Canadian Mathematical Society
Société mathématique du Canada

2024 CMS Summer Meeting

PROGRAMME

Réunion d'été 2024 de la SMC

May 31 - June 3
31 mai au 3 juin
Saskatoon, SK

Canadian Mathematical Society
Société mathématique du Canada

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University of Saskatchewan
Saskatoon, Saskatchewan

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2	ARTS 102	Mini Course: Unveiling Infinite Symmetries Mini cours : Levée de voile sur les symétries infinies	
3	ARTS 106		CH - Thirty Years Later CH - trente ans plus tard
4	ARTS 108	Mini Course: Student Writing Workshop Mini cours : Atelier d'écriture des étudiants	
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SATURDAY | SAMEDI

#	ROOM | SALLE	SATURDAY | SAMEDI AM	SATURDAY | SAMEDI PM
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2	ARTS 106	CH - Thirty Years Later | CH - trente ans plus tard	
3	ARTS 214	Inverse Eigenvalue Problems and Matrix Theory Problèmes inverses des valeurs propres et théorie des matrices	
4	ARTS 207	Mathematical Aspects of Quantum Science and Technology Aspects mathématiques de la science et de la technologie quantiques	
5	ARTS 213	Mathematics of Machine Learning Mathématiques de l'apprentissage automatique	
6	ARTS 211	Moduli Spaces in Complex and Algebraic Geometry: Recent Developments Espaces de modules en géométrie complexe et algébrique : Développements récents	
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8	ARTS 200	Numerical Methods For and With Special Functions Méthodes numériques pour et avec des fonctions spéciales	
9	ARTS 108	Operators, Matrices, and Analytic Function Spaces Opérateurs, matrices et espaces de fonctions analytiques	
10	ARTS 109	Symmetry Methods and Analytical Techniques for Nonlinear Partial Differential Equations Méthodes de symétrie et techniques analytiques pour les équations différentielles partielles non linéaires	
11	ARTS 100	The Representation Theory and Geometry of Quantum Algebras Théorie des représentations et géométrie des algèbres quantiques	
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2	ARTS 217	Association Schemes and their Applications Les schémas d'association et leurs applications	
3	ARTS 106	CH - Thirty Years Later | CH - trente ans plus tard	
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5	ARTS 108	Geometry and Representation Theory | Géométrie et théorie des représentations	
6	ARTS 206	Integrable Systems and Quantization | Systèmes intégrables et quantification	
7	ARTS 214	Inverse Eigenvalue Problems and Matrix Theory Problèmes inverses des valeurs propres et théorie des matrices	
8	ARTS 207	Mathematical Aspects of Quantum Science and Technology Aspects mathématiques de la science et de la technologie quantiques	
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12	ARTS 200	Numerical Methods For and With Special Functions Méthodes numériques pour et avec des fonctions spéciales	
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14	ARTS 109	Symmetry Methods and Analytical Techniques for Nonlinear PDEs Méthodes de symétrie et techniques analytiques pour les EDP non linéaires	
15	ARTS 208	Symplectic and Poisson Geometry | Géométrie symplectique et de Poisson	
16	ARTS 100	The Representation Theory and Geometry of Quantum Algebras Théorie des représentations et géométrie des algèbres quantiques	
17	ARTS 101	Mathematical Logic in Canada | Logique mathématique au Canada	
18	ARTS 202	A Lay of the Land: Mathematics Education in Saskatchewan Vue d'ensemble : L'enseignement des mathématiques en Saskatchewan	
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MONDAY | LUNDI

#	ROOM | SALLE	MONDAY | LUNDI AM	MONDAY | LUNDI PM
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2	ARTS 217	Association Schemes and their Applications Les schémas d'association et leurs applications	
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6	ARTS 208	Symplectic and Poisson Geometry | Géométrie symplectique et de Poisson	
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President's Welcome Letter

On behalf of the Canadian Mathematical Society, it is my pleasure to extend a warm welcome to Saskatoon and the 2024 CMS Summer Meeting. Hosted by the University of Saskatchewan, this conference offers numerous opportunities for collaboration and engaging mathematical discourse. Under the guidance of directors Elana Kalashnikov (University of Waterloo), Steven Rayan (University of Saskatchewan), and Jacek Szmigielski (University of Saskatchewan), the scientific organizing committee has curated a rich program featuring 19 sessions, three mini-courses, and a Quantum Computing Summer School taking place before the meeting.

The conference kicks off with a public lecture on Friday, May 31 st , delivered by Pamela E. Harris (University of Wisconsin – Milwaukee). Additionally, attendees can look forward to three plenary lectures by Michael Gekhtman (University of Notre Dame), Stephanie van Willigenburg (University of British Columbia), and Erica Walker (University of Toronto). Special events throughout the conference include a student poster session, the CMS AGM, and various prize lectures.

During the banquet on Saturday evening, we will celebrate and honour Renate Scheidler (University of Calgary) with the Krieger-Nelson Prize, Catherine Sulem (University of Toronto) with the Jeffery-Williams Prize, and Chris Eagle (University of Victoria) with the Excellence in Teaching Award. Winners from the student poster session will also be honoured during the banquet. This summer's special banquet will take place at Wanuskewin Heritage Park on a National Historic Site (and proposed UNESCO World Heritage Site) highlighting the Indigenous Plains culture.

The success of a conference of this magnitude and diversity is indebted to the diligent efforts of the scientific directors, committee members, session organizers, speakers, volunteers, host university, and CMS staff, all of whom deserve our heartfelt gratitude. On behalf of the Society, I extend our sincere appreciation to the sponsors of this meeting: the University of Saskatchewan, the Atlantic Association for Research in the Mathematical Sciences (AARMS), the City of Saskatoon, the Centre de recherches mathématiques (CRM), Fields Institute, the Pacific Institute for the Mathematical Sciences (PIMS), and quanTA.

To the conference participants, I hope that you have a positive and productive meeting, and that you enjoy coming together to discuss mathematics. For those not yet CMS members, our staff at the registration desk will gladly inform you about the Society's extensive array of activities beyond conference hosting.

Welcome!

David Pike, CMS President

Lettre de bienvenue du président

Au nom de la Société mathématique du Canada, j'ai le plaisir de vous accueillir chaleureusement à Saskatoon et à la Réunion d'été 2024 de la SMC. Accueillie par l'Université de la Saskatchewan, cette conférence offre de nombreuses possibilités de collaboration et de discours mathématiques engageants. Sous la direction des directeurs Elana Kalashnikov (Université de Waterloo), Steven Rayan (Université de la Saskatchewan) et Jacek Szmigielski (Université de la Saskatchewan), le comité organisateur scientifique a élaboré un riche programme comprenant 19 sessions, trois mini-cours et une école d'été sur l'informatique quantique qui aura lieu avant la réunion.

