huge body of work in analysis and number theory concerned with constructing large sets that fail to contain prescribed structures. I will discuss recent progress on this question and comment on its connections with a now 50-year old open problem of Erdos.

CRISTIAN RIOS, University of Calgary
[Saturday December 6 / samedi 6 décembre, 15:30 – Rosetti A]
Characterizations of the Kakeya maximal conjecture in three dimensions

We present two characterizations of the Kakeya maximal problem in three-dimensional space in terms of a trilinear formulation. The bilinear equivalence due to Tao, Vargas, and Vega dates to 1998, and previous trilinear formulations due to Bourgain and Guth [BG] fall short of characterizing the problem. We introduce a weaker condition on the separation of the domains for the multilinear components than the transversality condition required in [BG] which proves to be equivalent to the whole linear conjecture. The proof also provides single-scale wavelet projection estimates which are sufficient to establish the conjecture.

YURIJ SALMANIW, Cape Breton University
[Sunday December 7 / dimanche 7 décembre, 8:30 – Rosetti A]
Well-posedness of aggregation-diffusion equations and systems with irregular kernels

In this talk, I will discuss some recent progress towards understanding properties of solutions to the aggregation-diffusion equation

$$\partial_t u = \Delta u + \nabla \cdot (u \nabla (W * u)),$$

where $W*\cdot$ denotes a spatial convolution with a kernel W on either $\mathbb{R}^d$ or $\mathbb{T}^d$. When W is sufficiently regular (e.g., $\nabla W \in L^\infty$), spatial derivatives can be transferred to W, and the existence and uniqueness of solutions follows from standard parabolic theory ; in practice, kernels need not be differentiable, and one must use the regularity of u to deduce further information on the potential $W*u$. I will present some recent results regarding the existence and uniqueness of weak (and sometimes classical) solutions for merely bounded kernels (i.e., $W \in L^\infty$) under two regimes: a **small mass** regime, and an **arbitrary mass** regime with some additional structural requirements. I will then discuss how these results translate to the multi-species system with a matrix of bounded interaction kernels, highlighting what is known and where gaps remain. This is joint work with José Carrillo and Jakub Skrzeczkowski.

ERIC SAWYER, McMaster University
[Saturday December 6 / samedi 6 décembre, 15:00 – Rosetti A]
A comparison of trilinear testing conditions for the paraboloid Fourier extension and Kakeya conjectures in three dimensions

We compare the smooth Alpert testing condition for the paraboloid Fourier extension conjecture in RiSa3 to the modulated testing condition for the Kakeya conjecture in RiSa2. To this end, the modulated testing condition is converted to a certain restricted smooth Alpert testing condition for the paraboloid Fourier extension conjecture.

SHAHABODDIN SHAABANI, University of Toronto
[Monday December 8 / lundi 8 décembre, 8:30 – Rosetti A]
A view from above on JN$_p((R)^n$

In this talk, we discuss the John–Nirenberg space $\mathrm{JN}_p(\mathbb{R}^n)$ from the tent-space point of view. We show how the "tent perspective" on this space leads to a natural extension of the Riesz–Markov–Kakutani representation theorem to the upper half-space $\mathbb{R}^{n+1}_+$. We also demonstrate that this extension connects such representation theorems to well-known combinatorial geometric problems concerning intersection graphs of shapes and their chromatic numbers. If time permits, we will discuss an application related to the construction of functions in $\mathrm{JN}_p(\mathbb{R}^n)$.

IGNACIO URIARTE-TUERO, University of Toronto
[Saturday December 6 / samedi 6 décembre, 16:00 – Rosetti A]
Muckenhoupt A_p weights, BMO, distance functions and Hardy-Sobolev inequalities

Vasin (for $n = 1$) and Anderson, Lehrbäck, Mudarra, and Vähäkangas (for $n > 1$) provided a geometric characterization of the sets $E \subset \mathbb{R}^n$ so that $w = dist(\cdot, E)^{-\alpha}$ is a Muckenhoupt A_1 weight for some $\alpha > 0$. We provide a geometric characterization of the sets $E \subset \mathbb{R}^n$ (which we call median porous sets) so that $w = dist(\cdot, E)^{-\alpha}$ is a Muckenhoupt A_p weight for some $\alpha > 0$ (given any $1 < p \leq \infty$).

Given $1 < p \leq \infty$, we also find the precise range of exponents α so that $w = dist(\cdot, E)^{-\alpha} \in A_p$ (in analogy to the $p = 1$ case done by Anderson, Lehrbäck, Mudarra, and Vähäkangas).

With our characterization we prove that $\mathbb{R}^n \setminus E$ supports a Hardy-Sobolev inequality if E is an appropriate median porous set. All previous such results that we are aware of make the strictly stronger assumption that the set E is porous. The proofs rely on a new median-value characterization of BMO. Joint work with Marcus Pasquariello.

DIMITER VASSILEV, University of New Mexico
[Saturday December 6 / samedi 6 décembre, 17:00 – Rosetti A]
Regularity of solutions to non-local semilinear equations related to Sobolev type embeddings on homogeneous groups

I will present regularity and asymptotic decay results for positive solutions to certain non-local equations on homogeneous Lie groups. The equations include Schrödinger equations with suitable potential and the equations for the extremals of Sobolev type inequalities. In the latter case, the considered operator can be seen as generalization of nonlocal conformally invariant operators arising in conformal and sub-Riemannian geometry. However, we work in a setting where a Hörmander type condition might not hold.

KATJA VASSILEV, University of Chicago
[Monday December 8 / lundi 8 décembre, 9:00 – Rosetti A]
One-dimensional wave kinetic theory

Kinetic theory aims to write effective equations for the statistical laws arising in microscopic systems with many degrees of freedom. Such equations, referred to as kinetic equations, have been studied dating back to the Boltzmann equation in the late 1800's and were later proposed for wave systems in the mid-1900's. Wave kinetic equations (WKEs) have been rigorously derived in dimension $d \geq 2$, but are less understood both physically and mathematically in dimension one. Here we consider the MMT (Majda, McLaughlin, and Tabak) model, a 1D dispersive model first proposed with the purpose of performing numerical studies on wave turbulence. This model encompasses various dispersive relations, some of which yield a trivial wave kinetic equation. For all dispersion relations we derive the (potentially trivial) WKE, and begin to answer the question of what the appropriate kinetic theory is in the setting when the WKE is trivial.

CHENJIAN WANG, The University of British Columbia
[Sunday December 7 / dimanche 7 décembre, 17:30 – Rosetti A]
Pinned patterns and density theorems in $\mathbb{R}^d$

We consider the abundance property of pinned k-point patterns occurring in $E \subseteq \mathbb{R}^d$ with positive upper density $\delta(E)$. We show that for any fixed k-point pattern V, there is a set E with positive upper density such that E avoids all sufficiently large affine copies of V, with one vertex fixed at any point in E. However, we obtain a positive quantitative result, which states that for any fixed E with positive upper density, there exists a k-point pattern V, such that for any $x \in E$, a carefully chosen *pinned scaling factor set* has upper density $\geq \tilde{\varepsilon} > 0$, where constant $\tilde{\varepsilon}$ depends on k, d and $\delta(E)$.

JULIAN WEIGT, ICTP
[Sunday December 7 / dimanche 7 décembre, 16:00 – Rosetti A]
Regularity of maximal functions in higher dimensions

The classical Hardy-Littlewood maximal function theorem states that the Hardy-Littlewood maximal operator is a bounded operator on $L^p(\mathbb{R}^d)$ if and only if $1 < p \leq \infty$. In 1997 Juha Kinnunen proved the corresponding result for the gradient of the maximal function, i.e. that the $L^p(\mathbb{R}^d)$-norm of the gradient of the maximal function is controlled by the $L^p(\mathbb{R}^d)$-norm of the gradient of the function if $1 < p \leq \infty$. However, he provides no counterexample in the endpoint $p = 1$, and so in 2004 Hajłasz and Onninen formally posed the question if the endpoint gradient bound also holds.

Many special cases, generalizations and variations of this problem have been explored, with partial success. The original question by Hajłasz and Onninen remains unanswered. We discuss recent progress in higher dimensions, based on the coarea formula, dyadic decompositions and the relative isoperimetric inequality. As a by-product we obtain a Vitali-type covering lemma for the boundary.

ALEXIA YAVICOLI, The University of British Columbia
[Sunday December 7 / dimanche 7 décembre, 15:00 – Rosetti A]
The Erdős similarity problem for non-small Cantor sets

I will introduce the Erdős similarity problem, providing background and an overview of known partial results. I will then discuss a recent joint work with P. Shmerkin, in which we show that Cantor sets with positive logarithmic dimension satisfy the conjecture.

Horizons in Operator Algebras
Horizons dans les algèbres d'opérateurs

Org: M. Ali Asadi-Vasfi (Purdue University), **George Elliott** (University of Toronto) and/et **Viola Maria Grazia** (Lakehead University Orillia)

Operator algebras studies algebras of bounded linear operators on Hilbert spaces. Originating in the late 1920s and early 1930s to provide a rigorous mathematical framework for quantum mechanics, the field has become central to modern mathematics and theoretical physics, serving as a foundation for quantum information theory and quantum computing. Work in operator algebras and noncommutative geometry has also influenced number theory, harmonic analysis, model theory, group theory, knot theory, and ergodic theory. This session aims to highlight recent advances, discuss open questions, and explore new connections in the field. This session is done in organization with Paul Skoufranis (York).

Schedule/Horaire **Room/Salle: Whistler**

Saturday December 6 — samedi 6 décembre

8:00 - 8:30	Ken Davidson (University of Ottawa), *Large Perturbations of Nest Algebras* (p. 101)
8:30 - 9:00	Christopher Schafhauser (University of Nebraska - Lincoln), *KK-rigidity of simple nuclear C*-algebras* (p. 104)
9:00 - 9:30	Andrew Dean (Lakehead University), *Classification problems concerning real structures and gradings* (p. 101)
9:30 - 10:00	Dolapo Oyetunbi (University of Windsor), *Maximality and symmetry related to the 2-adic ring C*-algebra* (p. 103)
10:00 - 10:30	Remus Floricel (University of Regina), *The spectral C^*-algebra of a product system* (p. 101)
15:00 - 15:30	Thomas Sinclair (Purdue University), *Computability of C*-norms* (p. 104)
15:30 - 16:00	Zhuang Niu (University of Wyoming), *$\mathcal{Z}$-absorption and small boundary property* (p. 103)
16:00 - 16:30	Branimir Cacic (University of New Brunswick), *Revisiting the differential topology of higher-dimensional noncommutative tori* (p. 101)
16:30 - 17:00	Cristian Ivanescu (MacEwan University), *Preservation of the Way-Below Relation Under Tensor Products* (p. 102)
17:00 - 17:30	Patrick Melanson (University of Regina), *Pro-Tori and Inductive Limits of Non-Commutative Tori* (p. 103)
17:30 - 18:00	Bradd Hart (McMaster University), *Decidedly undecidable results in operator algebras* (p. 102)

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Charles Starling (Carleton University), *Uniqueness theorems for combinatorial C*-algebras* (p. 104)
8:30 - 9:00	Saeed Ghasemi (Lakehead University), *Preservation of Elementary Equivalence under Tensor Products* (p. 101)
9:00 - 9:30	Ebrahim Samei (University of Saskatchewan), *Tempered representations on stationary spaces* (p. 104)
9:30 - 10:00	Dan Ursu (York University), *Non-conventional averaging in C*-algebras* (p. 105)
10:00 - 10:30	Mehdi Moradi (University of Ottawa), *On locally finite-dimensional traces* (p. 103)
15:00 - 15:30	Huaxin Lin (Shanghai Institute for Mathematics and Interdisciplinary Sciences), *Almost commuting self-adjoint operators and quantum mechanics* (p. 102)
15:30 - 16:00	Jananan Arulseelan (Iowa State University) (p. 101)
16:00 - 16:30	Aareyan Manzoor (University of Waterloo), *There is a non-Connes embeddable Equivalence Relation* (p. 103)
16:30 - 17:00	David Kribs (University of Guelph), *Operator Algebra Perspective on Entanglement-Assisted Quantum Codes* (p. 102)
17:00 - 17:30	Feodor Kogan (University of Toronto) (p. 102)
17:30 - 18:00	Aaron Tikuisis (University of Ottawa), *Basic homotopy lemmas via abstract classification* (p. 105)

Abstracts/Résumés

JANANAN ARULSEELAN, Iowa State University
[Sunday December 7 / dimanche 7 décembre, 15:30 – Whistler]

BRANIMIR CACIC, University of New Brunswick, Fredericton
[Saturday December 6 / samedi 6 décembre, 16:00 – Whistler]
Revisiting the differential topology of higher-dimensional noncommutative tori

The earliest results in noncommutative (NC) differential geometry à la Connes concern the differential topology of higher-dimensional NC tori. In this talk, I'll sketch how these results interface with recent progess in NC differential and Riemannian geometry. In particular, I'll sketch how Elliott's calculation of the diffeomorphism group of a Diophantine-irrational NC 2-torus generalizes to higher dimensions and how Rieffel–Schwarz and Li's classification of higher-dimensional NC tori up to complete Morita equivalence can be refined to classify NC Hermitian line bundles with unitary connection on totally irrational higher-dimensional NC tori up to gauge equivalence. This is partly based on joint work with T. Venkata Karthik.

KEN DAVIDSON, U.Waterloo and U.Ottawa
[Saturday December 6 / samedi 6 décembre, 8:00 – Whistler]
Large Perturbations of Nest Algebras

Let $\mathcal{M}$ and $\mathcal{N}$ be nests on separable Hilbert space. If the two nest algebras are distance less than 1 ($d(\mathcal{T}(\mathcal{M}), \mathcal{T}(\mathcal{N})) < 1$), then the nests are distance less than 1 ($d(\mathcal{M}, \mathcal{N}) < 1$). If the nests are distance less than 1 apart, then the nest algebras are similar, i.e. there is an invertible S such that $S\mathcal{M} = \mathcal{N}$, so that $S\mathcal{T}(\mathcal{M})S^{-1} = \mathcal{T}(\mathcal{N})$. However there are examples of nests closer than 1 for which the nest algebras are distance 1 apart.

ANDREW DEAN, Lakehead University
[Saturday December 6 / samedi 6 décembre, 9:00 – Whistler]
Classification problems concerning real structures and gradings

We shall give a survey and update on progress for problems concerning classification of real structures and gradings on C^*-algebras, and their associated range of invariant problems.

REMUS FLORICEL, University of Regina
[Saturday December 6 / samedi 6 décembre, 10:00 – Whistler]
The spectral C^*-algebra of a product system

The spectral C^*-algebra $C^*(E)$ associated with a product system $E = \{E(t)\}_{t>0}$ was introduced by Arveson in the 1990s and serves as a natural "spectrum" for E, linking the representation theory of the product system with that of the algebra itself. In this talk, I will give an overview of the construction and main properties of $C^*(E)$, and then discuss some recent progress on classifying these C^*-algebras.

SAEED GHASEMI, Lakehead University
[Sunday December 7 / dimanche 7 décembre, 8:30 – Whistler]
Preservation of Elementary Equivalence under Tensor Products

Horizons in Operator Algebras
Horizons dans les algèbres d'opérateurs

The study of how elementary equivalence behaves under various operations on structures traces back to 1959, when Feferman and Vaught proved that it is preserved under reduced products. Although elementary equivalence is not, in general, preserved under tensor products in the category of C*-algebras, it remains open whether this preservation holds in the category of tracial von Neumann algebras. In joint work with Ilijas Farah, we applied a Feferman–Vaught–type theorem to show that tensoring with type I algebras does preserve elementary equivalence within the category of tracial von Neumann algebras.

BRADD HART, McMaster University
[Saturday December 6 / samedi 6 décembre, 17:30 – Whistler]
Decidedly undecidable results in operator algebras

It is difficult to recall that it has only been 6 years (essentially the last time the CMS meeting was held at the Chelsea Hotel !) since the start of what I would call the era of undecidability in the model theory of operator algebras. These results have followed from the breakthrough results in quantum complexity that goes by the call signal MIP*= RE. I will survey some of the highlights of the past few years, look at the role of embedding problems and say something about current open problems in the area.

CRISTIAN IVANESCU, MacEwan University
[Saturday December 6 / samedi 6 décembre, 16:30 – Whistler]
Preservation of the Way-Below Relation Under Tensor Products

We show that the way-below relation is preserved under tensor products. While completing this work, we became aware that, in the context of the Cuntz semigroup, an instance of this result was previously established by Antoine, Perera, and Thiel. We nevertheless present our proof here, as it provides a complementary approach and may offer additional insight into the behaviour of the way-below relation under tensorial constructions.

FEODOR KOGAN, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 17:00 – Whistler]

DAVID KRIBS, University of Guelph
[Sunday December 7 / dimanche 7 décembre, 16:30 – Whistler]
Operator Algebra Perspective on Entanglement-Assisted Quantum Codes

The idea of using entanglement as a resource in quantum computing and communication has been around for a long time. Two decades ago, 'entanglement-assisted' quantum codes were introduced in quantum error correction (EAQEC) as a resource for boosting transmission rates when a sender and receiver share pre-existing entanglement. Shortly thereafter, a pair of (not so clearly related I'd say) generalizations of EAQEC were formulated for 'subsystem codes' and for the classical enhancement of quantum code transmission. As it turns out, each of these three types of code can be viewed as special cases of a general framework for EA codes built on an operator algebra approach to quantum error correction. In addition to unifying these code types under a single umbrella, the resulting framework (EAOAQEC) yields new types of EA codes. In this talk, I'll give a brief introduction to entanglement-assisted codes, the EAOAQEC framework, and some of our results (time dependent). This talk is based on joint work with Serge Adonsou, Guillaume Dauphinais, Priya Nadkarni, and Michael Vasmer.

HUAXIN LIN, Shanghai Institute for Mathematics and Interdisciplinary Sciences
[Sunday December 7 / dimanche 7 décembre, 15:00 – Whistler]
Almost commuting selfadjoint operators and quantum mechanics

We show that Mumford's Approximately Macroscopically Unique (AMU) states exist for quantum systems consisting of unbounded self-adjoint operators when the commutators are small. In particular, AMU states always exist in position and momentum systems when the Planck constant $|\hbar|$ is sufficiently small. However, we show that these standard quantum mechanical systems are far away from classical mechanical (commutative) systems even when $|\hbar| \to 0$.

AAREYAN MANZOOR, University Of Waterloo
[Sunday December 7 / dimanche 7 décembre, 16:00 – Whistler]
There is a non-Connes embeddable Equivalence Relation

Connes embeddability of a group is a finite dimensional approximation property. It turns out this property depends only on the group von Neumann algebra. The property can be extended to all tracial von Neumann algebras. The fact that there is a von Neumann algebra without this property was proved in 2020 using the quantum complexity result MIP*=RE. It is still open for group von Neumann algebras. I will discuss the best-known partial result, which is that there is a group action without this property. In particular, this implies the negation to the Aldous-Lyons conjecture, a big problem in probability theory about finite approximability of a certain class of random graphs.

PATRICK MELANSON, University of Regina
[Saturday December 6 / samedi 6 décembre, 17:00 – Whistler]
Pro-Tori and Inductive Limits of Non-Commutative Tori

It is a known result that the inductive limit non-commutative tori (also called irrational rotation algebras) can be realized as a non-commutative N-solenoid. Both of these are examples of twisted group C*-algebras. We can generalize to non-commutative d-tori (the higher dimensional analogue) and perform a similar analysis. That is, given a family of non-commutative d_k-tori, $d_k > 1$, and a sufficiently nice embeddings (that is, unital *-homomorphisms), we can realize their inductive limit as a twisted C*-algebra, analogous to a higher dimensional non-commutative N-solenoid.

MEHDI MORADI, University of Ottawa
[Sunday December 7 / dimanche 7 décembre, 10:00 – Whistler]
On locally finite-dimensional traces

Locally finite-dimensional (LFD) traces emerged out of Popa's "local finite-dimensional approximation" as an intrinsic property of C^*-algebras. In my talk, I will provide a new characterization of LFD-traces in terms of projections in the enveloping von Neumann algebra. Then I will address some long-standing questions regarding LFD-traces and their behaviour under convex combinations. I will finish by giving a reformulation of the Universal Coefficient Theorem question in terms of strongly self-absorbing algebras.

ZHUANG NIU, University of Wyoming
[Saturday December 6 / samedi 6 décembre, 15:30 – Whistler]
$\mathcal{Z}$-absorption and small boundary property

A C*-algebra is said be $\mathcal{Z}$-absorbing if it absorbs the Jiang-Su algebra $\mathcal{Z}$ tensorially. Let us consider a free and minimal $\mathbb{Z}^d$ action on a compact metrizable space, and let us consider the corresponding crossed product C*-algebra. Then it is shown recently that the $\mathcal{Z}$-absorption of the crossed product C*-algebra, which is a C*-algebra property, indeed is completely characterized by the small boundary property (or the zero mean dimension) of the standard Cartan subalgebra, which is a dynamical system property. Along the way, the $\mathcal{Z}$-absorption of the crossed product C*-algebra is also shown to be equivalent to other (C*-algebra or Cantan subalgebra) properties such as uniform property Gamma or zero real rank of certain sequence algebras. The talk is base on joint works with George A. Elliott.

DOLAPO OYETUNBI, University of Windsor
[Saturday December 6 / samedi 6 décembre, 9:30 – Whistler]
Maximality and symmetry related to the 2-adic ring C-algebra*

The 2-adic ring C*-algebra $\mathcal{Q}_2$ is the universal C*-algebra generated by a unitary and an isometry satisfying certain relations. It contains a canonical copy of the Cuntz algebra $\mathcal{O}_2$, which we denote by the same symbol. In this talk, we explore the maximality of this canonical copy of $\mathcal{O}_2$ inside $\mathcal{Q}_2$, the fixed-point algebra of a periodic *-automorphism σ of $\mathcal{Q}_2$ extending the flip-flop automorphism of $\mathcal{O}_2$, and the relationship between these two notions for $\mathcal{Q}_2$. This is based on joint work with Dilian Yang.

EBRAHIM SAMEI, University of Saskatchewan
[Sunday December 7 / dimanche 7 décembre, 9:00 – Whistler]
Tempered representations on stationary spaces

Let G be a countable discrete group, and let μ be a probability measure on G with finite Shannon entropy. We use ideas from harmonic analysis to generalize Shannon and Avez entropies, taking into account the given weight ω on G, and investigate their relations together as well as to the actions of G on measurable stationary spaces. We apply our approach to show that for a large class of groups (e.g. groups with rapid decay) and probability measures on them, tempered representations on a μ-stationary space (X, ξ) are precisely those satisfying

$$h(G, \mu) = h_\mu(X, \xi),$$

where $h(G, \mu)$ is the Avez entopy of μ and $h_\mu(X, \xi)$ is the Furstenberg entropy of (X, ξ). This implies that these types of stationary spaces are precisely measure-preserving extension of the Poisson boundary of (G, μ). In particular, (X, ξ) is an amenable (G, μ)-space if and only if it is a measure-preserving extension of the Poisson boundary of (G, μ).

This is a join work with Benjamin Anderson-Sackaney, Tim de Laat, and Matthew Wiersma.

CHRISTOPHER SCHAFHAUSER, University of Nebraska - Lincoln
[Saturday December 6 / samedi 6 décembre, 8:30 – Whistler]
KK-rigidity of simple nuclear C-algebras*

A landmark result in C*-algebra theory is the classification of unital separable simple nuclear Z-stable C*-algebras satisfying the universal coefficient theorem (UCT) in terms of their K-theory and traces. I will discuss this result with a focus on the role of UCT. In the infinite setting, without the UCT, two unital Kirchberg algebras are isomorphic if and only they are KK-equivalent in a unit-preserving way. I'll discuss some results along these lines in the finite case.

THOMAS SINCLAIR, Purdue University
[Saturday December 6 / samedi 6 décembre, 15:00 – Whistler]
Computability of C-norms*

We will present joint work with Isaac Goldbring which combines techniques from continuous logic with the recent result $\mathrm{MIP}^{\mathrm{co}}$ = coRE to answer a question of Fritz, Netzer, and Thom on the computability of the norm on $C^*(\mathbb{F}_2 \times \mathbb{F}_2)$.

CHARLES STARLING, Carleton University
[Sunday December 7 / dimanche 7 décembre, 8:00 – Whistler]
Uniqueness theorems for combinatorial C-algebras*

Loosely speaking, a combinatorial C*-algebra is one defined in terms by generators and relations in some countable object, like a cancellative monoid, the paths in a directed graph, or the small category associated to a self-similar action. I will present uniqueness theorems akin to the classical Cuntz-Krieger uniqueness theorem, where injectivity of a *-homomorphism is equivalent to injectivity on a subalgebra generated by a subset of the generators.

AARON TIKUISIS, University of Ottawa
[Sunday December 7 / dimanche 7 décembre, 17:30 – Whistler]
Basic homotopy lemmas via abstract classification

Basic homotopy lemmas, as a first approximation, are results saying that an approximately central unitary in a C*-algebra can be connected to the unit by a continuous path of approximately central unitaries. Going back to work of Bratteli, Elliott, Evans, and Kishimoto from the '90s, they feature heavily in the Gong-Lin-Niu classification of simple nuclear stably finite regular C*-algebras.

A different approach to classification (joint work with Carrión, Gabe, Schafhauser, and White) avoids the use of these basic homotopy lemmas, and produces an abstract classification of *-homomorphisms under minimal hypotheses. Moreover, the generality of our classification of *-homomorphisms allows us to prove a basic homotopy lemma in greater generality as an application. I will discuss our basic homotopy lemma and its relation to classification.

DAN URSU, York University
[Sunday December 7 / dimanche 7 décembre, 9:30 – Whistler]
Non-conventional averaging in C-algebras*

Several important averaging properties have shown up in the theory of operator algebras, most notably the Dixmier averaging property and its variants, which deals with convex averages of elements in some unitary orbit. In joint work with Matthew Kennedy, expanding upon the work of Magajna in the theory of C*-convex averages, we develop a strong new averaging property and separation theorem, and use it to characterize when the intermediate subalgebra structure of a crossed product is entirely canonical. Progress-permitting, we will also give a sneak peek at some preliminary results using these same averaging techniques applied to the ideal structure of crossed products.

Integrability, Geometry, and Symmetry of Differential Equations

Org: Stephen Anco (Brock University) and/et **Konstantin Druzhkov** (University of Saskatchewan)

This session is devoted to exploration of recent developments in three interconnected areas of formal geometry of nonlinear PDEs. One common thread is the use of jet calculus, variational structures, and related methods in the study of these topics. Applications, both pure and applied, are welcomed.

Schedule/Horaire **Room/Salle: Churchill Ballroom**

Saturday December 6 **samedi 6 décembre**

8:00 - 8:30	Archishman Saha (University of Ottawa), *Deterministic Behaviour in Stochastic Collective Hamiltonian Systems* (p. 108)
8:30 - 9:00	Alireza Sharifi (University of Manitoba), *Integrability and KAM Non–Ergodicity in the Thermostated Hamiltonian Systems* (p. 108)
9:00 - 9:30	Jordan Fazio (Brock University), *Hierarchies of Flow Invariants and Conservation Laws in One-Dimensional Fluids* (p. 107)
9:30 - 10:00	Kostya Druzhkov (University of Saskatchewan), *Invariant reduction for partial differential equations: Poisson brackets* (p. 106)
10:00 - 10:30	Jacek Szmigielski (University of Saskatchewan), *Spinor Camassa-Holm Equations* (p. 109)
15:00 - 15:30	Barbara Prinari (University of Buffalo), *Breather interactions in the integrable discrete Manakov system* (p. 108)
15:30 - 16:00	Alexander Odesski (Brock University), *p-Determinants and monodromy of differential operators* (p. 108)
16:00 - 16:30	Mahdieh Gol Bashmani Moghadam (Brock University), *Symmetry Transformation Group Arising from the Laplace–Runge–Lenz Vector* (p. 107)
16:30 - 17:00	James Hornick (McMaster University), *BIFURCATIONS OF SOLITARY WAVES IN A COUPLED SYSTEM OF LONG AND SHORT WAVES* (p. 107)
17:00 - 17:30	Evans Boadi (University at Buffalo), *Discrete Kutznetsov-Ma breather solutions of the focusing Ablowitz-Ladik equation* (p. 106)
17:30 - 18:00	Serhii Koval (Memorial University), *Weyl algebras and symmetries of differential equations* (p. 107)

Abstracts/Résumés

STEPHEN ANCO, Brock University
[Churchill Ballroom]

EVANS BOADI, State University of New York at Buffalo
[Saturday December 6 / samedi 6 décembre, 17:00 – Churchill Ballroom]
Discrete Kutznetsov-Ma breather solutions of the focusing Ablowitz-Ladik equation

In this talk, I will discuss a class of solutions to the focusing Ablowitz–Ladik lattice, which are the discrete analogs of the Kutznetsov–Ma (KM) breathers of the focusing nonlinear Schrödinger equation. In 2015, the inverse scattering transform was used to construct a solution that was shown to be regular. In this talk, I will present a novel KM-type breather solution that is also regular on the lattice. Using Darboux transformation, I will also construct a multi-KM breather solution and demonstrate that the double KM breather remains regular on the lattice.

KOSTYA DRUZHKOV, University of Saskatchewan
[Saturday December 6 / samedi 6 décembre, 9:30 – Churchill Ballroom]
Invariant reduction for partial differential equations: Poisson brackets

In this talk I will show that, under suitable conditions, finite-dimensional systems describing invariant solutions of PDEs inherit local Hamiltonian operators through a mechanism of invariant reduction, which applies uniformly to point, contact, and higher symmetries. The inherited operators endow the reduced systems with Poisson bivectors that relate constants of invariant motion to symmetries. The induced Poisson brackets agree with those of the original systems, up to sign. At the core of this construction lies the interpretation of Hamiltonian operators as degree-2 conservation laws of degree-shifted cotangent equations.

JORDAN FAZIO, Brock University
[Saturday December 6 / samedi 6 décembre, 9:00 – Churchill Ballroom]
Hierarchies of Flow Invariants and Conservation Laws in One-Dimensional Fluids

Flow invariants are geometric quantities that are "frozen-in" to a fluid flow. They can tell us a lot about the properties of a system, such as integrability, and are closely related to the concept of conservation laws. The geometric character of flow invariants is general, and they can take the form of a scalar, vector, differential form, or a more general tensor. We start by introducing the structure of flow invariants in a general setting as well as their connection to conservation laws. We look at a relationship between invariants of different geometric character which enables us to construct a recursion operator acting on flow invariants. In one-dimensional fluids, we see how the recursion operator can produce infinite hierarchies of invariants, starting with two seed invariants given by the mass density and entropy of the fluid. This method is generalizable, and we look at how we can adapt this recursion operator on flow invariants to produce new conservation laws in isentropic one-dimensional fluid flows, using members of the well-known hierarchies of conservation laws as seeds for the generated hierarchies.

JAMES HORNICK, mcmaster
[Saturday December 6 / samedi 6 décembre, 16:30 – Churchill Ballroom]
BIFURCATIONS OF SOLITARY WAVES IN A COUPLED SYSTEM OF LONG AND SHORT WAVES

We consider families of solitary waves in the Korteweg–de Vries (KdV) equation coupled with the linear Schrodinger (LS) equation. This model has been used to describe interactions between long and short waves. To get a comprehensive characterization of solitary waves, we consider a sequence of local (pitchfork) bifurcations of coupled solitary waves from the uncoupled KdV solitons. The first member of the sequence is the KdV soliton coupled with the ground state of the LS equation, which is proven to be the constrained minimizer of energy for fixed mass and momentum. The other members of the sequence are the KdV soliton coupled with the excited states of the LS equation. We connect the first two bifurcations with the exact solutions of the KdV–LS system frequently used in the literature.

SERHII KOVAL, Memorial University of Newfoundland
[Saturday December 6 / samedi 6 décembre, 17:30 – Churchill Ballroom]
Weyl algebras and symmetries of differential equations

Let $\mathbb{K}$ be a field of characteristic zero. The first Weyl algebra A_1 is a unital associative $\mathbb{K}$-algebra generated by elements x and ∂ that satisfy the defining relation $\partial x - x\partial = 1$. The nth Weyl algebra is the n-fold tensor product $A_1^{\otimes n}$, and it is canonically isomorphic to the ring of differential operators $\mathbb{K}[x_1, \dots, x_n][\frac{\partial}{\partial x_1}, \dots \frac{\partial}{\partial x_n}]$.

Weyl algebras are fundamental objects in ring theory and they arise in many branches of mathematics and physics, for example, quantum mechanics, representation theory and noncommutative geometry. In this talk, I will discuss how algebras A_n arise in symmetry analysis of differential equations, and what new knowledge about the structure of A_n can be obtained using symmetries of differential equations. This talk is based on a joint project with Roman O. Popovych.

MAHDIEH GOL BASHMANI MOGHADAM
[Saturday December 6 / samedi 6 décembre, 16:00 – Churchill Ballroom]
Symmetry Transformation Group Arising from the Laplace–Runge–Lenz Vector

The Kepler problem in classical mechanics exhibits a rich structure of conserved quantities, highlighted by the Laplace–Runge–Lenz (LRL) vector. Through Noether's theorem in reverse, The LRL vector gives rise to a corresponding infinitesimal dynamical symmetry on the kinematical variables, which are well known in the literature. However, the physically relevant part of the LRL vector is its direction angle in the plane of motion (its magnitude is just a function of energy and angular momentum).

In this talk, I will derive the infinitesimal dynamical symmetry corresponding to the direction part of the LRL vector, and obtain the explicit form of the symmetry transformations that it generates. When combined with the rotation symmetries, the resulting symmetry group is shown to be the semi-direct product of $SO(3)$ and R^3. This stands in contrast to the SO(4) symmetry group generated by the LRL symmetries and the rotations. As a by-product, the action of the new infinitesimal symmetries on all of the conserved quantities is obtained.

The results are given in terms of the physical kinematical variables in the Kepler problem, rather than in an enlarged auxiliary space in which the LRL symmetries are usually stated.

ALEXANDER ODESSKI, Brock University
[Saturday December 6 / samedi 6 décembre, 15:30 – Churchill Ballroom]
p-Determinants and monodromy of differential operators

We review interrelations between arithmetic properties (so-called p-determinants) and analytic properties (eigenvalues of monodromy operators) for differential operators of certain type. This is a joint project with Maxim Kontsevich.

BARBARA PRINARI, University at Buffalo
[Saturday December 6 / samedi 6 décembre, 15:00 – Churchill Ballroom]
Breather interactions in the integrable discrete Manakov system

In this talk we will consider a vector generalization of the Ablowitz-Ladik model referred to as the integrable discrete Manakov system. In the focusing regime, this system admits a variety of discrete vector soliton solutions, referred to as fundamental solitons, fundamental breathers, and composite breathers. We will give a full characterization of the interactions of these solitons and breathers, including the explicit forms of their polarization vectors before and after the interaction. Additionally, the results will be interpreted in terms of a Yang-Baxter refactorization property for the transmission coefficients associated with the interacting solitons.

ARCHISHMAN SAHA, University of Ottawa
[Saturday December 6 / samedi 6 décembre, 8:00 – Churchill Ballroom]
Deterministic Behaviour in Stochastic Collective Hamiltonian Systems

We consider stochastic perturbations of Hamiltonian systems by noise arising from collective Hamiltonians. We show that these perturbations typically preserve many symmetry-related features of the deterministic system even though the stochastic differential equations governing the dynamics are not symmetric in general. When the deterministic Hamiltonian is symmetric under a free, proper and canonical Lie group action, we show that the projection of a solution of the stochastic system onto the reduced space evolves deterministically. This is joint work with Tanya Schmah (University of Ottawa) and Cristina Stoica (Wilfrid Laurier University).

ALIREZA SHARIFI, University of Manitoba
[Saturday December 6 / samedi 6 décembre, 8:30 – Churchill Ballroom]
Integrability and KAM Non–Ergodicity in the Thermostated Hamiltonian Systems

In this talk I will discuss Hamiltonian systems that are thermostated using the Jellinek–Berry (JB) thermostat (J. Phys. Chem. 1988 ; Phys. Rev. A 1988). Jellinek and Berry proposed this model as a functional extension of Nosé's thermostat (J. Chem. Phys. 1984), introducing several functional parameters that generalize the coupling between the physical system and the thermal reservoir. In molecular dynamics, the JB family aims to generate the canonical ensemble of a Hamiltonian H by coupling H to a one–dimensional heat reservoir with potential energy $v(s)$ and kinetic energy $\frac{1}{2Q}(p_s/u(s))^2$; i.e.,

$$G(x,s,p_s) := \underbrace{H(a(s)\cdot x)}_{\text{Physical system}} + \underbrace{\frac{p_s^2}{2Q\,u(s)^2} + gkT\,v(s)}_{\text{Thermostat}}\,.$$

I will describe when the JB–thermostated periodic ideal gas is Liouville completely integrable and satisfies a KAM twist condition known as Rüssmann non–degeneracy. This property ensures that the system admits action–angle variables and a nondegenerate frequency map. Using these results, one can show that a thermostated, collisionless, non–ideal gas—that is, a smooth perturbation of the ideal case—possesses a positive–measure set of invariant tori at sufficiently high reservoir temperatures. Consequently, the thermostated dynamics remain non–ergodic in this regime.

The talk will emphasize the geometric structure underlying these results, including the role of symplectic transformations, the existence and persistence of invariant tori, highlighting the connection between thermostat design and classical problems of integrability and ergodicity in Hamiltonian systems.

JACEK SZMIGIELSKI, University of Saskatchewan
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Ballroom]
Spinor Camassa-Holm Equations

I will outline a construction of spinor analogs of the Camassa-Holm equation. In essence, to each orthogonal group, one can associate a Camassa-Holm-type equation that has a complex internal structure. I will motivate this generalization using the example of spectral deformations of the Euler-Bernoulli beam problem, which corresponds to the Clifford algebra on two generators with Minkowski signature. The talk is based on recent work with R. Beals and ongoing research with A. Hone and V. Novikov.

Joy in university math classes
La joie dans les cours de mathématiques à l'université

Org: Matt Coles (University of British Columbia), **Peter Harrington** (Yale University) and/et **Kelly Paton** (University of British Columbia)

Fun and joyful activities are one way to entice students to come to class, keep them engaged while they are there, and help them appreciate the beauty of mathematics. In this session we want to learn from instructors who have run activities in university classes that have brought their students joy. The session will conclude with a round table discussion centered on ways to bring joy to the university math classroom and the relative importance of joy in university mathematics.

We expect this session to be dynamic and interactive, so come prepared to participate in the activities run by the presenters. Presentations will run consecutively, so while you are welcome to leave or enter the session freely, the times on the following schedule are only an estimate of when each presentation will start and end.

Les activités ludiques et joyeuses sont un moyen d'inciter les étudiant(e)s à venir en classe, de les maintenir attentifs pendant qu'ils y sont et de les aider à apprécier la beauté des mathématiques. Au cours de cette session, nous voulons apprendre des instructeur(trice)s qui ont organisé des activités dans des classes universitaires qui ont apporté de la joie à leurs étudiant(e)s. La session se terminera par une table ronde centrée sur les moyens d'apporter de la joie dans les cours de mathématiques à l'université et sur l'importance relative de la joie dans les mathématiques universitaires.

Nous nous attendons à ce que cette session soit dynamique et interactive, alors venez préparé à participer aux activités menées par les présentateurs. Les présentations se succéderont, donc bien que vous soyez libre de quitter la session ou d'y entrer à tout moment, les heures indiquées dans le calendrier ci-dessous ne sont qu'une estimation du début et de la fin de chaque présentation.

Schedule/Horaire — Room/Salle: Gerrard

Sunday December 7 — dimanche 7 décembre

15:00 - 15:15	Burcu Karabina (University of Waterloo), *Thinking Dice* (p. 111)
15:15 - 15:35	Thomas Kielstra (University of Toronto Scarborough), *Sweet Shots, Sharp Concepts: Teaching Piecewise Derivatives with a Marshmallow Gun* (p. 112)
15:35 - 15:55	Parker Glynn-Adey and Samira Goder (University of Toronto Scarborough), *String Stars: A Joyful Ending for a Class* (p. 111)
15:55 - 16:05	Break (p. 111)
16:05 - 16:15	Christopher Heggerud (University of Manitoba), *The joy of getting stuck in traffic* (p. 111)
16:15 - 16:35	Michael Pawliuk (University of Toronto Mississauga), *Valentine's Day Gallery Walk* (p. 112)
16:35 - 16:50	Muhammad Awais (University of Victoria), *Guessing & Graphing Trig. Functions* (p. 110)
16:50 - 17:10	Egan Chernoff (University of Saskatchewan), *The Perplexing Power of Pop Quiz Pageantry* (p. 111)
17:10 - 17:20	Break (p. 110)
17:20 - 18:00	Roundtable Discussion (p. 111)

Abstracts/Résumés

MUHAMMAD AWAIS, University of Victoria
[Sunday December 7 / dimanche 7 décembre, 16:35]
Guessing & Graphing Trig. Functions

For students with weaker math backgrounds or those returning to math after a break, teaching math topics through interactive activities can make learning both easier and enjoyable. One such example is function transformations on trigonometric graphs!