La conférence débute le vendredi 31 mai par une conférence publique donnée par Pamela E. Harris (Université du Wisconsin - Milwaukee). De plus, les participants pourront assister à trois conférences plénières données par Michael Gekhtman (Université de Notre Dame), Stephanie van Willigenburg (Université de Colombie Britannique) et Erica Walker (Université de Toronto). Parmi les événements spéciaux organisés tout au long de la conférence figurent une session d'affichage pour les étudiants, l'AGA de la SMC et diverses conférences de remise de prix.

Au cours du banquet du samedi soir, nous célébrerons et honorerons Renate Scheidler (Université de Calgary) avec le prix Krieger-Nelson, Catherine Sulem (Université de Toronto) avec le prix Jeffery-Williams, et Chris Eagle (Université de Victoria) avec le prix d'excellence en enseignement. Les lauréats de la session d'affichage des étudiants seront également récompensés lors du banquet. Le banquet spécial de cet été aura lieu au Wanuskewin Heritage Park, sur un site historique national (et proposé comme site du patrimoine mondial de l'UNESCO) mettant en valeur la culture autochtone des Plaines.

Le succès d'une conférence de cette ampleur et de cette diversité est attribuable aux efforts diligents des directeurs scientifiques, des membres des comités, des organisateurs de sessions, des conférenciers, des bénévoles, de l'université hôte et du personnel de la SMC, qui méritent tous notre plus sincère gratitude. Au nom de la Société, je remercie sincèrement les commanditaires de cette réunion : l'Université de Saskatchewan, l'*Atlantic Association for Research in the Mathematical Sciences* (AARMS), la ville de Saskatoon, le Centre de recherches mathématiques (CRM), l'Institut Fields, le *Pacific Institute for the Mathematical Sciences* (PIMS) et quanTA.

Aux participants à la conférence, j'espère que votre réunion sera positive et productive, et que vous prendrez plaisir à vous réunir pour discuter des mathématiques. Pour ceux qui ne sont pas encore membres de la SMC, notre personnel au bureau d'inscription se fera un plaisir de vous informer sur le large éventail d'activités de la Société au-delà de l'organisation de conférences.

Bienvenue à tous !

David Pike, président de la SMC

Scientific Directors' Welcome Letter

Elana Kalashnikov
University of Waterloo

Steven Rayan
University of Saskatchewan

Jacek Szmigielski
University of Saskatchewan

Welcome to the Summer 2024 Meeting of the Canadian Mathematical Society (CMS)! We are delighted that you — students, postdocs, professors, educators, teachers, researchers, industry representatives, outreach leaders (many of us playing more than one role!) — are able to join us here in sunny Saskatoon, which is situated along the South Saskatchewan River on Treaty 6 Territory and the Homeland of the Métis. Saskatoon is the largest city in the province of Saskatchewan and home to the University of Saskatchewan, founded in 1912 and which is today a member of the U15 group of universities in Canada. We are very pleased for this event to be taking place on the beautiful campus of the university amongst its classic stone buildings and green spaces.

Highlights of the CMS Summer Meeting include a public lecture by Prof. Pamela Harris, three plenary lectures, and three special talks by the CMS prize winners — speaking on diverse and exciting topics ranging from cluster structures to the stories we tell about mathematical life. There will be, as always, many parallel scientific and education sessions, representing the full array of research in the mathematical sciences and education as conducted across Canada. In addition to all of this, there will be a satellite quantum computing summer school (on the Wednesday and Thursday preceding the meeting), exciting mini-courses on the Friday, various special sessions and activities for students, a lunch for women in math, and much more. We look forward to deepening our knowledge of familiar topics and to broadening our knowledge about topics new to us. At the same time, we relish this opportunity to both connect with new colleagues and reconnect with longtime friends from across Canada and beyond.

We hope that participants will also have time to sample the natural splendor, attractions,

Scientific Directors' Welcome Letter (cont.)

restaurants, and other amenities of the City of Saskatoon during their time here. Feel free to find us and ask us about our recommendations or favourite spots to grab a bite to eat!

The hard work of many people went into the creation of this event. We especially thank the CMS executive and staff, the organizers of the parallel sessions and mini-courses, the scientific organizing committee, and all of the other volunteers who are contributing their time and effort to the success of this meeting. Finally, we express deep gratitude to all of our sponsors, without whose generosity this gathering could not be possible.

Cordially,
The Scientific Directors
Elana Kalashnikov (University of Waterloo)
Steven Rayan (University of Saskatchewan)
Jacek Szmigielski (University of Saskatchewan)

Scientific Organizing Committee

Caleb Ashley
Boston College

Gary Au
University of Saskatchewan

Anne Broadbent
University of Ottawa

Andie Burazin
University of Toronto

Emily Cliff
Université de Sherbrooke

Charles Doran
University of Alberta

Habiba Kadiri
University of Lethbridge

Robert Milson
Dalhousie University

Robin Shuttleworth
Altos Labs

Lettre de bienvenue des directeurs scientifiques

Elana Kalashnikov
University of Waterloo

Steven Rayan
University of Saskatchewan

Jacek Szmigielski
University of Saskatchewan

Bienvenue à la Réunion d'été 2024 de la Société mathématique du Canada (SMC) ! Nous sommes ravis que vous - étudiants, postdocs, professeurs, éducateurs, enseignants, chercheurs, représentants de l'industrie, responsables de la sensibilisation (beaucoup d'entre nous jouant plus d'un rôle !) - puissiez vous joindre à nous ici, dans la ville ensoleillée de Saskatoon, située le long de la rivière Saskatchewan Sud, sur le territoire du Traité 6 et la terre natale des Métis. Saskatoon est la plus grande ville de la province de Saskatchewan et le siège de l'Université de Saskatchewan, fondée en 1912 et aujourd'hui membre du groupe des universités U15 au Canada. Nous sommes très heureux que cet événement se déroule sur le magnifique campus de l'université, au milieu de ses bâtiments classiques en pierre et de ses espaces verts.

Les points saillants de la réunion d'été de la SMC comprennent une conférence publique du professeur Pamela Harris, trois conférences plénières et trois conférences spéciales données par les lauréats des prix de la SMC - sur des sujets divers et passionnants allant des structures de grappes aux histoires que nous racontons sur la vie mathématique. Il y aura, comme toujours, de nombreuses sessions scientifiques et éducatives parallèles, représentant l'ensemble des recherches en sciences mathématiques et en éducation menées à travers le Canada. De plus, il y aura une école d'été satellite sur l'informatique quantique (le mercredi et le jeudi précédant la réunion), des mini-cours passionnants le vendredi, diverses sessions et activités spéciales pour les étudiants, un dîner pour les femmes en mathématiques, et bien d'autres choses encore. Nous nous réjouissons d'approfondir nos connaissances sur des sujets familiers et d'élargir nos connaissances sur des sujets nouveaux pour nous. En même temps, nous nous réjouissons de l'occasion qui nous est donnée de rencontrer de nouveaux collègues et de renouer avec des amis de longue date du

Lettre de bienvenue des directeurs scientifiques (suite)

Canada et d'ailleurs.