BREAK,
[Sunday December 7 / dimanche 7 décembre, 17:10]

BREAK,
[Sunday December 7 / dimanche 7 décembre, 15:55]

EGAN CHERNOFF, University of Saskatchewan
[Sunday December 7 / dimanche 7 décembre, 16:50]
The Perplexing Power of Pop Quiz Pageantry

Come walk a mile in my students' shoes. My students: future teachers of elementary and secondary school mathematics. Their task: a pop quiz given during the first few minutes of the very first day of the semester. Our task: answer a few questions from the pop quiz, engage in a bit of "what do you think they thought" discussion, and see how doing the quiz twice, first alone then second in a group, along with some of my "patented" pop quiz pageantry, turns one of the most feared math class activities into, of all things, a fun and joyful activity that acts as an important callback throughout the rest of the semester. Fair warning: my dog has already eaten the answer key to the pending pop quiz questions you will answer, and please be prepared to work in small groups.

ROUNDTABLE DISCUSSION,
[Sunday December 7 / dimanche 7 décembre, 17:20]

PARKER GLYNN-ADEY AND SAMIRA GODER, University of Toronto (UTSC)
[Sunday December 7 / dimanche 7 décembre, 15:35]
String Stars: A Joyful Ending for a Class

Our activity will teach participants to make a string star. This string figure was originally made in Japan, but connects to the universal childhood pastime of playing with string. The activity of making a string star connects students' lived experience of playing cat's cradle in childhood to their university education. In our teaching, we use this activity as a means to end a course and create a lasting memory of joy in the mathematics classroom.

CHRISTOPHER HEGGERUD, University of Manitoba
[Sunday December 7 / dimanche 7 décembre, 16:05]
The joy of getting stuck in traffic

In this activity I let students hypothesize, model and experience what factors cause a traffic jam ! This particular activity was originally designed as an introduction to mathematical and numerical modelling ! We explore why traffic slows down only for it to speed up again mysteriously, how our models can inform road design and speed limits, and how navigation apps decide what colour a route should be. Come prepared to move around, unless you get stuck.

BURCU KARABINA, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 15:00]
Thinking Dice

Engaging students in meaningful mathematical thinking often begins with inviting them to play. In my calculus classes, I use a simple tool I call Thinking Dice: oversized dice with transparent side pockets that hold interchangeable prompts. Depending

on the lesson, the dice become a lesson opener, a reflective closing activity, or a way to guide students through "thinking levels." Each roll creates an element of surprise and curiosity, encouraging students to articulate reasoning, make connections, and explore ideas collaboratively. This brief presentation will showcase how "Thinking Dice" brings joy, creativity, and active learning into the calculus classroom.

THOMAS KIELSTRA, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 15:15]
Sweet Shots, Sharp Concepts: Teaching Piecewise Derivatives with a Marshmallow Gun

In first-semester single-variable calculus, students often find computing the derivative to be quite challenging. This is especially true when working with piecewise functions. In this workshop, we will explore how one could use a marshmallow gun as a manipulative to leverage students intuition to gain a better understanding for: why we use a piece-wise function in real world situations ; the relationship between average velocity and average rate of change ; why the velocity function is a derivative ; and how to compute the velocity/determine if it is defined, when the function changes definition with the piece-wise function. In the worksheet we will explore, students are challenged to reanalyse the function, thinking about the acceleration of the marshmallow, when it is defined and why determine if the defined accelerations make sense physically. Finally, we discuss how this manipulative could be used again, later within the same course. As students are learning about initial value problems, students could derive the piece-wise function that defines the position of the marshmallow for themselves by proving force is equal to mass times acceleration and assuming: the marshmallow had no initial velocity ; a constant force is being applied while within the marshmallow gun ; no force is being applied (horizontally) while the marshmallow travels through the air ; and the marshmallow sticks to the wall it hits. We provide the .tex file for both worksheets as well as a parts list for the marshmallow gun.

MICHAEL PAWLIUK, Univeristy of Toronto Mississauga
[Sunday December 7 / dimanche 7 décembre, 16:15]
Valentine's Day Gallery Walk

Gallery walks have been a powerful tool in my senior combinatorics class for promoting communication skills, as well as demystifying preconceptions about how others in the class think, approach, and express.

"I thought I was the only one who didn't solve it !" melted into "I'm going to work on this approach." morphed into strategizing problem solving time in a way that will be well suited to achieving and sharing partial results.

In this activity we will do a "Valentine's Day" version of a gallery walk, that promotes connections, social validation, and joy ! There will be hearts.

Logic in Canada IV

Org: Bradd Hart (McMaster University) and/et **Rahim Moosa** (University of Waterloo)

Logic in Canada has had a long and storied history with contributions in model theory, set theory, category theory, computability and proof theory. This diversity has a common foundational core and three times in recent memory, the community has come together to celebrate this commonality and provide a venue for a new generation of young logicians.

Schedule/Horaire **Room/Salle: Wren A**

Sunday December 7 **dimanche 7 décembre**

15:00 - 15:50	Spencer Unger (UofT), *Circle squaring with algebraic irrationals and few pieces* (p. 115)
16:00 - 16:30	Mathias Stout (McMaster), *Integration in Hensel minimal fields* (p. 114)
16:30 - 17:00	Leo Jimenez (Ohio State), *Pfaffian functions and model theory* (p. 114)
17:00 - 17:30	Ali Hamad (Ottawa), *Bundles of metric structures as left ultrafunctors* (p. 113)
17:30 - 18:00	Christine Eagles (Waterloo), *Algebraic independence of solutions to multiple Lotka-Volterra systems* (p. 113)

Monday December 8 **lundi 8 décembre**

8:30 - 9:00	Ilgwon Seo (McMaster), *O-minimality of almost regular multisummable germs* (p. 114)
9:30 - 10:00	Joey Lakerdas-Gayle (Waterloo), *Computability theory of function composition* (p. 114)
10:00 - 10:30	Diego Bejarano (York), *Finding Order in Metric Structures* (p. 113)

Abstracts/Résumés

DIEGO BEJARANO, York University
[Monday December 8 / lundi 8 décembre, 10:00 – Wren A]
Finding Order in Metric Structures

In continuous logic, there are plenty of examples of interesting stable metric structures. On the other side of the SOP line, there are only a few metric structures where order is relevant, and order appears in a different way in each of them. In this talk, joint work with Aaron Anderson, we present a unified approach to linear orders in continuous logic. We axiomatize these theories, and find generic completions in the ultrametric case, analogous to the complete theory DLO. We study some expansions of these theories, including real closed metric valued fields, from this perspective, and characterize which expansions of metric linear orders should be considered o-minimal.

CHRISTINE EAGLES, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 17:30 – Wren A]
Algebraic independence of solutions to multiple Lotka-Volterra systems

A major problem in recent applications of the model theory of DCF_0 is determining when a given system of algebraic differential equations defines a strongly minimal set. A definable set S is *strongly minimal* if it is infinite and for any other definable set R (over any set of parameters), either $S \cap R$ or $S \setminus R$ is finite. In joint work with Yutong Duan and Léo Jimenez, we classify exactly when the solution set to a Lotka-Volterra system is strongly minimal. In the strongly minimal case, we classify all algebraic relations between Lotka-Volterra systems and show that for any distinct solutions $x_1, ..., x_n$ (not in the algebraic closure of the base field F), $\mathrm{trdeg}(x_1, \cdots, x_m/F) = 2m$.

ALI HAMAD, University of Ottawa
[Sunday December 7 / dimanche 7 décembre, 17:00 – Wren A]
Bundles of metric structures as left ultrafunctors

The ultraproduct construction play a fundamental role in both classic and continuous first-order logic. Categorical treatment of that construction can be done in the framework of ultracategories first introduced by Makkai and then by Lurie, where it was used in classic model theoretic and topos theoretic settings. We have used this new framework to study categories of models of continuous logic, and showed a result related to bundle theory. A certain class of functors from a compact Hausdorff space to the category of models of a continuous theory is equivalent to a nice enough notion of bundles of models of this theory, with the compact Hausdorff space being the base space. This notion allows for the recovery of familiar notions of bundles like Banach bundles and continuous fields of C^* algebras.

LEO JIMENEZ, The Ohio State University
[Sunday December 7 / dimanche 7 décembre, 16:30 – Wren A]
Pfaffian functions and model theory

Pfaffian functions, which are defined as solutions of triangular systems of order one polynomial differential equations, have played an important role in the model theory of the real field, thanks to their finiteness properties. However, determining whether solutions of a given differential equation are Pfaffian remains a challenging problem. In this talk, I will discuss some work in progress, joint with James Freitag and Ronnie Nagloo, which uses model-theoretic tools to find criteria for functions to be pfaffian.

JOEY LAKERDAS-GAYLE, University of Waterloo
[Monday December 8 / lundi 8 décembre, 9:30 – Wren A]
Computability theory of function composition

We will discuss the relationship between function composition and the computability-theoretic complexity of functions (their *partial degree*). We fully characterize the possible degrees of $g \circ f$ in terms of the degrees of f and g. We also consider the problem of "splitting over composition": Given a function h, what are the possible degrees of functions f and g for which $g \circ f = h$? We will discuss some new results, natural examples, and application to computable structure theory.

ILGWON SEO, McMaster University
[Monday December 8 / lundi 8 décembre, 8:30 – Wren A]
O-minimality of almost regular multisummable germs

As a step toward addressing Dulac's problem, the main goal of my project is to show the o-minimality of an algebra containing multisummable functions and almost regular germs. A multisummable function can be expressed as a series of holomorphic functions at 0. Together with Patrick Speissegger, I constructed an algebra by replacing holomorphic functions with a.r. germs. However, since the asymptotic expansion of an almost regular germ is generally divergent, this algebra fails to satisfy the closure properties required for o-minimality. To overcome this difficulty, we introduce a refined algebra Q, obtained by selectively choosing well-behaved functions. In this follow-up to my spring talk, I will present what has changed over the summer and explain how the algebra Q can be used to prove o-minimality.

MATHIAS STOUT, McMaster University/Fields Institute
[Sunday December 7 / dimanche 7 décembre, 16:00 – Wren A]
Integration in Hensel minimal fields

I will discuss the construction of Hrushovski-Kazhdan style integral for Hensel minimal fields, generalizing their construction in the V-minimal setting.

This talk will consist of two smaller parts, respectively centered around the following questions

1. What is Hensel minimality and why is it a natural and desirable setting to work in ?

2. How to read our main theorem, and why is it (un)surprising ?

This is based on joint work with Floris Vermeulen.

SPENCER UNGER, University of Toronto

[Sunday December 7 / dimanche 7 décembre, 15:00 – Wren A]

Circle squaring with algebraic irrationals and few pieces

We show that a closed disk and square with the same area in the plane are equidecomposible using translations whose coordinates are linear combinations of algebraic irrationals. This solves a question of Laczkovich from 1990. Our proof uses a new method for bounding the discrepancy of product sets in the k-torus using the Erdos-Turan inequality. As an application of our work, we obtain an improved upper bound on the number of pieces required to square the circle. For this we fix certain algebraic irrationals and make use of: (1) effective constants in Roth's theorem on diophantine approximation, (2) an idea of Frank Calegari for bounding sums of products of fractional parts of those numbers and (3) computer assistance. This is joint work with Andrew Marks.

Mathematical Finance
Finance mathématique

Org: Christoph Frei and/et **Alexander Melnikov** (University of Alberta)

This session will feature recent advances in mathematical finance, including topics such as asset pricing, risk management, market microstructure, and systemic risk. Emphasis will be placed on the development and application of stochastic, optimization-based, and machine learning methods in finance and insurance.

Cette session présentera les avancées récentes en finance mathématique, notamment dans des domaines tels que la valorisation des actifs, la gestion des risques, la microstructure des marchés et le risque systémique. L'accent sera mis sur le développement et l'application de méthodes stochastiques, d'optimisation et d'apprentissage automatique dans les domaines de la finance et de l'assurance.

Schedule/Horaire **Room/Salle: Rosetti B**

Saturday December 6 — samedi 6 décembre

8:00 - 8:30	Anne MacKay (Université de Sherbrooke), *Pricing lookback options on quantum computers* (p. 121)
8:30 - 9:00	Tahir Choulli (University of Alberta), *Pricing formulas for vulnerable claims and death derivatives* (p. 117)
9:00 - 9:30	Frédéric Godin (Concordia University), *Deep Hedging with Options Using the Implied Volatility Surface* (p. 119)
9:30 - 10:00	Alexandru Badescu (University of Calgary), *Option Pricing with Recurrent Variance Dependent Stochastic Discount Factors and Realized Volatility* (p. 117)
10:00 - 10:30	Alexander Melnikov (University of Alberta), *On Market Completions Approach to Option Pricing and Related Questions* (p. 121)
15:00 - 15:30	Geneviève Gauthier (HEC Montréal), *Beyond volatility of volatility: Decomposing the informational content of VVIX* (p. 119)
15:30 - 16:00	Lars Stentoft (Western University), *In estimation, the key is the volatility index, not the returns* (p. 123)
16:00 - 16:30	Matt Davison (Western University), *A Real Options Approach to Wildfire Evacuations* (p. 118)
16:30 - 17:00	Mark Reesor (Wilfrid Laurier University), *Approximating the Money-Weighted Rate of Return* (p. 122)
17:00 - 17:30	Kristina Stankova (Western University), *Applying ruin theory to retirement savings: A case study* (p. 123)
17:30 - 18:00	Adam Metzler (Wilfrid Laurier University), *Comparing Life-Cycle and Contrarian Investment Strategies* (p. 121)

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Matheus Grasselli (McMaster University), *A Tale of Two Regions: A North and South Macroeconomic-Ecological Model* (p. 120)
8:30 - 9:00	Alexandre Roch (Université du Québec à Montréal), *Optimal Green Transition for a Firm* (p. 122)
9:00 - 9:30	François-Michel Boire (University of Ottawa), *Modeling Systemic House Price Risk* (p. 117)
9:30 - 10:00	Antony Ware (University of Calgary), *Generative Pricing of Basket Options via Signature-Conditioned Mixture Density Networks* (p. 124)
10:00 - 10:30	Xiaofei Shi (University of Toronto), *The Price of Information* (p. 123)
15:00 - 15:30	Alexander Schied (University of Waterloo), *Exploring Roughness in Stochastic Processes: From Weierstrass Bridges to Volatility Estimation* (p. 123)
15:30 - 16:00	Cody Hyndman (Concordia University), *Optimal annuitization with labor income under age-dependent force of mortality* (p. 120)
16:00 - 16:30	Jinniao Qiu (University of Calgary), *Some recent progress on stochastic HJB equations* (p. 122)
16:30 - 17:00	Anastasis Kratsios (McMaster University), *A Neural Black–Scholes Formula* (p. 120)

17:00 - 17:30	Dena Firoozi (University of Toronto), *Ranking Quantilized Mean-Field Games and Early-Stage Venture Investments* (p. 118)
17:30 - 18:00	Foivos Xanthos (Toronto Metropolitan University), *Star-Shaped Risk Measures: Representations and Cash-Additive Hulls* (p. 124)

Monday December 8 lundi 8 décembre

8:00 - 8:30	David Saunders (University of Waterloo), *Exploratory Investment-Consumption with Non-Exponential Discounting* (p. 122)
8:30 - 9:00	Ting-Kam Leonard Wong (University of Toronto), *Excess growth rate and axiomatic characterizations* (p. 124)
9:00 - 9:30	Niushan Gao (Toronto Metropolitan University), *On Continuity and Asymptotic Consistency of Measures of Risk and Variability* (p. 119)
9:30 - 10:00	Roman Makarov (Wilfrid Laurier University), *Spectral Expansions for Structural Credit Risk Models Incorporating Occupation Area and Occupation Time* (p. 121)
10:00 - 10:30	Christoph Frei (University of Alberta), *A Doubly Continuous Model for Equilibrium Trading Dynamics* (p. 118)

Abstracts/Résumés

ALEXANDRU BADESCU, University of Calgary
[Saturday December 6 / samedi 6 décembre, 9:30 – Rosetti B]
Option Pricing with Recurrent Variance Dependent Stochastic Discount Factors and Realized Volatility

This paper develops an option pricing framework that integrates general Realized EGARCH return dynamics with an exponential linear stochastic discount factor (SDF), in which variance risk aversion is modelled using a recurrent neural network (RNN). Using S&P 500 index options, we show that the RNN-based SDF substantially improves the cross-sectional fit relative to standard autoregressive and constant variance-dependent specifications, with the largest gains for deep out-of-the-money and short-maturity contracts. The results indicate that allowing the pricing kernel to incorporate complex, state-dependent variance risk premia is essential for capturing option market nonlinearities. A GPU-accelerated implementation based on Libtorch (PyTorch's C++ API) and CUDA ensures computational feasibility for large-scale estimation.

FRANÇOIS-MICHEL BOIRE, University of Ottawa
[Sunday December 7 / dimanche 7 décembre, 9:00 – Rosetti B]
Modeling Systemic House Price Risk

Economists and policy makers have become increasingly aware of the role of house price risk in driving financial fragility. This paper develops a semiparametric framework to model and assess downside risk in the U.S. housing market. First, we use panel quantile regressions to capture heterogeneous effects of supply, demand, and non-fundamental factors across the distribution of state-level house price changes. Second, we estimate the quantile regression jointly with a copula-based structure to capture cross-state dependence. Finally, we construct a measure of systemic housing risk using a weighted composition of state-level Case–Shiller price indices, allowing us to compare tail exposures and quantify cross-state contributions to aggregate risk. This is joint work with S. van Norden.

TAHIR CHOULLI, University of Alberta
[Saturday December 6 / samedi 6 décembre, 8:30 – Rosetti B]
Pricing formulas for vulnerable claims and death derivatives

We consider the discrete-time market model described by the triplet $(S, \mathbb{F}, \tau)$. Herein $\mathbb{F}$ is the "public" flow of information which is available to all agents overtime, S is the discounted price process of d-tradable assets, and τ is an arbitrary random time whose occurrence might not be observable via $\mathbb{F}$. This framework covers the credit risk theory where τ represents the default time, the life insurance setting where τ models the death time, and other areas of finance. For various vulnerable claims in credit risk and death derivatives in life insurance, we address the super-hedging pricing valuation problem in many aspects. First of all, we discuss how the Immediate-Profit arbitrage (IP for short), which is the economical assumption that guarantees the existence of the "minimal" super-hedging price $\widehat{P}^{\mathbb{G}}$, is affected by τ. Then we show, as explicit as possible, how the set of all super-hedging prices expands under the stochasticity of τ and its various risks. Afterwards, we elaborate, as explicit as possible, the pricing formulas for vulnerable claims and death derivatives. Finally, we single out explicitly the various informational risks in the dynamics of the price process $\widehat{P}^{\mathbb{G}}$ and quantify them. This latter fact is highly important for the mortality and longevity securitizations.

This talk is based on the following joint work with Emmanuel Lepinette (Paris-Dauphine, France):

T. Choulli and Emmanuel: Super-hedging-pricing formulas and Immediate-Profit arbitrage for market models under random horizon. to appear in Finance and Stochastics. A version of the paper is available at: arXiv:2401.05713.

MATT DAVISON, Western University Canada
[Saturday December 6 / samedi 6 décembre, 16:00 – Rosetti B]
A Real Options Approach to Wildfire Evacuations

Joint work with Daniel Guerrero and Doug Woolford

Wildfires pose an increasing threat to human life and property in Canada. Approximately 12Significant research efforts has been devoted to understanding different components of wildfire risk, including the way in which wildfire moves on the landscape. When fire approaches populated areas, it can be optimal to evacuate the area to reduce danger to life. Evacuating too late will be much more expensive, if possible at all ; evacuating too early risks disruptive unnecessary evacuations. In this talk I will examine how financial mathematics approach can help frame this problem in useful ways that not only allow evacuation decisions to be made, but which also provides a way to compare, apples to apples, to financial benefit of measures taken to prevent wildfire spread against their cost.

DENA FIROOZI, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 17:00 – Rosetti B]
Ranking Quantilized Mean-Field Games and Early-Stage Venture Investments

We study a class of quantilized mean-field game models with a capacity for ranking games, where the performance of each agent is evaluated based on its terminal state relative to the population's α-quantile value, $\alpha \in (0, 1)$. This evaluation criterion is designed to select the top $(1 - \alpha)\%$ performing agents. We provide two formulations for this competition: a target-based formulation and a threshold-based formulation. In the former and latter formulations, to satisfy the selection condition, each agent aims for its terminal state to be *exactly* equal and *at least* equal to the population's α-quantile value, respectively.

For the target-based formulation, we obtain an analytic solution and demonstrate the ϵ-Nash property for the asymptotic best-response strategies in the N-player game. Specifically, the quantilized mean-field consistency condition is expressed as a set of forward-backward ordinary differential equations, characterizing the α-quantile value at equilibrium. For the threshold-based formulation, we obtain a semi-explicit solution and numerically solve the resulting quantilized mean-field consistency condition.

Subsequently, we propose a new application in the context of early-stage venture investments, where a venture capital firm financially supports a group of start-up companies engaged in a competition over a finite time horizon, with the goal of selecting a percentage of top-ranking ones to receive the next round of funding at the end of the time horizon. We present the results and interpretations of numerical experiments for both formulations discussed in this context and show that the target-based formulation provides a very good approximation for the threshold-based formulation.

CHRISTOPH FREI, University of Alberta
[Monday December 8 / lundi 8 décembre, 10:00 – Rosetti B]
A Doubly Continuous Model for Equilibrium Trading Dynamics

Analysis of financial markets is usually based on rational expectations, where investors use all available information to trade in order to maximize their expected utility. In equilibrium models, prices are determined so that the market clears, meaning that demand equals supply. Typically, diverging information among homogeneous agents is not enough to generate trade in equilibrium. To address this issue, we introduce and analyze a doubly continuous model with continuous time and continuous agent space. In this setting, each agent is infinitesimally small, contributing zero to trade, while collective trade emerges from the aggregation over non-negligible sets of agents. Our approach leverages tools from Brownian sheets and multiparametric stochastic calculus, providing insights into the interplay of information, behaviour, and equilibrium in financial markets.

This talk is based on joint work with Efstathios Avdis (University of Alberta), Sergei Glebkin (INSEAD), and Raphael Huwyler (University of Alberta).

NIUSHAN GAO, Toronto Metropolitan University
[Monday December 8 / lundi 8 décembre, 9:00 – Rosetti B]
On Continuity and Asymptotic Consistency of Measures of Risk and Variability

Ruszczynski and Shapiro (2006) showed that a convex, real-valued functional on a Banach lattice is continuous whenever it is either increasing or decreasing. This result has played an important role in the development of the theory of risk measures. In this talk, we show that the monotonicity assumption can be relaxed to a much weaker condition: it suffices that the functional be bounded above on every interval. This extension permits new applications, particularly to measures of variability. We also present an improvement of a result of Kratschmer, Schied and Zahle (2014) concerning the asymptotic consistency of law-invariant risk measures.

This talk is based on joint work with Foivos Xanthos.

GENEVIÈVE GAUTHIER, HEC Montréal
[Saturday December 6 / samedi 6 décembre, 15:00 – Rosetti B]
Beyond volatility of volatility: Decomposing the informational content of VVIX

This study investigates the informational content of the VVIX, traditionally viewed as a proxy for the S&P 500 index's volatility of the volatility (VOV). We show that this interpretation is incomplete: the VVIX also embeds a long-run variance (LRV) component. To establish this result, we first demonstrate that regressions of squared VVIX on VOV proxies gain substantial explanatory power once LRV measures are incorporated. We then develop a tractable theoretical framework linking VVIX to three risk drivers—instantaneous variance, LRV, and VOV—and show that the VVIX loads on both VOV and LRV. Our empirical analysis reveals that VVIX dynamics are dominated by LRV in calm markets, but by VOV during financial stress. We further show that these variance components explain option returns in distinct markets: S&P 500 index option straddles load on the instantaneous variance and LRV, while VIX option straddles load on the VOV. Taken together, our results redefine the role of the VVIX, establishing it as a measure of both VOV and LRV uncertainty, with important implications for how it should be read and used by finance practitioners.

FRÉDÉRIC GODIN, Concordia University
[Saturday December 6 / samedi 6 décembre, 9:00 – Rosetti B]
Deep Hedging with Options Using the Implied Volatility Surface

We propose a deep hedging framework for index option portfolios, grounded in a realistic market simulator that captures the joint dynamics of S&P 500 returns and the full implied volatility surface. Our approach integrates surface-informed decisions

with multiple hedging instruments and explicitly accounts for transaction costs. The hedging strategy also considers the variance risk premium embedded in the hedging instruments, enabling more informed and adaptive risk management. Tested on a historical out-of-sample set of straddles from 2020 to 2023, our method consistently outperforms traditional delta-gamma hedging strategies across a range of market conditions.

MATHEUS GRASSELLI, McMaster University
[Sunday December 7 / dimanche 7 décembre, 8:00 – Rosetti B]
A Tale of Two Regions: A North and South Macroeconomic-Ecological Model

In this talk, I will describe an extension of the GEMMES climate-economic model proposed in Bovari et al. (2018a) that considers two regions, a Global North and a Global South, interacting through trade. Each region decides on its own carbon pricing policy and abatement subsidies independently, leading to separate paths for industrial emissions, which contribute together to the increase of atmospheric carbon concentration and global average increase in temperature. The two regions are subject to distinct damages caused by climate change, leading to separate paths for economic variables such as output and inflation. I will show a calibration of the model to data available up to 2016 and a test of the predictions up to 2024 with broad agreement for the key variables in the model. I will then investigate three different scenarios for future damages and climate policies and their effects on each of the regions, as well as a case study for financial transfers from the North to the South to help mitigate climate change. I conclude with a sensitivity analysis of the proposed model using similar techniques previously used to analyze the original GEMMES model. This is joint work with B. Badenhorst, K. Baldeo, K. Bopape, E. Kroell, and D. Presta.

CODY HYNDMAN, Concordia University
[Sunday December 7 / dimanche 7 décembre, 15:30 – Rosetti B]
Optimal annuitization with labor income under age-dependent force of mortality

We consider the problem of optimal annuitization with labour income, where an agent aims to maximize utility from consumption and labor income under age-dependent force of mortality. Using a dynamic programming approach, we derive closed-form solutions for the value function and the optimal consumption, portfolio, and labor supply strategies. Our results show that before retirement, investment behavior increases with wealth until a threshold set by labor supply. After retirement, agents tend to consume a larger portion of their wealth. Two main factors influence optimal annuitization decisions as people get older. First, the agent's perspective (demand side) ; the agent's personal discount rate rises with age, reducing their desire to annuitize. Second, the insurer's perspective (supply side) ; insurers offer higher payout rates (mortality credits). Our model demonstrates that beyond a certain age, sharply declining survival probabilities make annuitization substantially optimal, as the powerful incentive of mortality credits outweighs the agent's high personal discount rate. Finally, post-retirement labor income serves as a direct substitute for annuitization by providing an alternative stable income source. It enhances the financial security of retirees. (Joint work with Criscent Birungi)

ANASTASIS KRATSIOS, McMaster University
[Sunday December 7 / dimanche 7 décembre, 16:30 – Rosetti B]
A Neural Black–Scholes Formula

Despite its central role in option markets, the implied volatility surface (IVS) remains exceptionally difficult to calibrate to quoted call prices without breaching fundamental economic constraints. We resolve this long-standing problem by deriving a simple, model-free, smooth call option pricing formula describing a (sparse fully-trained) two-layer neural network matching quoted market call prices ; both in the strike and maturity. Our formula is *adaptively arbitrage free* (AF) in that is necessrily produces an arbitrage-free call surface whenever the quoted market data is arbitrage-free. The regularity of our data-driven call surface allows us obtain a closed-form reconstruct risk-neutral dynamics for the underlying only using the available market call quotes via the Dupire formula. Moreover, on AF data, our IVS is guaranteed to uniformly approximate call slices at an optimal rate of $\mathcal{O}(1/n^2)$ all all points between any quoted market prices, using n neurons.

We demonstrate state-of-the-art predictive power with virtually no computational overhead, across synthetic data and real-world cryptocurrency markets, by routinely achieving several orders of magnitude greater accuracy than both industry and deep learning benchmarks. Our model-free option pricing formula is subsumes the classical *Black–Scholes* (BS) formula, in that it uses the BS put price as its activation function.

Joint work: Hans Buehler, Blanka Horvath, Yannick Limmer, and Raeid Saiqur

---

ANNE MACKAY, Université de Sherbrooke
[Saturday December 6 / samedi 6 décembre, 8:00 – Rosetti B]
Pricing lookback options on quantum computers

Quantum computing promises computational speed up that could have a significant impact across industries. In this presentation, we explore the application of VarQITE, a quantum time evolution algorithm, to option pricing. Extending the work of Fontanela et al. (2021), we consider discretely monitored lookback options and use VarQITE to solve a partial differential equation associated to its price. To address the jump condition in the PDE, which poses a significant challenge in the quantum implementation, we re-write it in terms of multiple continuous equations, thus improving the accuracy of the results. A brief introduction to quantum computing will also be presented.

ROMAN MAKAROV, Wilfrid Laurier University
[Monday December 8 / lundi 8 décembre, 9:30 – Rosetti B]
Spectral Expansions for Structural Credit Risk Models Incorporating Occupation Area and Occupation Time

We develop structural credit risk models with liquidation barriers and hazard rates driven by occupation time, occupation area, and their combinations. Defaults are classified according to Chapter 7 (liquidation) and Chapter 11 (reorganization) of the U.S. Bankruptcy Code. For a firm's value modelled as a diffusion with killing, we obtain a general closed-form representation of the associated Green's function. Using spectral methods, we derive a discrete spectral expansion of the transitional density, which in the geometric Brownian motion (GBM) case can be written in terms of Airy functions. This allows us to derive liquidation probabilities and implied hazard rates through spectral expansions. The framework extends to other solvable processes, including the constant elasticity of variance (CEV) model and state-dependent volatility hypergeometric diffusion models.

This is a continuation of the joint work with Giuseppe Campolieti and Hiromichi Kato.

ALEXANDER MELNIKOV, University of Alberta
[Saturday December 6 / samedi 6 décembre, 10:00 – Rosetti B]
On Market Completions Approach to Option Pricing and Related Questions

We consider a financial market with a reducible incompleteness. It means that the market can be embedded to a complete market by adding new risky assets. We call such embedding as a market completion. In the framework of such a market one can give a dual characterization of upper and lower option prices via maximization/minimization of expectations of discounted payoffs over market completions instead of martingale measures. Moreover, the method also works for the so-called indifference option pricing. To improve option price approximations, we explore a combination of the market completion method and machine learning technique in an incomplete jump-diffusion market model. Finally, we show how this approach work in life insurance applications.

ADAM METZLER, Wilfrid Laurier University
[Saturday December 6 / samedi 6 décembre, 17:30 – Rosetti B]
Comparing Life-Cycle and Contrarian Investment Strategies

Conventional wisdom holds that, when saving for retirement, individual investors should reduce their exposure to equities as retirement approaches. A recent strand of (high profile) literature criticizes this approach and purports to empirically

demonstrate the superiority of so-called contrarian strategies, where exposure to equities is increased as retirement approaches. In this talk we formally (i.e. theoretically and rigorously) demonstrate that the underlying analysis is flawed and misleading, and prove that, within a certain parametric class, decreasing allocations (those that reduce their exposure to equities over time) strictly dominate increasing allocations in the mean-variance sense.

JINNIAO QIU, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 16:00 – Rosetti B]
Some recent progress on stochastic HJB equations

In this talk, we shall present some recent progress in the study of stochastic Hamilton-Jacobi-Bellman (HJB) equations, which arise naturally in the context of non-Markovian control problems, particularly within the field of mathematical finance. The non-Markovian nature of these problems may also involve path dependence or mean-field interactions, in addition to general randomness in the coefficients. The discussion will cover various aspects, including the well-posedness of such stochastic HJB equations, numerical approximations, and their applications.

MARK REESOR, Wilfrid Laurier University
[Saturday December 6 / samedi 6 décembre, 16:30 – Rosetti B]
Approximating the Money-Weighted Rate of Return

We develop a closed-form approximation to the so-called money-weighted rate of return (MWRR). The approximation is general in the sense that (i) it allows for contributions of varying sizes made at irregularly-spaced times (including both discrete and continuous contributions), (ii) it allows the composition of the underlying portfolio (as manifested through the mean and standard deviation of its instantaneous return) to vary through time and (iii) it does not make any specific assumptions on the stochastic dynamics of the underlying portfolio return. The approximation facilitates insights into a complicated object, which in turn allows us to explain and/or resolve findings elsewhere in the literature.

This is joint work with A. Metzler, M. Lau and D. Polegato.

ALEXANDRE ROCH, ESG UQAM
[Sunday December 7 / dimanche 7 décembre, 8:30 – Rosetti B]
Optimal Green Transition for a Firm

I present a stochastic singular control problem that models a firm's optimal transition from Brown to Green technologies. Remaining in the Brown regime generates ongoing costs, while switching entails a proportional investment cost. The firm may distribute dividends but must maintain solvency through capital injections. Using viscosity-solution methods and comparison principles, I characterize the optimal transition policy and show that it is governed by endogenous threshold rules. Numerical experiments illustrate how parameters impact the viability and timing of the transition.

DAVID SAUNDERS, University of Waterloo
[Monday December 8 / lundi 8 décembre, 8:00 – Rosetti B]
Exploratory Investment-Consumption with Non-Exponential Discounting

We extend the classic Merton optimal investment-consumption problem to the reinforcement learning (RL) framework. Additionally, we incorporate a general non-exponential discounting function to capture an investor's risk preferences, which leads to time inconsistency in the exploratory control problem. Under entropy regularization and logarithmic utility, we obtain closed-form equilibrium investment-consumption policies. Specifically, the optimal investment policy follows a Gaussian distribution, while the optimal consumption policy follows a Gamma distribution. Our results show that uncertainty about the discount rate leads the investor to adopt more conservative policies, with the Gaussian-distributed investment policy retaining the same mean but lower variance, and the Gamma-distributed consumption policy having both a lower mean and variance. We further develop

and implement two RL algorithms- one based on the policy evaluation approach and the other on the q-learning approach- demonstrating their effectiveness through simulation studies. This is joint work with Y. Chen and Y. Li from the University of Waterloo.

ALEXANDER SCHIED, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 15:00 – Rosetti B]
Exploring Roughness in Stochastic Processes: From Weierstrass Bridges to Volatility Estimation

Motivated by the recent success of rough volatility models, we introduce the notion of a roughness exponent to quantify the roughness of trajectories. It can be computed in a straightforward manner for many stochastic processes and fractal functions and also inspired the introduction of a new class of stochastic processes, the so-called Weierstrass bridges. After taking a look at Weierstrass bridges and their sample path properties, we discuss the relations between the roughness exponent and other roughness measures. We show furthermore that the roughness exponent can be statistically estimated in a model-free manner from direct observations of a trajectory but also from discrete observations of an antiderivative—a situation that corresponds to estimating the roughness of volatility from observations of the realized variance. This is joint work with Xiyue Han and Zhenyuan Zhang.

XIAOFEI SHI, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 10:00 – Rosetti B]
The Price of Information

When an investor is faced with the option to purchase additional information regarding an asset price, how much should she pay ? To address this question, we solve for the indifference price of information in a setting where a trader maximizes her expected utility of terminal wealth over a finite time horizon. If she does not purchase the information, then she solves a partial information stochastic control problem, while, if she does purchase the information, then she pays a cost and receives partial information about the asset's trajectory. We further demonstrate that when the investor can purchase the information at any stopping time prior to the end of the trading horizon, she chooses to do so at deterministic time(s).

KRISTINA STANKOVA, University of Western Ontario
[Saturday December 6 / samedi 6 décembre, 17:00 – Rosetti B]
Applying ruin theory to retirement savings: A case study

In this talk, we will discuss how an advanced ruin theory model can be applied to retirement savings of individuals aiming at evaluating long-term risks related to their portfolios. To illustrate our approach, we fit the model to transactional data provided by a registered investment provider to the Financial Wellness Lab at Western University. We split the clients by gender and risk tolerance and examine how investment portfolios evolve over time in each group of clients.

LARS STENTOFT, University of Western Ontario
[Saturday December 6 / samedi 6 décembre, 15:30 – Rosetti B]
In estimation, the key is the volatility index, not the returns

This paper proposes a new methodology to estimate a GARCH model using only returns and volatility index (vli) data. The approach is centered on applying likelihood to the vli with an approximation to returns, denoted A-C-VIX-Ret, rather than the standard approach of applying likelihood to returns with an approximation to the vli, denoted A-Ret-VIX. The new approach overcomes the ill-posed problem of an infinite likelihood from the vli, proposing the well-posed A-C-VIX for working with vli data only. We apply and compare the methodologies on three GARCH models, several volatility indexes, and stock data sets, with the main focus on the GARCH model of Heston & Nandi (2000), i.e., the HN-GARCH model, and the time series of S&P 500 and VIX from CBOE. Our analyses demonstrate that the volatility index holds more information on the parameters

of a GARCH model than the returns, leading to A-C-VIX-Ret improving the quality of estimation compared to A-Ret-VIX, as seen by RMSE reductions of up to 90% ; with significant improvements also in predicting the variance process. As part of the novelty, our methodology overcomes the problem of infinity-likelihood arising from Chi-squares with 1 degree of freedom, delivering a robust numerical procedure.

ANTONY WARE, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 9:30 – Rosetti B]
Generative Pricing of Basket Options via Signature-Conditioned Mixture Density Networks

We present a generative framework for pricing European-style basket options by learning the conditional terminal distribution of the log arithmetic-weighted basket return. A Mixture Density Network (MDN) maps time-varying market inputs—encoded via truncated path signatures—to the full terminal density in a single forward pass. Traditional approaches either impose restrictive assumptions or require costly re-simulation whenever inputs change. Trained on Monte Carlo (MC) under GBM with time-varying volatility or local volatility, the MDN acts as a reusable surrogate distribution: once trained, it prices new scenarios by integrating the learned density. Across maturities, correlations, and basket weights, the learned densities closely match MC (low KL) and produce small pricing errors, while enabling train-once, price-anywhere reuse at inference-time latency.

This is joint work with MD Hasib Uddin Molla, Ilnaz Asadzadeh and Nelson Fernandes

---

TING-KAM LEONARD WONG, University of Toronto
[Monday December 8 / lundi 8 décembre, 8:30 – Rosetti B]
Excess growth rate and axiomatic characterizations

The excess growth rate is a fundamental logarithmic functional in portfolio theory. After reviewing its financial definition and properties, we present three axiomatic characterization theorems in terms of (i) the relative entropy, (ii) the gap in Jensen's inequality, and (iii) the logarithmic divergence that generalizes the Bregman divergence. We also consider maximization of expected excess growth rate and compare its solution with the growth optimal portfolio. Joint work with Steven Campbell.

FOIVOS XANTHOS, Toronto Metropolitan University
[Sunday December 7 / dimanche 7 décembre, 17:30 – Rosetti B]
Star-Shaped Risk Measures: Representations and Cash-Additive Hulls

In this talk, we present representation results for star-shaped risk measures defined on general model spaces. We further investigate the cash-additive hulls of star-shaped risk measures and establish conditions under which these hulls preserve key continuity properties. The results provide new insights into the structure of Optimized Certainty Equivalents and Haezendonck–Goovaerts risk measures.

The talk is based on joint work with Denny Leung and Niushan Gao

Mathematical Relativity and Geometric Analysis
Relativité mathématique et analyse géométrique

Org: Aghil Alaee (Clark University) and/et **Hari Kundrui** (McMaster University)

Mathematical general relativity addresses deep questions raised by Einstein's theory at the interface of geometric analysis, differential geometry, and mathematical physics. The purpose of this session is to bring together a varied set of researchers to (1) discuss recent advances across a range of subfields, and (2) create an environment for a useful exchange of ideas and possible collaboration across these subfields.

La relativité générale mathématique aborde les questions profondes soulevées par la théorie d'Einstein à l'interface entre l'analyse géométrique, la géométrie différentielle et la physique mathématique. L'objectif de cette session est de réunir un groupe varié de chercheur(euse)s afin (1) de discuter des avancées récentes dans divers sous-domaines et (2) de créer un environnement propice à un échange d'idées fructueux et à une éventuelle collaboration entre ces sous-domaines.

Schedule/Horaire **Rooms/Salles: Stevenson, Windsor**

Saturday December 6 — samedi 6 décembre

8:30 - 9:00	Niky Kamran (McGill University), *Global counterexamples to uniqueness for a Calderón problem with C^k conductivities* (p. 127), Stevenson
9:00 - 9:30	Eric Woolgar (University of Alberta), *Marginally outer trapped surfaces governed by Bakry-Émery Ricci curvature bounds* (p. 128), Stevenson
9:30 - 10:00	Tracey Balehowsky (University of Calgary), *The Inverse Problem of Recovering a Riemannian Metric from Area Data* (p. 126), Stevenson
10:00 - 10:30	Jeff Jauregui (Union College), *Optimizing capacity with nonnegative scalar curvature* (p. 127), Stevenson
15:00 - 15:30	Ivan Booth (Memorial University of Newfoundland), *Black hole evolution and internal structure: constraints from the stability operator* (p. 126), Stevenson
15:30 - 16:00	Graham Cox (Memorial University of Newfoundland), *Black hole mergers and bifurcations of marginally outer trapped surfaces* (p. 126), Stevenson
16:00 - 16:30	Amir Babak Aazami (Clark University), *Normal forms, "almost-Einstein" metrics, and conformal invariants* (p. 125), Stevenson
16:30 - 17:00	Ryan Ugner (University of California, Berkeley) (p. 128), Stevenson
17:00 - 17:30	Nishanth Gudapati (College of the Holy Cross), *Remarks on the s=1 Teukolsky Equation* (p. 126), Stevenson

Sunday December 7 — dimanche 7 décembre

15:00 - 15:30	Argam Ohanyan (University of Toronto), *On the geometry of continuously differentiable spacetime metrics* (p. 127), Windsor
15:30 - 16:00	James Wheeler (University of Michigan), *Asymptotically Euclidean Solutions of the Constraint Equations with Prescribed Asymptotics* (p. 128), Windsor
16:00 - 16:30	Yakov Shlapentokh Rothman (University of Toronto), *Polynomial Decay for the Klein-Gordon Equation on the Schwarzschild Black Hole* (p. 128), Windsor
16:30 - 17:00	Mariem Magdy (Perimeter Institute), *Estimates for spinor fields using the space-spinor formalism* (p. 127), Windsor

Abstracts/Résumés

Mathematical Relativity and Geometric Analysis
Relativité mathématique et analyse géométrique

AMIR BABAK AAZAMI, Clark University
[Saturday December 6 / samedi 6 décembre, 16:00]
Normal forms, "almost-Einstein" metrics, and conformal invariants

A semi-Riemannian manifold has a "normal form" if its curvature tensor is determined by just the critical points and values of its sectional curvature. Examples include Riemannian Einstein 4-manifolds and the classification of Lorentzian spacetimes by their Petrov Types. In this talk we will combine these two cases, yielding new examples of distinguished "almost-Einstein" metrics. We will also briefly discuss higher-dimensional analogues of these results, focusing on conformal invariants.

TRACEY BALEHOWSKY, University of Calgary
[Saturday December 6 / samedi 6 décembre, 9:30]
The Inverse Problem of Recovering a Riemannian Metric from Area Data

Broadly speaking, there are two classes of inverse problems — those that are concerned with the analysis of PDEs, and those that are geometric in nature. In this talk, I will introduce the audience to these classes by highlighting classical examples. Then, I will introduce the geometric problem of recovering a Riemannian metric from area data. I will connect this problem to questions which arise in the AdS/CFT correspondence. I will survey several cases where it is possible to determine a metric from knowledge of the areas of certain families of surfaces. A key feature of these results is that they combine techniques from both PDE and geometric perspectives.

IVAN BOOTH, Memorial University
[Saturday December 6 / samedi 6 décembre, 15:00]
Black hole evolution and internal structure: constraints from the stability operator

For over 50 years apparent horizons have been the canonical examples of marginally outer trapped surfaces (MOTS). However, in the last few years it has come to be understood that they are not the only examples. In fact, most MOTS are not horizons but instead lurk deep inside black holes. Not only can they be used to better understand black hole internal structure but also these internal MOTS play key roles in dynamical events such as black hole mergers. Geometrically MOTS are close relatives of minimal surfaces from Riemannian geometry and the spectra of their analogous stability operators play a key role in determining their behaviour and properties. In this talk I will review some recent work with G.Cox and C.M.Okpala in which we define a generalized stability operator, study its properties, and then use analytical and numerical techniques to explore the implications for black hole geometry and evolution.

GRAHAM COX, Memorial University of Newfoundland
[Saturday December 6 / samedi 6 décembre, 15:30]
Black hole mergers and bifurcations of marginally outer trapped surfaces

It is well known that a marginally outer trapped surface evolves smoothly in time if 0 is not an eigenvalue of its stability operator ; otherwise it may bifurcate. In this talk I will present geometric criteria for saddle-node, transcritical and pitchfork bifurcations to occur as the initial data is varied. These results apply to any variation of the initial data, not just time evolution. Using these criteria, I will show the existence of an infinite sequence of pitchfork and transcritical bifurcations along the inner horizon in the Reissner-Nordström spacetime, as the charge varies between zero and the extremal value. This talk represents joint work with Liam Bussey and Hari Kunduri.

NISHANTH GUDAPATI, College of the Holy Cross
[Saturday December 6 / samedi 6 décembre, 17:00]
Remarks on the s=1 Teukolsky Equation

The mathematical problem of stability of Kerr black hole spacetimes has been a major subject in mathematical and theoretical studies of the Einstein equations of general relativity. In the 1970s, a major breakthrough was achieved when Teukolsky was able to construct a master equation for the gauge-invariant ('extreme') Newman-Penrose scalars.

The structure of the linearized Einstein equations is such that the Teukolsky master equation does not admit a natural variational formulation for higher spin fields, such as the Maxwell and the linearized Einstein fields. As a result the energy methods are not directly applicable for this equation.

In this talk, we shall present the construction of a positive-definite energy for the Teukolsky variables for the Maxwell fields (spin s=1) in the special case of axial symmetry. The origin of this positive-definite energy is a Hamiltonian principle and the construction is based on using certain 'twist' potentials as the main variables as opposed to the vector potential.

JEFF JAUREGUI, Union College (NY)
[Saturday December 6 / samedi 6 décembre, 10:00]
Optimizing capacity with nonnegative scalar curvature

Inspired by Bartnik's well-known problem of minimizing the ADM mass among all asymptotically flat manifolds of nonnegative scalar curvature extending some compact region, we will discuss a complementary problem of maximizing the capacity over the same class of objects. We will also tie this in with joint work with Raquel Perales and Jim Portegies on the upper semicontinuity of capacity for Sormani–Wenger intrinsic flat convergence.

NIKY KAMRAN
[Saturday December 6 / samedi 6 décembre, 8:30]
Global counterexamples to uniqueness for a Calderón problem with C^k conductivities

Let Ω be a bounded subset of $\mathbb{R}^n$ with C^∞ boundary, where $n \geq 3$, and let $\gamma = (\gamma^{ij})$ be a bounded measurable function on $\overline{\Omega}$ taking values in the set $\mathcal{S}_n$ of positive definite $n \times n$ symmetric matrices. The Calderón inverse problem consists in recovering the map γ from the from the knowledge of the Dirichlet-to-Neumann map at fixed frequency for the operator $L_\gamma = -\partial_i(\gamma^{ij}\partial_j)$, up to some gauge equivalences induced by the invariance properties of the Dirichlet-to-Neumann map. We obtain counterexamples to uniqueness for the Calderón problem by showing that for any smooth map γ and any frequency that does not belong to the Dirichlet spectrum of L_γ, there exists, for any $k \geq 1$ and any $\epsilon > 0$, a pair of non gauge-equivalent maps γ_1, γ_2 of class C^k which are ϵ-close to γ in the $C^k(\overline{\Omega}, \mathcal{S}_n)$ topology, such that their Dirichlet-to-Neumann maps are equal. This is joint work with Thierry Daudé (Besançon), Bernard Helffer (Nantes) and François Nicoleau (Nantes).

MARIEM MAGDY, Perimeter Institute for Theoretical Physics
[Sunday December 7 / dimanche 7 décembre, 16:30]
Estimates for spinor fields using the space-spinor formalism

I will discuss ongoing work on estimates for spinor fields obeying first-order equations, formulated within the space–spinor framework. The approach is motivated by the positive commutator method presented in the work of P. Hintz and A. Vasy, originally designed for tensor fields satisfying second-order equations. In this talk, I will outline how these ideas can be adapted to the spinorial setting and how the resulting estimates fit naturally into the first-order structure of the equations.

ARGAM OHANYAN, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 15:00]
On the geometry of continuously differentiable spacetime metrics

Nonsmooth metrics appear naturally in mathematical relativity and spacetime geometry, whether as solutions of Einstein's equations or during the course of physically relevant operations such as spacetime matching. It is important to study their geometry also to give further physical credence to the singularity theorems of Hawking and Penrose. In this talk, we will

discuss the class of continuously differentiable spacetime metrics, for which many important theorems have been established recently. After introducing the main approximation tools and methods of study, we will discuss important applications such as the Hawking and Penrose singularity theorems, the Hawking-Penrose singularity theorem, and the splitting theorem.

This talk is partly based on joint collaborations with Kunzinger, Schinnerl, Steinbauer and with Braun, Gigli, McCann, Sämann.

YAKOV SHLAPENTOKH ROTHMAN, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 16:00]
Polynomial Decay for the Klein-Gordon Equation on the Schwarzschild Black Hole

We will start with a review of previous instability results concerning solutions to the Klein-Gordon equation on rotating Kerr black holes and the corresponding conjectural consequences for the dynamics of the Einstein-Klein-Gordon system. Then we will discuss recent work where we show that, despite the presence of stably trapped timelike geodesics on Schwarzschild, solutions to the corresponding Klein-Gordon equation arising from strongly localized initial data nevertheless decay polynomially. Time permitting we will explain how the proof uses, at a crucial step, results from analytic number theory for bounding exponential sums. The talk is based on joint work(s) with Federico Pasqualotto and Maxime Van de Moortel.

RYAN UGNER, University of California, Berkeley
[Saturday December 6 / samedi 6 décembre, 16:30]

JAMES WHEELER, University of Michigan
[Sunday December 7 / dimanche 7 décembre, 15:30]
Asymptotically Euclidean Solutions of the Constraint Equations with Prescribed Asymptotics

I will discuss ongoing work on the construction of asymptotically flat vacuum initial data sets in General Relativity via the conformal method. My collaborators (Lydia Bieri, David Garfinkle, Jim Isenberg, and David Maxwell) and I have demonstrated that certain asymptotic structures may be prescribed a priori through the method's seed data, including the ADM momentum components, the leading- and next-to-leading-order decay rates, and anisotropy in the metric's mass term, yielding a recipe to construct initial data sets with desired asymptotics. As an application, we discuss a simple numerical example, with stronger asymptotics than have been presented in previous work, of an initial data set whose evolution does not exhibit the conjectured antipodal symmetry between future and past null infinity.

ERIC WOOLGAR, University of Alberta
[Saturday December 6 / samedi 6 décembre, 9:00]
Marginally outer trapped surfaces governed by Bakry-Émery Ricci curvature bounds

Recent efforts to define energy conditions synthetically often assume a reference measure on spacetime. In the smooth context, reference measures arise in many applications. In a warped product (Kaluza-Klein) spacetime the reference measure describes the volume of the fibre (internal space), and in conformally invariant formulations of some classical theorems the reference measure provides a conformal scale factor. The corresponding generalization of Ricci curvature is the Bakry-Émery Ricci curvature. Using this approach, I will give a conformally invariant formulation of the Penrose singularity theorem and then explore constraints on horizon topology when the dominant energy condition is replaced by a Bakry-Émery type condition. This can be thought of as the dominant energy condition applied only to "base null directions" in a warped product.

The talk is based on recent work with Eric Ling and Argam Ohanyan.

Mathematics of Machine Learning
Mathématiques de l'apprentissage automatique

Org: Ben Adcock (Simon Fraser University), **Ricardo Baptista** (University of Toronto) and/et **Giang Tran** (University of Waterloo)

Despite the profound impact of machine learning on many different sectors including scientific research, industry, and policy-making, its mathematical foundations are still far from being well understood. By bringing together researchers with diverse backgrounds, this session explores emerging ideas aimed at reducing the gap between theory and practice in this fast-growing and exciting field.

Malgré l'impact profond de l'apprentissage automatique sur de nombreux secteurs différents, notamment la recherche scientifique, l'industrie et l'élaboration des politiques, ses fondements mathématiques sont encore loin d'être bien compris. En réunissant des chercheur(euse)s issu(e)s d'horizons divers, cette session explore les idées émergentes visant à réduire l'écart entre la théorie et la pratique dans ce domaine passionnant et en pleine expansion.

Schedule/Horaire — Room/Salle: Wren A

Saturday December 6 — samedi 6 décembre

8:30 - 9:00	Isaac Gibbs (University of California, Berkeley), *Designing probabilistic predictors for multiple decision makers* (p. 130)
9:00 - 9:30	Hung-Hsu Chou (University of Pittsburgh), *More is Less: Understanding Compressibility of Neural Networks via Implicit Regularization and Neural Collapse* (p. 129)
9:30 - 10:00	Rachel Morris (Concordia University), *Regularity guarantees for adversarially robust learning* (p. 132)
10:00 - 10:30	Yunan Yang (Cornell University), *Training Distribution Optimization in the Space of Probability Measures* (p. 133)
15:00 - 15:30	Cameron Musco (University of Massachusetts Amherst), *Structured Matrix Approximation via Matrix-Vector Products* (p. 132)
15:30 - 16:00	Alex Townsend (Cornell University), *A Mathematical Guide to Operator Learning* (p. 133)
16:00 - 16:30	Avi Gupta (Simon Fraser University), *Universal Nonlinear Learning of High-Dimensional Anisotropic Sobolev Functions from Point Samples* (p. 130)
16:30 - 17:00	Anastasis Kratsios (McMaster University), *Incremental Generation is Necessity and Sufficient for Universality in Flow-Based Modelling* (p. 131)
17:00 - 17:30	Mohamed Hibat-Allah (University of Waterloo), *Language models for quantum many-body physics* (p. 130)
17:30 - 18:00	Spencer Hill (Queen's University), *Communication Complexity of Exact Sampling under Exponential Cost* (p. 131)

Sunday December 7 — dimanche 7 décembre

8:30 - 9:00	Matthew Thorpe (Warwick University), *How Many Labels Do You Need in Semi-Supervised Learning ?* (p. 133)
9:00 - 9:30	Sophie Morin (Polytechnique Montreal), *Equivariant machine learning for collision detection of ellipses and related shapes* (p. 131)
9:30 - 10:00	Esha Saha (University of Alberta), *Data-Driven Solutions to Coupled PDEs using Disjoint Priors* (p. 132)
10:00 - 10:30	Shikhar Jaiswal (University of Toronto), *Understanding The Modality Gap In Multi-Modal Systems* (p. 131)

Abstracts/Résumés

Mathematics of Machine Learning
Mathématiques de l'apprentissage automatique

HUNG-HSU CHOU, University of Pittsburgh
[Saturday December 6 / samedi 6 décembre, 9:00 – Wren A]
More is Less: Understanding Compressibility of Neural Networks via Implicit Regularization and Neural Collapse

Despite their recent successes, most modern machine learning algorithms lack theoretical guarantees, which are crucial to further development towards delicate tasks. One mysterious phenomenon is that, among infinitely many possible ways to fit data, the algorithms often find the "good" ones, even when the definition of "good" is not specified by the designers. In this talk I will approach this from both the microscopic view and the macroscopic view, with empirical and theoretical study of the connection between the good solutions in neural networks and the sparse solutions in compressed sensing. The key concepts are the implicit bias/regularization in machine learning models, and the neural collapse phenomenon induced by the block structure of neural tangent kernel, which can be used for out-of-distribution detection.

ISAAC GIBBS, University of California, Berkeley
[Saturday December 6 / samedi 6 décembre, 8:30 – Wren A]
Designing probabilistic predictors for multiple decision makers

We consider the problem of constructing probabilistic predictions that lead to accurate decisions when employed by downstream users to inform actions. For a single decision maker, designing an optimal predictor is equivalent to minimizing a proper loss function corresponding to the negative utility of that individual. For multiple decision makers, our problem can be viewed as a variant of omniprediction in which the goal is to design a single predictor that simultaneously minimizes multiple losses. We will discuss two strategies for designing sample-efficient algorithms for this problem. The first is a two-player game based approach in which the two players alternate between estimating and responding to the worst-case loss. The second is a more direct procedure that exploits structural properties of the set of proper losses. Empirical evaluations show that both of these methods perform well in practice.

AVI GUPTA, Simon Fraser University
[Saturday December 6 / samedi 6 décembre, 16:00 – Wren A]
Universal Nonlinear Learning of High-Dimensional Anisotropic Sobolev Functions from Point Samples

A central problem in scientific machine learning is high-dimensional function recovery from limited data. Widths, an important concept from information-based complexity, provide a standard way to quantify this. At the same time, universal approximation theorems highlight the representational power of nonlinear models such as neural networks and have become a central theme in machine learning. In anisotropic settings, where different coordinates exhibit different smoothness, universality questions arise naturally. In this work, we study them for recovery from point samples (standard information) in periodic Sobolev spaces with anisotropic smoothness, including both anisotropic Sobolev and anisotropic mixed-smoothness Sobolev spaces. Our approach is a theoretical nonlinear reconstruction scheme inspired by compressed sensing, for which we derive worst-case upper bounds on the recovery error. We prove a universal approximation result by showing that our nonlinear reconstruction map achieves asymptotically better error guarantees, simultaneously over a family of anisotropic smoothness classes, than any linear method, thus justifying nonlinear algorithms for universal approximation in such spaces. In terms of widths, we establish matching upper and lower bounds for nonlinear widths, thereby identifying the optimal performance of sampling-based recovery on these spaces. Such results on nonlinear widths in anisotropic settings have been largely absent, so our bounds are of concrete interest for sampling recovery and their learning-theoretic applications.

MOHAMED HIBAT-ALLAH, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 17:00 – Wren A]
Language models for quantum many-body physics

Recent large language models have achieved remarkable success, performing at near-human levels on many tasks such as speech recognition, machine translation, and text generation. In this talk, I will show how we can adapt language-model architectures,

particularly recurrent neural networks (RNNs), to study quantum many-body systems. By training these models on quantum many-body physics problems, we obtain results that are competitive with traditional numerical quantum simulation methods. This progress highlights the exciting possibility of bringing insights from modern language models to quantum simulation.

SPENCER HILL, Queen's University
[Saturday December 6 / samedi 6 décembre, 17:30 – Wren A]
Communication Complexity of Exact Sampling under Exponential Cost

Exact sampling is the problem of communicating a message so that, given a shared source of randomness, a receiver can generate a random sample with a prescribed probability distribution. This problem arises naturally in many forms of learned data compression, most notably as a promising alternative to quantization in nonlinear transform coding.

In this talk, I will describe some applications of exact sampling in machine learning and several state-of-the-art sampling algorithms. I will provide an overview of recent work in the exponential cost setting, presenting matching upper and lower bounds and discussing surprising differences in algorithm performance in this generalized setup.

SHIKHAR JAISWAL, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 10:00 – Wren A]
Understanding The Modality Gap In Multi-Modal Systems

Multi-modal systems are integral components of machine learning models that process information from various data modalities, like text, images and audio by mapping these inputs into a shared representation space. Inherent to the development of these systems is the phenomenon of "modality gap", wherein, image embeddings and text embeddings are "distributed" differently within the shared representation space. This "gap" between the learnt representations has detrimental consequences for downstream tasks like search, retrieval and recommendation. While several empirical studies have attributed this phenomenon to the inherent difference in the distributional richness of the modalities, the mathematical analysis of its origins remains limited. In this talk, we will (i) define the modality gap in a generalized way, with a focus on its effect for downstream applications ; (ii) present recent studies to better understand and mitigate this issue ; and (iii) analyze the problem under simplifying assumptions regarding the network architecture and data distribution.

ANASTASIS KRATSIOS, McMaster University
[Saturday December 6 / samedi 6 décembre, 16:30 – Wren A]
Incremental Generation is Necessity and Sufficient for Universality in Flow-Based Modelling

Incremental flow-based denoising models have reshaped generative modelling, but their empirical advantage still lacks a rigorous approximation-theoretic foundation. We show that incremental generation is necessary and sufficient for universal flow-based generation on the largest natural class of self-maps of $[0,1]^d$ compatible with denoising pipelines, namely the orientation-preserving homeomorphisms of $[0,1]^d$. All our guarantees are uniform on the underlying maps and hence imply approximation both samplewise and in distribution.

Using a new topological-dynamical argument, we first prove an impossibility theorem: the class of all single-step autonomous flows, independently of the architecture, width, depth, or Lipschitz activation of the underlying neural network, is meagre and therefore not universal in the space of orientation-preserving homeomorphisms of $[0,1]^d$. By exploiting algebraic properties of autonomous flows, we conversely show that every orientation-preserving Lipschitz homeomorphism on $[0,1]^d$ can be approximated at rate $\mathcal{O}(n^{-1/d})$ by a composition of at most K_d such flows, where K_d depends only on the dimension. Under additional smoothness assumptions, the approximation rate can be made dimension-free, and K_d can be chosen uniformly over the class being approximated. Finally, by linearly lifting the domain into one higher dimension, we obtain structured universal approximation results for continuous functions and for probability measures on $[0,1]^d$, the latter realized as pushforwards of empirical measures with vanishing 1-Wasserstein error.

Joint work: Hossein Rouhvarzi

SOPHIE MORIN, Polytechnique Montréal
[Sunday December 7 / dimanche 7 décembre, 9:00 – Wren A]
Equivariant machine learning for collision detection of ellipses and related shapes

Computing the distance between two objects in space, in particular determining whether they have collided or are very close to doing so, is essential in a wide range of computational applications. It is trivial when the objects are spheres, line segments, or other very simple shapes, and good algorithms are known for polytopes. However, something as apparently simple as the distance between two ellipses in the plane remains surprisingly difficult if one wants both speed and accuracy. In this talk, I will discuss an equivariant machine learning framework for this problem and present some results from ongoing work.

RACHEL MORRIS, Concordia University
[Saturday December 6 / samedi 6 décembre, 9:30 – Wren A]
Regularity guarantees for adversarially robust learning

While neural network image classification enjoys high success rates in most settings, recent work discovered that well-targeted adversarial attacks can transform a correctly classified image into one that is visually indistinguishable from the original but that completely fools the classification algorithm. This has sparked many new approaches to classification which include an adversary in the training process: such an adversary can improve robustness and generalization properties, at the cost of decreased accuracy and increased training time. By considering a "worst-case" adversary, the resulting mathematical model for adversarial training can be understood as an energy minimization problem with a regularizing nonlocal perimeter term. In this presentation, I will discuss my current work studying regularity guarantees for the decision boundary of an adversarially robust minimizer. In particular, for a continuous and bounded underlying density, the decision boundary is C^2 smooth. I will discuss using explicit geometric perturbations and second variation analysis to show singular points (i.e. corners, cusps) are suboptimal. For the smoother points, I will demonstrate how leveraging necessary conditions allows one to upgrade C^1 regularity to C^2 regularity.

CAMERON MUSCO, University of Massachusetts Amherst
[Saturday December 6 / samedi 6 décembre, 15:00 – Wren A]
Structured Matrix Approximation via Matrix-Vector Products

In this talk, I will give an overview of recent progress on the problem of structured matrix approximation from matrix-vector products. Given a target matrix A that can only be accessed through a limited number of (possibly adaptively chosen) matrix-vector products, we seek to find a near-optimal approximation to A from some structured matrix class – e.g., a low-rank approximation, a hierarchical low-rank approximation, a sparse or diagonal approximation, etc. This general problem arises across the computational sciences and data science, both in algorithmic applications and, more recently, in scientific machine learning, where it is closely related to the problem of linear operator learning from input/output samples.

I will overview recent work, where we give 1) optimal algorithms for approximating A with a matrix with a fixed sparsity pattern (e.g., a diagonal or banded matrix), 2) the first algorithms with strong relative error bounds for hierarchical low-rank approximation, and 3) the first bounds for generic structured families with sample complexity depending on the parametric complexity of the family. I will highlight several open questions on structured matrix approximation and its applications to operator learning.

ESHA SAHA, University of Alberta
[Sunday December 7 / dimanche 7 décembre, 9:30 – Wren A]
Data-Driven Solutions to Coupled PDEs using Disjoint Priors

Advances in data acquisition and computational power have led to a rapid increase in high-dimensional (ODE or PDE) modelling. In many applications, especially in biological and ecological modeling, the primary challenge is not data unavailability but the

existence of data that is incomplete, making it either useless or the entire data collection effort a waste of resources. Complex phenomena are often described by coupled (or more) variables, yet only a subset is supported by known governing equations, while the remaining variables are available only through data. This mismatch between known physics and observed data creates difficulties for finding solutions to the model, even with the well-known physics-informed machine learning techniques since they typically assume full knowledge of either the system physics or complete data across all variables. In this presentation, I will discuss some ground challenges in modelling partially observed, coupled systems and demonstrate how a neural-network-based approach can effectively solve them even when the variables constrained by physics and those informed by data are mutually exclusive.

MATTHEW THORPE, University of Warwick
[Sunday December 7 / dimanche 7 décembre, 8:30 – Wren A]
How Many Labels Do You Need in Semi-Supervised Learning ?

Semi-supervised learning (SSL) is the problem of finding missing labels from a partially labelled data set. The heuristic one uses is that "similar feature vectors should have similar labels". The notion of similarity between feature vectors explored in this talk comes from a graph-based geometry where an edge is placed between feature vectors that are closer than some connectivity radius. A natural variational solution to the SSL is to minimise a Dirichlet energy built from the graph topology. And a natural question is to ask what happens as the number of feature vectors goes to infinity ? In this talk I will give results on the asymptotics of graph-based SSL using an optimal transport topology. The results will include a lower bound on the number of labels needed for consistency.

ALEX TOWNSEND, Cornell University
[Saturday December 6 / samedi 6 décembre, 15:30 – Wren A]
A Mathematical Guide to Operator Learning

A fundamental challenge in modern scientific computing is learning an operator from finite data. In this talk, we offer a mathematical guide to operator learning, drawing a distinction between passive and active observation models and revealing the crucial role this choice plays in sample efficiency. We explore how the nature of the underlying partial differential equation, i.e., elliptic, parabolic, or hyperbolic, governs the difficulty of learning the associated solution operator, and we present recent learning theory that quantifies the number of queries needed for accurate recovery. Diffusive systems, as we shall see, are forgiving ; wave-like systems are not. Along the way, we reflect on what it means to learn in infinite dimensions and how mathematical structure can be exploited to tame the curse of dimensionality.

YUNAN YANG, Cornell University
[Saturday December 6 / samedi 6 décembre, 10:00 – Wren A]
Training Distribution Optimization in the Space of Probability Measures

A central question in data-driven modeling is: from which probability distribution should training samples be drawn to most effectively approximate a target function or operator ? This work addresses this question in the setting where "effectiveness" is measured by out-of-distribution (OOD) generalization accuracy across a family of downstream tasks. We formulate the problem as minimizing the expected OOD generalization error, or an upper bound thereof, over the space of probability measures. The optimal sampling distribution depends jointly on the model class (e.g., kernel regressors, neural networks), the evaluation metric, and the target map itself. Building on this characterization, we propose two adaptive, target-dependent data selection algorithms based on bilevel and alternating optimization. The resulting surrogate models exhibit significantly improved robustness to distributional shifts and consistently outperform models trained with conventional, non-adaptive, or target-independent sampling across benchmark problems in function approximation, operator learning, and inverse modeling.

NSERC-CSE Research Communities: Robust, Secure and Safe Artificial Intelligence and Exploratory Analysis of Unstructured Data
Communautés de recherche CRSNG-CSE : Intelligence artificielle robuste, sécurisée et sûre et analyse exploratoire des données non structurées

Org: Camille Archambault (McGill University), **Steven Ding** (McGill School of Information Studies) and/et **David Thomson** (Tutte Institute for Mathematics and Computing)

The NSERC-CSE Research Communities are multi-institutional collaborations in related domains. The first NSERC-CSE Research Community on Robust, Secure and Safe Artificial Intelligence was awarded to the project "An End-to-End Approach for Safe and Secure AI" and the second NSERC-CSE Research Community on Exploratory Analysis of Unstructured Data was awarded to the project "ZenithVector: Advanced Vectorization, Embedding, and Cybersecurity Analytics Toolkit for Scalable Intelligence." This session will highlight the mathematical underpinnings and recent advances at the nexus of these rich and timely areas.

Les communautés de recherche CRSNG-CSE sont des collaborations multi-institutionnelles dans des domaines connexes. La première communauté de recherche CRSNG-CSE sur l'intelligence artificielle robuste, sécurisée et sûre a été attribuée à un projet sur une approche de bout en bout pour rendre les systèmes d'IA sûrs et sécurisés, et la deuxième communauté de recherche CRSNG-CSE sur l'analyse exploratoire des données non structurées a été attribuée à un projet intitulé « ZenithVector: Advanced Vectorization, Embedding, and Cybersecurity Analytics Toolkit for Scalable Intelligence ». Cette session mettra en lumière les fondements mathématiques et les avancées récentes à la croisée de ces domaines riches et d'actualité.

Schedule/Horaire — Room/Salle: Stevenson

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Opening Remarks (p. 137)
8:30 - 9:00	John Healy (Tutte Institute for Mathematics and Computing), *Exploiting distortions in clustering and dimension reduction for unstructured data* (p. 136)
9:00 - 9:30	Kaleb Ruscitti (University of Waterloo), *Modifying Mapper for Temporal Topic Modelling* (p. 137)
9:30 - 10:00	Paul McNicholas (McMaster University), *Clustering and Dimension Reduction* (p. 136)
10:00 - 10:30	Sanjeena Dang (Carleton University), *Clustering compositional data with a logistic normal multinomial mixture model with an underlying latent factor structure* (p. 135)
15:00 - 15:30	Gerald Penn (University of Toronto), *Predicting Levenshtein Edit Sequences for Fine-Grained Estimation of Automatic Speech Recognition Error* (p. 136)
15:30 - 16:00	Toryn Qwyllyn Klassen (University of Toronto), *Remembering to Be Fair: Non-Markovian Fairness in Sequential Decision Making* (p. 136)
16:00 - 16:30	Benjamin Cookson (University of Toronto), *Unifying Proportional Fairness in Centroid and Non-Centroid Clustering* (p. 135)
16:30 - 17:00	Benoit Hamelin (Tutte Institute for Mathematics and Computing), *Representation of cyber defense telemetry for exploration tasks* (p. 136)
17:00 - 17:30	Camille Archambault (McGill University), *An Agentic Pipeline Combining GraphRAG and UMAP for Explainable Vulnerability Discovery in Low-Level Code.* (p. 134)
17:30 - 18:00	Steven Ding (McGill University) (p. 135)

Abstracts/Résumés

CAMILLE ARCHAMBAULT, McGill University

[Sunday December 7 / dimanche 7 décembre, 17:00 – Stevenson]

An Agentic Pipeline Combining GraphRAG and UMAP for Explainable Vulnerability Discovery in Low-Level Code.

Identifying the root cause of vulnerabilities in low-level code is difficult, time-consuming, and requires expert knowledge. Understanding the cause, not just the visible symptom, is essential for patching and analyzing security impact. However,

low-level code provides little structural context: during compilation, programs are re-organized into many small blocks, and a vulnerability may appear in one location even though its true cause lies elsewhere. Existing tools typically highlight where the problem is detected but cannot trace the underlying source-sink chain that leads to it. With the rise of Large Language Models (LLMs), new opportunities emerge for automating vulnerability discovery while improving transparency in vulnerability analysis.

To address this challenge, we treat the binary and its low-level code as a searchable knowledge base that the LLM can query during analysis. However, because vulnerability causes span long chains across multiple functions, standard RAG is insufficient. We therefore turned to GraphRAG, which incorporates graph relationships between code elements but is computationally expensive on large graphs and still lacks a global semantic view of the program. Our pipeline therefore also leverages UMAP to organize code embeddings into a compact semantic space. This combination allows the agent to quickly identify relevant blocks of code before performing focused graph traversal, enabling more efficient discovery of source-sink paths and producing more interpretable explanations of low-level vulnerabilities.

This work is part of an ongoing master's thesis project and presents a research direction for explainable vulnerability discovery in assembly code, laying the foundation for future implementation and evaluation.

BENJAMIN COOKSON, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 16:00 – Stevenson]
Unifying Proportional Fairness in Centroid and Non-Centroid Clustering

Proportional fairness criteria inspired by democratic ideals of proportional representation have received growing attention in the clustering literature. Prior work has investigated them in two separate paradigms. Chen et al. (2019) study centroid clustering, in which each data point's loss is determined by its distance to a representative point (centroid) chosen in its cluster. Caragiannis et al. (2024) study non-centroid clustering, in which each data point's loss is determined by its maximum distance to any other data point in its cluster.

We generalize both paradigms to introduce semi-centroid clustering, in which each data point's loss is a combination of its centroid and non-centroid losses, and study two proportional fairness criteria, the core and, its relaxation, fully justified representation (FJR). Our main result is a novel algorithm which achieves a constant approximation to the core, in polynomial time, even when the distance metrics used for centroid and non-centroid loss measurements are different. We also derive improved results for more restricted loss functions and the weaker FJR criterion, and establish lower bounds in each case.

Based on joint work with Nisarg Shah and Ziqi Yu

SANJEENA DANG, Carleton University
[Sunday December 7 / dimanche 7 décembre, 10:00 – Stevenson]
Clustering compositional data with a logistic normal multinomial mixture model with an underlying latent factor structure

The human microbiome plays a crucial role in health and disease. Advances in next-generation sequencing technologies have made it possible to quantify microbiome composition with high resolution. Clustering microbiome data can uncover meaningful patterns across samples, offering insights into biological variability and disease mechanisms. However, this task presents several challenges. Microbiome data are typically high-dimensional, over-dispersed, and compositional, reflecting relative abundances. As such, analyzing such compositional data presents many challenges because they are restricted to a simplex, which complicates standard statistical analysis. Here, we develop a family of logistic normal multinomial factor analyzers (LNM-FA) by incorporating a factor analyzer structure. The family of models is suitable for high-dimensional microbiome data, as the number of parameters in LNM-FA can be greatly reduced by assuming that the underlying latent factors are small. Parameter estimation is done using a computationally efficient variant of the alternating expectation conditional maximization algorithm that utilizes variational Gaussian approximation. The proposed method is illustrated using simulated and real datasets.

NSERC-CSE Research Communities: Robust, Secure and Safe Artificial Intelligence and Exploratory Analysis of Unstructured Data
Communautés de recherche CRSNG-CSE : Intelligence artificielle robuste, sécurisée et sûre et analyse exploratoire des données non structurées

---

STEVEN DING, McGill University
[Sunday December 7 / dimanche 7 décembre, 17:30 – Stevenson]

BENOIT HAMELIN, Tutte Institute for Mathematics and Computing
[Sunday December 7 / dimanche 7 décembre, 16:30 – Stevenson]
Representation of cyber defense telemetry for exploration tasks

Cyber defense of networks relies on the acquisition of large quantities of system telemetry, providing visibility into events that reveal intrusions. We present here a simple methodology for building a representation of salient objects that enables identifying *interesting* activity through an explorative lens. This approach organizes anomalies along similarity axes, while emphasizing features that distinguish objects from others. The methodology leverages labelling of routine activity, providing factual documentation of the baseline of systems as observed by sensors. Anomalous objects, among which lie traces of intrusions, are thus expressed through a vocabulary of modes of normal behaviour they are similar to, facilitating their interpretation.

JOHN HEALY, Tutte Institute for Mathematics and Computing
[Sunday December 7 / dimanche 7 décembre, 8:30 – Stevenson]
Exploiting distortions in clustering and dimension reduction for unstructured data

Understanding data is crucial for generating useful hypotheses and identifying various problems and biases that may be present in a dataset. Unstructured data can make this exploration challenging, but recent advances in vectorization methods have enabled the conversion of unstructured data into meaningful vector representations. Dimension reduction and clustering algorithms are powerful techniques for exploring and gaining insights from such vectorized data. However, these techniques inherently distort data—sometimes in useful ways, and sometimes problematically. In this talk, we examine the strengths, assumptions, and distortions inherent in some of the most popular clustering and dimension reduction techniques with a focus on some of the methods developed at the Tutte Institute.

TORYN QWYLLYN KLASSEN, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 15:30 – Stevenson]
Remembering to Be Fair: Non-Markovian Fairness in Sequential Decision Making

Fair decision making has largely been studied with respect to a single decision. Here we investigate the notion of fairness in the context of sequential decision making where multiple stakeholders can be affected by the outcomes of decisions. We observe that fairness often depends on the history of the sequential decision-making process, and in this sense that it is inherently non-Markovian. We further observe that fairness often needs to be assessed at time points within the process, not just at the end of the process. To advance our understanding of this class of fairness problems, we explore the notion of non-Markovian fairness in the context of sequential decision making. We identify properties of non-Markovian fairness, including notions of long-term, anytime, periodic, and bounded fairness. We explore the interplay between non-Markovian fairness and memory and how memory can support construction of fair policies. Finally, we introduce the FairQCM algorithm, which can automatically augment its training data to improve sample efficiency in the synthesis of fair policies via reinforcement learning.

This is joint work with Parand A. Alamdari, Elliot Creager, and Sheila A. Mcilraith.

PAUL MCNICHOLAS, McMaster University
[Sunday December 7 / dimanche 7 décembre, 9:30 – Stevenson]
Clustering and Dimension Reduction

An overview of some important concepts in clustering and dimension reduction. Some recent research and examples are discussed.

NSERC-CSE Research Communities: Robust, Secure and Safe Artificial Intelligence and Exploratory Analysis of Unstructured Data
Communautés de recherche CRSNG-CSE : Intelligence artificielle robuste, sécurisée et sûre et analyse exploratoire des données non structurées

---

GERALD PENN, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 15:00 – Stevenson]
Predicting Levenshtein Edit Sequences for Fine-Grained Estimation of Automatic Speech Recognition Error

The predominant method for scoring the quality of automatic speech recognition (ASR) transcripts when ground-truth labels are not available is to predict the word error rate (WER) from the corresponding audio segment. We propose WAV2LEV, a novel paradigm for WER estimation which predicts the underlying sequences of Levenshtein edit operations (substitutions, deletions, insertions and matches) from which the WER can be computed. This approach offers more fine-grained token-level error estimation in comparison to previous work without compromising on performance for WER estimation. To support this investigation, we present Mini-CNoiSY (Miniature Clean-Noisy Speech from YouTube), a bespoke 353 hour noisy speech corpus which ensures confidence in ground-truth labeling and captures a diverse range of noise artifacts which degrade ASR performance. Our results show that WAV2LEV achieves near state-of-the-art performance for the task of WER estimation with a root mean square error (RMSE) of 0.1706 and a Pearson correlation coefficient (PCC) of 87.42

OPENING REMARKS,
[Sunday December 7 / dimanche 7 décembre, 8:00 – Stevenson]

KALEB RUSCITTI, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 9:00 – Stevenson]
Modifying Mapper for Temporal Topic Modelling

In this talk, I will discuss how the Mapper algorithm can be used to model the evolution of topics in a corpus of documents over time. Many real-world corpora have document publication frequency that varies locally in semantic space, and this makes it difficult to select appropriate parameters for Mapper. I will describe my proposed modification of Mapper that removes the assumption of a single resolution scale across semantic space and improves the robustness of the results under change of parameters, as well as how this improves Mapper's utility for temporal topic modelling of real-world datasets.

New trends in Analysis
Nouvelles tendances en matière d'analyse

Org: Almut Buchard (University of Toronto) and/et **Angel Martinez** (CUNEF Universidad, Madrid)

This session will bring together the sparse community of outlier analysts, whose problems and techniques touch upon other areas without fully belonging to them. In particular, we expect mathematicians interested in spectral, convex, geometric and variational problems to join this session.