Nous espérons que les participants auront également le temps de goûter à la splendeur naturelle, aux attractions, aux restaurants et aux autres commodités de la ville de Saskatoon pendant leur séjour. N'hésitez pas à nous trouver et à nous demander nos recommandations ou nos endroits préférés pour casser la croûte !

La création de cet événement est le fruit du travail acharné de nombreuses personnes. Nous remercions tout particulièrement le comité exécutif et le personnel de la SMC, les organisateurs des sessions parallèles et des mini-cours, le comité d'organisation scientifique et tous les autres bénévoles qui consacrent leur temps et leurs efforts à la réussite de cette réunion. Enfin, nous exprimons notre profonde gratitude à tous nos commanditaires, sans la générosité desquels cette réunion n'aurait pas été possible.

Cordialement,
Les directeurs scientifiques
Elana Kalashnikov (University of Waterloo)
Steven Rayan (University of Saskatchewan)
Jacek Szmigielski (University of Saskatchewan)

Comité scientifique

— City of —
Saskatoon

OFFICE OF THE MAYOR

On behalf of Saskatoon City Council, I would like to welcome you all to the Canadian Mathematical Society Summer Meeting, here on Treaty 6 Territory and the Homeland of the Métis.

The University of Saskatchewan is no stranger to research and innovation in the field of mathematics, statistics, and quantum computing. There have been partnerships dating back to Dr George H. Ling, one of the original five professors at the University, with a more recent partnership including access to the Quantum System One.

I hope that through this year's summer meetings, mini courses, guest lectures and speakers, and summer school, you enjoy collaborating, networking, and learning from one another.

During your stay in Saskatoon, I hope you're able to explore our vibrant city. Saskatoon is the home of the beautiful Meewasin river valley, the Remai Modern Art Gallery of Saskatchewan, and we have a growing restaurant scene and many unique stores and shopping districts that are well worth a visit. And enjoy your awards banquet at Wanuskewin Heritage Park, currently in the process of obtaining UNESCO World Heritage Status.

Best wishes for a successful conference and enjoy your stay in our community!

Sincerely,

Charlie Clark
Mayor

Au nom du conseil municipal de Saskatoon, j'aimerais vous souhaiter la bienvenue à la réunion d'été de la Société mathématique du Canada, ici, sur le territoire du traité no 6 et la terre natale des Métis.

L'Université de la Saskatchewan n'est pas étrangère à la recherche et à l'innovation dans le domaine des mathématiques et de l'informatique quantique. Des partenariats existent depuis le Dr George H. Ling, l'un des cinq premiers professeurs de l'université, et un partenariat plus récent comprend l'accès au Quantum System One.

J'espère que les réunions d'été, les mini-cours, les conférences et les orateurs invités, ainsi que l'école d'été de cette année vous permettront de collaborer, de réseauter et d'apprendre les uns des autres.

Pendant votre séjour à Saskatoon, j'espère que vous pourrez explorer notre ville dynamique. Saskatoon abrite la magnifique vallée de la rivière Meewasin, la Remai Modern Art Gallery of Saskatchewan, ainsi qu'une scène gastronomique en plein essor et de nombreux magasins et quartiers commerçants uniques qui valent la peine d'être visités. Et profitez de votre banquet de remise des prix au Wanuskewin Heritage Park, qui est en train d'obtenir le statut de patrimoine mondial de l'UNESCO.

Nous vous souhaitons une conférence réussie et un séjour agréable dans notre communauté !

Bien à vous,

Charlie Clark
Maire

Traduit librement par la SMC

Krieger-Nelson Prize

The CMS is delighted to award the 2024 Krieger-Nelson Prize to **Dr. Renate Scheidler (University of Calgary)** in recognition of her important and significant contributions to research, particularly in the fields of computational number theory and algebraic number theory.

Dr. Scheidler earned her BSc and MSc equivalent in Mathematics at the University of Cologne (Germany), and her PhD in Computer Science at the University of Manitoba in 1993. She then held a faculty appointment at the University of Delaware. In 2021, she joined the University of Calgary, where she has since held various roles. Initially an Associate Professor, she was appointed Professor in 2008. From 2011 to 2016, she served as the Graduate Program Director of the Department of Mathematics & Statistics at the University of Calgary. Then, in 2022, she spent a year at the Department of Mathematics of Carl von Ossietzky Universität Oldenburg (Germany) as a Helene Lange Visiting Professor. Today, Dr. Scheidler remains a Professor at the University of Calgary, with a joint appointment in the Department of Mathematics & Statistics and the Department of Computer Science. She is also a Fellow of the Association for Women in Mathematics.

Dr. Scheidler's primary research is situated at the intersection of mathematics and computer science, focusing on the design and analysis of algorithms and computations within global fields. These fields encompass algebraic number fields and those derived from algebraic curves over finite fields, situated in the realms of algebraic number theory, arithmetic geometry, and cryptography. The primary objective is to develop and implement cutting-edge algorithms for global fields, emphasizing mathematical aspects while considering cryptographic applications. Dr. Scheidler's research integrates methodologies from algebraic number theory, arithmetic geometry, complexity theory, cryptography, and computing. This interdisciplinary approach involves abstract mathematics, algorithm design and analysis, computer implementation, and the synthesis of numerical data.

Dr. Scheidler boasts an impressive publication record, having (co-)authored over 60 papers that have been published in widely recognized and esteemed journals.

Together with Kristin Lauter and Rachel Pries, Dr. Scheidler organized the very first Women in Numbers (WIN) conference that took place in Banff in 2008, and founded the Women in Numbers Network that oversees the organization of the WIN conferences and serves as a community for female researchers in number theory.

In summary, Dr. Scheidler is an accomplished researcher and a leader in her field, and she has greatly contributed to the promotion of research by junior mathematicians and women in mathematics. Renate Scheidler holds a distinguished and vital role within the mathematical community.

Prix Krieger-Nelson

La SMC a le plaisir de remettre le prix Krieger-Nelson 2024 à la **Dre. Renate Scheidler (Université de Calgary)** en reconnaissance de ses contributions importantes et significatives à la recherche, en particulier dans les domaines de la théorie algorithmique des nombres et de la théorie algébrique des nombres.