Schedule/Horaire **Room/Salle: Wren B**

Monday December 8 **lundi 8 décembre**

8:00 - 8:30	Dmitry Jakobson (McGill University), *Nodal solutions of Yamabe equations and curvature prescription* (p. 138)
8:30 - 9:00	Jérôme Vetois (McGill University), *Nonexistence of extremals for the second conformal eigenvalue in low dimensions* (p. 139)
9:30 - 10:00	Robert Haslhofer (University of Toronto), *Free boundary minimal disks in convex balls* (p. 138)
10:00 - 10:30	Bruno Staffa (Rice University), *Density and equidistribution of closed geodesics and stationary geodesic nets* (p. 139)
15:00 - 15:30	Dan Mangoubi (The Hebrew University), *On common roots of Legendre polynomials* (p. 139)
15:30 - 16:00	Alba Dolores García Ruiz (CUNEF Universidad), *High-Energy Laplace Eigenfunctions on Integrable Billiards* (p. 139)
16:30 - 17:00	John Toth (McGill University), L^2 *restriction bounds for analytic continuations of quantum ergodic Laplace eigenfunctions.* (p. 139)
17:00 - 17:30	Francisco Torres de Lizaur (Universidad de Sevilla), *Symmetries of eigenfunctions* (p. 138)

Abstracts/Résumés

FRANCISCO TORRES DE LIZAUR, Universidad de Sevilla
[Monday December 8 / lundi 8 décembre, 17:00 – Wren B]
Symmetries of eigenfunctions

The symmetry conjecture asks whether, on a closed Riemannian manifold, the signs of laplace eigenfunction in the $\lambda \to \infty$ limit are evenly distributed. In the talk I will report on recent progress on this question and related problems on the properties of the value distribution of eigenfunctions. This is joint work with Ángel David Martínez.

ROBERT HASLHOFER, University of Toronto
[Monday December 8 / lundi 8 décembre, 9:30 – Wren B]
Free boundary minimal disks in convex balls

The classical Lusternik-Schnirelman theorem says that any 2-sphere equipped with an arbitrary metric contains at least 3 embedded geodesic loops. Moving up one dimension, Yau asked about the existence of multiple embedded minimal surfaces of simple topology, namely minimal 2-spheres in 3-spheres or minimal 2-disks in 3-balls. In this talk, I will discuss joint work with Dan Ketover, where we show that every strictly convex 3-ball with nonnegative Ricci-curvature contains at least 3 embedded free boundary minimal 2-disks for any generic metric, and at least 2 solutions even without genericity assumption. Our approach combines ideas from min-max theory, geometric flows, and degree theory.

New trends in Analysis
Nouvelles tendances en matière d'analyse

DMITRY JAKOBSON, McGill
[Monday December 8 / lundi 8 décembre, 8:00 – Wren B]
Nodal solutions of Yamabe equations and curvature prescription

We discuss several old and new results about conformal invariants arising from nodal solutions of Yamabe type equations, and applications to curvature prescription

DAN MANGOUBI, Hebrew University
[Monday December 8 / lundi 8 décembre, 15:00 – Wren B]
On common roots of Legendre polynomials

Let S be a closed Riemannian surface, and $\gamma \subset S$ be a curve. An old question in Spectral Geometry asks how many Laplace eigenfunctions can vanish on γ. Bourgain and Rudnick showed that on the flat torus $\mathbb{T}^2$ this number is finite unless γ is a closed geodesic. A conjecture by Stieltjes says that no two zonal spherical harmonics may vanish on the same small circle, or in arithmetic terms, no two Legendre polynomials share a non-zero common root. We show that the number of Legendre polynomials which share any given non-zero root is finite. The talk is based on joint work in progress with Borys Kadets.

ALBA DOLORES GARCÍA RUIZ, CUNEF Universidad
[Monday December 8 / lundi 8 décembre, 15:30 – Wren B]
High-Energy Laplace Eigenfunctions on Integrable Billiards

A famous conjecture by Berry suggests that, in chaotic dynamical systems, Laplace eigenfunctions, with specific boundary conditions, resemble to random monochromatic waves ; however, this behavior is generally not expected in integrable dynamical systems. Here, we explore the behavior of high-energy eigenfunctions and their connection to Berry's random wave model. In particular, we study a related property, which we call Inverse Localization, describing how eigenfunctions can approximate monochromatic waves in small regions of the domain.

BRUNO STAFFA, Rice University
[Monday December 8 / lundi 8 décembre, 10:00 – Wren B]
Density and equidistribution of closed geodesics and stationary geodesic nets

This talk will be about the distribution of closed geodesics and stationary geodesic nets in a closed Riemannian manifold (M, g). When $\dim(M) = 2$, together with Xinze Li we could prove that for a generic metric g, there exists an equidistributed sequence of closed geodesics in (M, g). When $\dim(M) \geq 3$, in collaboration with Yevgeny Liokumovich we showed that stationary geodesic nets (which are analogs of closed geodesics whose domain is a graph instead of a circle) are dense. In fact, one can obtain generic equidistribution of these objects. The main tools used to prove these results were the Almgren Pitts Min-Max Theory (in particular the Weyl Law for the Volume Spectrum) and a Structure Theory for stationary geodesic nets analogous to that of Brian White for minimal submanifolds.

JOHN TOTH, McGill University
[Monday December 8 / lundi 8 décembre, 16:30 – Wren B]
L^2 restriction bounds for analytic continuations of quantum ergodic Laplace eigenfunctions.

We prove a quantum ergodic restriction (QER) theorem for real hypersurfaces $\Sigma \subset X$, where X is the Grauert tube associated with a real-analytic, compact Riemannian manifold. As an application, we obtain h independent upper and lower bounds for the L^2 - restrictions of the FBI transform of quantum ergodic Laplace eigenfunctions restricted to Σ satisfying certain generic geometric conditions. This is joint work with X. Xiao.

JÉRÔME VETOIS, McGill University
[Monday December 8 / lundi 8 décembre, 8:30 – Wren B]
Nonexistence of extremals for the second conformal eigenvalue in low dimensions

In this talk, we will consider the second conformal eigenvalue on a closed Riemannian manifold of positive Yamabe type and dimension greater than or equal to 3. The second conformal eigenvalue is defined as the infimum of the second eigenvalue of the conformal Laplacian in a conformal class of metrics with renormalized volume. We will discuss a recent result showing that this infimum is not attained for metrics close to the round metric on the sphere in dimensions 3 to 10, which contrasts sharply with the situation in dimensions greater than or equal to 11, where Ammann and Humbert obtained the existence of minimizers on any closed nonlocally conformally flat manifold. This is a joint work with Bruno Premoselli (Université Libre de Bruxelles).

Number Theory by Early Career Researchers
Théorie des nombres par des chercheurs en début de carrière

Org: Jérémy Champagne, **AJ Fong** and/et **Zhenchao Ge** (University of Waterloo)

This session provides a platform for early-career researchers, including PhD students nearing graduation, recent PhD graduates and postdoctoral fellows, to present their work in number theory. With contributions spanning algebraic and analytic number theory, as well as arithmetic geometry and other related topics, we aim to foster collaboration, exchange ideas and offer a space for networking. This is an excellent opportunity for young researchers to gain visibility and engage with the broader number theory community.

Cette session offre une plateforme aux chercheur(euse)s en début de carrière, notamment aux doctorant(e)s en fin de cursus, aux jeunes docteur(e)s et aux postdoctorant(e)s, pour présenter leurs travaux en théorie des nombres. Avec des contributions couvrant la théorie algébrique et analytique des nombres, ainsi que la géométrie arithmétique et d'autres sujets connexes, nous souhaitons favoriser la collaboration, l'échange d'idées et offrir un espace de réseautage. Il s'agit d'une excellente occasion pour les jeunes chercheur(euse)s de se faire connaître et d'entrer en contact avec la communauté plus large de la théorie des nombres.

Schedule/Horaire **Room/Salle: Rosetti C**

Sunday December 7 / dimanche 7 décembre

8:00 - 8:30	Emily Quesada-Herrera (University of Lethbridge), *On the vertical distribution of the zeros of the Riemann zeta-function* (p. 145)
8:30 - 9:00	Jose Cruz (University of Calgary), *A tale on trascendence and arithmetic equivalence* (p. 142)
9:00 - 9:30	Fatemeh Jalalvand (University of Calgary), *Shape of log-unit lattices in D_6 fields* (p. 144)
9:30 - 10:00	Paul Péringuey, *Joint distributions of error terms for primes in arithmetic progressions modulo 11* (p. 144)
10:00 - 10:30	Félix Baril Boudreau (CICMA & Université du Luxembourg), *Abelian varieties with homotheties* (p. 142)
15:00 - 15:30	Kyle Yip (Georgia Tech), *Diophantine tuples and Diophantine powersets* (p. 146)
15:30 - 16:00	Alex Cowan (University of Waterloo), *Murmurations from functional equations* (p. 142)
16:00 - 16:30	Keira Gunn (Mt Royal University), *Some Results in Dynamics of the Positive Characterstic Tori* (p. 143)
16:30 - 17:00	Ali Alsetri (University of Kentucky), *Burgess-type character sum estimates over generalized arithmetic progressions of rank 2.* (p. 142)
17:00 - 17:30	Nicol Leong (University of Lethbridge), *On some results involving the Riemann zeta function and the Mobius function* (p. 144)
17:30 - 18:00	Nic Fellini (Queen's University), *Non-Wieferich Primes in Number Fields* (p. 143)

Monday December 8 / lundi 8 décembre

8:00 - 8:30	Isabella Negrini (University of Toronto), *Rigid Cocycles and the p-adic Kudla Program* (p. 144)
8:30 - 9:00	Hazem Hassan (McGill University), *p-adic higher Green's functions* (p. 143)
9:00 - 9:30	Gian Cordana Sanjaya (University of Waterloo), *Squarefree density of discriminant of polynomials with restricted coefficients* (p. 145)
9:30 - 10:00	Xiao Zhong (University of Waterloo), *A dynamical Manin–Mumford type question on polynomial endomorphisms of $\mathbb{A}^2$* (p. 146)
10:00 - 10:30	Fateme Sajadi (University of Toronto), *A Unified Finiteness Theorem For Curves* (p. 145)
15:00 - 15:30	Hymn Chan (University of Toronto), *The p-adic Langlands Program and Breuil's Lattice Conjecture* (p. 142)
15:30 - 16:00	Anton Shakov (Queen's University), *Some Distributional Properties of 2-Regular Integer Sequences* (p. 145)

Abstracts/Résumés

ALI ALSETRI, University of Kentucky
[Sunday December 7 / dimanche 7 décembre, 16:30 – Rosetti C]
Burgess-type character sum estimates over generalized arithmetic progressions of rank 2.

We extend the classical Burgess estimates to character sums over proper generalized arithmetic progressions (GAPs) of rank 2 in prime fields. The core of our proof is a sharp upper bound for the multiplicative energy of these sets, established by adapting an argument of Konyagin and leveraging tools from the geometry of numbers. This is joint work with Xuancheng Shao.

FÉLIX BARIL BOUDREAU, CICMA & Université du Luxembourg
[Sunday December 7 / dimanche 7 décembre, 10:00 – Rosetti C]
Abelian varieties with homotheties

Let A be an Abelian variety defined over a number field K. The celebrated Bogomolov–Serre theorem states that, for any prime ℓ, the image of the ℓ-adic representation of the absolute Galois group of K contains all c-th power homotheties, where c is a positive integer. When K is a global function field, Zarhin has shown that the corresponding statement fails in general. In this talk, I will present an analogue to Bogomolov–Serre's theorem when K is a finitely generated field of positive characteristic. This is part of an ongoing joint work with Sebastian Petersen (University of Kassel).

HYMN CHAN, University of Toronto
[Monday December 8 / lundi 8 décembre, 15:00 – Rosetti C]
The p-adic Langlands Program and Breuil's Lattice Conjecture

Roughly speaking, the local Langlands correspondence is between n-dimensional Galois representations of $\mathrm{Gal}(\overline{\mathbb{Q}_p}/\mathbb{Q}_p)$ and certain admissible smooth representations of $\mathrm{GL_n}(\mathbb{Q}_p)$. However, if we take the coefficient field to be an extension of the p-adic numbers, the objects on both sides are much more complicated, and it is the study of the p-adic Langlands Program. Currently, it is known only for the group $\mathrm{GL}_2(\mathbb{Q}_p)$. Breuil conjectured a lattice conjecture, which provides evidence for such a correspondence in the case of $\mathrm{GL}_2(K)$, where K is an unramified extension of $\mathbb{Q}_p$.

ALEX COWAN, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 15:30 – Rosetti C]
Murmurations from functional equations

Unexpected and striking oscillations in the average a_p values of sets of elliptic curves, dubbed murmurations, were recently discovered using techniques from data science. Since then, similar patterns have been discovered for many other types of arithmetic objects. In this talk we present a new approach for studying murmurations, revolving around mean values of L-functions in the critical strip and guided by random matrix theory. With our approach, we prove murmurations in many cases conditional on standard conjectures, and unconditionally for all GL1 automorphic representations. To handle the case of elliptic curves knowledge is needed of the distribution of conductors of elliptic curves when ordered by height, which is of independent interest.

JOSE CRUZ, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 8:30 – Rosetti C]
A tale on trascendence and arithmetic equivalence

Number Theory by Early Career Researchers
Théorie des nombres par des chercheurs en début de carrière

This talk is about current work in progress that is inspired by TeamsUp ! project (25frg504). It is well known that the Dedekind zeta function determines the product of the class number and the regulator of a number field, but not each of these invariants individually. As Perlis showed in the 1970s, there exist number fields with the same Dedekind zeta function but with different regulators and class numbers.

In this talk, we explore a converse phenomenon. Our main result is that, assuming the algebraic independence of logarithms (the weak Schanuel conjecture), two totally real number fields with the same regulator must have the same Dedekind zeta function. As a further consequence of our methods, we show that the weak Schanuel's conjecture implies that the residues at $s = 1$ of two distinct Dedekind zeta functions of totally real number fields are linearly independent over the algebraic closure of $\mathbb{Q}$ in $\mathbb{C}$.

It is worth mentioning that Gun, Murty, and Rath previously proved that the weak Schanuel conjecture implies the transcendence of these residues for arbitrary number fields, so this may be viewed as a very tiny addendum to that story.

NIC FELLINI, Queen's University
[Sunday December 7 / dimanche 7 décembre, 17:30 – Rosetti C]
Non-Wieferich Primes in Number Fields

An odd prime p is called a base-a Wieferich prime for some integer $a \neq 0, \pm 1$ if

$$a^{p-1} \equiv 1 \bmod p^2.$$

The interest in Wieferich primes stems from their connection to Fermat's Last Theorem. While results on base-a Wieferich primes remain elusive, there has been some progress in understanding their complement, known as non-Wieferich primes, under various hypotheses. In this talk, I will discuss joint work with M. Ram Murty on number field analogues of non-Wieferich primes.

KEIRA GUNN, Mount Royal University
[Sunday December 7 / dimanche 7 décembre, 16:00 – Rosetti C]
Some Results in Dynamics of the Positive Characterstic Tori

The positive characteristic tori T_F are a set of counterparts to the real torus $T = R/Z$. In positive characteristic we define the "integers" as polynomials with coefficients from a finite field F ($Z_F := F[t]$) and the "reals" as the field of Laurent series with coefficients in F ($R_F := F((t))$) so that the positive characteristic torus over F is similarly defined: $T_F := R_F/Z_F$. While T and T_F have some structural and operational similarities, they behave fundamentally differently, particularly with regards to dynamics. In particular, we find that Furstenberg's orbital density theorem falls apart in positive characteristic, and establish that the intersection of orbits of affine maps rely on sets that depend on powers of the characteristic of F rather than arithmetic progressions. At first glance, the simplicity of working in T_F and its similarities to T suggest that we should be able to find many of the same simple results ; however in reality the structure of T_F consists of infinitely defined sub-structures constructed by shifts of Frobenius maps into itself and these sub-structures present themselves frequently in a manner that does not occur in T.

HAZEM HASSAN, McGill University
[Monday December 8 / lundi 8 décembre, 8:30 – Rosetti C]
p-adic higher Green's functions

Heegner cycles are higher weight analogues of Heegner points. Their arithmetic intersection numbers also appear as Fourier coefficients of modular forms and often belong to abelian extensions of imaginary-quadratic fields. The archemdiean contribution to height pairings of Heegner cycles is related to so-called Higher Green's functions, whose algebraicity was conjectured by Gross and Zagier and has been recently proven by Bruinier, Li and Yang.

I will discuss higher weight generalization of Darmon–Vonk's theory of rigid meromorphic cocycles and of Manin–Drinfeld's theta functions. This leads to a definition of p-adic higher Green's function for Heegner cycles on Shimura curves, as well as their conjectured real-quadratic analogue, Stark–Heegner cycles on modular curves. These p-adic functions computationally seem to be producing algebraic numbers in abelian extensions of quadratic number fields, and might be realized as a local contribution to a p-adic height pairing of cycles.

FATEMEH JALALVAND, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 9:00 – Rosetti C]
Shape of log-unit lattices in D_6 fields

Lattices play an important role in modern mathematics and are essential in Minkowski's geometry of numbers, the sphere-packing problem in Euclidean space, and arithmetic statistics. The shape of a lattice is defined to be its equivalence class up to isometries and homotheties. In number theory, an important class of lattices are log-unit lattices, and a deeper understanding of them leads to new perspectives on computational problems in number fields. In this talk, I will describe the shapes and geometry of log-unit lattices arising from D_6 sextic number fields of signature $(0, 3)$. This work is a result of the TeamsUp ! project (25frg504), available at: https://www.birs.ca/events/2025/focussed-research-groups/25frg504.

NICOL LEONG, University of Lethbridge
[Sunday December 7 / dimanche 7 décembre, 17:00 – Rosetti C]
On some results involving the Riemann zeta function and the Mobius function

The summatory Mobius function M(x) is closely related to the notorious Riemann zeta function and is an object of much study. It is well known that while Merten's conjecture is false, proving something just slightly weaker would imply Riemann's hypothesis. In this talk, we present some recent unconditional explicit results on the summatory Mobius function M(x) (joint with Ethan Lee), while along the way proving some improvements in lower bounds for the zeta function. Finally we will discuss some ongoing joint work with Nathan Ng on the logarithmic density of the set of reals for which Merten's conjecture fails.

ISABELLA NEGRINI, University of Toronto
[Monday December 8 / lundi 8 décembre, 8:00 – Rosetti C]
Rigid Cocycles and the p-adic Kudla Program

Rigid cocycles, introduced by Darmon and Vonk in 2017, offer a promising framework to extend complex multiplication theory to real quadratic fields, suggesting a theory of "real multiplication." They exhibit striking parallels with modular forms and are central to the emerging p-adic Kudla program. While the classical Kudla program studies the theta correspondence between automorphic forms on different groups, the p-adic version appears to replace automorphic forms with rigid cocycles. Although a theory for a p-adic theta correspondence has yet to be developed, recent results suggest its existence. In this talk, I present some of these p-adic results, draw comparisons to the classical setting, and discuss the evidence for an underlying p-adic theta correspondence.

PAUL PÉRINGUEY
[Sunday December 7 / dimanche 7 décembre, 9:30 – Rosetti C]
Joint distributions of error terms for primes in arithmetic progressions modulo 11

In 1983, Bays and Hudson noted two surprising phenomena for the prime race mod 11. First, that the leading residue class seems to cycle through a pattern with only minor deviations ; and secondly, that the trailing residue class tends to be the additive inverse of the leading one.

In this talk, I will discuss, assuming GRH and the Linear Independence of zeros of Dirichlet L-functions, a formula for the logarithmic density of the set of positive real numbers on which two prime counting functions $\psi(x; q, a)$ and $\psi(x; q, b)$ are

simultaneously larger than their asymptotic main terms. This formula provides, when $q = 11$, a deeper mathematical explanation of the phenomena observed by Bays and Hudson. This is joint work with Kübra Benli and Greg Martin.

EMILY QUESADA-HERRERA, University of Lethbridge
[Sunday December 7 / dimanche 7 décembre, 8:00 – Rosetti C]
On the vertical distribution of the zeros of the Riemann zeta-function

In 1973, assuming the Riemann hypothesis (RH), Montgomery studied the vertical distribution of zeta zeros, and conjectured that they behave like the eigenvalues of some random matrices. We will discuss some models for zeta zeros – starting from the random matrix model but going beyond it – and related questions, conjectures and results on statistical information on the zeros. In particular, assuming RH and a conjecture of Chan for how often gaps between zeros can be close to a fixed non-zero value, we will discuss our proof of a conjecture of Berry (1988) for the number variance of zeta zeros, in a regime where random matrix models alone do not accurately predict the actual behavior (based on joint work with Meghann Moriah Lugar and Micah B. Milinovich).

FATEME SAJADI, University of Toronto
[Monday December 8 / lundi 8 décembre, 10:00 – Rosetti C]
A Unified Finiteness Theorem For Curves

This talk presents a unified framework for finiteness results concerning arithmetic points on algebraic curves, exploring the analogy between number fields and function fields. The number field setting, joint work with F. Janbazi, generalizes and extends classical results of Birch–Merriman, Siegel, and Faltings. We prove that the set of Galois-conjugate points on a smooth projective curve with good reduction outside a fixed finite set of places is finite, when considered up to the action of the automorphism group of a proper integral model. Motivated by this, we consider the function field analogue, involving a smooth and proper family of curves over an affine curve defined over a finite field. In this setting, we show that for a fixed degree, there are only finitely many étale relative divisors over the base, up to the action of the family's automorphism group (and including the Frobenius in the isotrivial case). Together, these results illustrate both the parallels and distinctions between the two arithmetic settings, contributing to a broader unifying perspective on finiteness.

GIAN CORDANA SANJAYA, University of Waterloo
[Monday December 8 / lundi 8 décembre, 9:00 – Rosetti C]
Squarefree density of discriminant of polynomials with restricted coefficients

The squarefree density problem, which asks to determine the probability that a multivariate integer polynomial $F(x_1, \ldots, x_n)$ attains a squarefree value, is a classical problem. Some recent progress has been made in the case where F is the discriminant of a monic integer polynomial. Namely, Bhargava, Shankar, and Wang proved that the density of monic integer polynomials with squarefree discriminant exists and is given by the product of the local densities, which were previously computed by Yamamura.

In this talk, I will discuss the case where F is the discriminant of a monic integer polynomial with restricted coefficients, with the emphasis on local density computations. This talk is partially based on a joint work with Valentio Iverson and Xiaoheng Wang.

ANTON SHAKOV, Queen's University
[Monday December 8 / lundi 8 décembre, 15:30 – Rosetti C]
Some Distributional Properties of 2-Regular Integer Sequences

The class of k-regular sequences provides an important generalization of automatic sequences and is deeply connected to many topics in number theory. We generalize a recent result of Bettin, Drappeau, and Spiegelhofer on the statistical distribution of Stern's diatomic sequence to show that a large family of 2-regular integer sequences obey a log-normal statistical distribution.

Our approach relies on viewing the distribution of k-regular sequences from the perspective of products of random matrices. We discuss a connection between a specific 2-regular integer sequence and the arithmetic function $\tau(n^2+1)$.

KYLE YIP, Georgia Institute of Technology
[Sunday December 7 / dimanche 7 décembre, 15:00 – Rosetti C]
Diophantine tuples and Diophantine powersets

Let k, n be integers with $k \geq 2$ and $n \neq 0$. A set A of positive integers is a Diophantine tuple with property $D_k(n)$ if the product of $ab+n$ is a perfect k-th power for every $a, b \in A$ with $a \neq b$. These Diophantine tuples have been studied extensively. In this talk, I will discuss some recent progress on "Diophantine powersets" (first studied by Gyarmati, Sárközy, and Stewart), where we allow $ab+n$ to be a perfect power instead of a perfect k-th power for some fixed k. Joint work with Ernie Croot.

XIAO ZHONG, University of Waterloo
[Monday December 8 / lundi 8 décembre, 9:30 – Rosetti C]
A dynamical Manin–Mumford type question on polynomial endomorphisms of $\mathbb{A}^2$

In this talk, I will discuss regular polynomial endomorphisms of $\mathbb{A}^2$ that admit infinitely many periodic curves. I will show that if a family of curves contains a Zariski dense set of periodic curves under a regular polynomial endomorphism F, then this family is invariant under some iterate of F. Furthermore, I will present a complete classification of regular polynomial endomorphisms that have infinitely many periodic curves of bounded degree. As a consequence, we obtain a weaker form of a special case of the Dynamical Manin–Mumford Conjecture, a dynamical analogue of the classical Manin–Mumford Conjecture in arithmetic geometry.

Practical approaches to mentoring undergraduate research projects

Org: Elisa Bellah (University of Toronto) and/et **Yuveshen Mooroogen** (University of British Columbia)

This session will explore effective strategies for mentoring undergraduate students in mathematical research. Experienced mentors will share insights on selecting projects, guiding students through research processes, and developing essential skills such as mathematical communication and problem-solving.

Schedule/Horaire **Room/Salle: Gerrard**

Saturday December 6 **samedi 6 décembre**

9:00 - 9:30	Paige Bright (MIT) (p. 147)
9:30 - 10:00	Michael Lamoureux (University of Calgary), *Mathematical visualizations in undergraduate research projects* (p. 148)
10:00 - 10:30	Alex Losevich (University of Rochester), *Research as an integral part of undergraduate curriculum* (p. 148)
15:00 - 15:30	Hazem Hassan (McGill University), *Interaction between directed reading programs and undergraduate research projects* (p. 148)
15:30 - 16:00	Adrian Chitan (University of Western Ontario), *Mentoring Success: Lessons from a Graduate-Undergraduate Model* (p. 147)
16:00 - 16:30	Parker Glynn-Adey (University of Toronto), *Supporting A Departmental Culture of Undergraduate Research* (p. 147)

Abstracts/Résumés

PAIGE BRIGHT, MIT
[Saturday December 6 / samedi 6 décembre, 9:00 – Gerrard]

ADRIAN CHITAN, Western University
[Saturday December 6 / samedi 6 décembre, 15:30 – Gerrard]
Mentoring Success: Lessons from a Graduate-Undergraduate Model

Drawing on experience as a DRP(directed reading program) organizer and mentor, this talk addresses the core challenge of scoping rewarding yet feasible undergraduate research projects within a single semester. I will discuss effective project design methods that structure the term into distinct phases for background mastery and focused investigation of deep results through examples experienced locally. This approach enables mentors to design "failsafe" projects that guarantee positive learning outcomes, build student confidence, and provide techniques for successfully transitioning undergraduates into self-directed mathematical research, specifically from the graduate student position.

PARKER GLYNN-ADEY, University of Toronto (UTSC)
[Saturday December 6 / samedi 6 décembre, 16:00 – Gerrard]
Supporting A Departmental Culture of Undergraduate Research

Research, at any level, does not occur in a vacuum. It is an organic process rooted in the local culture. In this talk, I describe a pair of initiatives at UTSC that support undergraduate research: The $U(T)$-Mathazine and Undergraduate Seminar. After

recounting their histories, I describe how they support a culture of undergraduate research and how to go about starting similar initiatives at your institution.

HAZEM HASSAN, McGill University
[Saturday December 6 / samedi 6 décembre, 15:00 – Gerrard]
Interaction between directed reading programs and undergraduate research projects

The Directed Reading Program offers (DRP) undergraduate students an intermediate step before jumping into more formal undergraduate research projects. I will discuss the synergy between these two types of projects, how the DRP prepares students for research projects and possible room for coordination between the two programs.

MICHAEL LAMOUREUX, University of Calgary
[Saturday December 6 / samedi 6 décembre, 9:30 – Gerrard]
Mathematical visualizations in undergraduate research projects

Over several decades, a common theme has emerged in the undergraduate research projects I have supervised: the visualization of mathematical ideas via easy-to-use computational tools. The projects cover a diverse set of topics such as algebraic curves, self-similarity of operator spectra, mapping properties of analytic functions, and more. This talk will discuss the lessons learned in supervising students on such projects, including how to make "hard math" accessible and how to navigate rapidly evolving computing environments. Examples will include developing calculus without the use of limits.

Some recent work can be seen here: www.mlamoureux.ca

ALEX LOSEVICH
[Saturday December 6 / samedi 6 décembre, 10:00 – Gerrard]
Research as an integral part of undergraduate curriculum

In this talk, I will argue that concrete research activities should become an integral part of the undergraduate mathematics curriculum. I will describe some recent efforts in this direction at the University of Rochester in the context of the SteForAll undergraduate research program.

Probability and PDEs
Probabilité et EDP

Org: Vincent Martinez (CUNY Hunter College), **Geordie Richards** (University of Guelph) and/et **Philippe Sosoe** (Cornell University)

In this session the speakers will report on recent advances at the intersection of probability theory and the analysis of partial differential equations (PDEs). Topics will include probabilistic analysis of PDEs and the analysis of stochastic PDEs, with examples drawn from physics, engineering, and other fields.

Schedule/Horaire **Room/Salle: Galsworthy**

Saturday December 6 — samedi 6 décembre

8:00 - 8:30	Nathan Glatt-Holtz (Indiana University), *On Long Time Accuracy for Stochastic Partial Differential Equations Under Approximation.* (p. 151)
8:30 - 9:00	Yuri Bakhtin (Courant Institute NYU), *Differentiability of the effective Lagrangian for HJB equations in dynamic random environments* (p. 150)
9:00 - 9:30	Duncan Dauvergne (University of Toronto), *Characterization of the directed landscape from the KPZ fixed point* (p. 151)
9:30 - 10:00	Mihai Nica (University of Guelph), *A probabilist's guide to the Hermite polynomials* (p. 152)
10:00 - 10:30	Raluca Balan (University of Ottawa), *Recent advances for SPDEs with Lévy noise* (p. 150)
15:00 - 15:30	Jeremy Quastel (University of Toronto), *Integrable PDE in random growth* (p. 152)
15:30 - 16:00	Yu-Ting Chen (University of Victoria), *Martingale description of the two-dimensional stochastic heat equation* (p. 151)
16:00 - 16:30	Francesco Cellarosi (Queen's University), *Stochastic Calculus for the Theta Process* (p. 150)
16:30 - 17:00	Bjoern Bringmann (Princeton University), *Global well-posedness of the stochastic Abelian-Higgs equations in two dimensions* (p. 150)

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Arjun Krishnan (University of Rochester), *Field induced phase transition in the polymer model* (p. 152)
8:30 - 9:00	Christopher Kennedy (Queen's University), *On the analysis of fluid-solid interactions* (p. 151)
9:00 - 9:30	Mustafa Avci (Athabasca University), *A viscosity solution approach to the Feynman-Kac formula for a one-dimensional parabolic PDE with variable exponent coefficient* (p. 149)
9:30 - 10:00	Fauzia Jabeen (Toronto Metropolitan University), *Efficient Method of Estimating Second-Order Sensitivities for Stochastic Discrete Biochemical Systems* (p. 151)
10:00 - 10:30	Zaib Un Nisa Memon (Toronto Metropolitan University), *A hybrid method for stochastic simulations of reaction-diffusion epidemic models* (p. 152)

Abstracts/Résumés

MUSTAFA AVCI, Athabasca University

[Sunday December 7 / dimanche 7 décembre, 9:00 – Galsworthy]

A viscosity solution approach to the Feynman-Kac formula for a one-dimensional parabolic PDE with variable exponent coefficient

This work establishes the existence and uniqueness of a solution for a one-dimensional parabolic Cauchy problem set on the positive half-line involving coefficients with variable exponent whose generator is associated with a stochastic differential equation involving state-dependent variable exponent. The problem is analyzed within the framework of viscosity solutions,

addressing cases where classical solutions may not exist due to insufficient coefficient regularity. We demonstrate that the unique viscosity solution is given by the Feynman-Kac formula, thereby establishing a rigorous link between the probabilistic representation and the analytical solution. A key element of the proof relies on the property that the associated stochastic process remains strictly positive on its state space $(0, \infty)$, which allows for the application of local ellipticity arguments despite potential degeneracy at the boundary. The analysis is completed by applying the standard parabolic regularity theory to show that the viscosity solution possesses local Sobolev regularity in $W^{2,1}_{m,loc}$.

Keywords. stochastic process ; viscosity solutions ; Feynman-Kac formula ; degenerate parabolic PDE ; the comparison principle ; the dynamic programming principle ; local ellipticity.

YURI BAKHTIN, Courant Institute, NYU
[Saturday December 6 / samedi 6 décembre, 8:30 – Galsworthy]
Differentiability of the effective Lagrangian for HJB equations in dynamic random environments

We prove differentiability of the effective Lagrangian for continuous space-time multidimensional directed variational problems in random dynamic environments with positive dependence range in space and time. Thus the limiting fundamental solutions in the associated homogenization problems for HJB equations are classical. For several continuous models of FPP and LPP type, our method provides differentiability of limit shapes and shape functions. This is joint work with Douglas Dow.

RALUCA BALAN, University of Ottawa
[Saturday December 6 / samedi 6 décembre, 10:00 – Galsworthy]
Recent advances for SPDEs with Lévy noise

In this talk, we introduce a new class of processes that can be used as noise for stochastic partial differential equations (SPDEs). This noise is called the "Lévy colored noise", and is constructed from a Lévy white noise using the convolution with a suitable spatial kernel. We assume that the Lévy measure of the noise has finite variance. The stochastic integral with respect to this noise is constructed similarly to the integral with respect to the spatially-homogeneous Gaussian case considered in Dalang (1999). Using Rosenthal's inequality, we provide an upper bound for the p-th moment of the stochastic integral with respect to this noise. Then, we analyze the existence of moments for linear and non-linear SPDE with this noise, considering as examples the stochastic heat and wave equations. This talk is based on joint work with Juan Jiménez.

BJOERN BRINGMANN, Princeton University
[Saturday December 6 / samedi 6 décembre, 16:30 – Galsworthy]
Global well-posedness of the stochastic Abelian-Higgs equations in two dimensions

There has been much recent progress on the local solution theory for geometric singular SPDEs. However, the global theory is still largely open. In this talk, we discuss the global well-posedness of the stochastic Abelian-Higgs model in two dimension, which is a geometric singular SPDE arising from gauge theory. This is joint work with S. Cao.

FRANCESCO CELLAROSI, Queen's University
[Saturday December 6 / samedi 6 décembre, 16:00 – Galsworthy]
Stochastic Calculus for the Theta Process

A key step in stochastic analysis is the "art" of giving meaning to integrals against a random function. This is not a trivial task, since interesting random functions have poor regularity and Riemann-type approaches typically do not work. Sometimes, we may exploit the martingale-like properties of our random functions to give meaning to integrals against them. Alternatively, we may employ Rough Path Theory to define stochastic integration, trading some of the nice probabilistic properties for analytical and algebraic ones. I will outline how this is done in the case of the Theta Process. This is a stochastic process of number-theoretical origin that shares several (but not all!) properties with the Brownian Motion, and classical probabilistic tools to

define a stochastic calculus for this process cannot be used. Joint work with Zachary Selk (https://arxiv.org/abs/2406.05523)

YU-TING CHEN, University of Victoria
[Saturday December 6 / samedi 6 décembre, 15:30 – Galsworthy]
Martingale description of the two-dimensional stochastic heat equation

The two-dimensional stochastic heat equation has a simple, but purely formal, description as the two-dimensional heat equation with a random potential given by space-time white noise. Since this equation poses difficulties for solution theories of stochastic partial differential equations (SPDEs), some approximate solutions developed in the late 90s have played a vital role in subsequent studies. This talk will provide an overview of a precise martingale description of the limiting solutions. The description extends the existing random-field and semigroup formulations of SPDEs. Certain extremal properties of Gaussians, previously known in solvable models of quantum mechanics, are now incorporated.

DUNCAN DAUVERGNE, University of Toronto
[Saturday December 6 / samedi 6 décembre, 9:00 – Galsworthy]
Characterization of the directed landscape from the KPZ fixed point

The KPZ universality class is a collection of two-dimensional random metrics and one-dimensional random growth models that exhibit the same universal behaviour under rescaling. The directed landscape is the scaling limit of random metrics in this class. The KPZ fixed point is the scaling limit of random growth models in this class, and arises as a marginal of the directed landscape. In this talk, we will give a characterization of the directed landscape from its KPZ fixed point marginals. For a large range of models, this reduces the problem of proving convergence to the directed landscape to proving convergence to the KPZ fixed point. Joint work with Lingfu Zhang.

NATHAN GLATT-HOLTZ, Indiana University
[Saturday December 6 / samedi 6 décembre, 8:00 – Galsworthy]
On Long Time Accuracy for Stochastic Partial Differential Equations Under Approximation.

We are interested in the question of the long time accuracy of solutions of nonlinear stochastic partial differential equations (SPDEs) under various approximations. We will present a powerful and quite general framework which addresses such questions. It centers on 1) proving a (parameter uniform) contraction of the Markovian dynamic in an appropriate Wasserstein metric 2) establishing the accuracy of approximations over a finite time window. Our main paradigmatic application for this approach concerns the numerical approximation of the stochastically driven Navier-stokes equations where the question of long time accuracy was open.

FAUZIA JABEEN, Toronto Metropolitan University
[Sunday December 7 / dimanche 7 décembre, 9:30 – Galsworthy]
Efficient Method of Estimating Second-Order Sensitivities for Stochastic Discrete Biochemical Systems

Biochemical systems involving some small molecular populations may exhibit stochastic fluctuations that can influence cellular dynamics, thus discrete stochastic models are essential to accurately represent them. Additionally, their models are often stiff due to reactions occurring on widely separated time-scales. Sensitivity analysis is crucial for understanding how parameter changes affect system dynamics and second-order sensitivities provide concavity information and capture interactions between parameters. We propose a finite-difference technique for estimating second-order parametric sensitivities in moderately stiff to stiff stochastic discrete models of biochemical systems. This method uses an adaptive tau-leaping scheme combined with a coupling strategy for nominal and perturbed processes, to achieve both accuracy and computational efficiency. Moreover, this approach may be extended to models of reaction-diffusion systems. This is joint work with Silvana Ilie.

Probability and PDEs
Probabilité et EDP

CHRISTOPHER KENNEDY, Queen's University
[Sunday December 7 / dimanche 7 décembre, 8:30 – Galsworthy]
On the analysis of fluid-solid interactions

I will present a Saint-Venant system of equations for laminar shallow water, which describes the interaction of a viscous and incompressible fluid interacting with a floating rigid body. The governing fluid equations resemble the compressible Navier-Stokes equations with a particular choice of equation of state. Following previous work established by Feireisl on the existence of global-in-time weak solutions in the presence of a non-degenerate viscosity term, I will discuss the general approach of passing to the limit of Faedo-Galerkin solutions of artificially regularised equations using a compactness argument. In particular, following a careful analysis similar to Vasseur and Yu, I will provide an overview of our proof of the existence of weak solutions. I will explain how a jump discontinuity in the height of the fluid domain, when interacting with a partially immersed floating solid, presents an obstacle in proving the global existence of weak solutions. This talk is on joint work with Giusy Mazzone.

ARJUN KRISHNAN, University of Rochester
[Sunday December 7 / dimanche 7 décembre, 8:00 – Galsworthy]
Field induced phase transition in the polymer model

In three spatial dimensions or higher, it is a classical fact that the directed polymer model has two phases: Brownian behavior at high temperature, and non-Brownian behavior at low temperature. We consider the response of the polymer to an external field or tilt, and show that at fixed temperature, the polymer has Brownian behavior for some fields and non-Brownian behavior for others. In other words, the external field can induce the phase transition in the polymer model.

ZAIB UN NISA MEMON, Toronto Metropolitan University
[Sunday December 7 / dimanche 7 décembre, 10:00 – Galsworthy]
A hybrid method for stochastic simulations of reaction-diffusion epidemic models

Reactive Multiparticle Collision (RMPC) Dynamics, a particle-based method, is able to keep track of every single individual in a population. However, tracking of infectious individuals becomes infeasible as the cases increase, in which case a compartment-based method, such as Inhomogeneous Stochastic Simulation Algorithm (ISSA), is typically used. This motivated the development of a temporally coupled RMPC-ISSA framework. The hybrid method results in significant acceleration of the simulations of reaction-diffusion epidemic models compared to RMPC-only simulations. This is joint work with K. Rohlf.

MIHAI NICA, University of Guelph
[Saturday December 6 / samedi 6 décembre, 9:30 – Galsworthy]
A probabilist's guide to the Hermite polynomials

The Hermite polynomials are intimately connected to Dyson's Brownian motion and other important stochastic processes. In this talk, I will showcase a Gaussian expectation formula for the Hermite polynomials that allows one to easily derive limit theorems for some of these processes and other useful results. Based on this joint work with Janosch Ortmann https://arxiv.org/abs/2508.13910

JEREMY QUASTEL, University of Toronto
[Saturday December 6 / samedi 6 décembre, 15:00 – Galsworthy]
Integrable PDE in random growth

We'll survey the appearance of integrable equations such as KP, Toda and Hirota in integrable random growth models.

Progress in differential equations and their applications in mathematical biology
Progrès dans le domaine des équations différentielles et leurs applications en biologie mathématique

Org: Elena Braverman (University of Calgary), **Kunquan Lan** (Toronto Metropolitan University) and/et **Gail Wolkowicz** (McMaster University)

The session is devoted to recent progress in the areas of ordinary, partial, and fractional differential equations and their application in mathematical biology. A focus will be on the qualitative behaviour of such equations, together with applied models described by differential equations in population dynamics, analysis of spread of infectious diseases, cell biology.

La session est consacrée aux progrès récents dans les domaines des équations différentielles ordinaires, partielles et fractionnaires et à leur application en biologie mathématique. L'accent sera mis sur le comportement qualitatif de ces équations, ainsi que sur les modèles appliqués décrits par des équations différentielles en dynamique des populations, analyse de la propagation des maladies infectieuses et biologie cellulaire.

Schedule/Horaire **Room/Salle: Scott A**

Saturday December 6 — samedi 6 décembre

8:00 - 8:30	Chris Goodrich (UNSW Sydney, Austrailia), *Luxemburg Norm Localisation for Nonlocal Differential Equations with Convolution Coefficients* (p. 155)
8:30 - 9:00	Chunhua Ou (Memorial University of Newfoundland), *Traveling waves and propagation dynamics of competitive systems in a road-field environment with climate change* (p. 157)
9:00 - 9:30	Zhisheng Shuai (University of Central Florida, USA), *A Tale of Two Incidence Functions: How Post-Infection Effects Shape Disease Dynamics* (p. 158)
9:30 - 10:00	Lin Wang (University of New Brunswick), *Global dynamics of a Filippov SIQR model with delayed control* (p. 158)
10:00 - 10:30	Jianhong Wu (York University), *An integro-differential equation with spatially varying delay* (p. 159)
15:00 - 15:30	Sue Ann Campbell (University of Waterloo), *The Eigenvalue Spectrum of Distributed Delay Differential Equations with Large Mean Delay* (p. 154)
15:30 - 16:00	Gail Wolkowicz (McMaster University), *A predator-prey model with delay in both the prey and the predator growth terms* (p. 159)
16:00 - 16:30	Chenkuan Li (Brandon University), *Existence, Uniqueness, and Hyers–Ulam's Stability of the Nonlinear Bagley–Torvik Equation with Functional Initial Conditions* (p. 156)
16:30 - 17:00	Xinzhi Liu (University of Waterloo), *Observer-Based Adaptive Robust Control of Dual-Layer Multiagent Epidemic Models* (p. 156)
17:00 - 17:30	Xingfu Zou (Western University), *Dynamics of a nonlocal dispersal population model with annually synchronized emergence of adults* (p. 160)
17:30 - 18:00	Hermann Eberl (University of Guelph), *Travelling Waves in a highly degenerate PDE-ODE coupled model of cellulosic biofilm formation* (p. 155)

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Jennifer Lawson (University of Calgary), *Incorporating Ecological Data into Models of Population Spread with Different Forms of Dispersal* (p. 155)
8:30 - 9:00	André Rickes (University of Calgary), *Average population size of single species diffusing in heterogeneous environments* (p. 157)
9:00 - 9:30	Hilaire Epstein Nonhou Zogo (Queen's University), *Event-Triggered Control for an SIS Epidemic Model* (p. 159)
9:30 - 10:00	Chongming Li (Queen's University), *Uniform Persistence Analysis of the Bacteria Persister Model* (p. 156)
10:00 - 10:30	Christopher Heggerud (University of Manitoba), *Regime shifts in biology and tools to predict them* (p. 155)

Progress in differential equations and their applications in mathematical biology
Progrès dans le domaine des équations différentielles et leurs applications en biologie mathématique

15:00 - 15:30	Tianxu Wang (University of Alberta), *Existence and asymptotic stability of a generic Lotka-Volterra system with nonlinear spatially heterogenous cross-diffusion* (p. 159)
15:30 - 16:00	Maryam Basiri (Toronto Metropolitan University), *Positive Solutions of Separated Boundary Value Problems* (p. 154)
16:00 - 16:30	Sumaira Rehman (Toronto Metropolitan University), *Initial value problems for nonlinear higher-order fractional differential equations* (p. 157)
16:30 - 17:00	Gustavo Cicchini Santos (Toronto Metropolitan University), *Strictly Positive Solutions of Neumann Boundary Value Problems and Applications to Duffing Type Models* (p. 157)
17:00 - 17:30	Afroditi Talidou (University of Calgary), *Stability of front-like solutions of the FitzHugh-Nagumo equations on warped cylinders* (p. 158)
17:30 - 18:00	Vitali Vougalter (University of Toronto), *Existence of stationary solutions for some integro-differential equations with the double scale anomalous diffusion* (p. 158)

Abstracts/Résumés

MARYAM BASIRI, Toronto Metropolitan Univeristy
[Sunday December 7 / dimanche 7 décembre, 15:30 – Scott A]
Positive Solutions of Separated Boundary Value Problems

In this talk, we prove the existence of positive solutions for a one-dimensional separated boundary value problem. To be more specific, we study the existence of nonzero nonnegative, or strictly positive, solutions of nonlinear second-order differential equations with separated boundary conditions, in which the parameters may have negative values. We also assume that the nonlinear part can take negative values. The solution to this boundary value problem can be considered as a steady-state solution for a reaction-diffusion-advection equation with logistic-type nonlinearity, which can be applied to model the dynamics of a species in a stream. One of the boundary conditions corresponds to upstream, where there is no flux, and the other one to downstream, where the flux across the boundary is proportional to the density. We prove the result by rewriting the boundary value problem as a Hammerstein integral equation. To do this, we use the Nemytskii operator corresponding to non-linearity and the Green's function for the homogeneous second-order differential equation. After proving the appropriate properties of the operator, we apply a fixed point theorem for r-nowhere normal-outward maps to prove the existence of solutions to our problem.

This is a joint work with Prof. Kunquan Lan at Toronto Metropolitan University and Prof. Jianhong Wu at York University.

ELENA BRAVERMAN, University of Calgary
[Scott A]

SUE ANN CAMPBELL, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 15:00 – Scott A]
The Eigenvalue Spectrum of Distributed Delay Differential Equations with Large Mean Delay

This talk studies the eigenvalue spectrum of linear delay differential equations with a uniformly distributed delay kernel. We carry out asymptotic analysis in the limit of large mean delay to show that the spectrum splits into (i) a strong critical spectrum referring to a finite set of isolated, pure imaginary eigenvalues that are unaffected by delay, (ii) an asymptotic strong spectrum consisting of a finite set of eigenvalues with limits that are determined by non-delayed terms in the model, and (iii) a pseudo-continuous spectrum consisting of infinitely many eigenvalues that limit on the imaginary axis, with real parts that scale

linearly with the delay. This behaviour is similar to the fixed delay case, but the distributed delay introduces additional spectral features, including a countably infinite number of horizontal asymptotes in the pseudo-continuous spectrum at frequencies inversely proportional to the width of the distribution. We validate our theoretical results through numerical studies of several examples and compare our findings with fixed-delay results from the literature. Finally, we apply the results to study the stability and bifurcations of a Wilson-Cowan model with a delayed self-coupling, large mean delay, and homeostatic plasticity. This is joint work with Isam Al-Darabsah and Bootan Rahman

---

HERMANN EBERL, University of Guelph
[Saturday December 6 / samedi 6 décembre, 17:30 – Scott A]
Travelling Waves in a highly degenerate PDE-ODE coupled model of cellulosic biofilm formation

In Eberl et al, $Biochem.Eng.J.$, 122, 2017, we presented a PDE-ODE coupled model describing inverse colony formation of cellulolytic biofilms which play a role in sustainable energy production, more specifically bioethanol that is produced from non edible, non-feedstock biomass such as wood and grass. The PDE component is a highly degenerated quasilinear diffusion reaction equation that encompasses both a porous-medium degeneracy where the dependent variable vanishes and a super-diffusion singularity as it approaches its maximum physical limit. In that earlier paper we also presented numerical simulations that suggest the possibility of travelling waves (for which there is also some, albeit scant, experimental evidence. In this talk I will present an existence and a non-existence theorem for such TW solutions, in dependence on model parameters.

CHRIS GOODRICH, UNSW Sydney
[Saturday December 6 / samedi 6 décembre, 8:00 – Scott A]
Luxemburg Norm Localisation for Nonlocal Differential Equations with Convolution Coefficients

I will discuss how a nonstandard cone together with topological fixed point theory can be used to deduce existence results for boundary value problems involving a nonlocal differential equation. A model case is the one-dimensional steady-state Kirchhoff-like equation

$$-A\left(\|u\|_{L^2}^2\right) u''(t) = f\big(t, u(t)\big),\ 0 < t < 1$$

subject to the Dirichlet data $u(0) = 0 = u(1)$. I will discuss the various assumptions imposed on the functions A and f, and how these assumptions are affected by the use of the Luxemburg norm as part of the fixed point analysis.

CHRISTOPHER HEGGERUD, University of Manitoba
[Sunday December 7 / dimanche 7 décembre, 10:00 – Scott A]
Regime shifts in biology and tools to predict them

Regime shifts pose unique challenges when dealing with predictions and management of biological systems yet little headway has been made on understanding when a system might be in a transient state, or if a regime shift is imminent. In particular, given a timeseries, it is difficult to determine the underlying mechanism causing a regime shift, or if one is occurring at all. Through a series of simplifications, we analyze synthetic data known to exhibit crawl-by type transient dynamics or that undergo some nonlinear excursion through state space that appears as a transient dynamic. Using dynamical systems theory, we create metrics that predict transient dynamics and furthermore to understand useful characteristics of the regime shift. These new metrics are additionally compared to typical early warning signals in ecology and the utility of both are discussed

---

KUNQUAN LAN, Toronto Metropolitan University
[Scott A]

Progress in differential equations and their applications in mathematical biology
Progrès dans le domaine des équations différentielles et leurs applications en biologie mathématique

JENNIFER LAWSON, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 8:00 – Scott A]
Incorporating Ecological Data into Models of Population Spread with Different Forms of Dispersal

Over the last few years, there has been significant interest in partial differential equation models with different forms of dispersal. However, much of the research done has been theoretical, with little explanation of how the model connects to real world ecological data.

In this talk, we will explore some of the assumptions that give rise to models with alternate forms of dispersal, and then develop a model that can represent the competition of two species with biased diffusion, where the species choose to diffuse according to habitat suitability and density. Habitat suitability maps will be derived from publicly available resources such as the Alberta Biodiversity Monitoring Institute (ABMI), which provides data on biodiversity across the province. We will conclude by reflecting on some of the challenges that arise when trying to connect theoretical models to practical data.

CHENKUAN LI, Brandon University
[Saturday December 6 / samedi 6 décembre, 16:00 – Scott A]
Existence, Uniqueness, and Hyers–Ulam's Stability of the Nonlinear Bagley–Torvik Equation with Functional Initial Conditions

The nonlinear Bagley–Torvik equation is of fundamental importance, as it captures a realistic and intricate interplay among memory effects, nonlinearity, and functional dependence—making it a powerful model for a wide range of natural and engineered systems. Its analysis contributes significantly to both the theoretical development of fractional differential equations and their practical applications across science and technology. In this paper, we employ the inverse operator method, the multivariate Mittag-Leffler function, and several classical fixed-point theorems to establish sufficient conditions for the existence, uniqueness, and Hyers–Ulam stability of solutions to the nonlinear Bagley–Torvik equation with functional initial conditions. Finally, we present several examples by explicitly computing values of the multivariate Mittag-Leffler functions to illustrate the main results.

CHONGMING LI, Queen's University
[Sunday December 7 / dimanche 7 décembre, 9:30 – Scott A]
Uniform Persistence Analysis of the Bacteria Persister Model

In this talk, we will explore eigenvalue problems arising from nonlocal elliptic equations that model the population dynamics of a bacterial group with presenting the persisters and available resource. The nonlocal component originates from epigenetic inheritance, more broadly referred to as a birth-jump process. In this setting, an offspring may leave its parent's location immediately after birth. In our model, this mechanism captures the phenotypic variations between parents and their offspring. Our main interest lies in understanding how changes in available resources—such as nutrient effects that constrain bacterial growth—impact the overall population size, especially in the presence of persister cells that cannot be eradicated. To address this, we establish a link between the principal eigenvalue and changes in resource availability, and then apply the super solution and maximum principle technique to examine the continuity and monotonicity of these effects.

XINZHI LIU, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 16:30 – Scott A]
Observer-Based Adaptive Robust Control of Dual-Layer Multiagent Epidemic Models

This work proposes an innovative dual-layer multi-agent-based SIS epidemic model that integrates a physical contact layer and an information layer. The physical layer captures disease transmission through travel or migration between cities, while the information layer enables the exchange of infection data among healthcare providers across cities, even in the absence of direct physical connections. An observer is designed to estimate the infected fraction in each city by utilizing information from neighboring cities connected through the physical layer in a distributed manner. These estimates are subsequently used in the

information layer to synchronize each city's infection trajectory with that of a virtual leader. Furthermore, the control input, typically defined in multi-agent systems, is employed as the sliding surface, whose stability is proven via Lyapunov analysis within the dual-layer SIS framework. To handle parameter uncertainties and ensure convergence to the sliding surface, an adaptive sliding mode control strategy is developed, effectively integrating the dynamics of the physical and information layers to drive the system toward disease eradication. This is a joint work with Zohreh Abbasi.

CHUNHUA OU, Memorial University of Newfoundland
[Saturday December 6 / samedi 6 décembre, 8:30 – Scott A]
Traveling waves and propagation dynamics of competitive systems in a road-field environment with climate change

In response to climate change caused largely by the industrial development of humans, lot of species may have to change their residential habitats and living habits to survive. Meanwhile, it has been well-known that networks (like roads, rivers and seismic lines etc.) have deep impacts on the spread of pandemics, invasive species, plant pathogens and so on. Motivated by the recent work of Berestycki and his research group, in this talk, we study the joint influence of a road-field diffusive system coupled with climate changes on the dynamical behaviors of two competitive populations in the case of one of which is assumed to be home territory. Viewed as one of the most important phenomena in propagation dynamics, forced traveling wave solution (TWS) is firstly investigated and we find that its existence is relevant to the values of the shift speed c which the climate changes with. When and only when $c \in (0, c^*)$ (c^* is a threshold shifting speed and its value is related to the ratio of the two diffusion coefficients–on the road and in the filed), one can establish the forced TWS for the system. Moreover, we show that the forced TWS is locally stable by using a squeezing result. Finally, to draw a complete figure of the propagation dynamics, we investigate the global spreading behaviors in the case $c \in (c^*, \infty)$. In this case, the spatial domain for the extinction of both populations are established, and can be interpreted as gap formation for the two biological species.

SUMAIRA REHMAN, Toronto Metropolitan University
[Sunday December 7 / dimanche 7 décembre, 16:00 – Scott A]
Initial value problems for nonlinear higher-order fractional differential equations

In this talk, I'll present results on the existence and uniqueness of solutions or local solutions for initial-value problems of nonlinear higher-order Riemann-Liouville type fractional differential equations with nonlinearities that may not be continuous. Some topological tools like Schauder fixed point theorem, Banach contraction principle and Weissinger's uniqueness fixed point theorem are employed to obtain these results.

This is joint work with Professor Kunquan Lan at Toronto Metropolitan University and Professor Jianhong Wu at York University.

ANDRÉ RICKES, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 8:30 – Scott A]
Average population size of single species diffusing in heterogeneous environments

Extending previous research on how environmental heterogeneity influences population dynamics, in this talk we analyze how spatial diffusion affects the total population of a species evolving accordingly to the logistic equation. We consider that the species' intrinsic growth rate r is proportional to a power of the carrying capacity K, namely $r = \alpha K^\lambda$ for $\alpha > 0$ and $\lambda \in \mathbb{R}$.

A well-established result is that for $\lambda = 1$, the average population always exceeds that of the non-diffusing case, whereas for $\lambda = 0$, spatial heterogeneity induces a population decline. This talk will cover the intermediate case $\lambda \in (0, 1)$, which exhibits a more complex dependence on dispersal: slow diffusion leads to population growth, while sufficiently fast dispersal causes a decline. We will also provide insights for the cases $\lambda < 0$ and $\lambda > 1$.

Progress in differential equations and their applications in mathematical biology
Progrès dans le domaine des équations différentielles et leurs applications en biologie mathématique

---

GUSTAVO CICCHINI SANTOS, Toronto Metropolitan University
[Sunday December 7 / dimanche 7 décembre, 16:30 – Scott A]
Strictly Positive Solutions of Neumann Boundary Value Problems and Applications to Duffing Type Models

The existence of one or two strictly positive solutions of Neumann boundary value problems is studied in this paper where the nonlinearities are L^1-Carathéodory functions, so they are not necessarily continuous. Additional weaker and better conditions than those used in previous results are posted on the nonlinearities to obtain these existence results. Applications of these new results are given to Duffing type models arising from mechanical vibrations for the first time.

ZHISHENG SHUAI, University of Central Florida
[Saturday December 6 / samedi 6 décembre, 9:00 – Scott A]
A Tale of Two Incidence Functions: How Post-Infection Effects Shape Disease Dynamics

In epidemiological modeling, mass-action and standard incidence are two fundamental formulations of disease transmission. The former assumes a constant per-capita contact rate that scales with population size, while the latter accounts for limited contacts by normalizing the transmission term. Although both often produce similar long-term dynamics, their differences become pronounced when complex biological mechanisms are included.

In this study, we analyze a compartmental model incorporating post-infection mortality and partial immunity to compare these two incidence forms. For the mass-action model, bifurcation analysis reveals possible periodic outbreaks under certain parameter regimes, whereas the standard incidence model tends to suppress oscillations, leading to stable endemic equilibria. When infections persist, both analytical and numerical results show that endemic levels can remain low before rising sharply as transmission increases. These results highlight how incidence structure and reinfection jointly shape disease dynamics and have important implications for modeling long-term pathogen persistence in host populations.

AFRODITI TALIDOU, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 17:00 – Scott A]
Stability of front-like solutions of the FitzHugh-Nagumo equations on warped cylinders

The FitzHugh-Nagumo model is a reaction-diffusion system that describes the behavior of spiking neurons. While stability of traveling wave solutions is well understood in one dimension, much less is known in two dimensions. In this talk, we will examine the stability of traveling front solutions on the surfaces of both standard and warped cylinders. A standard cylinder has a constant radius, whereas the radius of a warped cylinder varies along its length. The latter geometry offers a more realistic model of the morphology of neuronal axons. I will outline how surface geometry enters the FitzHugh-Nagumo dynamics, describe criteria relevant to nonlinear stability, and illustrate geometric effects through numerical examples.

VITALI VOUGALTER, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 17:30 – Scott A]
Existence of stationary solutions for some integro-differential equations with the double scale anomalous diffusion

The work is devoted to the investigation of the solvability of an integro-differential equation in the case of the double scale anomalous diffusion with a sum of two negative Laplacians in different fractional powers in R^3. The proof of the existence of solutions relies on a fixed point technique. Solvability conditions for the elliptic operators without the Fredholm property in unbounded domains are used.

LIN WANG, University of New Brunswick
[Saturday December 6 / samedi 6 décembre, 9:30 – Scott A]
Global dynamics of a Filippov SIQR model with delayed control

In this talk, I will discuss the global dynamics of a Filippov SIQR epidemic model incorporating delayed relay control. We show that the introduction of delay can induce periodic behavior, including the appearance of slowly oscillating periodic orbits. By combining analytical tools such as Poincaré maps, displacement functions, and a Melnikov-like method, we establish sufficient conditions for the existence, uniqueness, and global stability of slowly oscillating periodic solutions.

TIANXU WANG, University of Alberta
[Sunday December 7 / dimanche 7 décembre, 15:00 – Scott A]
Existence and asymptotic stability of a generic Lotka-Volterra system with nonlinear spatially heterogenous cross-diffusion

This article considers a class of Lotka-Volterra systems with multiple nonlinear cross-diffusion, commonly known as prey-taxis models. The existence and stability of classic solutions for such systems with spatially homogeneous sources and taxis have been studied in one- or two-dimensional space, however, the proof is non-trivial for a more general setting with spatially heterogeneous predation functions and taxis coefficient functions in arbitrary dimensions. This study introduces a new weighted L^p_ϵ-norm and extends some classical inequalities within this normed space. Coupled energy estimates are employed to establish initial bounds, followed by applying heat kernel properties and an advanced bootstrap process to enhance solution regularity. For stability analysis, we extend LaSalle's invariance principle to a general L^∞ setting and utilize it alongside Lyapunov functions to analyze the stability of each possible constant equilibrium. All results are achieved without introducing an extra logistic growth term for predators or imposing smallness conditions on taxis coefficients.

GAIL WOLKOWICZ, McMaster University
[Saturday December 6 / samedi 6 décembre, 15:30 – Scott A]
A predator-prey model with delay in both the prey and the predator growth terms

A predator-prey model with a discrete delay in both the prey and predator growth terms is formulated and analyzed. Delay is incorporated so that only those that survive the delay period, consistent with the decline terms in the model, can contribute to growth. The model without delay allows only convergence to a globally asymptotically stable equilibrium. Using delay in the predator growth term as a bifurcation parameter can result in complex dynamics, including a period doubling route to chaos followed by period halving, and eventual extinction of the predator population. Delay in the growth term of the prey on the other hand is shown to tame the dynamics.

JIANHONG WU, York University
[Saturday December 6 / samedi 6 décembre, 10:00 – Scott A]
An integro-differential equation with spatially varying delay

We consider an integro-differential equation with spatially varying delay, motivated by the tick population dynamics with development delay influenced by spatially varying environmental conditions. We establish the threshold dynamics and show how the spatial distribution of the positive equilibrium (if exists) is impacted by the spatial heterogeneity of the development delay. Our analysis illustrates two novel phenomena for the ecological system modelled: population survival is highly sensitive to environmental change rates (slow changes cause extinction, whereas rapid changes facilitate survival through redistributing the population in space) ; for a given mode of spatial distribution, we can select a corresponding spatially varying development delay so that the stable positive equilibrium has the target mode. This is based on joint work with Y. Tang and B. Dai.

HILAIRE EPSTEIN NONHOU ZOGO, Queen's University
[Sunday December 7 / dimanche 7 décembre, 9:00 – Scott A]
Event-Triggered Control for an SIS Epidemic Model

In this talk, we will explore two control strategies, namely event-triggered feedback control and event-triggered impulse control, applied to an SIS epidemic model. In the event-triggered feedback control case, we construct a threshold to ensure the

asymptotic stability of the disease-free equilibrium while maintaining the positivity of the proportion of infected individuals at all times. The control updates are triggered once the error between the proportion of infected individuals at the latest triggering time and the current proportion of infected individuals reaches that threshold. The update remains active and constant for a certain period of time before the next triggering instant is determined, and this control strategy operates continuously. The event-triggered impulse control case on the other hand, relies on a predefined threshold, aiming primarily at the convergence of the proportion of infected individuals toward the disease-free equilibrium. Control interventions are discrete and determined when the proportion of infected individuals reaches that threshold. Additionally, we analyze the effect of execution delays in both control strategies and demonstrate that in either control case, the controlled SIS system does not exhibit Zeno behavior.

XINGFU ZOU, University of Western Ontario

[Saturday December 6 / samedi 6 décembre, 17:00 – Scott A]

Dynamics of a nonlocal dispersal population model with annually synchronized emergence of adults

In this talk, I present some recent results on the spatial dynamics of a nonlocal dispersal species model with annually synchronized emergence of adults. For the case of a bounded domain, we confirm threshold dynamics of the adult population, and provide the exact persistence criterion. For the case when the domain is the 1-D full space, we explore the existence of spreading speed and obtain their computation formula which coincide with the minimal wave speed for the traveling waves. The above results are obtain for both monotone and non-monotone maturation impulse functions. We also present some numerical simulations to demonstrate the theoretical results.

Quantum Error Correction and Related Topics
Correction d'erreurs quantiques et sujets connexes

Org: David Kribs and/et **Rajesh Pereira** (University of Guelph)

Quantum error correction (QEC) is a central topic in quantum information science, now touching on almost every aspect of the field, ranging from theoretical to experimental investigations and in recent years as a key facet in the development of new quantum technologies. This session will explore recent developments in QEC with an emphasis on mathematical aspects of the subject. Related topics in which QEC techniques and tools have arisen will also be explored.

La correction d'erreurs quantiques est un sujet central dans le domaine de l'informatique quantique, qui touche désormais presque tous les aspects de ce domaine, allant des recherches théoriques aux recherches expérimentales, et qui est devenu ces dernières années un élément clé dans le développement de nouvelles technologies quantiques. Cette session explorera les développements récents en matière de correction d'erreurs quantiques, en mettant l'accent sur les aspects mathématiques du sujet. Les sujets connexes dans lesquels les techniques et les outils de correction d'erreurs quantiques ont vu le jour seront également abordés.

Schedule/Horaire **Room/Salle: Wren C**

Monday December 8 **lundi 8 décembre**

9:00 - 9:30	Alexander Frei (University of Waterloo) (p. 162)
9:30 - 10:00	Ningping Cao (National Research Council), *Quantum Error-Corrected Non-Markovian Metrology* (p. 161)
10:00 - 10:30	Guillaume Dauphinais (Xanadu Quantum Technologies) (p. 162)
15:00 - 15:30	Andrew Nemec (University of Texas at Dallas), *Entanglement-Assisted Subspace Codes* (p. 162)
15:30 - 16:00	Sooyeong Kim (University of Guelph), *Quasiorthogonality of Commutative Algebras and Implications for Quantum Information* (p. 162)
16:00 - 16:30	Sarah Hagen (University of Illinois at Urbana-Champaign), *Quantum Secret Sharing with Three and Four Qubits* (p. 162)
16:30 - 17:00	Serge Adonsou (University of Guelph), *Unified and Generalized Approach to Entanglement-Assisted Quantum Error Correction* (p. 161)
17:00 - 17:30	Mukesh Taank (University of Guelph), *Generalized Knill–Laflamme theorem for families of isoclinic subspaces* (p. 163)

Abstracts/Résumés

SERGE ADONSOU, University of Guelph
[Monday December 8 / lundi 8 décembre, 16:30 – Wren C]
Unified and Generalized Approach to Entanglement-Assisted Quantum Error Correction

We introduce a framework for entanglement-assisted quantum error correcting codes that unifies the three original frameworks for such codes called entanglement-assisted quantum error correction, entanglement-assisted operator quantum error correction, and entanglement-assisted classical enhanced quantum error correction under a single umbrella. The unification is arrived at by viewing entanglement-assisted codes from the operator algebra quantum error correction perspective, and it is built upon a recently established extension of the stabilizer formalism to that setting. We denote the framework by entanglement-assisted operator algebra quantum error correction, and we prove a general error correction theorem for such codes, derived from the algebraic perspective, that generalizes each of the earlier results. This leads us to a natural notion of distance for such codes, and we derive a number of distance results for subclasses of the codes. We show how the classically enhanced codes form a proper subclass of the entanglement-assisted subspace codes defined by the general framework. We identify and construct new classes of entanglement-assisted subsystem codes and entanglement-assisted hybrid classical-quantum codes that are found outside of the earlier approaches, and we include a quantum communication application.

Quantum Error Correction and Related Topics
Correction d'erreurs quantiques et sujets connexes

NINGPING CAO, National Research Council Canada
[Monday December 8 / lundi 8 décembre, 9:30 – Wren C]
Quantum Error-Corrected Non-Markovian Metrology

Quantum metrology aims to maximize measurement precision on quantum systems, with a wide range of applications in quantum sensing. Achieving the Heisenberg limit (HL)—the fundamental precision bound set by quantum mechanics—is often hindered by noise-induced decoherence, which typically reduces achievable precision to the standard quantum limit (SQL). While quantum error correction (QEC) can recover the HL under Markovian noise, its applicability to non-Markovian noise remains less explored. In this work, we analyze a hidden Markov model (HMM) in which a quantum probe, coupled to an inaccessible environment, undergoes joint evolution described by Lindbladian dynamics, with the inaccessible degrees of freedom serving as a memory. We derive generalized Knill-Laflamme conditions for the HMM and establish three types of sufficient conditions for achieving the HL under non-Markovian noise using QEC. Additionally, we demonstrate the attainability of the SQL when these sufficient conditions are violated, by analytical solutions for special cases and numerical methods for general scenarios. Our results not only extend prior QEC frameworks for metrology but also provide new insights into precision limits under realistic noise conditions.

GUILLAUME DAUPHINAIS, Xanadu Quantum Technologies
[Monday December 8 / lundi 8 décembre, 10:00 – Wren C]

ALEXANDER FREI, University of Waterloo
[Monday December 8 / lundi 8 décembre, 9:00 – Wren C]

SARAH HAGEN, University of Illinois at Urbana-Champaign
[Monday December 8 / lundi 8 décembre, 16:00 – Wren C]
Quantum Secret Sharing with Three and Four Qubits

Quantum replacer codes correct for errors in which the state of one subsystem is replaced, and the location of the error is known. A secret sharing code refers to the special requirement that all possible replacer errors may each be corrected. We build on our previous work deriving general conditions met by any quantum replacer codes to completely characterize quantum secret sharing codes for three and four qubits. Additionally, we introduce helper codes as a relaxation of the conditions of a general secret sharing code. Instead of being able to correct errors in all locations, only some errors may be corrected with use of a non-erasable party referred to as the helper. This inequality between qubits of a code can be experimentally motivated.

SOOYEONG KIM, University of Guelph
[Monday December 8 / lundi 8 décembre, 15:30 – Wren C]
Quasiorthogonality of Commutative Algebras and Implications for Quantum Information

The notion of quasiorthogonality for operator algebras was introduced to provide a quantitative measure of the geometric relationships between algebras. Pivotal to the development and motivation for considering quasiorthogonality were applications in quantum information theory. We deepen the theory of quasiorthogonal operator algebras through an analysis of the commutative algebra case. We give a new approach to calculate the measure of orthogonality between two such subalgebras of matrices, based on a matrix-theoretic notion we introduce that has a connection to complex Hadamard matrices. We also show how this new tool can yield significant information on the general non-commutative case.

Quantum Error Correction and Related Topics
Correction d'erreurs quantiques et sujets connexes

ANDREW NEMEC, University of Texas at Dallas
[Monday December 8 / lundi 8 décembre, 15:00 – Wren C]
Entanglement-Assisted Subspace Codes

We show how entanglement-assisted codes can be constructed from arbitrary quantum codes by sending correctable subsets to the receiver ahead of time. In the case of degenerate codes, we show that the shared entanglement can be reduced. We also give examples of permutation-invariant EA codes, the first EA codes outside of the codeword-stabilized framework.

MUKESH TAANK, University of Guelph
[Monday December 8 / lundi 8 décembre, 17:00 – Wren C]
Generalized Knill–Laflamme theorem for families of isoclinic subspaces

Isoclinic subspaces have been studied for over a century. Quantum error correcting codes were recently shown to define a subclass of families of isoclinic subspaces. The Knill–Laflamme theorem is a seminal result in the theory of quantum error correction, a central topic in quantum information. We show there is a generalized version of the Knill–Laflamme result and conditions that applies to all families of isoclinic subspaces. In the case of quantum stabilizer codes, the expanded conditions are shown to capture logical operators. We apply the general conditions to give a new perspective on a classical subclass of isoclinic subspaces defined by the graphs of anti-commuting unitary operators. We show how the result applies to recently studied mutually unbiased quantum measurements (MUMs), and we give a new construction of such measurements motivated by the approach.

Recent Developments in Complex Analysis and Geometry
Développements récents en analyse complexe et géométrie

Org: Alexander Brudnyi (University of Calgary), **Rasul Shafikov** (Western University) and/et **Mahishanka Withanachchi** (University of Calgary)

This session brings together recent advances in complex analysis, several complex variables, operator theory, harmonic analysis, and geometric measure theory. Emphasizing both classical problems and emerging techniques, the session fosters dialogue between analysis and geometry to explore foundational and modern challenges.

Cette session rassemble les avancées récentes en analyse complexe, variables complexes multiples, théorie des opérateurs, analyse harmonique et théorie géométrique de la mesure. Mettant l'accent à la fois sur les problèmes classiques et les techniques émergentes, la session favorise le dialogue entre l'analyse et la géométrie afin d'explorer les défis fondamentaux et modernes.

Schedule/Horaire **Room/Salle: Seymour**

Saturday December 6 — samedi 6 décembre

9:00 - 10:00	Ilia Binder (Toronto), *SLE as critical interface limits: power law rate of convergence* (p. 165)
10:00 - 10:30	Harshith Alagandala (UWO), *Local Polynomial Convexity at Hyperbolic CR-singularity in $M^n \subset \mathbb{C}^n$* (p. 164)
15:00 - 15:30	Tatyana Barron (UWO), *Vanishing of Poincare series, revisited* (p. 165)
15:30 - 16:00	Roberto Albesiano (Waterloo), *From division to extension* (p. 164)
16:00 - 17:00	Isabelle Chalendar (Université Gustave Eiffel) (p. 165)
17:00 - 17:30	Debraj Chakrabarti (Central Michigan), *Restricted type estimates and the Bergman Projection* (p. 165)
17:30 - 18:00	Jesse Hulse (Manitoba), *A Formula for the Pluricomplex Green Function of the Bidisk* (p. 166)

Sunday December 7 — dimanche 7 décembre

9:00 - 9:30	Pierre-Olivier (UQTR) (p. 166)
9:30 - 10:00	Yunus Zeytuncu (Michigan), *Spectral Theory of the Kohn Laplacian on Quotient Manifoldsv* (p. 167)
10:00 - 10:30	Lis Vivas (Ohio State) (p. 166)
15:00 - 15:30	Luka Mernik (Florida Polytechnic University) (p. 166)
15:30 - 16:30	Dan Coman (Syracuse), *Tian's theorem for Grassmannian embeddings and degeneracy sets of random sections* (p. 166)
16:30 - 17:00	Andy Raich (Arkansas), *Tower multitype and compactness of the dbar-Neumann operator in complex manifolds* (p. 166)
17:00 - 18:00	Dror Varolin (Stony Brook) (p. 166)

Abstracts/Résumés

HARSHITH ALAGANDALA, Western University

[Saturday December 6 / samedi 6 décembre, 10:00 – Seymour]

Local Polynomial Convexity at Hyperbolic CR-singularity in $M^n \subset \mathbb{C}^n$

Let M be a smooth manifold of dimension n embedded in $\mathbb{C}^n$. If $T_pM \subset T_p\mathbb{C}^n$ is a totally real subspace for $p \in M$, then M is locally polynomially convex at p. For a generic embedding M, we are interested in assessing polynomial convexity of M at a CR-singularity, i.e., at a point $p \in M$ where T_pM is not totally real. An order one CR-singularity in M can be broadly classified as elliptic and hyperbolic. It is known that elliptic points give obstruction to polynomial convexity. In the case $n = 2$, $M^2 \subset \mathbb{C}^2$ is locally polynomially convex at a hyperbolic complex point. We investigate local polynomial convexity of $M^n \subset \mathbb{C}^n$ at hyperbolic points in higher dimension.

Recent Developments in Complex Analysis and Geometry
Développements récents en analyse complexe et géométrie

ROBERTO ALBESIANO, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 15:30 – Seymour]
From division to extension

Extending holomorphic data from subvarieties (L^2 extension) and lifting holomorphic sections of quotient bundles (L^2 division) are fundamental problems in complex geometry and several complex variables. They are also intimately related: in fact, Ohsawa showed that a version of the L^2 division theorem can be proved as a corollary of the L^2 extension theorem. We will see how, conversely, a version of the extension theorem can be obtained as an easy corollary of a division theorem with bounded generators.

TATYANA BARRON, University of Western Ontario
[Saturday December 6 / samedi 6 décembre, 15:00 – Seymour]
Vanishing of Poincare series, revisited

Let H be the complex vector space of holomorphic sections of the k-th tensor power of the canonical bundle on a compact ball quotient. It is well known that if k is sufficiently large, then the Poincare series map $P : W \to H$ is surjective (here W is the corresponding weighted Bergman space on the ball). I will discuss a criterion for $f \in W$ to be in $\ker(P)$.

ILIA BINDER, University of Toronto
[Saturday December 6 / samedi 6 décembre, 9:00 – Seymour]
SLE as critical interface limits: power law rate of convergence

This talk explores the rate of convergence of critical interfaces in various lattice models to Schramm–Loewner Evolution (SLE). We present a general framework for establishing power law convergence rates, offering a unified approach applicable across multiple models. As a central example, we examine the exploration process in critical percolation, demonstrating that for any "reasonable" critical percolation model, convergence to SLE is guaranteed and the polynomial rate follows automatically. This result holds unconditionally for critical site percolation on the hexagonal lattice and several of its generalizations, which will be discussed in detail. We further illustrate the applicability of the framework to other models, including the Harmonic Explorer and the Ising model.

This talk is based on joint projects with L. Chayes, D. Chelkak, H. Lei, and L. Richards.

BLAKE BOUDREAUX, Arkansas
[Seymour]

DEBRAJ CHAKRABARTI, Central Michigan University
[Saturday December 6 / samedi 6 décembre, 17:00 – Seymour]
Restricted type estimates and the Bergman Projection

We obtain (weighted) restricted-type estimates for the Bergman projection operator on monomial polyhedra, a class of domains generalizing the Hartogs triangle. A restricted-type estimate is an estimate in the L^p-norm on an operator, which however holds only on characteristic functions. From these restricted-type estimates, we recapture L^p-boundedness results of the Bergman projection on these domains. On some monomial polyhedra, we show that the Bergman projection could fail to be of weak type (q_*, q_*) , where q_* denotes the right end-point of the interval of L^p-boundedness of the Bergman projection.

Recent Developments in Complex Analysis and Geometry
Développements récents en analyse complexe et géométrie

ISABELLE CHALENDAR, Université Gustave Eiffel
[Saturday December 6 / samedi 6 décembre, 16:00 – Seymour]

DAN COMAN, Syracuse University
[Sunday December 7 / dimanche 7 décembre, 15:30 – Seymour]
Tian's theorem for Grassmannian embeddings and degeneracy sets of random sections

Let (X, ω) be a compact Kähler manifold, (L, h^L) be a positive line bundle, and (E, h^E) be a Hermitian holomorphic vector bundle of rank r on X. We show that the pullback by the Kodaira embedding associated to $L^p \otimes E$ of the k-th Chern class of the dual of the universal bundle over the Grassmannian converges as $p \to \infty$ to the k-th power of the Chern form $c_1(L, h^L)$, for $0 \leq k \leq r$. As a consequence we show that the limit distribution of zeros of random sequences of holomorphic sections of high powers $L^p \otimes E$ is $c_1(L, h^L)^r$. Furthermore, we compute the expectation of the currents of integration along degeneracy sets of random holomorphic sections. This is joint work with Turgay Bayraktar, Bingxiao Liu and George Marinescu.

JESSE HULSE, University of Manitoba
[Saturday December 6 / samedi 6 décembre, 17:30 – Seymour]
A Formula for the Pluricomplex Green Function of the Bidisk

A formula for the pluricomplex Green function of the bidisk with two poles of equal weights will be derived. We divide the bidisk into two open regions, where the formula is found explicitly on the first region, and the other region is the union of a family of hypersurfaces. Time permitting, the newly derived formula will be used to find a formula for the Caratheodory metric on the symmetrized bidisk (up to a fourth degree polynomial) that matches Agler and Young's formula but without the supremum.

LUKA MERNIK, Florida Polytechnic University
[Sunday December 7 / dimanche 7 décembre, 15:00 – Seymour]

PIERRE-OLIVIER, UQTR
[Sunday December 7 / dimanche 7 décembre, 9:00 – Seymour]

ANDY RAICH, University of Arkansas
[Sunday December 7 / dimanche 7 décembre, 16:30 – Seymour]
Tower multitype and compactness of the dbar-Neumann operator in complex manifolds

In this talk, I will discuss a new approach to establishing compactness of the $\bar{\partial}$-Neumann operator on (p, q)-forms on not necessarily pseudoconvex domains in complex manifolds. I will introduce a construction called the tower multitype and use it to build a stratification of the boundary. The stratification implies Property (P_q) which in turn implies compactness of the $\bar{\partial}$-Neumann operator. I will also provide examples.