La Dre. Scheidler a obtenu un BSc et une MSc équivalents en mathématiques à l'Université de Cologne (Allemagne), puis son doctorat en informatique à l'Université du Manitoba en 1993. Elle a ensuite occupé un poste de professeure à l'université du Delaware. En 2001, la Dre. Scheidler a rejoint l'Université de Calgary, où elle a depuis occupé diverses fonctions. D'abord professeure agrégée, elle a été nommée professeure en 2008. De 2011 à 2016, elle a été directrice du programme d'études supérieures du département de mathématiques et de statistiques de l'Université de Calgary. Puis, en 2022, elle a passé un an au département de mathématiques de la Carl von Ossietzky Universität Oldenburg (Allemagne) en tant que professeure invitée Helene Lange. Aujourd'hui, la Dre. Scheidler est toujours professeure à l'Université de Calgary, avec une nomination conjointe au département de mathématiques et de statistiques et au département d'informatique. Elle est également Fellow de l'Association for Women in Mathematics.

La recherche principale de la Dre. Scheidler se situe à l'intersection des mathématiques et de l'informatique, et se concentre sur la conception et l'analyse d'algorithmes et de calculs dans des corps globaux. Ces corps englobent les corps de nombres algébriques et ceux dérivés des courbes algébriques sur les corps finis, situés dans les domaines de la théorie algébrique des nombres, de la géométrie arithmétique et de la cryptographie. L'objectif principal est de développer et de mettre en œuvre des algorithmes de pointe pour les corps globaux, en mettant l'accent sur les aspects mathématiques tout en envisageant des applications cryptographiques. Les recherches de la Dre. Scheidler intègrent des méthodologies issues de la théorie algébrique des nombres, de la géométrie arithmétique, de la théorie de la complexité, de la cryptographie et de l'informatique. Cette approche interdisciplinaire implique des mathématiques abstraites, la conception et l'analyse d'algorithmes, la mise en œuvre informatique et la synthèse de données numériques.

La Dre. Scheidler affiche un nombre impressionnant de publications, ayant (co-)rédigé plus de 60 articles qui ont été publiés dans des revues largement reconnues et réputées. De plus, avec Kristin Lauter et Rachel Pries, la Dre. Scheidler a organisé la toute première conférence *Women in Numbers* (WIN) qui a eu lieu à Banff en 2008, et a fondé le réseau *Women in Numbers Network* qui supervise l'organisation des conférences WIN et sert de communauté pour les chercheuses en théorie des nombres.

En résumé, la Dre. Scheidler est une chercheuse accomplie et une leader dans son domaine, et elle a grandement contribué à la promotion de la recherche par les jeunes mathématiciens et les femmes en mathématiques. Renate Scheidler joue un rôle essentiel au sein de la communauté mathématique.

Jeffery-Williams Prize

The CMS is pleased to award the 2024 Jeffery-Williams Prize to **Dr. Catherine Sulem (University of Toronto)** for her significant contributions to mathematical research, particularly in the areas of nonlinear partial differential equations and fluid dynamics.

Dr. Sulem received the degree Docteur ès Sciences in 1983 from the Université Paris-Nord. In France, she held positions with the CNRS at the University of Nice and the École Normale Supérieure in Paris. Since 1990, Dr. Sulem has been a professor in the Department of Mathematics at the University of Toronto. Over the course of her career, Dr. Sulem has served as an editor of severals journals, including the Canadian Journal of Mathematics, Proceedings of the AMS, SIAM Journal of Mathematical Analysis, Mathematische Zeitschrift and Annales Mathématiques du Québec.

Dr. Sulem's research focuses on nonlinear dynamics in various fields of physics, in particular, evolution equations that describe wave phenomena in fluids, nonlinear optics and plasma physics. She has significantly contributed to these fields, notably co-authoring with Pierre-Louis Sulem a monograph dedicated to the Nonlinear Schrödinger equation, a work that has been a source of inspiration for numerous mathematicians. Together with Vladimir Zakharov and Walter Craig, Dr. Sulem is credited with a formulation of the water-wave equations which is pivotal to current research in mathematical analysis, numerical simulations and in the derivation of asymptotic models.

These results only scratch the surface of Dr. Sulem's extensive work. She has authored or co-authored over 100 publications, leaving a profound impact on various domains of physics and mathematics.

In addition to her research endeavors, Dr. Sulem actively contributes to the cultivation and advancement of future mathematicians. She has played a pivotal role in mentoring numerous postdoctoral fellows and graduate students. Furthermore, her achievements are recognized through her fellowship in the Royal Society of Canada, the American Mathematical Society and the Canadian Mathematical Society. Dr. Sulem has been a featured speaker at many international conferences, including the 2019 ICIAM where she delivered the AWM-SIAM Sonia Kovalevsky Prize lecture.

Dr. Sulem's productive and prolific career has left (and continues to leave) a profound impact on multiple domains of mathematics.

Prix Jeffery-Williams

La SMC a le plaisir de remettre le prix Jeffery-Williams 2024 à la **Dre. Catherine Sulem (Université de Toronto)** pour ses contributions importantes à la recherche mathématique, en particulier dans les domaines des équations aux dérivées partielles non linéaires et de la dynamique des fluides.

La Dre. Sulem a reçu le titre de Docteur ès Sciences en 1983 de l'Université Paris-Nord. En France, elle a occupé des postes au CNRS, à l'Université de Nice et à l'École Normale Supérieure de Paris. Depuis 1990, la Dre. Sulem est professeure au département de mathématiques de l'Université de Toronto. Au cours de sa carrière, la Dre. Sulem a été rédactrice en chef de plusieurs revues, dont le Journal canadien de mathématiques, Proceedings of the AMS, SIAM Journal of Mathematical Analysis, Mathematische Zeitschrift et Annales Mathématiques du Québec.

Les recherches de la Dre. Sulem portent sur la dynamique non linéaire dans divers domaines de la physique, en particulier les équations d'évolution qui décrivent les phénomènes ondulatoires dans les fluides, l'optique non linéaire et la physique des plasmas. Elle a contribué de manière significative à ces domaines, notamment en cosignant avec Pierre-Louis Sulem une monographie consacrée à l'équation de Schrödinger non linéaire, un ouvrage qui a été une source d'inspiration pour de nombreux mathématiciens. Avec Vladimir Zakharov et Walter Craig, la Dre. Sulem est à l'origine d'une formulation des équations des vagues d'eau qui est essentielle à la recherche actuelle en analyse mathématique, aux simulations numériques et à la dérivation de modèles asymptotiques.

Ces résultats ne font qu'effleurer la surface du travail considérable de la Dre. Sulem. Elle est auteure ou coauteure de plus de 100 publications, laissant un impact profond sur divers domaines de la physique et des mathématiques.

En plus de ses travaux de recherche, la Dre. Sulem contribue activement à la formation et à la promotion des futurs mathématiciens. Elle a joué un rôle essentiel dans l'encadrement de nombreux boursiers postdoctoraux et étudiants diplômés. En outre, ses réalisations sont reconnues par ses bourses de recherche (fellowship) de la Société royale du Canada, de l'American Mathematical Society et de la Société mathématique du Canada. La Dre. Sulem a été oratrice invitée à de nombreuses conférences internationales, notamment à l'ICIAM 2019, où elle a prononcé la conférence du prix AWM-SIAM Sonia Kovalevsky.

La carrière productive et prolifique de la Dre. Sulem a eu (et continue d'avoir) un impact profond sur de multiples domaines des mathématiques.

Excellence in Teaching Award

The CMS is pleased to award the 2024 Excellence in Teaching Award to **Dr. Christopher Eagle (University of Victoria)** for his innovative teaching style, student mentorship, and depth of subject knowledge.

Dr. Eagle earned his B.Math (2007) and M.Math (2010) in Mathematics at the University of Waterloo, and a M.Litt (2008) in the Philosophy of Mathematics from the University of St. Andrews. Following this, he pursued his PhD in Mathematics at the University of Toronto, completing it in 2015. He then transitioned to the University of Victoria in 2016, initially serving as an Assistant Teaching Professor and later advancing to the position of Associate Teaching Professor in 2023. Throughout his career, Dr. Eagle has secured numerous grants to support research and teaching projects in mathematics. Additionally, he has been an invited speaker on mathematics education at various conferences.

Dr. Eagle is known for his innovative and engaging teaching style. Annually, he coordinates the course MATH 110, Matrix Algebra for Engineers. He has authored an open-source digital textbook specifically for this course, incorporating interactive computer-based exercises. This innovative resource has yielded impressive outcomes within the class and has garnered significant praise from fellow faculty members.

Dr. Eagle's teaching repertoire spans a wide array of subjects and levels, consistently demonstrating remarkable effectiveness. His classes boast notably low attrition and failure rates, coupled with outstanding student evaluations. Esteemed among fellow faculty members and students alike, he is recognized for his compassion, unwavering dedication, fervent love for mathematics, and steadfast commitment to student achievement.

Engaged in fostering the growth of undergraduate students inside and outside of the classroom, Dr. Eagle has served as a keynote speaker at various events hosted by the undergraduate student society. He has also guided numerous undergraduate research students.

In summary, Dr. Eagle demonstrates remarkable effectiveness in the classroom, exhibiting a profound commitment to teaching, his students, and his broader community of colleagues. His significant contributions to the educational mission of the University of Victoria distinguish him as an exceptional educator.

Prix d'excellence en enseignement

La SMC a le plaisir de remettre le Prix d'excellence en enseignement 2024 au **Dr. Christopher Eagle (Université de Victoria)** pour son style d'enseignement novateur, son mentorat auprès des étudiants et ses connaissances approfondies de la matière.

Le Dr. Eagle a obtenu son B.Math (2007) et son M.Math (2010) en mathématiques à l'Université de Waterloo, ainsi qu'un M.Litt (2008) en philosophie des mathématiques à l'Université de St Andrews. Il a ensuite obtenu un doctorant en mathématiques à l'Université de Toronto, qu'il a terminé en 2015. Puis, en 2016, il est passé à l'Université de Victoria, où il a d'abord occupé le poste de professeur adjoint, avant d'accéder à celui de professeur agrégé en 2023. Tout au long de sa carrière, le Dr. Eagle a obtenu de nombreuses subventions pour soutenir des projets de recherche et d'enseignement en mathématiques. De plus, il a été invité en tant que conférencier sur l'enseignement des mathématiques lors de diverses conférences.

Le Dr. Eagle est connu pour son style d'enseignement innovant et engageant. Chaque année, il coordonne le cours MATH 110, Matrix Algebra for Engineers. Il est l'auteur d'un manuel numérique à source ouverte spécialement conçu pour ce cours, qui comprend des exercices interactifs sur ordinateur. Cette ressource innovante a permis d'obtenir des résultats impressionnants dans le cadre du cours et a suscité des éloges de la part des autres membres du corps professoral.

Le répertoire d'enseignement du Dr. Eagle couvre un large éventail de sujets et de niveaux, et fait constamment preuve d'une efficacité remarquable. Ses cours affichent des taux d'abandon et d'échec remarquablement bas, ainsi que des évaluations exceptionnelles de la part des étudiants. Estimé tant par ses collègues enseignants que par ses étudiants, il est reconnu pour sa compassion, son dévouement inébranlable, son amour fervent des mathématiques et son engagement indéfectible à l'égard de la réussite des étudiants.

Engagé dans la promotion de la croissance des étudiants de premier cycle à l'intérieur et à l'extérieur de la salle de classe, le Dr. Eagle a été conférencier principal lors de divers événements organisés par la société des étudiants de premier cycle. De plus, il a activement guidé de nombreux étudiants en recherche de premier cycle.

En résumé, le Dr. Eagle fait preuve d'une efficacité remarquable en classe et d'un engagement profond envers l'enseignement, ses étudiants et l'ensemble de ses collègues. Ses contributions significatives à la mission éducative de l'Université de Victoria font de lui un éducateur exceptionnel.