The result is joint work with Professor Dmitri Zaitsev of Trinity College Dublin.

DROR VAROLIN, Stony Brook
[Sunday December 7 / dimanche 7 décembre, 17:00 – Seymour]

LIS VIVAS, Ohio State
[Sunday December 7 / dimanche 7 décembre, 10:00 – Seymour]

YUNUS ZEYTUNCU, University of Michigan-Dearborn
[Sunday December 7 / dimanche 7 décembre, 9:30 – Seymour]
Spectral Theory of the Kohn Laplacian on Quotient Manifoldsv

In this talk, we study the spectrum of the Kohn Laplacian on quotient manifolds. In particular, we relate the asymptotic properties of the Kohn Laplacian's eigenvalues on sphere quotients to the group action.

Recent progress in convex and discrete geometry
Progrès récents en géométrie convexe et discrète

Org: Ferenc Fodor (University of Szeged, Hungary and University of Calgary, Canada) and/et **Alina Stancu** (Concordia University, Canada)

This session will bring together leading researchers and emerging scholars to explore the latest advances in the theory and applications of convex geometry, discrete structures, and their rich interplay. Topics will include new results in the Brunn–Minkowski theory, geometric inequalities, phenomena in high dimensions, classical problems in discrete and combinatorial geometry, and computational aspects of convex bodies. Our goal is to foster collaboration and inspire novel research directions by providing a vibrant platform for exchanging ideas within the Canadian and international mathematical communities.

Cette session réunira des chercheur(euse)s de renom et de jeunes universitaires afin d'explorer les dernières avancées en matière de théorie et d'applications de la géométrie convexe, des structures discrètes et de leurs riches interactions. Les thèmes abordés comprendront les nouveaux résultats de la théorie de Brunn-Minkowski, les inégalités géométriques, les phénomènes dans les dimensions élevées, les problèmes classiques de la géométrie discrète et combinatoire, ainsi que les aspects computationnels des corps convexes. Notre objectif est de favoriser la collaboration et d'inspirer de nouvelles orientations de recherche en offrant une plateforme dynamique pour l'échange d'idées au sein des communautés mathématiques canadiennes et internationales.

Schedule/Horaire **Room/Salle: Wren C**

Saturday December 6 — samedi 6 décembre

8:00 - 8:30	Dylan Langharst (Cargnegie Mellon University), *Grünbaum's inequality for probability measures* (p. 170)
8:30 - 9:00	Alex Iosevich (University of Rochester), *Some parallels between Erdos type problems and exact signal recovery* (p. 169)
9:00 - 9:30	Pavlos Kalantzopoulos (University of Waterloo), *Extremal Convex Bodies in Liakopoulos's Generalized Dual Loomis–Whitney Inequality.* (p. 170)
9:30 - 10:00	Lam Nguyen (Memorial University of Newfoundland), *Logarithmic Sobolev, Poincaré, and Beckner Inequalities on Hyperbolic Spaces* (p. 171)
10:00 - 10:30	Jie Xiao (Memorial University of Newfoundland), *C^1-maximizer of p-mean torsion rigidity on convex bodies* (p. 172)
15:00 - 15:30	Bartlomiej Zawalski (Case Western Reserve University), *On flat shadow boundaries from point light sources and the characterization of ellipsoids* (p. 172)
15:30 - 16:00	Kateryna Tatarko (University of Waterloo), *Minimizing inradius for a given constraint* (p. 171)
16:00 - 16:30	Egon Schulte (Northeastern University), *Bounding the Regularity Radius of Delone Sets* (p. 171)

Sunday December 7 — dimanche 7 décembre

8:30 - 9:00	Jaskaran Kaire (University of Manitoba), *Hadwiger's Conjecture for Cap Bodies* (p. 170)
9:00 - 9:30	Dmitry Faifman (University of Montreal), *Bi-invariant valuations and convolution on Lie groups* (p. 169)
9:30 - 10:00	Karoly Bezdek (University of Calgary), *Non-separable arrangements revisited* (p. 169)
10:00 - 10:30	Elisabeth Werner (Case Western Reserve University), *L_p relative surface areas* (p. 172)
15:00 - 15:30	Gergely Ambrus (University of Szeged, Hungary), *Large signed sums, polarization problems, and projection constants of convex bodies* (p. 169)
15:30 - 16:00	Ted Bisztriczky (University Calgary), *Construction methods for polytopes* (p. 169)
16:00 - 16:30	Sergii Myroshnychenko (University of the Fraser Valley), *Polytope Reconstruction: floating and illuminating structures* (p. 170)
16:30 - 17:00	Viktor Vigh (University of Szeged, Hungary), *Circumscribed random spherical disc-polygons via duality* (p. 172)
17:00 - 17:30	Carsten Schütt (University of Kiel, Germany), *Expected extremal area of facets of random polytopes* (p. 171)

Abstracts/Résumés

GERGELY AMBRUS, University of Szeged & Rényi Institute
[Sunday December 7 / dimanche 7 décembre, 15:00 – Wren C]
Large signed sums, polarization problems, and projection constants of convex bodies

Vector balancing problems have been studied extensively for at least half a century, while their siblings, anti-balancing problems received much less attention. In this talk, we make up for this deficit by considering the following problem . Given a norm on $\mathbb{R}^d$, and a positive integer n, what is the largest constant $C(n)$ so that for any set of n unit vectors $u_1, \ldots, u_n$ in the chosen norm), one can assign signs $\varepsilon_i \in \pm 1$ to them for which the signed sum $\varepsilon_1 u_1 + \ldots \varepsilon_n u_n$ has norm at least $C(n)$? Equivalently, one would like to partition the set of vectors into two parts so that the corresponding sums are far from each other in the specified norm. We show that the worst case (i.e. the smallest $C(n)$) corresponds to the maximum norm, while $C(n)$ is asymptotically the largest for the Euclidean norm. En route, we also introduce the notion of the polarization constant of general convex bodies, demonstrate its connection to the question of large signed sums, and in the limit case, to the 1-absolutely summing and projection constants.

This is joint work with Florian Grundbacher (TU Munich).

KAROLY BEZDEK, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 9:30 – Wren C]
Non-separable arrangements revisited

A problem posed by Erdős in 1945 initiated the study of non-separable arrangements of convex bodies. A finite family of convex bodies in Euclidean d-space is called a non-separable family (or NS-family) if every hyperplane intersecting their convex hull also intersects at least one member of the family. Minimal coverings of NS-families of positive homothetic convex bodies have been investigated in several recent works. This lecture extends those results to weakly non-separable families and weakly k-impassable families of convex d-polytopes for $0 < k < d - 1$. This is a joint work with Z. Lángi (Rényi Inst. and Univ. of Szeged, Hungary).

TED BISZTRICZKY, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 15:30 – Wren C]
Construction methods for polytopes

A survey of the hows and whys of following methods of construction of d-dimensional convex polytopes:fundamental, inductive, descriptive and combinatorial.

DMITRY FAIFMAN, Université de Montréal
[Sunday December 7 / dimanche 7 décembre, 9:00 – Wren C]
Bi-invariant valuations and convolution on Lie groups

Minkowski addition of sets is the geometric embodiment of the additive structure of the underlying Euclidean space. It gives rise to the convolution product on translation-invariant valuations, introduced by Bernig and Fu, which is closely tied to integral geometry, namely to additive kinematic formulas. Convolution of valuations has also been defined on compact Lie groups by Alesker and Bernig. We unify the two operations, introducing a convolution product of smooth bi-invariant valuations on arbitrary unimodular Lie groups. As a key ingredient in the construction, we find all connected Lie groups which admit non-trivial bi-invariant valuations. Based on a joint work with A. Bernig and J. Kotrbaty

Recent progress in convex and discrete geometry
Progrès récents en géométrie convexe et discrète

ALEX IOSEVICH, University of Rochester
[Saturday December 6 / samedi 6 décembre, 8:30 – Wren C]
Some parallels between Erdos type problems and exact signal recovery

We are going to discuss some connections between Erdos-type problems in the discrete setting and the theory of exact signal recovery. The restriction theory of the Fourier transform will be presented as the unifying theme.

JASKARAN KAIRE, University of Manitoba
[Sunday December 7 / dimanche 7 décembre, 8:30 – Wren C]
Hadwiger's Conjecture for Cap Bodies

Hadwiger's covering conjecture states that every n-dimensional convex body can be covered by at most 2^n smaller positive homothetic copies of itself, with 2^n copies required only for affine images of the n-cube. Despite recent progress on the Hadwiger's conjecture, it remains open in general, as well as for specific classes of bodies.

In this talk, I will show that the conjecture holds for the class of cap bodies in all dimensions. For $3 \leq n \leq 15$, the proof combines a probabilistic technique with reduction to integer linear programming. For $n \geq 15$, we obtain an explicit bound based on the same probabilistic technique but avoiding computer aid. Furthermore, for $n = 3$, we prove that the value of the covering number for the class of cap bodies is 6.

This talk is based on joint work with A. Arman and A. Prymak.

PAVLOS KALANTZOPOULOS, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 9:00 – Wren C]
Extremal Convex Bodies in Liakopoulos's Generalized Dual Loomis–Whitney Inequality.

We characterize equality cases in volume inequalities for sections of convex bodies by certain lower-dimensional linear subspaces. These inequalities, introduced by Liakopoulos, generalize Meyer's dual Loomis–Whitney inequality and provide a generalized dual form of the Bollobás–Thomason uniform cover inequality. Our approach builds on a previous result characterizing equality in Barthe's geometric reverse Brascamp–Lieb inequalities. We show that equalities occur when the convex body is the convex hull of its intersections with certain orthogonal subspaces determined by the Brascamp–Lieb data. This is joint work with Károly Böröczky and Ferenc Fodor.

DYLAN LANGHARST, Carnegie Mellon University
[Saturday December 6 / samedi 6 décembre, 8:00 – Wren C]
Grünbaum's inequality for probability measures

Given a convex body K in $\mathbb{R}^n$, a natural question is: if one partitions the body into two pieces along its barycenter, how small can each piece be ? By "partition along its barycenter", we mean intersecting K with a half-space whose boundary is a hyperplane containing said barycenter. Grünbaum showed that the volume of each piece is at least $\left(\frac{n}{n+1}\right)^n$ times the total volume of K. Furthermore, this constant is sharp: there is equality if and only if K is a cone, which means there exists a $(n-1)$-dimensional convex body L and a vector b, such that K has face L and vertex b (i.e. K is the convex hull of b and L).

In this work, which is joint with M. Fradelizi, J. Liu, F. Marin Sola, and S. Tang, we are interested in generalizing Grünbaum's inequality to other measures. Our main results are a sharp inequality for the Gaussian measure and a sharp inequality for s-concave probability measures. The characterization of the equality case is of particular interest. Along the way, we discover new facts about the equality case of the Borell-Brascamp-Lieb inequality.

Recent progress in convex and discrete geometry
Progrès récents en géométrie convexe et discrète

SERGII MYROSHNYCHENKO, University of the Fraser Valley
[Sunday December 7 / dimanche 7 décembre, 16:00 – Wren C]
Polytope Reconstruction: floating and illuminating structures

The surface of buoyancy (or surface of centers) of a convex body plays a central role in the study of floating bodies. Its properties and significance have been the focus of extensive recent work by D. Florentin, H. Huang, D. Ryabogin, C. Schutt, B. Slomka, E. Werner, B. Zawalski, N. Zhang, among others. In this talk, we address the problem of unique determination of a convex polytope by its surface of buoyancy or by its Dupin floating body. We also consider the dual questions in the setting of illumination bodies. The presented results are based on joint work with S. Dann and O. Herscovici.

LAM NGUYEN, Memorial University of Newfoundland
[Saturday December 6 / samedi 6 décembre, 9:30 – Wren C]
Logarithmic Sobolev, Poincaré, and Beckner Inequalities on Hyperbolic Spaces

This talk presents recent progress in the study of logarithmic Sobolev, Poincaré, and Beckner inequalities on hyperbolic spaces. We focus on determining the best constants and exploring their close connection to Gaussian measures. We also discuss new versions of Beckner inequalities that come from studying heat flow on hyperbolic spaces. This work is a collaboration with Anh Do, Guozhen Lu, and Debdip Ganguly.

EGON SCHULTE, Northeastern University
[Saturday December 6 / samedi 6 décembre, 16:00 – Wren C]
Bounding the Regularity Radius of Delone Sets

Delone sets are uniformly discrete point sets X in Euclidean d-space that are used in the modeling of crystals. They can be characterized by parameters r and R, where (usually) $2r$ is the smallest interpoint distance of X and R is the radius of a largest "empty ball" that can be placed into the interstices of X. The local theory for Delone sets searches for local conditions on X that guarantee the emergence of a crystallographic group of symmetries producing X as an orbit set consisting of a single point orbit or finitely many point orbits, respectively. The regularity radius $\hat{\rho}_d$ is defined as the smallest positive number ρ such that each Delone set X with congruent clusters of radius ρ is a regular system, that is, a point orbit under a crystallographic group. We discuss bounds for the regularity radius in terms of R, and present conjectures that have been verified for some particularly interesting classes of Delone sets. This is joint work with Nikolai Dolbilin, Alexey Garber and Marjorie Senechal.

CARSTEN SCHÜTT, Christian-Albrechts-University Kiel
[Sunday December 7 / dimanche 7 décembre, 17:00 – Wren C]
Expected extremal area of facets of random polytopes

We study extremal properties of spherical random polytopes, the convex hull of random points chosen from the unit Euclidean sphere in $\mathbb{R}^n$. The extremal properties of interest are the expected values of the maximum and minimum surface area among facets.

KATERYNA TATARKO, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 15:30 – Wren C]
Minimizing inradius for a given constraint

It is well known that among all convex bodies in $\mathbb{R}^n$ with a given surface area, the Euclidean ball has the largest inradius. We will show that this result can be reversed in the class of convex bodies with curvature at each point of their boundary bounded below by some positive constant λ (λ-convex bodies). In particular, we show that among λ-convex bodies of a given surface

area, the λ-convex lens (the intersection of two balls of radius $\frac{1}{\lambda}$) minimizes the inradius. If time permits, we will also discuss a few related questions. This is a joint work with K. Drach.

VIKTOR VIGH, University of Szeged
[Sunday December 7 / dimanche 7 décembre, 16:30 – Wren C]
Circumscribed random spherical disc-polygons via duality

In this talk, we work on S^2 and study random spherical disc-polygons within a spherical convex disc whose boundary is C^2 smooth. This model encompasses the usual spherical convex model and, as a limiting case, planar spindle convexity as well. We establish asymptotic results for the area and perimeter of the inscribed random disc-polygon. Next, we introduce a spherical spindle-convex duality, which allows us to naturally define circumscribed random spherical disc-polygons. Using the area and perimeter formulas of the dual disc, we obtain asymptotic results in the circumscribed model as well.

This is a joint work with Kinga Nagy.

ELISABETH WERNER
[Sunday December 7 / dimanche 7 décembre, 10:00 – Wren C]
L_p relative surface areas

Motivated by a duality result, we define new surface area measures for ball-convex bodies. We call these measures L_p relative surface areas. We show that these quantities are rigid motion invariant, upper semi continuous valuations. We establish monotonicity properties of these quantities which lead to new entropy functionals for convex bodies.

Joint work with D. Yalikun.

JIE XIAO, Memorial University
[Saturday December 6 / samedi 6 décembre, 10:00 – Wren C]
C^1-maximizer of p-mean torsion rigidity on convex bodies

Given a bounded domain $B \subset \mathbb{R}^{n\geq 2}$ with its boundary ∂B, a solution u_B of the torsion problem

$$\begin{cases} \Delta u_B = -1 & \text{in } B; \\ u_B = 0 & \text{on } \partial B, \end{cases}$$

is called a stress function of B. Via the torsion rigidity

$$\int_B |\nabla u_B(x)|^2 \, dx,$$

this talk is about to show that the maximization problem for $[1,\infty) \ni p$-mean torsion rigidity

$$(\star) \qquad \sup_{\text{all convex bodies } B \subset \mathbb{R}^n} \int_B \left(\frac{|\nabla u_B(x)|^2}{|B|^{\frac{2}{n}}} \right)^p \frac{dx}{|B|},$$

is achievable and the boundary $\partial B_\bullet$ of any maximizer $B_\bullet$ of $(\star)$ is C^1-smooth, thereby finding that if $|\nabla u_{B_\bullet}|$ is constant on $\partial B_\bullet$ then $B_\bullet$ is a Euclidean ball.

BARTLOMIEJ ZAWALSKI, Case Western Reserve University
[Saturday December 6 / samedi 6 décembre, 15:00 – Wren C]
On flat shadow boundaries from point light sources and the characterization of ellipsoids

Recent progress in convex and discrete geometry
Progrès récents en géométrie convexe et discrète

The study of convex bodies whose hyperplane sections exhibit specific symmetry traces back to the classical works of W. Blaschke and H. Brunn. More recently, in a series of papers by I. Gonzalez-Garcia, J. Jeronimo-Castro, E. Morales-Amaya, and D.J. Verdusco-Hernandez, attention has turned to a dual viewpoint: instead of symmetries of sections by a prescribed family of hyperplanes, one investigates symmetries of supporting cones with apexes in a prescribed family of points. In this talk, we will present a precise duality framework that connects known and conjectured results in these two settings. We will further show that if the shadow boundaries generated by point light sources placed on a hypersurface enclosing a sufficiently smooth convex body $K \subset \mathbb{R}^n$, $n \geq 3$, are all flat, then K must necessarily be an ellipsoid. This extends a classical theorem of Blaschke, who established the analogous characterization in the case of parallel light sources placed at infinity.

Set theory and its applications
Théorie des ensembles et ses applications

Org: Spencer Unger (University of Toronto) and/et **Andy Zucker** (University of Waterloo)

The session will bring together a group of researchers working in the diverse area of applications of set theory to other areas of mathematics

La session réunira un groupe de chercheur(euse)s travaillant dans le domaine varié des applications de la théorie des ensembles à d'autres domaines des mathématiques.

Schedule/Horaire **Room/Salle: Wren B**

Saturday December 6 **samedi 6 décembre**

9:00 - 10:00	Jorge Cruz Chapital (University of Toronto) (p. 174)
10:00 - 10:30	Isabella Negrini (University of Toronto), *An Erdős–Rado theorem for perfect trees* (p. 174)
15:00 - 16:00	Narmada Varadarajan (University of Toronto), *Circle-squaring with low Borel complexity* (p. 175)
16:00 - 17:00	Jashan Bal (University of Waterloo), *Projectivity in topological dynamics* (p. 174)
17:00 - 18:00	Bo Peng (McGill University), *Anti-classification results in dynamical systems* (p. 175)

Sunday December 7 **dimanche 7 décembre**

8:00 - 9:00	Julian Camilo Cano Ramos (Universidad de Los Andes), *Combinatorics of Ramsey ideals* (p. 175)
9:00 - 10:00	Ronnie Chen (University of Florida) (p. 174)

Abstracts/Résumés

JASHAN BAL, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 16:00 – Wren B]
Projectivity in topological dynamics

Motivated by Gleason's result on projective compact spaces we study projectivity in the category of G-flows and affine G-flows for Polish groups G. We present a characterization of extreme amenability and amenability for closed subgroups $H \leq G$ in terms of the Samuel compactification of G/H being projective. Then we introduce a new notion of extensions between affine G-flows, called proximally irreducible, and use it to prove an analogues result characterizing strong amenability of subgroups. This answers an open question of Zucker and provides a structure theorem for when the universal minimal proximal flow is metrizable or contains a comeager orbit.

JORGE CRUZ CHAPITAL, University of Toronto
[Saturday December 6 / samedi 6 décembre, 9:00 – Wren B]

RONNIE CHEN, University of Florida
[Sunday December 7 / dimanche 7 décembre, 9:00 – Wren B]

ISABELLA NEGRINI, University of Toronto
[Saturday December 6 / samedi 6 décembre, 10:00 – Wren B]
An Erdős–Rado theorem for perfect trees

The Erdős–Rado theorem states that any equivalence relation on $[\omega]^k$ can be reduced to a *canonical* equivalence relation on $[M]^k$ for some infinite M. In this joint work in progress with Unger, we establish an analogous result for equivalence relations on certain finite trees inside perfect trees.

BO PENG, McGill University
[Saturday December 6 / samedi 6 décembre, 17:00 – Wren B]
Anti-classification results in dynamical systems

Classification theory plays an important role in dynamical systems. In recent years, the focus has shifted towards so-called anti-classification results. By applying techniques from descriptive set theory, we can prove that specific types of classifications are impossible. In this talk, I will discuss some recent anti-classification results regarding classifying topological and smooth dynamical systems by topological conjugacy and classifying measure-preserving transformation by measure isomorphism.

JULIAN CAMILO CANO RAMOS, Universidad de Los Andes
[Sunday December 7 / dimanche 7 décembre, 8:00 – Wren B]
Combinatorics of Ramsey ideals

In this talk, we primarily study several combinatorial properties of Ramsey–type ideals on countably infinite sets. Specifically, we show new combinatorial characterizations of Ramsey ideals through various partition and convergence properties. Furthermore, we analyze ideal versions of some relevant high–dimensional Ramsey–type theorems, in order to research ideals related to finite colorings of fronts on the natural numbers as well as ideals associated with finite partitions of any family of finite subsets of the natural numbers. In particular, Galvin ideals are introduced as an intermediate combinatorial concept between Ramsey ideals and semiselective ideals. Finally, we also prove that under CH and $\neg SH$ there is a semiselective coideal that does not contain any selective ultrafilter, although it is also consistent that every semiselective coideal contains a selective ultrafilter.

NARMADA VARADARAJAN, University of Toronto
[Saturday December 6 / samedi 6 décembre, 15:00 – Wren B]
Circle-squaring with low Borel complexity

Laczkovich famously showed in 1990—answering a long-standing question of Tarski—that a circle and a square of the same area are equidecomposable using only translations. This has been steadily improved upon over the past decade by a series of results showing that the pieces, originally chosen in a non-constructive way, can have stronger regularity properties. The first completely constructive equidecomposition is due to Marks and Unger, who proved that the pieces can be Borel ; Máthé, Noel, and Pikhurko later improved this to pieces with low Borel complexity (Δ^0_3). In this talk, I will sketch an argument that, in fact, the pieces can be as low complexity as Δ^0_2. The main new idea in our proof comes from a recent paper of Gao, Jackson, Krohne, and Seward. We generalize their definition of a weakly orthogonal decomposition to construct a low complexity (Δ^0_2) "toast", and then use network flows and graph theory (as in previous works) to achieve a low complexity equidecomposition.

This talk is based on joint work with Spencer Unger and Felix Weilacher.

Student Research Session
Session de présentations de recherche par les étudiants

Schedule/Horaire **Room/Salle: Chesterton**

Sunday December 7 **dimanche 7 décembre**

8:00 - 8:30	Kate Tretiakova (University of Ottawa), *"But How Do We Know?": Epistemological Trespass in the Math Classroom* (p. 178)
8:30 - 9:00	Rick Lu and Haonan Zhao (University of Toronto), *L-functions and Numerical Computations Concerning Landau-Siegel Zeros* (p. 177)
9:00 - 9:30	Amaury De Burgos (University of Calgary), *On the length of cyclic algebras* (p. 176)
9:30 - 10:00	Adrian Chitan (Western University), *Stratification of the half-density quantization of the Jeffrey-Weitsman-Witten invariants* (p. 176)
15:00 - 15:30	Jiatong Sun (University of Alberta), *Data-Driven Computation for Periodic Stochastic Differential Equations* (p. 178)
15:30 - 16:00	Dariche Nguyen (McMaster University), *Weak anchoring around a colloidal particle* (p. 178)
16:00 - 16:30	Thanh Huynh (McMaster University), *A numerical approach for local isoperimetric partitions* (p. 177)
16:30 - 17:00	Shohel Ahmed (University of Alberta), *Modelling Foraging Behavior in Ecological Dynamics* (p. 176)
17:00 - 17:30	Shan Gao (University of Alberta), *Tipping in Ecological Systems Driven by Periodic Climate Variability* (p. 177)
17:30 - 18:00	Austin Sun (University of Toronto), *The Grassmannian of lines as the space of pencils of binary quantics: towards a GIT-free PGL_2-stratification of $Gr(2, n+1)$* (p. 178)

Abstracts/Résumés

SHOHEL AHMED, University of Alberta
[Sunday December 7 / dimanche 7 décembre, 16:30 – Chesterton]
Modelling Foraging Behavior in Ecological Dynamics

Foraging behavior is often highly flexible, with individuals adjusting how, when, and where they feed in response to changing environmental conditions and predation risk. In this work, a set of mechanistic models is developed to investigate how such foraging flexibility shapes population dynamics and ecosystem functioning. First, consumer–resource models are formulated in which attack rates adapt to food availability and population density, capturing behavioral feedback between foraging effort and resource depletion. Second, nutrient balance and food quality are incorporated into stoichiometric foraging models that link diet choice to growth efficiency and energy allocation. Together, these complementary frameworks demonstrate how flexible foraging decisions, grounded in explicit mechanistic processes, can stabilize or destabilize ecological dynamics and generate diverse outcomes in community structure and resilience.

ADRIAN CHITAN, Western University
[Sunday December 7 / dimanche 7 décembre, 9:30 – Chesterton]
Stratification of the half-density quantization of the Jeffrey-Weitsman-Witten invariants

This talk presents a stratified quantization procedure motivated by the geometric foundations of the Jeffrey-Weitsman formalization of Witten's 3-manifold invariants. The core challenge we address is the singular structure of the space of flat connections on the bounding surface that extend into the handlebody—the so-called Lagrangian leaf, and the natural quantization procedure it suggests.

Student Research Session
Session de présentations de recherche par les étudiants

AMAURY DE BURGOS, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 9:00 – Chesterton]
On the length of cyclic algebras

Cyclic algebras were first introduced by Leonard Eugene Dickson in 1906. He remarked that, for appropriate choice of parameters, his construction yielded a division algebra. These cyclic division algebras were one of the earliest examples of non-commutative division algebras over a field and are now applied in wireless communication systems (e.g. 4G LTE, 5G, Wi-Fi networks) via space-time block coding.

A notable numerical invariant of any algebra over a field is its length, defined as the length of its longest chain of linear subspaces. In 2016, the length of 4-dimensional cyclic algebras was proven to be 2. Five years later, the length of cyclic algebras of dimension 9, 16, and 25 was stated to be 4, 6, and 8 respectively. We show these latter values are ill-derived, meaning the length of cyclic algebras of dimension greater than 4 is still an open problem.

In pursuit of solving this open problem, we construct an infinite family of cyclic division algebras and give a lower bound on the length of its members. Lastly, we tensor members of a subfamily with the Gaussian rationals to produce fully-diverse linear space-time block codes with non-vanishing determinant.

SHAN GAO, University of Alberta
[Sunday December 7 / dimanche 7 décembre, 17:00 – Chesterton]
Tipping in Ecological Systems Driven by Periodic Climate Variability

Tipping points refer to abrupt, substantial, and often irreversible transitions in dynamic systems that can be triggered by minor perturbations. Four tipping mechanisms are recognized: bifurcation-induced tipping (B-tipping) focusing on the magnitude of changes, rate-induced tipping (R-tipping) focusing on the rate of changes, noise-induced tipping (N-tipping) emphasizing the role of randomness or noise, and phase-induced tipping (P-tipping) highlighting the timing or phase of changes. In this talk, I will introduce another plausible way to trigger sudden shifts: a deterministic system can be driven to a tipping point by periodic external forcing inputs whose amplitude never crosses the critical threshold.

THANH HUYNH, McMaster University
[Sunday December 7 / dimanche 7 décembre, 16:00 – Chesterton]
A numerical approach for local isoperimetric partitions

We propose and study a numerical algorithm for isoperimetric partitioning problems with volume constraints. The algorithm is based on a total variation formulation to measure the perimeters of the sets, and an ADMM relaxation and FFT is used to formulate and solve the associated optimality conditions. We validate our method against known examples like the half space and sphere, before examining numerically the convergence properties. Finally, we propose several conjectures about minimizing configurations.

RICK LU AND HAONAN ZHAO, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 8:30 – Chesterton]
L-functions and Numerical Computations Concerning Landau-Siegel Zeros

Let χ be a Dirichlet character mod q, $L(s,\chi) = \sum_{n=1}^{\infty} \frac{\chi(n)}{n^s}$ be the associated Dirichlet L-function, and $s = \sigma + it$ be a complex number. (If $\chi \equiv 1$ then L is the Riemann zeta function.) Let $\zeta_q(s) = \prod_{\chi} L(s,\chi)$ where χ ranges over all Dirichlet characters of modulus q. A theorem due to Landau showed that there is a constant $c > 0$ such that for all q, $\zeta_q(s)$ has at most one zero in the region

$$\sigma \geq 1 - \frac{c}{\log\left(q(|t|+1)\right)}, \tag{1}$$

and furthermore if there is such a zero, then it is necessarily real and the associated character χ is quadratic. Such a zero, if it exists, is called a Landau-Siegel zero or an exceptional zero. It is a particular kind of counterexample to the Generalized Riemann Hypothesis. Proving the nonexistence of Landau-Siegel zeros is of great interest, with applications to e.g. bounds on class numbers of quadratic number fields.

In this talk, we will demonstrate a new computational result regarding the non-existence of such zeros. Following methods that were developed by Heath-Brown, and Thorner and Zaman, we refined an inequality concerning the logarithmic derivative of Dirichlet L-functions and their largest real zeros. With modern computing clusters, we utilized this inequality and computationally verified that Landau-Siegel zeros do not exist for any quadratic character of modulus $q \leq 10^{10}$, with $c = 1/5$ in the above region.

DARICHE NGUYEN, McMaster University
[Sunday December 7 / dimanche 7 décembre, 15:30 – Chesterton]
Weak anchoring around a colloidal particle

In the mathematics of liquid crystals, we study minimizers of the Landau-de Gennes energy in $\mathbb{R}^3 \setminus B_1(0)$ with external magnetic field in the large particle limit. We impose weak surface anchoring on the boundary and derive a lower bound for the energy in terms of the optimal boundary condition. We also conjecture about what these optimal boundary conditions look like for a few different cases of weak anchoring.

AUSTIN SUN, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 17:30 – Chesterton]
The Grassmannian of lines as the space of pencils of binary quantics: towards a GIT-free PGL_2-stratification of $Gr(2, n+1)$

In the last century, geometric invariant theory (GIT) has been central to the study of reductive group actions on varieties such as Grassmannians. Using GIT, one may classify orbits of a reductive group acting on an algebraic variety and obtain stratifications of that variety consisting of collections of orbits. However, even with well-studied examples such as the n-dimensional projective space viewed as the space of binary quantics under the natural PGL_2-action, we only know explicit stratifications for small n's: as n grows larger, one would have to compute exceptionally large numbers of polynomial invariants for the PGL_2-action in order to give an explicit stratification.

The goal of this talk is to illustrate an approach for constructing PGL_2-stratifications of the Grassmannian $Gr(2, n+1)$ viewed as the space of pencils of binary quantics with minimal knowledge of GIT, which is the subject of one of the speaker's current research directions. Specifically, the proposed approach will not involve any computations of polynomial invariants for the PGL_2-action, and will be based on the Hilbert-Mumford criterion, Schubert cell decompositions as well as the theory of algebraic groups. I will discuss some of the unresolved difficulties for writing down explicit PGL_2-stratifications for $Gr(2, n+1)$ in general, and make connections to contemporary research on PGL_2-stratifications for the projective space as the space of binary quantics.

JIATONG SUN, University of Alberta
[Sunday December 7 / dimanche 7 décembre, 15:00 – Chesterton]
Data-Driven Computation for Periodic Stochastic Differential Equations

Many stochastic differential equations in various applications, like coupled neuronal oscillators, are driven by time-periodic forces. In this talk, I will introduce several data-driven computational tools extended from the autonomous Fokker-Planck equation to the time-periodic setting. This enables the efficient computation of the time-periodic invariant probability measure using either a grid-based method or an artificial neural network solver, and the estimation of the speed of convergence towards the time-periodic invariant probability measure. I will also show the convergence analysis and performance of the algorithms using several numerical examples.

Student Research Session
Session de présentations de recherche par les étudiants

KATE TRETIAKOVA, University of Ottawa

[Sunday December 7 / dimanche 7 décembre, 8:00 – Chesterton]

"But How Do We Know?": Epistemological Trespass in the Math Classroom

What do mathematicians, TAs, and students assume it means to know something in mathematics, and why does it matter?

This talk introduces core epistemological perspectives that quietly shape mathematical teaching: correspondence, coherence, pragmatism, constructivism, and more. Rather than debating the truth, epistemological pluralism invites us to notice how different lenses highlight different aspects of the same classroom moment.

Through examples from undergraduate courses, I'll illustrate how instructors' implicit epistemologies influence what they emphasize and how these choices shape students' experiences. We then examine the promise and frustration of constructivist teaching: why mathematics education advocates for it, and why students who have grown up with high expectations of mathematical authority often encounter difficulties.

The session offers practical insights for TAs and future instructors seeking to design learning environments that align with both mathematical values and real students, while giving experienced educators room for re-interpreting familiar challenges and seeing their practice in a new light.

Theory and application of Inverse Problems in mathematical physics
Théorie et application des problèmes inverses en physique mathématique

Org: Peter Gibson (York University) and/et **Yue Zhao** (Central China Normal University)

The session aims to bring together a diversity of researchers in Inverse Problems to discuss recent results and open problems both from the theoretical and applied perspectives. Inverse problems related to medical and acoustic imaging, as well as to Riemannian or Lorentzian geometry are of particular interest.

La session proposée vise à réunir divers chercheurs spécialisés dans les problèmes inverses afin de discuter des résultats récents et des problèmes ouverts, tant d'un point de vue théorique qu'appliqué. Les problèmes inverses liés à l'imagerie médicale et acoustique, ainsi qu'à la géométrie riemannienne ou lorentzienne, présentent un intérêt particulier.

Schedule/Horaire **Room/Salle: Windsor**

Saturday December 6 **samedi 6 décembre**

8:00 - 8:30	Mahishanka Withanachchi (University of Calgary), *Complex Analytic Methods in One Dimensional Scattering: Harmonic Exponentials, Inner Functions, and Toeplitz Kernels* (p. 182)
8:30 - 9:00	Ru-Yu Lai (University of Minnesota), *Partial data inverse problems for the nonlinear magnetic Schrodinger equation* (p. 181)
9:00 - 9:30	Cristian Rios (University of Calgary), *Applications of Alpert wavelets to imaging-based medical diagnosis* (p. 182)
9:30 - 10:00	Peter Gibson (York University), *Inversion of the Miura map on the line* (p. 181)
10:00 - 10:30	Ali Feizmohammadi (University of Toronto) (p. 181)

Sunday December 7 **dimanche 7 décembre**

8:00 - 8:30	Tracey Balehowsky (Calgary), *Transformation Optics and Models of Spatial Topology* (p. 180)
8:30 - 9:00	Spyros Alexakis (University of Toronto) (p. 180)
9:00 - 9:30	Isaac Harris (Purdue University), *Qualitative Methods Applied to Biharmonic Scattering* (p. 181)
9:30 - 10:00	Wenyuan Liao (University of Calgary), *Adjoint Analysis of Seismic Wave Equation and its Applications in Full Waveform Inversion* (p. 182)
10:00 - 10:30	Michael Lamoureux (University of Calgary), *Inverse problems in seismic imaging* (p. 181)

Abstracts/Résumés

SPYROS ALEXAKIS, University of Toronto
[Sunday December 7 / dimanche 7 décembre, 8:30 – Windsor]

TRACEY BALEHOWSKY, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 8:00 – Windsor]
Transformation Optics and Models of Spatial Topology

What is the topology and geometry of the spatial universe? This fundamental question in cosmology remains open. Some cosmologists argue that closed 3-manifolds may provide a better fit to observational data than simply connected models. In this talk, I will describe how techniques from transformation optics allow one to physically model harmonic wave propagation on any closed, orientable 3-manifold.

First, I will give an overview of transformation optics. For our purposes, we prove a strengthened form of the Lickorish–Wallace link surgery theorem. Using this, we construct a diffeomorphism from the complement of a smooth link in a closed 3-manifold

to a bounded domain in $\mathbb{R}^3$. Pushing forward the spatial metric through this map allows us to construct a metamaterial device whose induced anisotropic conductivity suitably reproduces the Helmholtz dynamics of the original manifold.

ALI FEIZMOHAMMADI, University of Toronto
[Saturday December 6 / samedi 6 décembre, 10:00 – Windsor]

PETER GIBSON, York University
[Saturday December 6 / samedi 6 décembre, 9:30 – Windsor]
Inversion of the Miura map on the line

The Miura map relates the modified and classical Korteweg-de-Vries equations, as well as the one-dimensional Helmholtz and Schrödinger equations. The problem of inverting the Miura map arises in the context of scattering theory. Although the Miura map on the circle has long been known to be a global fold, the structure of the Miura map on the line has until recently been less well understood. In this talk we present a recent solution to the scalar Riccati equation that allows explicit inversion of the Miura map. We show that, for an appropriate notion of weak solution to the Riccati equation, inverse images of the Miura map on the line are parameterized by the Riemann sphere.

ISAAC HARRIS, Purdue University
[Sunday December 7 / dimanche 7 décembre, 9:00 – Windsor]
Qualitative Methods Applied to Biharmonic Scattering

Inverse wave propagation problems arise in various fields, including non-destructive testing and medical imaging. The central challenge is to develop stable and reliable methods for identifying hidden obstacles or defects. This talk presents recent progress in extending qualitative reconstruction methods to biharmonic scattering problems, which describe wave scattering in long, thin elastic plates. This model is relevant to numerous engineering and physical systems.

Qualitative methods recover the shape of an unknown object from measured scattering data with minimal a priori information. However, these methods often break down at certain frequencies tied to an associated transmission eigenvalue problem. These eigenvalues can, in turn, serve as target signatures for estimating material properties, since they can be recovered from the scattering data and depend (often monotonically) on the unknown parameters.

The talk will outline new analytical results in qualitative reconstruction and explore their connection to transmission eigenvalue problems. Numerical methods for recovering the scatterer from the given data will also be discussed.

RU-YU LAI, University of Minnesota
[Saturday December 6 / samedi 6 décembre, 8:30 – Windsor]
Partial data inverse problems for the nonlinear magnetic Schrodinger equation

In this talk, we will discuss unique determination of the nonlinear coefficients in the dynamic nonlinear magnetic Schrodinger equation from the knowledge of the Dirichlet-to-Neumann map measured on an arbitrary part of the boundary. The main tool is the construction of special solutions to the linearized Schrodinger equation, which is obtained from the linearization process.

MICHAEL LAMOUREUX, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 10:00 – Windsor]
Inverse problems in seismic imaging

Mathematics has a long history of impact on the problem of seismic imaging, starting as far back as the early 1800's with the foundations of wave theory, acoustics, and of course the Fourier transform. This talk will present some of this history including

early efforts in seismic measurements, tomography and reflection seismology, along with current developments in full waveform inversion and machine learning.

WENYUAN LIAO, University of Calgary
[Sunday December 7 / dimanche 7 décembre, 9:30 – Windsor]
Adjoint Analysis of Seismic Wave Equation and its Applications in Full Waveform Inversion

The adjoint-state method provides a rigorous framework for analyzing sensitivity and gradient information in inverse problems constrained by partial differential equations. In this talk, we present an adjoint analysis of the seismic wave equation from a mathematical perspective. Starting with the continuous formulation of the acoustic (and elastic) wave equation, we derive the corresponding adjoint system and establish key identities linking perturbations in the model parameters to variations in the data misfit functional. This framework clarifies the structure of the gradient and Hessian operators that underpin full waveform inversion (FWI). We also discuss the role of regularization and the theoretical connections between adjoint analysis and PDE-constrained optimization. The presentation aims to highlight how the adjoint framework unifies sensitivity analysis and optimization theory in the context of seismic imaging.

Finally, if time allows, I will present real-world applications of FWI in hydrocarbon exploration, carbon sequestration monitoring, and medical imaging, emphasizing the central role of adjoint-based analysis in advancing both the theory and practice of seismic inversion.