List of Abbreviations
Liste des abbréviations

Asch	Association schemes and their applications Les schémas d'association et leurs applications
DNAtop	Applied Topology: DNA topology, Material Science, Topological Data Analysis Topologie appliquée : Topologie de l'ADN, science des matériaux, analyse des données topologiques
Eit	Excellence in Teaching Award Prix d'excellence en enseignement
EKRcomb	Erdos-Ko-Rado Combinatorics Combinatoire Erdos-Ko-Rado
FunHarA	Functional and Harmonic Analysis Functional and Harmonic Analysis
GeReTh	Geometry and Representation Theory Géométrie et théorie des représentations
InfEigM	Inverse Eigenvalue Problems and Matrix Theory Problèmes inverses des valeurs propres et théorie des matrices
IntSysQ	Integrable systems and quantization Systèmes intégrables et quantification
JW	Jefferey-Williams Prize Prix Jefferey-Williams
KN	Krieger-Nelson Prize Prix Krieger-Nelson
MachLea	Mathematics of Machine Learning Mathématiques de l'apprentissage automatique
MAQs	Mathematical aspects of Quantum Science and Technology Mathematical aspects of Quantum Science and Technology
MathEd	A Lay of the Land: Mathematics Education in Saskatchewan A Lay of the Land: Mathematics Education in Saskatchewan
MathLog	Mathematical Logic in Canada Mathematical Logic in Canada
ModSpa	Moduli Spaces in Complex and Algebraic Geometry: Recent Developments Espaces de modules en géométrie complexe et algébrique : Développements récents
NumMeSF	Numerical Methods for and with Special Functions Méthodes numériques pour et avec des fonctions spéciales
NumTheo	Number theory by early career researchers Théorie des nombres par les chercheurs en début de carrière
OpMaAFS	Operators, Matrices, and Analytic Function Spaces Opérateurs, matrices et espaces de fonctions analytiques
Plen	Plenary Lectures Conférences plénières
Pub	Public Lecture Conférence publique
QuaAlg	The Representation Theory and Geometry of Quantum Algebras Théorie des représentations et géométrie des algèbres quantiques
STUrea	Student Research Session Session de recherche des étudiants
SymMeth	Symmetry Methods and Analytical Techniques for Nonlinear Partial Differential Equations Méthodes de symétrie et techniques analytiques pour les équations différentielles partielles non linéaires
SymPoiG	Symplectic and Poisson geometry Géométrie symplectique et de Poisson
Unveil	Unveiling Infinite Symmetries Unveiling Infinite Symmetries
CH30	CH-Thirty Years Later CH - trente ans plus tard

Schedule for Business Meetings
Horaire pour Séances de travail

Friday May 31	**vendredi 31 mai**
12:30 - 16:30	CMS Board of Directors Meeting / Réunion du Conseil d'administration SMC, THORV 118

Saturday June 1	**samedi 1er juin**
12:00 - 13:30	CMS AGM / L'AGA de la SMC, ARTS 241

Schedule for Related Activities
Horaire pour Activités sociales

Friday May 31	vendredi 31 mai
16:45 - 17:00	Opening and Welcome / Ouverture et bienvenue, ARTS 241
18:00 - 19:30	Welcome Reception / Réception de bienvenue, ARTS 241 Foyer
19:30 - 22:00	Student Social / Soirée étudiante, ARTS 208

Saturday June 1	samedi 1er juin
10:30 - 11:00	Break / Pause, ARTS 241 Foyer
14:30 - 15:00	Break / Pause, ARTS 241 Foyer
18:30 - 22:00	Awards Banquet / Banquet de prix, Wanuskewin Heritage Park

Sunday June 2	dimanche 2 juin
10:30 - 11:00	Break / Pause, ARTS 241 Foyer
14:30 - 15:00	Break / Pause, ARTS 241 Foyer
18:30 - 20:30	Women in Math Panel / Panel des femmes en maths, ARTS 104

Monday June 3	lundi 3 juin
10:30 - 11:00	Break / Pause, ARTS 241 Foyer
14:30 - 15:00	Break / Pause, ARTS 241 Foyer

Schedule
Horaire

Friday May 31	**vendredi 31 mai**
13:00 - 13:50	Roberto Camassa (University of North Carolina-Chapel Hill, USA), *Mathematical modeling of shallow water wave propagation.*, CH30 (p. 42), ARTS 106
14:00 - 14:50	Alex Himonas (University of Notre Dame, USA), *Analysis of the CH equation and family*, CH30 (p. 42), ARTS 106
15:00 - 15:50	Andrew Hone (University of Kent, UK), *An elliptic analogue of the Camassa-Holm equation*, CH30 (p. 43), ARTS 106
16:00 - 16:50	Zhijun Qiao (University of Texas Rio Grande Valley, USA), *Integrable CH hierarchy and beyond*, CH30 (p. 44), ARTS 106
16:45 - 17:00	Opening and Welcome / Ouverture et bienvenue, ARTS 241
17:00 - 18:00	Pamela E. Harris (University of Wisconsin - Milwaukee), *Parking Functions: Choose your own adventure*, Pub (p. 26), ARTS 241
18:00 - 19:30	Welcome Reception / Réception de bienvenue, ARTS 241 Foyer
19:30 - 22:00	Student Social / Soirée étudiante, ARTS 208

Saturday June 1 — samedi 1er juin

8:00 - 8:30	James Bremer (University of Toronto), *Frequency-indepedent solvers for linear ODEs*, NumMeSF (p. 88), ARTS 200
8:00 - 8:30	Shawn McAdam (Saskatchewan), *Symmetry and numerical analysis of nonlinear Love wave model*, SymMeth (p. 101), ARTS 109
8:15 - 9:15	Darlayne Addabbo (University of Arizona), Unveil (p. 114), ARTS 102
8:30 - 9:00	Maxim Bazhenov (University of California, San Diego), *Sleep: from biological to artificial systems*, MachLea (p. 74), ARTS 213
8:30 - 9:00	Barbara Csima (University of Waterloo), *Measurements of complexity of mathematical notions*, MathLog (p. 64), ARTS 101
8:30 - 9:00	Kostya Druzhkov (Saskatchewan), *Stationary-action principle and the intrinsic geometry of PDEs*, SymMeth (p. 99), ARTS 109
8:30 - 9:00	Nic Fellini (Queen's University), *Congruence relations for class numbers of real quadratic fields*, NumTheo (p. 83), ARTS 210
8:30 - 9:00	Amparo Gil (University of Cantabria (Universidad de Cantabria (UniCan))), *Computation and inversion of some cumulative distribution functions*, NumMeSF (p. 88), ARTS 200
8:30 - 9:00	Lisa Jeffrey (University of Toronto), *Character Varieties*, ModSpa (p. 80), ARTS 211
8:30 - 9:00	Manish Patnaik (University of Alberta), *Metaplectic Groups and Quantum Groups*, QuaAlg (p. 111), ARTS 100
8:30 - 9:00	Mahishanka Withanachchi (Laval), *Lebesgue Constants in Local Dirichlet Spaces*, OpMaAFS (p. 94), ARTS 108
8:30 - 9:20	Darryl Holm (Imperial College, UK), *Emergent singular solutions (ESS) in nonlinear wave PDEs*, CH30 (p. 43), ARTS 106
9:00 - 9:30	Javier Arsuaga (UCDavis), *Using liquid crystal models to study DNA knotting in bacteriophages*, DNAtop (p. 33), ARTS 212
9:00 - 9:30	Nicoleta Bila (Fayetteville), *Symmetry Reduction Operators for Monge-Ampère Equations*, SymMeth (p. 99), ARTS 109
9:00 - 9:30	Ilia Binder (University of Toronto), *Harmonic measure: can it be computed ?*, OpMaAFS (p. 92), ARTS 108
9:00 - 9:30	Francis Bischoff (University of Regina), *The derived moduli stack of logarithmic flat connections*, ModSpa (p. 79), ARTS 211
9:00 - 9:30	Peter Crooks (Utah State University), *Topological quantum field theories in the Moore-Tachikawa category*, QuaAlg (p. 108), ARTS 100
9:00 - 9:30	Shaun Fallat (Univeristy of Regina), *Bordering Matrices and the Inverse Eigenvalue Problem for Graphs*, InfEigM (p. 59), ARTS 104
9:00 - 9:30	Jonas Fransson (Uppsala University), *Current Induced Spin-Polarization in Chiral Molecules*, MAQs (p. 69), ARTS 207
9:00 - 9:30	Fatemeh Jalavand (University of Calgary), *Geometry of log-unit lattices*, NumTheo (p. 83), ARTS 210
9:00 - 9:30	Martina Neuman (University of Vienna), *Efficient Learning Using Spiking Neural Networks Equipped With Affine Encoders and Decoders*, MachLea (p. 76), ARTS 213
9:00 - 9:30	Javier Segura (University of Cantabria (Universidad de Cantabria (UniCan)), *Computation of classical Gaussian quadratures and associated barycentric interpolation*, NumMeSF (p. 90), ARTS 200
9:10 - 9:40	Bo Peng (McGill University), *The complexity of pointed minimal and transitive systems in different spaces*, MathLog (p. 65), ARTS 101
9:30 - 10:00	George Bluman (UBC), *The natural extension of Lie's reduction of order algorithm for ODES to PDEs*, SymMeth (p. 99), ARTS 109
9:30 - 10:00	Hubert De Guise (University of Calgary), *The regular representation of S_n in interference of fermions and bosons*, MAQs (p. 69), ARTS 207
9:30 - 10:00	Meng Guo (University of Illinois Urbana-Champaign), *On the spectrification of Khovanov arc algebras*, QuaAlg (p. 109), ARTS 100
9:30 - 10:00	Poornendu Kumar (University of Manitoba), *On Caratheodory's Approximation Theorem.*, OpMaAFS (p. 93), ARTS 108

9:30 - 10:00	Steve Rayan (University of Saskatchewan), *Resolutions of finite quotient singularities and quiver varieties*, ModSpa (p. 81), ARTS 211
9:30 - 10:00	Diego Ruiz-Antolín (University of Cantabria (Universidad de Cantabria (UniCan)), *Asymptotic and numerical approximations to the zeros of parabolic cylinder functions*, NumMeSF (p. 89), ARTS 200
9:30 - 10:00	Hristo Sendov (Western University), *On the Hadamard-Fischer Inequality, the Inclusion-Exclusion Formula, and Bipartite Graphs*, InfEigM (p. 62), ARTS 104
9:30 - 10:00	Koya Shimokawa (Ochanomizu University), *Interlocking molecules and polyhedral links*, DNAtop (p. 36), ARTS 212
9:30 - 10:00	Alexander Slamen (University of Toronto), *A Twisted Variant of Malle's Conjecture*, NumTheo (p. 84), ARTS 210
9:30 - 10:00	Yifan Sun (Stony Brook University), *Learning over very large graphs*, MachLea (p. 76), ARTS 213
9:30 - 10:20	Helge Holden (Norwegian University of Science and Technology, Norway), *On the stochastic Camassa—Holm equation with transport noise*, CH30 (p. 43), ARTS 106
9:30 - 10:30	Maryam Khaqan (University of Toronto), Unveil (p. 114), ARTS 102
9:50 - 10:20	Jananan Arulseelan (McMaster University), *Computability in Continuous Logic with Applications to Operator Algebras*, MathLog (p. 64), ARTS 101
10:00 - 10:30	Ludovick Bouthat (Laval), *Matrix Norms Induced by Random Vectors*, OpMaAFS (p. 92), ARTS 108
10:00 - 10:30	Emily Cliff (Universite de Sherbrooke), *Moduli spaces of principal 2-group bundles and a categorification of the Freed–Quinn line bundle*, ModSpa (p. 79), ARTS 211
10:00 - 10:30	Rainer Dick (University of Saskatchewan), *Where are the photons ?*, MAQs (p. 69), ARTS 207
10:00 - 10:30	Niklas Garner (University of Washington), *Raviolo vertex algebras*, QuaAlg (p. 109), ARTS 100
10:00 - 10:30	E J Janse van Rensburg (York University), *Knot probabilities in confined lattice knots*, DNAtop (p. 34), ARTS 212
10:00 - 10:30	Anastasis Kratsios (McMaster University), *Pathwise Generalization bounds for Transformers*, MachLea (p. 75), ARTS 213
10:00 - 10:30	Sarah Plosker (Brandon University), *Spectral Inequalities for Factor Width of a Matrix*, InfEigM (p. 61), ARTS 104
10:00 - 10:30	Subhankar Sil (UBC), *Revisit of differential invariant method for finding nonlocal symmetries of nonlinear partial differential equations*, SymMeth (p. 102), ARTS 109
10:00 - 10:30	Richard M. Slevinsky (University of Manitoba), *Fast and stable rational approximation of generalized hypergeometric functions*, NumMeSF (p. 90), ARTS 200
10:00 - 10:30	Naik Sunil (Queen's University), *On some problems in Matsuda monoids*, NumTheo (p. 85), ARTS 210
10:30 - 11:00	Break / Pause, ARTS 241 Foyer
11:00 - 12:00	Michael Gekhtman (Notre Dame), *Generalized Cluster Structures*, Plen (p. 27), ARTS 241
13:30 - 14:30	Christopher Eagle (University of Victoria), *Teaching with care*, Eit (p. 29), ARTS 241
14:30 - 15:00	Break / Pause, ARTS 241 Foyer
15:00 - 15:30	Abhishek Bharadwaj (Queen's University), *On a conjecture of Erdős*, NumTheo (p. 82), ARTS 210
15:00 - 15:30	Martin Frankland (University of Regina), *Multiparameter persistence modules in the large scale*, DNAtop (p. 34), ARTS 212
15:00 - 15:30	Noah Friesen (University of Saskatchewan), *Braid groups and Baxter polynomials*, QuaAlg (p. 108), ARTS 100
15:00 - 15:30	Thomas Hillen (Alberta), *Symmetries in Non-local Adhesion Models*, SymMeth (p. 100), ARTS 109
15:00 - 15:30	Matthew Kreitzer (University of Guelph), *Matrix methods to construct De Bruijn Tori and Families*, OpMaAFS (p. 93), ARTS 108
15:00 - 15:30	Derek Krepski (University of Manitoba), *Lie 2-algebras of infinitesimal symmetries of bundle gerbes*, ModSpa (p. 80), ARTS 211
15:00 - 15:30	Ahmad Mojallal (University of Regina), *Nonregular Graphs with Three Eigenvalues*, InfEigM (p. 61), ARTS 104
15:00 - 15:30	Gordon Sarty (University of Saskatchewan), *A Concept for Direct MRI using Diamonds with Nitrogen Vacancies*, MAQs (p. 71), ARTS 207
15:00 - 15:30	Tom Trogdon (University of Washington), *Some old and new perspectives on the convergence of spectral methods*, NumMeSF (p. 90), ARTS 200