CRISTIAN RIOS, University of Calgary
[Saturday December 6 / samedi 6 décembre, 9:00 – Windsor]
Applications of Alpert wavelets to imaging-based medical diagnosis

We utilized an Alpert wavelet basis to encode images acquired as part of routine clinical late gadolinium enhancement (LGE) cardiac MRI protocols, and applied machine learning algorithms to develop a classification method to distinguish different types of cardio-myopathhies. The results were compared to non-preprocessed images and images processed with standard wavelet bases. In this talk we introduce the basic concepts of Alpert wavelets and some encouraging outcomes of the study. The research is done in collaboration with Ramneet Hunjan from the University of Calgary, and the Libin Cardiovascular Institute at the University of Calgary.

MAHISHANKA WITHANACHCHI, University of Calgary
[Saturday December 6 / samedi 6 décembre, 8:00 – Windsor]
Complex Analytic Methods in One Dimensional Scattering: Harmonic Exponentials, Inner Functions, and Toeplitz Kernels

One dimensional scattering for Schrödinger type and impedance form operators admits a rich complex analytic structure. In recent work, the scattering matrix can be written explicitly in terms of a harmonic exponential associated with the impedance profile, yielding closed form expressions for reflection and transmission coefficients as bounded analytic functions on the upper half plane. This description fits naturally into the framework of Hardy spaces, inner and outer factorization, and $SU(1,1)$ transfer matrices.

In this talk, I will explain how the transmission coefficient appears as an outer function in $H^\infty(\mathbb{C}_+)$ and how this connects to classical tools of complex analysis, including Poisson integrals, boundary uniqueness, and phaseless inverse problems. I will then discuss how the product integral formulation of the transfer matrix can be interpreted in the language of de Branges spaces and related to the Makarov and Poltoratski theory of meromorphic inner functions and Toeplitz kernels for canonical systems. This perspective suggests new ways to study completeness, spectral synthesis, and inverse scattering at low regularity by analyzing Toeplitz operators with symbols built from scattering data.

If time permits, I will outline ongoing work that uses these complex analytic techniques to formulate inverse and rigidity results for layered and low regularity media, emphasizing the role of Hardy space methods and the structure of inner and outer factors arising from the scattering matrix.

Topology
Topologie

Org: Hans Boden (McMaster University) and/et **Chris Kapulkin** (Western University)

The tools and language of topology have found applications in virtually every other field of mathematics and beyond, including areas as disparate as: theoretical computer science, data analysis, and quantum field theory. This session aims to bring together a diverse group of researchers working in different branches of topology, including: algebraic topology, geometric topology, homotopy theory, gauge theory, low-dimensional topology, knot theory, geometric group theory, symplectic and contact topology, and topological data analysis. The session would provide them an opportunity to present their latest advances in their fields.

Les outils et le langage de la topologie ont trouvé des applications dans pratiquement tous les autres domaines des mathématiques et au-delà, y compris dans des domaines aussi disparates que : l'informatique théorique, l'analyse de données et la théorie quantique des champs. Cette session vise à réunir un groupe diversifié de chercheur(euse)s travaillant dans différentes branches de la topologie, notamment : la topologie algébrique, la topologie géométrique, la théorie de l'homotopie, la théorie de jauge, la topologie de basse dimension, la théorie des nœuds, la théorie géométrique des groupes, la topologie symplectique et de contact, et l'analyse topologique des données. La session leur offrira l'occasion de présenter leurs dernières avancées dans leurs domaines respectifs.

Schedule/Horaire **Room/Salle: Baker**

Saturday December 6 — samedi 6 décembre

15:00 - 15:30	Nick Rozenblyum (University of Toronto), *String topology and the cyclic Deligne conjecture* (p. 188)
15:30 - 16:00	Daniel Carranza (Johns Hopkins University), *Generalizing the Bousfield-Kan formula* (p. 184)
16:00 - 16:30	Martin Frankland (University of Regina), *Enriched model categories and the Dold-Kan correspondence* (p. 185)
16:30 - 17:00	Kristine Bauer (University of Calgary), *Differentiability in homotopy theory* (p. 184)
17:00 - 17:30	Dorette Pronk (Dalhousie University), *A tom Dieck Fundamental Groupoid for Orbifolds* (p. 188)
17:30 - 18:00	Geunyoung Kim (McMaster University), *Heegaard diagrams for 5-manifolds* (p. 186)

Sunday December 7 — dimanche 7 décembre

8:00 - 8:30	Yvon Verberne (Western University), *Graphs of quasicircles* (p. 189)
8:30 - 9:00	B. Doug Park (University of Waterloo), *Symplectic geography problem* (p. 187)
9:00 - 9:30	Duncan McCoy (Universite du Quebec a Montreal), *Cusps of arithmetic hyperbolic manifolds* (p. 187)
9:30 - 10:00	Octav Cornea (Université de Montréal), *Triangulated persistence categories and symplectic topology* (p. 185)
10:00 - 10:30	Andrew Salch (Wayne State University), *Number theory and stable homotopy groups of spheres* (p. 188)
15:00 - 15:30	Martina Rovelli (University of Ottawa), *Towards a complicial set of cobordisms* (p. 188)
15:30 - 16:00	William Menasco (University of Buffalo), *A construction of minimal coherent filling pairs* (p. 187)
16:00 - 16:30	Nathan Kershaw (Western University), *Topological data analysis using discrete homology* (p. 185)
16:30 - 17:00	C.M. Michael Wong (University of Ottawa), *A profinite tensor product of vector spaces and bimodules* (p. 189)
17:00 - 17:30	Leland McInnes (Tutte Institute for Mathematics and Computing), *Persistent Homology in High Dimensions* (p. 187)
17:30 - 18:00	Alexander Kupers (University of Toronto), *Mapping class groups of exotic tori* (p. 186)

Monday December 8 — lundi 8 décembre

8:00 - 8:30	Adam Clay (University of Manitoba), *Slope detection in knot complements and the L-space conjecture* (p. 185)
8:30 - 9:00	Patrick Naylor (McMaster University), *Four-dimensional Murasugi sum* (p. 187)

Topology
Topologie

9:00 - 9:30	Jeffrey Marshall-Milne (McMaster University), *An invitation to alternating links and the Greene-Howie Theorem* (p. 186)
9:30 - 10:00	Steven Boyer (Université du Québec à Montréal), *The L-space conjecture* (p. 184)
10:00 - 10:30	Tyrone Ghaswala (University of Waterloo), *Mapping class groups admit a unique Polish topology* (p. 185)

Abstracts/Résumés

ALEJANDRO ADEM, University of British Columnia + NSERC
[Baker]

KRISTINE BAUER, University of Calgary
[Saturday December 6 / samedi 6 décembre, 16:30 – Baker]
Differentiability in homotopy theory

Homotopy theory is not usually seen as a setting for differentiation: homotopy classes of spaces and maps lack the rigidity needed for classical derivatives. Yet homotopy theory and calculus have been closely linked since Goodwillie's functor calculus of the 1990s, which shows that homotopy-invariant functors admit Taylor-like approximations whose layers behave like derivatives. Recent work with collaborators clarifies the structural basis for this analogy. With Johnson, Osborne, Riehl, and Tebbe, we showed that abelian functor calculus carries the structure of a *cartesian differential category*, providing an intrinsic notion of differentiation. With Burke and Ching, we further demonstrated that this viewpoint extends to the setting of homotopy functor calculus while simultaneously extending these ideas to infinity categories.

These ideas flow both ways: categorical structures illuminate the essential ingredients of functor calculus, while topological phenomena inspire new categorical constructions. Recent works of Schwarz in *tangent* categories, and work of Ching and Arro in *tangent infinity categories*, use these methods to generalize differential bundles, revealing new structures relevant to functor calculus.

This talk will survey these developments and outline emerging directions in differentiability and homotopy theory.

STEVEN BOYER, UQAM
[Monday December 8 / lundi 8 décembre, 9:30 – Baker]
The L-space conjecture

The L-space conjecture contends that the following three conditions are equivalent for closed, orientable 3-manifolds M: (a) M admits a co-oriented taut foliation, (b) the fundamental group of M admits a left-invariant total order (i.e. it is left-orderable), and (c) the reduced Heegaard Floer homology of M is non-trivial (i.e. M is not a Heegaard Floer L-space). In this talk I will survey what is known about the conjecture and discuss some of the most important open challenges.

DANIEL CARRANZA, Johns Hopkins University
[Saturday December 6 / samedi 6 décembre, 15:30 – Baker]
Generalizing the Bousfield-Kan formula

In 1972, Bousfield and Kan gave a formula for computing homotopy colimits of (pointed) spaces using an ordinary colimit of a "fattened up" diagram. This formula, which holds in any simplicial model category, is both intuitive and powerful, due to the

central role of homotopy colimits in homotopy theory. For instance, they provide a unifying framework for results such as the van-Kampen theorem, the Mayer-Vietoris long exact sequence, and the Blakers-Massey theorem.

In this talk, I will present a generalization of this formula to the setting of monoidal model categories (j/w Kensuke Arakawa and Chris Kapulkin, arXiv:2511.12809) . This talk aims to be accessible to mathematicians from across topology, and will introduce homotopy colimits from the ground up using a "topology-first" perspective.

ADAM CLAY, University of Manitoba
[Monday December 8 / lundi 8 décembre, 8:00 – Baker]
Slope detection in knot complements and the L-space conjecture

The L-space conjecture posits a connection between left-orderability of the fundamental group of a prime 3-manifold, whether or not the manifold admits a co-orientable taut foliation, and whether or not the manifold is a Heegaard Floer homology L-space. There is also a relative version of this conjecture for manifolds with torus boundary, which posits a connection between the boundary behaviours of these structures—tracking this boundary behaviour is known as "slope detection".

For knots in S^3 that admit L-space Dehn fillings, also known as L-space knots, I will explain how checking the expected boundary behaviour of left-orderings can be broken down into a two-step process, and explain how to complete step one. This is a joint work in progress with Junyu Lu.

OCTAV CORNEA, Université de Montréal
[Sunday December 7 / dimanche 7 décembre, 9:30 – Baker]
Triangulated persistence categories and symplectic topology

I will discuss how mixing persistence (in the sense of persistence modules familiar in data science) and triangulation (in the sense of triangulated categories) leads to natural notions of approximability that have significant applications to symplectic topology. The talk is based on joint work with G. Ambrosioni and P. Biran (both from ETH)

MARTIN FRANKLAND, University of Regina
[Saturday December 6 / samedi 6 décembre, 16:00 – Baker]
Enriched model categories and the Dold-Kan correspondence

If we start with a model category enriched in simplicial abelian groups and we normalize each hom complex, what kind of structure do we obtain ? In joint work with Arnaud Ngopnang Ngompé, we show that changing the enrichment along (the right adjoint of) a weak monoidal Quillen pair results in a "weak" enriched model category. The main issue is that we lose the tensoring and cotensoring, but we retain a weak form thereof.

TYRONE GHASWALA, University of Waterloo
[Monday December 8 / lundi 8 décembre, 10:00 – Baker]
Mapping class groups admit a unique Polish topology

Suppose you are given a topological group. You may wonder about how much the group structure determines the topology. At first glance, the answer appears to be "not very much at all", since every topological group admits the discrete topology, and the trivial topology, both of which are compatible with the group operation.

Big mapping class groups (mapping class groups of infinite-type surfaces) come equipped with a Polish topology. We can ask a refinement of the above question: How much does the group structure of a mapping class group determine its Polish topology ?

This talk is about showing the answer is, perhaps surprisingly, 'entirely' ! That is, that mapping class groups admit a unique Polish topology. This is joint work with Sumun Iyer, Robbie Lyman, and Nick Vlamis.

Topology
Topologie

NATHAN KERSHAW, Western University
[Sunday December 7 / dimanche 7 décembre, 16:00 – Baker]
Topological data analysis using discrete homology

Persistent homology is a tool of Topological Data Analysis commonly used to detect the shape of data. When the data of interest comes from a metric space, for example a finite subset of $\mathbb{R}^n$, the method is generally noise resistant. We show that this is not the case when the data fails the triangle inequality.

To solve this issue, we propose a new method: persistence discrete homology. This method uses discrete cubical homology, which is a homology theory for simple undirected graphs. This allows us to take homology over a filtration of graphs rather than the filtration of simplicial complexes normally used.

In this talk, we will introduce the classical method of persistent homology, discuss discrete cubical homology and how it can be used for persistence, and compare the two methods. We show that persistent discrete homology is better suited to analyze data not coming from metric spaces.

This talk is based on joint work with Chris Kapulkin, and the corresponding paper can be found here: arxiv.org/html/2506.15020.

GEUNYOUNG KIM, McMaster University
[Saturday December 6 / samedi 6 décembre, 17:30 – Baker]
Heegaard diagrams for 5-manifolds

In three dimensions, Heegaard diagrams are a powerful combinatorial tool for studying 3-manifolds, as they encode a 3-manifold using circles on a surface. In this talk, I will describe how to extend this idea to 5-manifolds by introducing a higher-dimensional version of Heegaard diagrams. I will discuss the construction and present several examples to illustrate how these diagrams can be used to understand the topology of 5-manifolds.

ALEXANDER KUPERS, University of Toronto Scarborough
[Sunday December 7 / dimanche 7 décembre, 17:30 – Baker]
Mapping class groups of exotic tori

The d-dimensional torus is a topological manifold that often admits many smooth structures. How does its mapping class group (isotopy classes of diffeomorphisms) depend on the smooth structure? I will explain a partial answer to this question that appears in joint work with Bustamante, Krannich, and Tshishiku, give some geometric applications, and state some open problems.

ÇAĞATAY KUTLUHAN, University of Buffalo
[Baker]

JEFFREY MARSHALL-MILNE, McMaster University
[Monday December 8 / lundi 8 décembre, 9:00 – Baker]
An invitation to alternating links and the Greene-Howie Theorem

Alternating links are a particularly well-behaved family of links. From a (reduced) alternating diagram of a link L, one can read off the crossing number of L, its prime factors, and its split components. Moreover, alternating links are highly sensitive to the invariants of knot theory. In short, an alternating link wears its heart on its sleeve. There is, however, one major source of dissatisfaction in the theory of alternating links: their definition is diagrammatic, dependent on a particular picture of the link. This concern was famously voiced by Ralph Fox, who asked "What is an alternating link?" Fox sought a topological

interpretation of the alternating condition, one devoid of the notion of diagram. The matter was finally put to rest in a pair of seminal 2017 papers by Joshua Greene and Joshua Howie. In this talk, we discuss the history and basic properties of alternating links, the Greene-Howie Characterisation Theorem for alternating links, and its implications and extensions. Ongoing work in this area is discussed.

DUNCAN MCCOY, UQAM
[Sunday December 7 / dimanche 7 décembre, 9:00 – Baker]
Cusps of arithmetic hyperbolic manifolds

The Margulis thick-thin decomposition implies that a non-compact n-dimensional hyperbolic manifold can be decomposed into a compact piece along with a collection of cusps, which are subsets diffeomorphic to the product of a flat $n-1$-manifold with an open interval. One natural question is thus to ask which combinations of flat manifolds can be realized as cusp cross-sections in some hyperbolic manifold. I will discuss some aspects of this question with an emphasis on the case of arithmetic hyperbolic manifolds. In particular, I will explain how one can characterize which flat manifolds arise as a cusp cross-section in a given commensurability class of arithmetic hyperbolic manifolds and, time permitting, some mildly interesting examples. This is joint work with Connor Sell.

LELAND MCINNES, Tutte Institute for Mathematics and Computing
[Sunday December 7 / dimanche 7 décembre, 17:00 – Baker]
Persistent Homology in High Dimensions

Persistent homology has proven itself to be a powerful tool for topological data analysis. It allows for shape analysis of "point-cloud" data in varying dimensions. In practice many applications of persistent homology have been on relatively low dimensional data. With the rise of deep learning, vast new troves of data have been unlocked – either through "embedding vectors" associated to unstructured datasets, or through the patterns of activations of the neural network itself. Such data sets typically have hundreds or thousands of dimensions. How well does persistent homology perform in such cases? What methods can we use to improve the results of persistent homology for such data? In this talk we'll explore these questions with simple example cases, and look at two different methods to make persistent homology more effective in high dimensions.

WILLIAM MENASCO, University of Buffalo
[Sunday December 7 / dimanche 7 décembre, 15:30 – Baker]
A construction of minimal coherent filling pairs

Let S_g denote the genus g closed orientable surface. A *coherent filling pair* of simple closed curves, (α, β) in S_g, is a filling pair that has its geometric intersection number equal to the absolute value of its algebraic intersection number. A *minimally intersecting* filling pair, (α, β) in S_g, is one whose intersection number is the minimal among all filling pairs of S_g. In this talk, we give a simple geometric procedure for constructing minimally intersecting coherent filling pairs on $S_g,\ g \geq 3$, from the starting point of a coherent filling pair of curves on a torus. Coherent filling pairs have a natural correspondence to square-tiled surfaces, or *origamis*, and we discuss the origami obtained from the construction.

This work is joint with Hong Chang [Beijing International Center for Mathematical Research (BICR)].

PATRICK NAYLOR, McMaster University
[Monday December 8 / lundi 8 décembre, 8:30 – Baker]
Four-dimensional Murasugi sum

In this talk, I will describe different constructions of spanning solids for knotted surfaces in the 4-sphere, several of which will use a 4-dimensional analogue of Murasugi sum. In particular, I will describe notions of arborescent surface-links and state solids for broken surface diagrams. There will be lots of examples and pictures!

B. DOUG PARK, University of Waterloo
[Sunday December 7 / dimanche 7 décembre, 8:30 – Baker]
Symplectic geography problem

By Freedman's seminal work, the homeomorphism type of a closed simply connected 4-dimensional manifold (4-manifold for short) is determined by its intersection form on the second homology group. The "symplectic geography problem" asks when a symmetric bilinear form (form for short) can be realized as the intersection form of a symplectic 4-manifold. The problem has been answered when the form has negative signature. We will discuss the current state of the problem when the signature is nonnegative, with a special focus on realizability by spin symplectic 4-manifolds.

DORETTE PRONK, Dalhousie University
[Saturday December 6 / samedi 6 décembre, 17:00 – Baker]
A tom Dieck Fundamental Groupoid for Orbifolds

In this talk I will introduce a version of the tom Dieck fundamental groupoid for orbifolds.

This fundamental groupoid was first introduced in the context of equivariant homotopy theory, as part of the Bredon approach (which provides finer invariants than the Borel approach). It provides more information about the fixed-point manifolds than the Borel fundamental group, and it provides the right object to define Bredon cohomology with twisted/local coefficients.

Each orbifold can be written as the quotient of a manifold by a compact Lie group but this representation is only unique up to Morita equivalence. So if we want to use invariants from equivariant homotopy theory, we need to show that they are Morita invariant and functorial with respect to orbifold maps.

So I will describe the tom Dieck fundamental groupoid for orbifolds, give some of its properties, sketch that it is indeed an orbifold invariant and give a number of examples for low dimensional orbifolds. As time permits, I will discuss the use in Bredon cohomology with twisted coefficients.

MARTINA ROVELLI, University of Ottawa
[Sunday December 7 / dimanche 7 décembre, 15:00 – Baker]
Towards a complicial set of cobordisms

Using a lot of pictures, we will explore a higher category whose k-morphisms are k-dimensional manifolds with boundary, interpreted as morphisms from their incoming to their outgoing boundary components. Higher categories of this kind provide the natural domains for topological quantum field theories. We will explain how the full structure of this higher category, which is truly an (∞, ∞)-category, can be encoded in an efficient way as a marked simplicial set.

NICK ROZENBLYUM, University of Toronto
[Saturday December 6 / samedi 6 décembre, 15:00 – Baker]
String topology and the cyclic Deligne conjecture

I will describe a new approach to genus zero operations in string topology via noncommuative geometry. Specifically, I will explain the cyclic version of the Deligne conjecture which gives an action of the framed E_2 operad on the Hochschild cochains of a Calabi-Yau category. In the setting of relative Calabi-Yau structures, this gives a generalization of the string topology operations to manifolds with boundary. Moreover, this structure has a natural interpretation in terms of deformation theory which gives a vast generalization of Turaev's theorem relating the Lie algebra of loops on a Riemann surface to the Poisson algebra of functions on the character variety. This is joint work with Christopher Brav.

ANDREW SALCH, Wayne State University
[Sunday December 7 / dimanche 7 décembre, 10:00 – Baker]
Number theory and stable homotopy groups of spheres

This will be a short survey talk. I will sketch the basic ideas and techniques for computing stable homotopy groups of spheres, and other finite CW-complexes, by means of the group cohomology of Morava stabilizer groups, i.e., the automorphism groups of one-dimensional formal group laws. Then I will review the cases in which such computations result in a formula which describes the orders of some part (given by a Bousfield localization) of the stable homotopy groups of some finite CW-complex, in terms of number-theoretic data: special values of an L-function, e.g. the Riemann zeta-function. This gives a compact and digestible way to describe the orders of various periodic families in the stable homotopy groups of finite CW-complexes, especially spheres.

YVON VERBERNE, The University of Western Ontario
[Sunday December 7 / dimanche 7 décembre, 8:00 – Baker]
Graphs of quasicircles

The curve graph of a surface was introduced by Harvey and is defined as the simplicial complex where vertices are isotopy classes of essential simple closed curves in the surface, and edges are pairs of disjoint curves. Work of Ivanov proves that the group of automorphisms of the curve graph is isomorphic to the extended mapping class group of the corresponding surface. In this talk, we will introduce the graph of quasicircles, and discuss an analogue of the result of Ivanov for the graph of quasicircles. This work is joint with Katherine Williams Booth and Alex Nolte.

C.M. MICHAEL WONG, University of Ottawa
[Sunday December 7 / dimanche 7 décembre, 16:30 – Baker]
A profinite tensor product of vector spaces and bimodules

Based on a computation using bordered Floer bimodules, it seems that the sutured Floer homology of the infinite cyclic cover of the exterior of a knot, if it made sense, would take the form of an infinite tensor product of bimodules. But such objects do not behave well at all. In this talk, I will outline the construction of a profinite tensor product of vector spaces and bimodules, corresponding to profinite cyclic covers, which will have much better properties. This is joint work in progress with David Treumann.

Variational Analysis: Theory and Applications
Analyse variationnelle : Théorie et applications

Org: Heinz Bauschke (University of British Columbia), **Walaa Moursi** (University of Waterloo) and/et **Shambhavi Singh** (University of Waterloo)

Variational Analysis lies at the heart of modern optimization and underlies the convergence analysis of several algorithms. The purpose of this session is to bring together selected experts from the Northamerican optimization and analysis communities to exchange ideas and present new results.

L'analyse variationnelle est au cœur de l'optimisation moderne et sous-tend l'analyse de convergence de plusieurs algorithmes. L'objectif de cette session est de réunir des expert(e)s sélectionné(e)s issu(e)s des communautés nord-américaines d'optimisation et d'analyse afin d'échanger des idées et de présenter de nouveaux résultats.

Schedule/Horaire **Room/Salle: Carlyle B**

Saturday December 6 **samedi 6 décembre**

9:00 - 9:30	Viktor Pavlovik, *Accelerated Proximal Gradient Methods in the affine-quadratic case* (p. 191)
9:30 - 10:00	Shambhavi Singh, *Eckstein-Ferris-Pennanen-Robinson duality revisited: paramonotonicity, total Fenchel-Rockafellar duality, and the Chambolle-Pock* (p. 191)
10:00 - 10:30	Aleksandr Arakcheev, *On Generalisations of Fejér Monotonicity: Fejér* and Opial Sequences* (p. 190)
15:00 - 15:30	Walaa Moursi (p. 191)
15:30 - 16:00	Yuan Gao, *On the equivalence of c-potentiability and c-path boundedness in the sense of Artstein-Avidan, Sadovsky and Wyczesany.* (p. 190)
16:00 - 16:30	Hongda Li, *Relaxed Weak Accelerated Proximal Gradient Method: A Unified Framework for Nesterov's Accelerations* (p. 191)
16:30 - 17:00	Tung Tran, *On the boundedness of sequences generated by stochastic gradient and random projection algorithms* (p. 192)
17:00 - 17:30	Sadra Nejati (p. 191)

Abstracts/Résumés

ALEKSANDR ARAKCHEEV, The University of British Columbia
[Saturday December 6 / samedi 6 décembre, 10:00 – Carlyle B]
On Generalisations of Fejér Monotonicity: Fejér and Opial Sequences*

In this talk, we explore recently introduced extensions of Fejér monotonicity, namely Fejér* monotonicity and Opial sequences. We present a series of counterexamples showing that, in these generalized settings, several classical Fejér properties fail; nevertheless, in certain cases, suitable weakened variants of these properties can still hold. The connections between these notions and various forms of quasi-Fejér monotonicity are examined.

YUAN GAO, University of British Columbia Okanagan
[Saturday December 6 / samedi 6 décembre, 15:30 – Carlyle B]
On the equivalence of c-potentiability and c-path boundedness in the sense of Artstein-Avidan, Sadovsky and Wyczesany.

A cornerstone of convex analysis, established by Rockafellar in 1966, asserts that a set has a potential if and only if it is cyclically monotone. This characterization was generalized to hold for any real-valued cost function c and lies at the core structure of optimal transport plans. However, this equivalence fails to hold for costs that attain infinite values. In this talk, we explore potentiability for an infinite-valued cost c under the assumption of c-path boundedness, a condition that was first

introduced by Artstein-Avidan, Sadovsky and Wyczesany. This condition is necessary for potentiability and is more restrictive than c-cyclic monotonicity. We provide general settings and other conditions under which c-path boundedness is sufficient for potentability, and therefore equivalent. We provide a general theorem for potentiability, requiring no topological assumptions on the spaces or the cost. We then provide sufficiency in separable metric spaces and costs that are continuous in their domain. Finally, we introduce the notion of a c-path bounded extension and use it to prove the existence of potentials for a special class of costs on $\mathbb{R}^2$. We illustrate our discussion and results with several examples.

HONGDA LI, University of British Columbia
[Saturday December 6 / samedi 6 décembre, 16:00 – Carlyle B]
Relaxed Weak Accelerated Proximal Gradient Method: A Unified Framework for Nesterov's Accelerations

This paper is devoted to the study of accelerated proximal gradient methods where the sequence that controls the momentum term doesn't follow Nesterov's rule. We propose a relaxed weak accelerated proximal gradient (R-WAPG) method, a generic algorithm that unifies the convergence results for strongly convex and convex problems where the extrapolation constant is characterized by a sequence that is much weaker than Nesterov's rule. Our R-WAPG provides a unified framework for several notable Euclidean variants of FISTA and verifies their convergences. In addition, we provide the convergence rate of the strongly convex objective with a constant momentum term. Without using the idea of restarting, we also reformulate R-WAPG as "Free R-WAPG" so that it doesn't require any parameter. Explorative numerical experiments were conducted to show its competitive advantages.

(Joint Work with Xianfu Wang.)

WALAA MOURSI,
[Saturday December 6 / samedi 6 décembre, 15:00 – Carlyle B]

SADRA NEJATI,
[Saturday December 6 / samedi 6 décembre, 17:00 – Carlyle B]

VIKTOR PAVLOVIK, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 9:00 – Carlyle B]
Accelerated Proximal Gradient Methods in the affine-quadratic case

Recent works by Bot¸-Fadili-Nguyen and by Jang-Ryu address the long–standing question of iterate convergence for accelerated (proximal) gradient methods. Specifically, Bot¸- Fadili-Nguyen proved weak convergence of the discrete accelerated gradient descent (AGD) iterates and, crucially, convergence of the accelerated proximal gradient (APG) method in the composite case, in infinite–dimensional Hilbert spaces ; their note also documents the an- nouncement timeline. In parallel, Jang-Ryu established point convergence both for the contin- uous–time accelerated flow and for the discrete AGD method in finite dimensions. These results leave unanswered the question of which minimizer is the limit point. We show in the affine-quadratic setting: starting from the same initial point, the difference between the PGM and APG iterates converges weakly to zero, so APG converges weakly to the best approximation of the starting point in the solution set ; moreover, under mild conditions, APG converges strongly. Our results are tight: a two–dimensional example shows that this coincidence of limits is specific to the affine–quadratic regime and does not extend in general.

SHAMBHAVI SINGH, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 9:30 – Carlyle B]
Eckstein-Ferris-Pennanen-Robinson duality revisited: paramonotonicity, total Fenchel-Rockafellar duality, and the Chambolle-Pock

Finding zeros of the sum of two maximally monotone operators involving a continuous linear operator is a central problem in optimization and monotone operator theory. We revisit the duality framework proposed by Eckstein, Ferris, Pennanen, and Robinson from a quarter of a century ago. Paramonotonicity is identified as a broad condition ensuring that saddle points coincide with the closed convex rectangle formed by the primal and dual solutions. Additionally, we characterize total duality in the subdifferential setting and derive projection formulas for sets that arise in the analysis of the Chambolle-Pock algorithm within the recent framework developed by Bredies, Chenchene, Lorenz, and Naldi.

TUNG TRAN, UBCO

[Saturday December 6 / samedi 6 décembre, 16:30 – Carlyle B]

On the boundedness of sequences generated by stochastic gradient and random projection algorithms

We study the boundedness of sequences generated by two fundamental algorithmic frameworks: stochastic gradient methods and, as a special case, random projection algorithms. For the stochastic gradient method, we extend a result of Orvieto, Lacoste-Julien, and Loizou—originally established under strong convexity—to a broader class of functions, including coercive functions. In a complementary direction, we focus on random projection algorithms and generalize Meshulam's boundedness theorem from affine subspaces in finite-dimensional spaces to polyhedral sets in infinite-dimensional Hilbert spaces. Several examples are provided to illustrate the sharpness of the obtained results.

Variational Problems: Trends and Applications
Problèmes variationnels : tendances et applications

Org: Xinyang Lu (Lakehead University) and/et **Chong Wang** (Washington and Lee University)

Variational problems are pervasive in the physical and biological worlds. This scientific session aims to bring together researches to discuss recent trends of variational problems, with diverse applications in physics, biology, and materials science.

Les problèmes variationnels sont omniprésents dans les domaines physique et biologique. Cette session scientifique vise à réunir des chercheur(euse)s afin de discuter des tendances récentes en matière de problèmes variationnels, avec diverses applications en physique, biologie et science des matériaux.

Schedule/Horaire **Room/Salle: Wren B**

Sunday December 7 **dimanche 7 décembre**

15:00 - 15:30	Li Bo (University of California, San Diego), *Variational Modeling and Analysis of Phase Separation with Elasticity* (p. 193)
15:30 - 16:00	Jack Tisdell (McGill University), *Minimizing asymptotic score in random bullseye darts* (p. 193)
16:00 - 16:30	Tong Zhang (Memorial University of Newfoundland), *Liouville-type theorem for the fractional p-Laplacian inequalties* (p. 194)
16:30 - 17:00	Xinyang Lu (Lakehead University) (p. 193)
17:00 - 17:30	Mustafa Avci (Athabasca University), *Existence of solutions for a singular double phase variable exponent problem with $(p(\cdot), q(\cdot))-$ Hardy-type potential* (p. 193)

Abstracts/Résumés

MUSTAFA AVCI, Athabasca University

[Sunday December 7 / dimanche 7 décembre, 17:00 – Wren B]

Existence of solutions for a singular double phase variable exponent problem with $(p(\cdot), q(\cdot))-$ Hardy-type potential

In this work, we study a singular double phase variable exponent problem with $(p(\cdot), q(\cdot))-$ Hardy-type potential. We establish existence results using variational methods and critical point theory adapted to the non-standard growth setting, addressing the technical difficulties arising from the lack of homogeneity, the singular nature of Hardy potentials, and the interplay between variable exponents and phase transitions.

Keywords. Singularity ; variable exponent ; variational approach ; critical point theory ; Hardy-type potential ; double phase operator.

LI BO, University of California, San Diego

[Sunday December 7 / dimanche 7 décembre, 15:00 – Wren B]

Variational Modeling and Analysis of Phase Separation with Elasticity

We construct phase-field and sharp-interface free-energy functionals for phase separation with elasticity and prove the consistency of these models. Motivated by our numerical simulations, we study the boundary force using a variational method and discuss the role of such force in the droplet morphology and the kinetics of phase boundary movement. This is joint work with Shibin Dai of University of Alabama.

XINYANG LU, Lakehead University

[Sunday December 7 / dimanche 7 décembre, 16:30 – Wren B]

Variational Problems: Trends and Applications
Problèmes variationnels : tendances et applications

JACK TISDELL, McGill University
[Sunday December 7 / dimanche 7 décembre, 15:30 – Wren B]
Minimizing asymptotic score in random bullseye darts

We explore the problem of minimizing the expected score in a certain game of random bullseye darts. Given the bullseye distribution, which among a specified class of joint distributions for the n throws yields the optimal expected score? The asymptotics for i.i.d. throws are well understood. We are interested in whether on not certain natural joint distributions strictly improve upon the i.i.d. case and in this talk we present new general methods for studying this question and related problems.

TONG ZHANG, Memorial Universiry
[Sunday December 7 / dimanche 7 décembre, 16:00 – Wren B]
Liouville-type theorem for the fractional p-Laplacian inequalties

This work addresses an open question posed in [Math. Ann. 2022, "Quasilinear Laplace equations and inequalities with fractional orders"]. In the process of resolving this problem, we uncovered a key structural insight. This discovery enables us to establish the existence of solutions for a broad class of fractional p-Laplacian inequalities, extending to cases with logarithmic, exponential, and power-law decay at infinity. (Joint work with Professor Jie Xiao.)

AARMS-CMS Student Poster Session

Room/Salle: Churchill Foyer

Abstracts/Résumés

SHOHEL AHMED, University of Alberta
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Behaviorally Structured Consumer-Resource Dynamics

Animals adjust their behavior in response to physiological states to optimize the trade-off between energy acquisition and survival. Consistent individual differences in behavior, often referred to as animal personality, play a crucial role in shaping ecological and evolutionary dynamics, particularly in foraging behavior. Traditional approaches in behavioral and evolutionary ecology typically focus on average behavior, neglecting the significance of individual variability. This study examines the impact of consumer behavior on ecological dynamics, focusing on how variations in food availability influence behavioral strategies and ecosystem functioning. The diverse expression of behavioural changes in a population has the potential to influence the whole population. This phenomenon has been modeled using a variety of methods, including population compartment models. Rather than make use of discrete levels of expression, we propose a novel model that treats the behavioural phenotype as a continuous distribution. The result is a coupled system composed of an ordinary differential equation and a partial differential equation, with the dynamics associated with behavioural phenotypes modeled as a diffusion process. The resulting analysis avoids some of the difficulties of scaling to larger systems of equations and opens up the possibility of using other techniques available for the qualitative analysis of partial differential equations.

GRACE D'AGOSTINO, University of Guelph
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Uncertainty Analysis of a River Quality Model

Uncertainty analyses were performed on a simple river quality model, the Streeter-Phelps equations, using parameter estimates, comparison theorems, and differential inequalities.

Model parameters in environmental systems are often non-constant and may only be known with some uncertainty. When parameters are not known exactly, the solution of the model cannot be obtained analytically or numerically.

The Streeter-Phelps equations are two partial differential equations describing the transport of pollutants, also called the biological oxygen demand (BOD), and dissolved oxygen in a river. In their original formulation, the model permits negative dissolved oxygen concentrations due to the lack of dependence of BOD degradation on available oxygen, marking a breakdown of the model. To remedy this, a dependence was imposed using the Monod function, creating a situation-adaptive transition of solutions between when oxygen is abundant and when oxygen is limited.

To satisfy the quasi-monotonicity condition of the Comparison Theorem for Quasimonotone Increasing Systems, the system was redefined in terms of the oxygen deficit, which is the difference in the saturation concentration and the dissolved oxygen concentration. Possibilistic regions in which the solution of the model with unknown parameters exist were constructed.

Parameter estimates were chosen arbitrarily based on data reported by the Grand River Conservation Authority for illustrative purposes. Plots were produced and limitations were discussed.

AMAURY DE BURGOS, University of Calgary
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
The length of cyclic algebras

Cyclic algebras, introduced by Leonard Eugene Dickson in 1906, were one of the earliest examples of non-commutative division algebras over a field. A notable numerical invariant of any algebra over a field is its length, defined as the length of its longest

chain of linear subspaces. In 2016, the length of 4-dimensional cyclic algebras was proven to be 2 (Guterman & Kudryavtsev). More recently, in 2021, the length of cyclic algebras of dimension 9, 16, and 25 was stated to be 4, 6, and 8 respectively (Miguel). Through the use of two counterexamples, we show these latter values are ill-derived, meaning the length of cyclic algebras of dimension greater than 4 is still an open problem. In pursuit of solving this open problem, we construct an infinite family of cyclic division algebras and give a lower bound on the length of its members.

XINWEN DING, University of Toronto
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Walk-on-Interfaces: A Monte Carlo Estimator for Elliptic Interface Problem

Elliptic interface problems arise in many areas of science and engineering, modeling heterogeneous materials whose physical properties change abruptly across internal boundaries. Computing solutions to these problems efficiently and accurately remains challenging, especially in domains with multiple irregular interfaces. In this poster, we present Walk-on-Interfaces (WoI), a grid-free Monte Carlo estimator for Neumann elliptic interface problems with general flux jump conditions. Unlike many numerical schemes, WoI maintains uniform accuracy throughout the domain and avoids near-interface singularities. Moreover, gradients of the solution can be estimated at almost no additional cost by differentiating the Green's function within WoI. Taking a scientific machine learning approach, we train a deep neural network to filter out high-frequency sampling noise, yielding a smooth and continuous representation of the solution. The resulting method is highly parallelizable, scales naturally to high dimensions, and can solve problems that are intractable for traditional numerical solvers. Numerical experiments demonstrate the effectiveness of the approach and highlight its potential for real-world applications.

TAN PHUONG DONG LE, Department of Applied Mathematics, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Stable Mesh-Free Variational Radial Basis Function Approximation for Elliptic PDEs and Obstacle Problems

We present a comprehensive study of radial basis function (RBF) network approximations for elliptic and obstacle-typed boundary value problems under a variational formulation. Our focus is on practical accuracy, robustness and efficiency across a range of partial differential equations. To address ill-conditioning in dense systems, we apply truncated singular value decomposition (TSVD) in the linear regime and quantify its effect on stability and accuracy trade-offs. Numerical experiments on benchmark problems demonstrate fast error decay and high accuracy. We map the trade-off between approximation and truncation errors for practical settings for number of basis functions N, oversampling ratio ζ and truncation threshold τ. Compared with other numerical methods, RBF variational approach would deliver competitive accuracy for boundary value problems.

ANTUN NIKOLA DVORSKI, University of Toronto
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
A new proof of Baernstein's convolution inequality on the unit circle using geometric flow

The well-known Riesz-Sobolev inequality (or Riesz rearrangement inequality) asserts that for non-negative measurable functions f, g, and h on $\mathbb{R}^n$, the quantity $f * g * h(0)$ does not decrease when f, g, and h are replaced with their symmetric decreasing rearrangements. There is an analogous convolution inequality for non-negative measurable functions on S^1 due to Albert Baernstein, for which we provide a novel proof using a flow of measurable subsets of S^1.

JOEY FINGOLD, University of Guelph
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Latent Gaussian Importance Sampling for Thinned Poisson Autoregressions

Count time series have gained popularity in infectious disease modelling due to their connection to traditional mechanistic transmission models and their straightforward implementation using both maximum likelihood and Bayesian paradigms. However,

observed data corresponding to daily infections is subject to under-reporting, where fewer than the true number of infected individuals are reported as sick. Thus, for each time series of data, Y, we have an associated time series of unknown true counts, X.

Conducting inference on these unknown counts is challenging as the X's are serially correlated integer-valued unknowns. State-of-the-art methods like Hamiltonian Monte Carlo utilize gradient-based optimization and thus do not apply due to the count-valued unknowns. We consider an approximate model defined by a latent Gaussian time series that imposes continuity in the parameter space and a non-bijective mapping that recovers the intended discrete marginal distributions of the target model whilst preserving the autocorrelation structure in the approximate model. We further introduce a self-normalized importance sampling approach to weight these observations to improve the estimation of expectations under the target posterior distribution.

SHAN GAO, University of Alberta
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Outbreak or Not ? A Framework for Detecting Infectious Disease Outbreaks

Forecasting the occurrence and absence of novel disease outbreaks is essential for disease management, yet existing methods are often context-specific, require a long preparation time, and non-outbreak prediction remains understudied. To address this gap, we propose a novel framework using a feature-based time series classification (TSC) method to forecast outbreaks and non-outbreaks. We tested our methods on synthetic data from a Susceptible–Infected–Recovered (SIR) model for slowly changing, noisy disease dynamics. Outbreak sequences give a transcritical bifurcation within a specified future time window, whereas non-outbreak (null bifurcation) sequences do not. We identified incipient differences, reflected in 22 statistical features and 5 early warning signal indicators, in time series of infectives leading to future outbreaks and non-outbreaks. Classifier performance, given by the area under the receiver-operating curve (AUC), ranged from 0.99 for large expanding windows of training data to 0.7 for small rolling windows. The framework is further evaluated on four empirical datasets: COVID-19 incidence data from Singapore, 18 other countries, and Edmonton, Canada, as well as SARS data from Hong Kong, with two classifiers exhibiting consistently high accuracy. Our results highlight detectable statistical features distinguishing outbreak and non-outbreak sequences well before potential occurrence, in both synthetic and real-world datasets presented in this study.

CAMERON JAKUB, University of Guelph
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Depth Degeneracy in Neural Networks: Vanishing Angles in Fully Connected ReLU Networks on Initialization

Despite remarkable performance on a variety of tasks, many properties of deep neural networks are not yet theoretically understood. One such mystery is the depth degeneracy phenomenon: the deeper you make your network, the closer your network is to a constant function on initialization. In this paper, we examine the evolution of the angle between two inputs to a ReLU neural network as a function of the number of layers. By using combinatorial expansions, we find precise formulas for how fast this angle goes to zero as depth increases. These formulas capture microscopic fluctuations that are not visible in the popular framework of infinite width limits, and leads to qualitatively different predictions. We validate our theoretical results with Monte Carlo experiments and show that our results accurately approximate finite network behaviour. We also empirically investigate how the depth degeneracy phenomenon can negatively impact training of real networks. The formulas are given in terms of the mixed moments of correlated Gaussians passed through the ReLU function. We also find a surprising combinatorial connection between these mixed moments and the Bessel numbers that allows us to explicitly evaluate these moments.

VINAY JOSHY, University of Guelph
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Sparse Group Lasso for Variable Selection in Finite Gaussian Mixture Regression Models

When analyzing heterogeneous data with latent subpopulations, finite mixture regression (FMR) models are effective as they allow for variations in regression coefficients across mixture components. Variable selection is important at two levels: (1)

at the group level by removing completely irrelevant covariates across all subpopulations and (2) at the individual level by removing irrelevant covariates within each subpopulation. However, existing variable selection methods for FMR focus solely on individual-level selection using the least absolute shrinkage and selection operator (LASSO), providing no mechanism for group-level variable elimination. We introduce a sparse group LASSO regularization method that performs efficient variable selection at both levels simultaneously in finite Gaussian mixture regression models. We developed a novel optimization procedure through a Majorization-Minimization algorithm. Simulation studies demonstrate our proposed method's effectiveness in retaining relevant covariates and accuracy in clustering observations into subpopulations. We apply our proposed method to a Chiroptera (bat) dataset exhibiting morphological heterogeneity for identifying relevant environmental and morphological covariates that influence bat forearm development.

LEXY LAWRYSHYN, University of Guelph

[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]

A Nonlinear ODE Model of Butyrate-Tumour-Immune Cell Dynamics in Colorectal Cancer

Colorectal cancer progression is strongly influenced by metabolic signals from the gut microbiome, yet the underlying mechanisms remain poorly understood. In particular, the short-chain fatty acid butyrate - produced by fiber-fermenting gut bacteria - has been shown to inhibit cancer cell proliferation while supporting the growth and function of healthy colonocytes and immune cells. We formulate a system of non-linear ordinary differential equations to describe key metabolic and immunological interactions between butyrate, colorectal cancer cells and host cell populations. The parameter space is explored through steady-state and sensitivity analyses, and preliminary simulations illustrate the emergence of varying dynamical behaviour driven by butyrate availability.

ERICA LIU, University of Waterloo

[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]

Toric Compactifications and Critical Points at Infinity in Analytic Combinatorics

The field of Analytic Combinatorics in Several Variables (ACSV) provides powerful tools for deriving asymptotic information from multivariate generating functions. A key challenge arises when standard saddle-point techniques fail due to the presence of critical points at infinity (CPAI), obstructing local analyses near singularities. Recent work has shown that Morse-theoretic decompositions remain valid under the absence of CPAI, traditionally verified using projective compactifications. We present a toric approach to compactification that leverages the Newton polytope of a generating function to construct a toric variety tailored to the function's combinatorial structure. This refinement not only tightens classification of CPAI but also enhances computational efficiency. Through concrete examples and an introduction to tropical and toric techniques, we will demonstrate how these methods clarify the asymptotic landscape of ACSV problems, especially in combinatorially meaningful settings. This poster draws on joint work studying toric compactifications as a bridge between algebraic geometry and analytic combinatorics.

RACHANA MANDAL, University of Guelph

[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]

Modelling and Simulation Experiments on Directed Movement of Bacteria in Aqueous Medium with Counter-Diffusive Substrate Uptakes

Particulate Organic Matter(POM), sediment grains, microplastics serve as substrates for various microorganisms, including planktonic bacteria, which are suspended in aqueous medium. Planktonic bacteria colonize particles' surfaces by forming a bacterial biozone and consume released nutrients to stimulate growth. For sinking particle plume in marine ecosystems, this bacterial activity and reshaping of the carbon plume affect marine carbon pump and thus carbon sequestration in deep sea. The nutrient gradient drives accumulation of bacteria as a response to directed movement. We develop a mathematical model that describes the planktonic bacterial growth and lysis, movement of cells by diffusion and a chemotaxis-like directed movement and perform simulation experiments. We assume that the biomass growth depends on the concentration of substrates, such as

carbon, an electron donor, and oxygen, an electron acceptor. Carbon, sourced from a particle surface wall, diffuses into domain from one boundary, while oxygen enters from opposite boundary, a distant source, establishing a counter-diffusion system. These two growth-limiting substrates control direction of transport of cells and bacterial colony accumulates in regions with favorable growth conditions. The Keller-Segel-Patlak type one-dimensional model with two stimuli consists of three non-linear PDEs. The transport terms in bacterial concentration equation are discretized in space using a flux-conservative-finite-volume method and substrate equations are discretized using library 'ReacTran' from 'R'. Then three discretized one-dimensional equations are solved numerically using a time-adaptive method from 'R'. The energy estimate method is applied to linearised system around uniform steady state to explore the long and short time behaviour of bacterial concentration.

ARION OKUBO, University of Toronto
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Explicit Estimates for the Size of the Markoff mod p Cage

The Markoff equation is given by $X^2+Y^2+Z^2=3XYZ$ and the positive integer solutions to this equation are called Markoff triples. Involutions can be defined on the set of Markoff triples by fixing two coordinates and finding the other root of the resulting quadratic. The group generated by these involutions and coordinate permutations, called the Vieta group, acts on the set of Markoff triples, and the graph defined by this action is known to be connected. In 1991, Baragar conjectured that the same holds modulo any prime p. Since the action of the Vieta group commutes with reduction mod p, this would imply that every mod p solution to the Markoff equation has an integer lift. In 2015, Bourgain, Gamburd, and Sarnak made progress toward this conjecture by proving that a subgraph called the cage is always connected. Computations suggest that roughly 80% of triples lie in the cage, but explicit bounds have been difficult to find. We provide an explicit lower bound for the size of the cage for primes p where $p+1$ has sufficiently large valuation. We also estimate the size of the cage for all primes in terms of the Euler totient function under a reasonable heuristic assumption. Our work also yields practical conditions for a Markoff triple to lie in the cage.

KENNETH SHEN, Carleton University Math Enrichment Centre
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Families of rational-sided triangles with the same area and perimeter

Can two non-congruent triangles share the same area and perimeter? While it may seem impossible at first, we soon find that for any non-equilateral triangle with *real*-valued sides, there exist infinitely many other triangles with the same area and perimeter. This raises the following question: what would an analogous result look like for *rational*-sided triangles?

We introduce the idea of *confined* triangles: rational-sided triangles for which only finitely many other non-congruent rational-sided triangles share the same area and perimeter. A triangle is *isolated* if no such companions exist. We prove that confined *scalene* triangles must be isolated, and completely characterize the structure of confined triangles, showing that only three configurations are possible: a single isolated isosceles triangle, exactly two isosceles triangles, or a single isolated scalene triangle.

Finally, we prove that the asymptotic proportion of confined triangles that are scalene tends to zero.

JOHN HUNN SMITH, University of Waterloo
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Explicit Diagonal Asymptotics of Symmetric Multi-Affine Rational Functions via ACSV

Multivariate sequences are often best studied via their generating functions, which are multivariate power series whose coefficients are the terms of the sequence. Analytic combinatorics in several variables (ACSV) provides a framework for deriving asymptotics for certain "diagonal" univariate subsequences using these generating functions and tools from topology, complex analysis, and algebraic geometry. In this work we show how to use ACSV to derive explicit asymptotics for diagonals of multivariate rational functions whose denominators are symmetric (invariant under permutations of the variables) and multi-affine (linear in each variable). By "explicit" we mean that all quantities involved in the asymptotic formula are effectively computable, and we give our asymptotic not in terms of a Big-O term, but instead in terms of explicit constants which bound the

error between our asymptotic and the true sequence of interest. Applications will be discussed, including coefficient positivity problems which are concerned with detecting whether a sequence, univariate or multivariate, has all positive terms.

AIDEN WILLIAM JAMES TAYLOR, University of Calgary
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Wavelet Transforms and Machine Learning Methods for the Classification of Auroral Images

The Aurora Borealis (or Northern Lights) is a natural phenomena regularly observed in North America which has fascinated humans for thousands of years. Even today, this phenomena gains a great deal of attention from the general public, media outlets, tourists, and scientists, where the latter have been collecting data on auroral behaviour for many years, most notably in the form of *all-sky images* (ASI). In recent years, there has been a push to label ASI data with the specific classifications that an aurora can take, e.g. arc, diffuse, discrete, etc..., which gives rise to a particularly interesting interdisciplinary *image classification problem* that many believe would greatly benefit from the usefulness of *machine learning* (ML). For our purposes, we intend to use this classification problem as an avenue to highlight the compression possibilities that *wavelet transforms* offer in the preprocessing stage of ML by implementing a proposed *discrete projection algorithm* (DPA) that can calculate the coefficients of a particular wavelet basis efficiently and accurately. The resulting wavelet coefficients can then be used as input to a *convolution neural network* (CNN), which in our case will be trained and validated on the Oslo aurora THEMIS (OATH) dataset. We hypothesize that the combination of this DPA with even a simple CNN will result in classification accuracies $>$ 80% and have tangible improvements in the efficiency of the preprocessing stage.

XUEMENG WANG, Simon Fraser University
[Saturday December 6 / samedi 6 décembre, 10:00 – Churchill Foyer]
Christoffel Adaptive Sampling for Sparse Random Feature Expansions

Random feature models are powerful tools for approximating high-dimensional functions and solving PDEs. Sparse random feature expansion (SRFE) enhances these methods by incorporating sparsity and compressive sensing, which is especially beneficial in data-scarce settings. We integrate active learning with SRFE by using the Christoffel function to guide an adaptive sampling process, dynamically selecting informative samples. Drawing random samples via the Christoffel function allows a weighted least-squares approximation with near-optimal sample complexity. Numerical experiments show that Christoffel adaptive sampling maintains high accuracy, demonstrating strong potential for scientific computing.

Canadian Journal of Mathematics

Journal canadien de mathématiques

Canadian Journal of Mathematics (CJM) publishes original, high-quality research papers in all branches of mathematics. The Journal is a flagship publication of the Canadian Mathematical Society and has been published continuously since 1949. New research papers are published continuously online and collated into print issues six times each year.

To be submitted to the Journal, papers should be at least 18 pages long and may be written in English or in French. Shorter papers should be submitted to the *Canadian Mathematical Bulletin*.

Le Journal canadien de mathématiques (JCM) publie des articles de recherche innovants de grande qualité dans toutes les branches des mathématiques. Publication phare de la Société mathématique du Canada, il est publié en continu depuis 1949. En ligne, la revue propose constamment de nouveaux articles de recherche, puis les réunit dans des numéros imprimés six fois par année.

Les textes présentés au JCM doivent compter au moins 18 pages et être rédigés en anglais ou en français. C'est le *Bulletin canadien de mathématiques* qui reçoit les articles plus courts.

Find out more | Pour en apprendre plus :
cambridge.org/CJM

Accepts Open Access
Accepte le libre accès

Useful Links
Liens utiles

DISCOVER | DÉCOUVREZ
OUR AIMS & SCOPE
NOS OBJECTIFS ET NOTRE PORTÉE

VIEW | CONSULTEZ
THE EDITORIAL BOARD
LE COMITÉ ÉDITORIAL

EXPLORE | EXPLOREZ
OUR INSTRUCTIONS FOR AUTHORS
NOS DIRECTIVES POUR LES AUTEURS

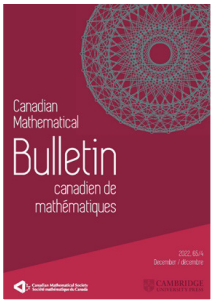
ACTIVATE | ACTIVEZ
STAY UPDATED WITH THE LATEST CONTENT | RESTEZ INFORMÉ DU CONTENU LE PLUS RÉCENT

JOIN THE CONVERSATION
REJOIGNEZ LA CONVERSATION

CAMBRIDGE UNIVERSITY PRESS

Canadian Mathematical Bulletin

Bulletin canadien de mathématiques



Canadian Mathematical Bulletin was established in 1958 to publish original, high-quality research papers in all branches of mathematics and to accommodate the growing demand for shorter research papers. The *Bulletin* is a companion publication to the *Canadian Journal of Mathematics* that publishes longer papers. New research papers are published continuously online and collated into print issues four times each year.

To be submitted to the *Bulletin*, papers should be at most 18 pages long and may be written in English or in French. Longer papers should be submitted to the *Canadian Journal of Mathematics*.

Fondé en 1958, le *Bulletin canadien de mathématiques* (BCM) publie des articles d'avant-garde et de grande qualité dans toutes les branches des mathématiques, de même que pour répondre à la demande croissante d'articles scientifiques plus brefs. Le BCM se veut une publication complémentaire au *Journal canadien de mathématiques*, qui publie de longs articles. En ligne, il propose constamment de nouveaux articles de recherche, puis les réunit dans des numéros imprimés quatre fois par année.

Les textes présentés au BCM doivent compter au plus 18 pages et être rédigés en anglais ou en français. C'est le *Journal canadien de mathématiques* qui reçoit les articles plus longs.

Find out more | Pour en apprendre plus :
cambridge.org/BCM

Accepts Open Access
Accepte le libre accès

Useful Links
Liens utiles

DISCOVER | DÉCOUVREZ
OUR AIMS & SCOPE
NOS OBJECTIFS ET NOTRE PORTÉE

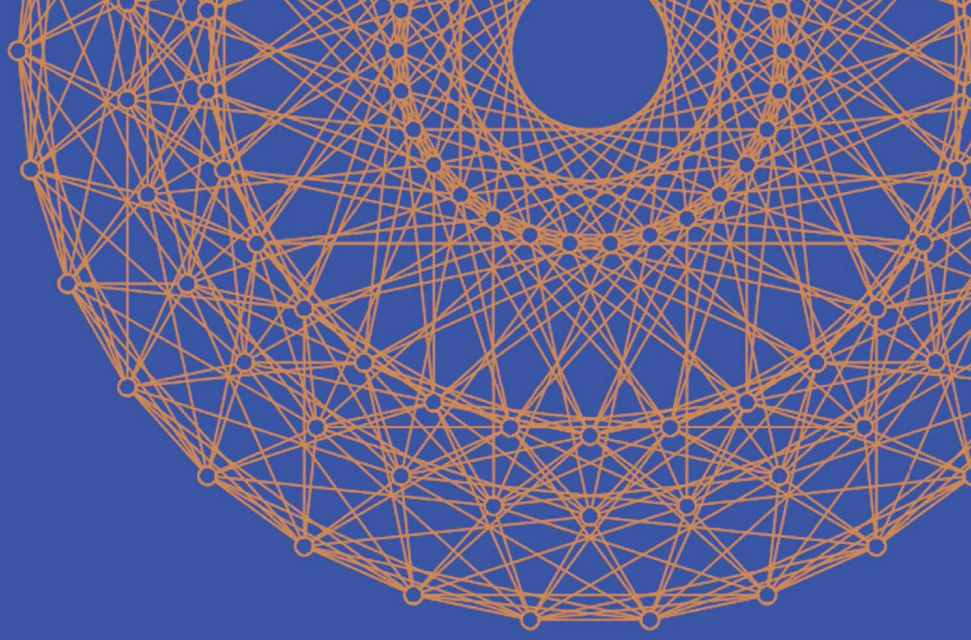
VIEW | CONSULTEZ
THE EDITORIAL BOARD
LE COMITÉ ÉDITORIAL

EXPLORE | EXPLOREZ
OUR INSTRUCTIONS FOR AUTHORS
NOS DIRECTIVES POUR LES AUTEURS

ACTIVATE | ACTIVEZ
STAY UPDATED WITH THE LATEST CONTENT | RESTEZ INFORMÉ DU CONTENU LE PLUS RÉCENT

JOIN THE CONVERSATION
REJOIGNEZ LA CONVERSATION

CAMBRIDGE UNIVERSITY PRESS



Canadian Mathematical Communications

mathématiques canadiennes

Canadian Mathematical Communications is a Gold Open Access journal, spanning all fields of mathematics and focusing on top quality longer papers.

Canadian Mathematical Communications est une revue en libre accès Gold qui couvre tous les domaines des mathématiques et se concentre sur des articles longs de grande qualité.

Canadian Mathematical Society
Société mathématique du Canada

CAMBRIDGE UNIVERSITY PRESS

Exhibitors | Exposants

Visit our exhibitors on ***Saturday and Sunday*** *from* ***10 a.m. to 4:30 p.m.*** *in the* ***Churchill Courtyard***

Visitez nos exposants ***samedi et dimanche*** *de* ***10 h à 16 h 30*** *dans le* ***Churchill Courtyard***

INSTITUT TUTTE INSTITUTE

Centre de la sécurité des télécommunications Canada

Communications Security Establishment Canada

DigitalEd

AMS

Maple™

FIELDS

MathMatize

Canadian Mathematical Society
Société mathématique du Canada

Call for Nominations
Appel à mises en candidature

2026 CMS

BLAIR SPEARMAN DOCTORAL PRIZE
PRIX DE DOCTORAT BLAIR SPEARMAN

de la SMC 2026

In recognition of an outstanding performance by a doctoral student who graduated from a Canadian university in the preceding year.

En reconnaissance d'une performance exceptionnelle d'un(e) doctorant(e) diplômé(e) d'une université canadienne au cours de l'année précédente.

Submit all documentation to docprize@cms.math.ca
no later than January 31, 2026

Soumettez tous les documents à prixdoc@smc.math.ca
au plus tard le 31 janvier 2026

Canadian Mathematical Society
Société mathématique du Canada

Call for Nominations
Appel à mises en candidature

2026 CMS

GRAHAM WRIGHT AWARD
PRIX GRAHAM WRIGHT

de la SMC 2026

In recognition of an individual who has made sustained and significant contributions to the Canadian mathematical community and, in particular, to the Canadian Mathematical Society.

En reconnaissance d'une personne ayant apporté une contribution soutenue et significative à la communauté mathématique canadienne et, en particulier, à la Société mathématique du Canada.

Submit all documentation to gwaward@cms.math.ca
no later than March 31, 2026

Soumettez tous les documents à prixgw@smc.math.ca
au plus tard le 31 mars 2026

Canadian Mathematical Society
Société mathématique du Canada

Call for Nominations
Appel à mises en candidature

2026 CMS
CMS FELLOWS
FELLOWS DE LA SMC
de la SMC 2026

In recognition of CMS members who have made excellent contributions to mathematical research, teaching, or exposition, as well as distinguished themselves in service to Canada's mathematical community.

En reconnaissance des membres de la SMC qui ont apporté d'excellentes contributions à la recherche, à l'enseignement ou à l'exposition en mathématiques, et qui se sont distingués par leurs services à la communauté mathématique du Canada.

Submit all documentation to awards-prizes@cms.math.ca
no later than March 31, 2026

Soumettez tous les documents à prix@smc.math.ca
au plus tard le 31 mars 2026

Canadian Mathematical Society
Société mathématique du Canada

See you next year

SAVE THE DATE

RÉSERVEZ LA DATE

À l'année prochaine

2026 CMS Summer Meeting
Réunion d'été 2026 de la SMC

June 5 to 8 | Du 5 au 8 juin

SAINT JOHN, NB

Canadian Mathematical Society
Société mathématique du Canada

See you next year

SAVE THE DATE

RÉSERVEZ LA DATE

À l'année prochaine

2026 CMS Winter Meeting
Réunion d'hiver 2026 de la SMC

December 11 to 14 | Du 11 au 14 décembre

MONTRÉAL, QC

Call for *Sessions*

2026 CMS Summer Meeting | Saint John, NB

The Canadian Mathematical Society (CMS) welcomes and invites scientific session proposals for the 2026 CMS Summer Meeting in Saint John, New Brunswick from June 5-8, 2026.

- The purpose of the scientific sessions is to share cutting edge research on a given mathematical topic, as suggested by the organizers.
- Sessions are scheduled blocks, with each block ranging from 2 to 2.5 hours in length, and take place from June 6-8. Typical scientific sessions have between 10 and 20 talks of 20 minutes each, with 10 minutes between talks, but 50-min talks are possible. Indeed, the organizers are welcome to suggest non-traditional usage of the block times and format.
- In accordance with the CMS mandate to propose conferences which are accessible and welcoming to all groups, diversity amongst organizers and speakers is strongly encouraged. To support organizers in their important work and in their efforts towards inclusivity and diversity, the CMS will host an open call for abstracts for all sessions, and asks organizers to consider all eligible abstract submissions for their session.
- Diversity includes topics of interest, career stages, geographic location, and demographics; designated underrepresented groups include, but are not limited to, women, Indigenous Peoples, persons with disabilities, members of visible minority/racialized groups, and members of LGBTQ2+ communities.
- Note that there will be a separate follow-up call for Education Sessions.
- All proposed sessions should be in line with the CMS Code of Conduct.

Proposals should be submitted online, and will require the following:

1. Names, affiliations, and contact information for two or three organizers: A lead organizer and one or two co-organizer(s).
2. A title and a two to three-sentence summary that will be posted on the website for potential speakers.
3. The number of blocks requested (blocks are 2 or 2.5 hours long).
4. A pdf file including a description of the topic and purpose of the session (1-2 paragraphs), as well as a description of considerations made towards an equitable and inclusive session for a diverse group of participants. This file will not be publicly posted.
5. A spreadsheet including list of possible speakers. Please have columns "Last Name", "First Name", "Affiliation", "Career Stage", and "Webpage", with as much information filled out for potential speakers as possible. This file will not be publicly posted. The template for the list of potential speakers can be found here.

Proposals will be selected by the Scientific Organizing Committee, limited by available classroom space, with priority for sessions that show intention to include a mix of senior and junior researchers, to make parts of their session accessible to graduate students, and to include speakers from designated underrepresented groups.

A note on Organizers

The lead organizer should hold a PhD or equivalent in the area of expertise relevant to the subject of the session. Having a senior researcher (e.g. Professor or tenured Associate Professor) paired with someone earlier in their career (e.g. tenure track Assistant Professor or Postdoctoral Fellow) would be ideal. We ask that each potential organizer only propose a single session.

Submission Forms and Deadlines

Please submit proposals by filling out this form. There will be two rounds of submissions. Proposals submitted by January 16, 2026, will be considered in the first round, with responses ongoing. The deadline for the second round will be March 30, 2026

Réunion d'été 2026 de la SMC | Saint John, NB

Appel à *Sessions*

La Société mathématique du Canada (SMC) sollicite les propositions de sessions scientifiques pour la Réunion d'été 2026 de la SMC qui se tiendra à Saint John, au Nouveau-Brunswick, du 5 au 8 juin 2026.

- L'objectif des sessions scientifiques est de partager les recherches de pointe sur un sujet mathématique donné, tel que suggéré par les organisateur(trice)s.
- Les sessions sont des blocs programmés, chacun d'une durée de 2 à 2,5 heures, et se déroulent du 6 au 8 juin. Les sessions scientifiques typiques comprennent entre 10 et 20 présentations de 20 minutes chacune, avec 10 minutes entre chaque présentation, mais des présentations de 50 minutes sont possibles. En effet, les organisateur(trice)s sont invité(e)s à suggérer une utilisation et un format non traditionnels des blocs de temps.
- Conformément à la mission de la SMC qui consiste à proposer des conférences accessibles et accueillantes pour tous les groupes, la diversité parmi les organisateur(trice)s et les orateurs(trices) est fortement encouragée. Afin de soutenir les organisateur(trice)s dans leur travail important et dans leurs efforts en faveur de l'inclusion et de la diversité, la SMC lancera un appel à résumés ouvert pour toutes les sessions et demandera aux organisateur(trice)s d'examiner toutes les soumissions de résumés éligibles pour leur session.
- La diversité comprend les sujets d'intérêt, les étapes de carrière, la situation géographique et les données démographiques ; les groupes sous-représentés désignés comprennent, sans s'y limiter, les femmes, les peuples autochtones, les personnes handicapées, les membres de minorités visibles/groupes racialisés et les membres des communautés LGBTQ2+.
- Veuillez noter qu'il y aura un appel séparé pour les sessions d'éducation.
- Toutes les sessions proposées doivent être conformes au code de conduite de la SMC.

Les propositions doivent être soumises en ligne et doivent comprendre les éléments suivants :

1. Noms, affiliations et coordonnées de deux ou trois organisateur(trice)s : un(e) organisateur(trice) principal(e) et un(e) ou deux coorganisateur(trice)s.
2. Un titre et un résumé de deux à trois phrases qui seront publiés sur le site Web à l'intention des orateur(trice)s potentiel(le)s.
3. Le nombre de blocs demandés (les blocs durent 2 ou 2,5 heures).
4. Un fichier pdf comprenant une description du thème et de l'objectif de la session (1 à 2 paragraphes), ainsi qu'une description des considérations prises en compte pour garantir une session équitable et inclusive pour un groupe diversifié de participant(e)s. Ce fichier ne sera pas publié.
5. Un fichier Excel comprenant la liste des orateur(trice)s potentiel(le)s. Veuillez inclure les colonnes « Nom », « Prénom », « Affiliation », « Étape de carrière » et « Page Web », en fournissant autant d'informations que possible sur les orateur(trice)s potentiel(le)s. Ce fichier ne sera pas publié. Le modèle pour la liste des orateur(trice)s potentiel(le)s est disponible ici.

Les propositions seront sélectionnées par le comité scientifique organisateur, en fonction de l'espace disponible dans les salles de classe, la priorité étant donnée aux sessions qui montrent l'intention d'inclure un mélange de chercheur(euse)s expérimenté(e)s et débutant(e)s, de rendre certaines parties de leur session accessibles aux étudiant(e)s diplômé(e)s et d'inclure des orateur(trice)s issu(e)s de groupes sous-représentés désignés.

À propos des organisteur(trice)s

L'organisateur(trice) principal(e) doit être titulaire d'un doctorat ou d'un diplôme équivalent dans le domaine d'expertise correspondant au thème de la session. L'idéal serait de jumeler un(e) chercheur(euse) chevronné(e) (par exemple, un.e professeur.e ou un.e professeur.e agrégé.e titulaire) avec une personne en début de carrière (par exemple, un.e professeur.e adjoint.e en voie de titularisation ou un.e postdoctorant.e). Nous demandons à chaque organisateur(trice) potentiel(le) de ne proposer qu'une seule session.

Formulaire de soumission et dates limites

Veuillez soumettre vos propositions en remplissant ce formulaire. Il y aura deux cycles de soumission. Les propositions soumises avant le 16 janvier 2026 seront examinées lors du premier cycle, et les réponses seront envoyées au fur et à mesure. La date limite pour le deuxième cycle est fixée au 30 mars 2026.

Call for *Education* Sessions

2026 CMS Summer Meeting | Saint John, NB

The Canadian Mathematical Society (CMS) welcomes and invites education session proposals for the 2026 CMS Winter Meeting in Saint John's New Brunswick, from June 5-8, 2026.

The education session proposals will be selected by the CMS Meeting Education Session Committee, which will also schedule the accepted sessions, in communication with the session co-organizers.

In accordance with the CMS mandate to propose conferences which are accessible and welcoming to all groups, diversity amongst organizers and speakers is strongly encouraged. To support organizers in their important work and in their efforts towards inclusivity and diversity, the CMS will host an open call for abstracts for all sessions, and asks organizers to consider all eligible abstract submissions for their session.

Diversity includes topics of interest, career stages, geographic location, and demographics; designated underrepresented groups include, but are not limited to, women, Indigenous Peoples, persons with disabilities, members of visible minority/racialized groups, and members of LGBTQ2+ communities. Please see here for more information about what is meant by diversity, and for tips towards organizing an inclusive session.

Note that there will be a separate call for Scientific Sessions.

All proposed sessions should be in line with the CMS Code of Conduct.

Proposals should be submitted online, and will require the following:

1. Names, affiliations, and contact information for all session co-organizers. Early career researchers are welcomed to propose sessions.
2. The education session's title, and a 2-3-sentence summary that will be posted on the CMS Meeting website if your proposal is selected.
3. A pdf file including a description of the topic and purpose of the session (1-2 paragraphs), as well as a description of considerations made towards an equitable and inclusive session for a diverse group of participants. This file will not be publicly posted.
4. Indicate the number of time blocks needed. A block can be between 2 and 2.5 hours in length.
5. A possible list of speakers with their full name and affiliation. An inclusive and diverse set of speakers is highly encouraged.
6. The structure of your session. Traditionally, each presenter gets 20 minutes to talk, 5 minutes of Q&A, and a 5-minute buffer for transition. We are open to different formats as well, such as a panel, interactive session/workshop, 10-minute lightning talks, etc.

Proposals will be selected by the Scientific Organizing Committee, limited by available classroom space, with priority for sessions that show intention to include a mix of senior and junior researchers, to make parts of their session accessible to graduate students, and to include speakers from designated underrepresented groups.

Proposals will be selected by the CMS Education Oversight Meetings Committee. If you have any questions, please email Andie Burazin (a.burazin@utoronto.ca) and Sarah Watson (meetings@cms.math.ca).

The CMS kindly asks session organizers to consider all eligible abstract submissions for their session, as up to 30 speakers per session can be accommodated.

All sessions will take place from June 6 - 8, 2026.

Submission Forms and Deadlines

Please submit proposals by filling out this form. There will be two rounds of submissions. Proposals submitted by January 16, 2026, will be considered in the first round, where preference will be given to first round submissions. The deadline for the second round will be March 29, 2026.

Appel aux sessions d'éducation

Réunion d'été 2026 de la SMC | Saint John, NB

La Société mathématique du Canada (SMC) accueille et invite les propositions de sessions d'éducation pour la Réunion d'été 2026 de la SMC, qui se tiendra à Saint John (Nouveau-Brunswick) du 5 au 8 juin 2026.

Les propositions de sessions d'éducation seront sélectionnées par le Comité des sessions d'éducation des réunions de la SMC, qui établira également le calendrier des sessions acceptées, en communication avec les co-organisateur(trice)s de la session.

Conformément au mandat de la SMC de proposer des conférences accessibles et accueillantes pour tous les groupes, la diversité parmi les organisateur(trice)s et les orateur(trice)s est fortement encouragée. Afin de soutenir les organisateur(trice)s dans leur travail important et dans leurs efforts en faveur de l'inclusion et de la diversité, la SMC lancera un appel à résumés ouvert pour toutes les sessions, et demande aux organisateur(trice)s de prendre en considération toutes les soumissions de résumés éligibles pour leur session.

La diversité comprend les sujets d'intérêt, les étapes de la carrière, la situation géographique et les données démographiques ; les groupes sous-représentés désignés comprennent, sans s'y limiter, les femmes, les peuples autochtones, les personnes handicapées, les membres de minorités visibles/de groupes raciaux et les membres des communautés LGBTQ2+.

Veuillez noter qu'il existe un appel distinct pour les sessions scientifiques.

Toutes les sessions proposées doivent être conformes au code de conduite de la SMC.

Les propositions doivent être soumises en ligne et doivent comporter les éléments suivants :

1. Noms, affiliations et coordonnées de tous les co-organisateur(trice)s de la session. Les chercheur(euse)s en début de carrière sont invité(e)s à proposer des sessions.
2. Le titre de la session et un résumé de deux à trois phrases qui sera affiché sur le site Web de la réunion si votre proposition est retenue.
3. Une brève description du sujet et de l'objectif de la session (1 à 2 paragraphes), pour examen par le Comité des réunions d'éducation de la SMC, qui ne sera pas publiée en ligne.
4. Indiquez le nombre de blocs de temps nécessaires. Un bloc peut durer entre 2 et 2,5 heures.
5. Une liste d'orateur(trice)s avec leur nom complet et leur affiliation, qui ont confirmé ou qui ont exprimé leur intérêt et ont été approché(e)s, avant de soumettre la proposition. Il est vivement recommandé de faire appel à un ensemble d'orateur(trice)s inclusif et diversifié.
6. La structure de votre session. Traditionnellement, chaque orateur(trice) dispose de 20 minutes pour parler, de 5 minutes de questions-réponses et d'une période transitoire de 5 minutes. Nous sommes également ouverts à d'autres formats, tels qu'un panel, une session interactive ou un atelier, des exposés éclair de 10 minutes, etc.

Les propositions seront sélectionnées par le Comité des réunions d'éducation de la SMC. Si vous avez des questions, veuillez envoyer un courriel à Andie Burazin (a.burazin@utoronto.ca) et Sarah Watson (meetings@cms.math.ca).

La SMC demande aux organisateur(trice)s de sessions de prendre en considération toutes les soumissions de résumés éligibles pour leur session, étant donné que jusqu'à 30 orateur(trice)s par session peuvent être accueilli(e)s.

Toutes les sessions auront lieu du 6 au 8 juin 2026.

Formulaire de soumission et dates limites :

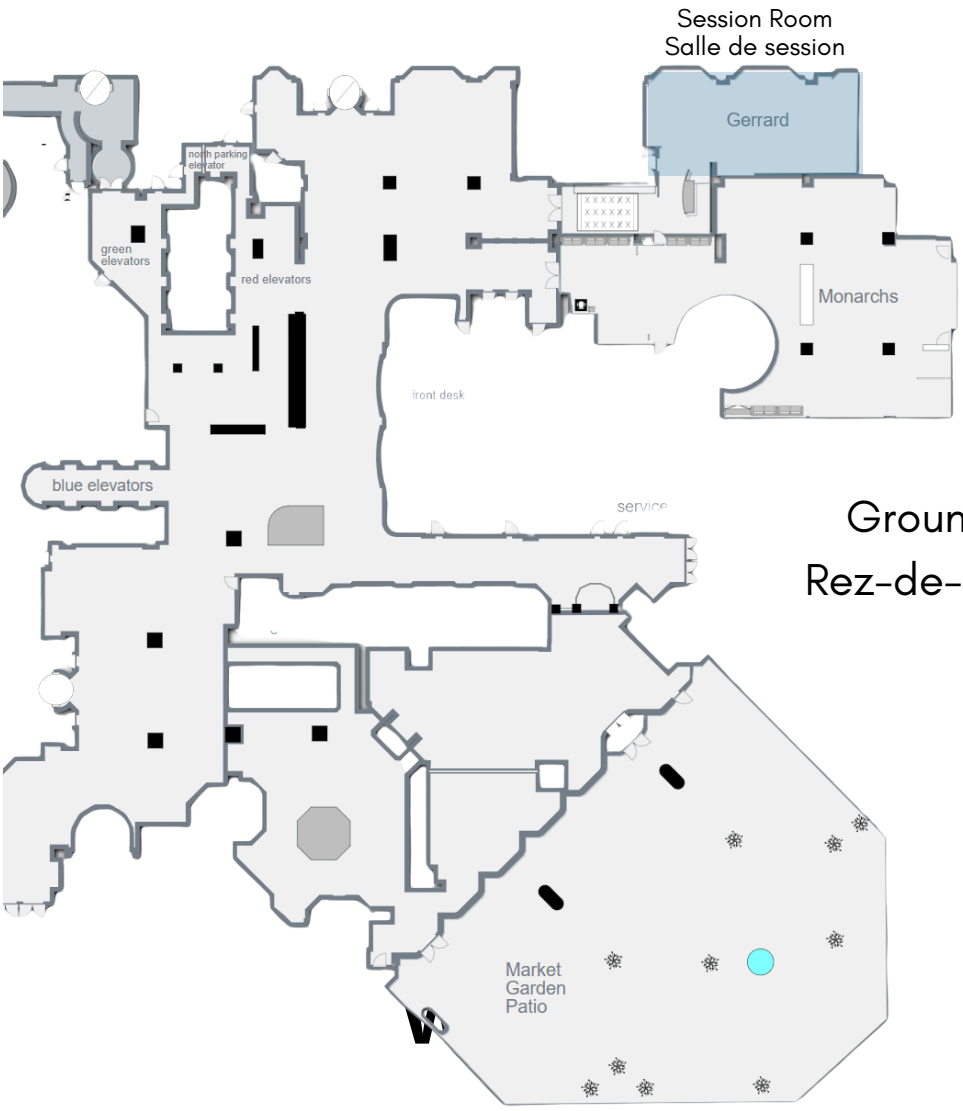
Veuillez soumettre vos propositions en remplissant ce formulaire. Il y aura deux séries de soumissions. Les propositions soumises avant le 16 janvier 2026 seront examinées lors du premier tour, la préférence étant donnée aux propositions soumises lors du premier tour. La date limite pour le deuxième tour sera le 29 mars 2026.

FLOORPLANS | PLANS D'ÉTAGE

HÔTEL CHELSEA HOTEL, TORONTO

FLOORPLANS | PLANS D'ÉTAGE

HÔTEL CHELSEA HOTEL, TORONTO



Ground Floor
Rez-de-chaussée

NETWORK | RÉSEAU :

Chelsea Meeting

PASSWORD | MOT DE PASSE :

Chelsea7979

EXCLUSIVE OFFERS!
OFFRES EXCLUSIVES!

18feet
ESPRESSO BAR & THE CHEONG

LE GÉNIE
Bakery & Espresso

sunset grill
Fresh is Tastiest.
FAMOUS ALL DAY BREAKFAST

BASIL BOX

reply:

Odd Burger
VEGAN FAST FOOD

bb·q CHICKEN
Toronto

Salad King
THAI FOOD

For more details, see the following page or speak to CMS staff.
Pour plus de détails, consultez la page suivante ou adressez-vous au personnel de la SMC.

Salad King THAI FOOD

340 Yonge St, Toronto, ON M5B 1R8

2 minutes

20% discount upon presentation of your conference badge.
20% de rabais sur présentation de votre badge de conférence.

reply:

637B Bay St, Toronto, ON M5G 1M7

3 minutes

15% discount upon presentation of your conference badge.
15% de rabais sur présentation de votre badge de conférence.

LE GÉNIE Bakery & Espresso

382 Yonge St First Floor, Toronto, ON M5B 1S8

1 minute

10% discount on all drinks upon presentation of your conference badge.
10% de rabais sur tous les breuvages sur présentation de votre badge de conférence.

18feet ESPRESSO BAR & THE CHEONG

86 Gerrard St E #100, Toronto, ON M5B 1G6

6 minutes

10% discount on all food and beverage items (including sandwiches, desserts, coffee, matcha, etc.) upon presentation of your conference badge.
10% de rabais sur la nourriture et les boissons (sandwichs, desserts, café, matcha, etc.) sur présentation de votre badge de conférence.

BASIL BOX

351 Yonge St, Toronto, ON M5B 1S1

3 minutes

10% discount upon presentation of your conference badge.
10% de rabais sur présentation de votre badge de conférence.

sunset grill — Fresh is Tastiest. — FAMOUS ALL DAY BREAKFAST

1 Richmond St W, Toronto, ON M5H 3W4

12 minutes

Free pancake with the purchase of a meal, upon presentation of your conference badge.
Pancake gratuit à l'achat d'un repas, sur présentation de votre badge de conférence.

bb·q CHICKEN Toronto

43 Elm St, Toronto, ON M5G 1H1

3 minutes

10% discount upon presentation of your conference badge.
10% de rabais sur présentation de votre badge de conférence.

Odd Burger VEGAN FAST FOOD

229 Church St Unit #3, Toronto, ON M5B 1Y7

9 minutes

20% discount with coupon.
20% de rabais avec coupon rabais.

Terms & conditions apply. Please consult CMS staff for details.
Certaines conditions s'appliquent. Veuillez consulter le personnel de la SMC pour plus de détails.