15:00 - 15:30 Sandra Zilles (University of Regina), *Formal Models of Active Learning from Contrastive Examples*, MachLea (p. 77), ARTS 213

15:00 - 15:50 Rahim Moosa (University of Waterloo), *Permutation groups in differentially closed fields*, MathLog (p. 65), ARTS 101

15:00 - 15:50 Dmitry Pelinovsky (McMaster, Canada), *Traveling waves in the Camassa-Holm equations: their stability and instability*, CH30 (p. 44), ARTS 106

15:00 - 16:00 Elizabeth Jurisich (The College of Charleston), Unveil (p. 114), ARTS 102

15:30 - 16:00 Mahta Abdollahzadehzare (University of Saskatchewan), *High-performance spectrum calculation of 3d transition metals in oxide compounds*, MAQs (p. 67), ARTS 207

15:30 - 16:00 Eric Boulter (University of Saskatchewan), *Co-Higgs bundles on Hopf surfaces*, ModSpa (p. 79), ARTS 211

15:30 - 16:00 Nick Dexter (Florida State University), *Sample-Efficient Active Learning Strategies for Deep Learning in Scientific Computing*, MachLea (p. 74), ARTS 213

15:30 - 16:00 Douglas Farenick (University of Regina), *Operator systems of Laurent polynomials of bounded degree*, OpMaAFS (p. 93), ARTS 108

15:30 - 16:00 Enrique Nuñez Lon-wo (University of Toronto), *On the Density of Quadratic Fields with Group of Units in Non-Maximal Orders*, NumTheo (p. 84), ARTS 210

15:30 - 16:00 Allison Moore (Virginia Commonwealth University), *Unknotting numbers and invariants of trivalent spatial graphs*, DNAtop (p. 35), ARTS 212

15:30 - 16:00 Dinushi Munasinghe (University of Toronto), *Schur Algebras in Type B*, QuaAlg (p. 111), ARTS 100

15:30 - 16:00 Cristina Stoica (Wilfrid Laurier), *Super-integrable systems with stochastic perturbations*, SymMeth (p. 102), ARTS 109

15:30 - 16:00 Hein van der Holst (Georgia State University), *Digraphs with maximum stable nullity at most 1*, InfEigM (p. 63), ARTS 104

16:00 - 16:30 Cade Ballew (University of Washington), *Numerical solutions of Riemann–Hilbert problems on disjoint intervals*, NumMeSF (p. 87), ARTS 200

16:00 - 16:30 Kuntal Banerjee (University of Saskatchewan), *A generalized spectral correspondence*, ModSpa (p. 79), ARTS 211

16:00 - 16:30 Mandana Bidarvand (University of Saskatchewan), *Analyzing arrays of qubits via a multi-scale approach*, MAQs (p. 68), ARTS 207

16:00 - 16:30 Alexandr Chernyavskiy (Buffalo), *Dark-bright soliton perturbation theory for the Manakov system*, SymMeth (p. 99), ARTS 109

16:00 - 16:30 Emily Cliff (University of Sherbrooke), *Quasi-universal sheaves and generic bricks*, QuaAlg (p. 108), ARTS 100

16:00 - 16:30 Zhenchao Ge (University of Waterloo), *Irregularities of Dirichlet L-functions and a parity bias in gaps of zeros*, NumTheo (p. 83), ARTS 210

16:00 - 16:30 Shafiqul Islam (UPEI), *Finite dimensional approximations of the Frobenius-Perron operator for piecewise convex maps with countable number of branches*, OpMaAFS (p. 93), ARTS 108

16:00 - 16:30 Elliot Kaplan (McMaster University), *Constant power maps on Hardy fields and Transseries*, MathLog (p. 65), ARTS 101

16:00 - 16:30 Kamyar Khodamoradi (University of Regina), *Parameterized Approximation for Robust Clustering in Discrete Geometric Spaces*, MachLea (p. 75), ARTS 213

16:00 - 16:30 Peter Liu (UCDavis), *Analyzing RNA structure data with tree polynomials*, DNAtop (p. 34), ARTS 212

16:00 - 16:30 Jacik Szmigielski (University of Saskatchewan), *Peakon inspired spectral and inverse spectral problems*, InfEigM (p. 62), ARTS 104

16:00 - 16:50 Katrin Grunert (Norwegian University of Science and Technology, Norway), *Uniqueness for the Camassa-Holm equation*, CH30 (p. 42), ARTS 106

16:30 - 17:00 Osama Bataineh (University of Saskatchewan), *Imprecise Probabilities for Cybersecurity Applications*, MachLea (p. 73), ARTS 213

16:30 - 17:00 Madeline Berezowski (University of Saskatchewan), *How Boson Dimers Reproduce Spin Projection Operators*, MAQs (p. 68), ARTS 207

16:30 - 17:00 Matthew Farkas (Washington), SymMeth (p. 100), ARTS 109

16:30 - 17:00 Chun-Hua Guo (University of Regina), *On absolute value equations associated with M-matrices*, InfEigM (p. 60), ARTS 104

16:30 - 17:00	Christopher Mahadeo (University of Illinois at Chicago), *Topological recursion and twisted Higgs bundles*, ModSpa (p. 81), ARTS 211
16:30 - 17:00	Andrew Rechnitzer (UBC), *On BFACF and stick numbers*, DNAtop (p. 35), ARTS 212
16:30 - 17:00	Hridoyananda Saikia (University of Manitoba), *A non-commutative boundary for the dilation order*, OpMaAFS (p. 94), ARTS 108
16:30 - 17:00	Shuyang Shen (University of Toronto), *Enumerative Galois Theory for Trinomials*, NumTheo (p. 84), ARTS 210
16:30 - 17:00	Mohan Zhao (University of Toronto), *The Approximation of Singular Functions by Series of Non-integer Powers*, NumMeSF (p. 90), ARTS 200
16:40 - 17:10	Nicolas Chavarria Gomez (University of Waterloo), *Abelian structures in continuous logic*, MathLog (p. 65), ARTS 101
17:00 - 17:30	Kai Ishihara (Hiroshima University), *Spatial graphs confined to tubes in the simple cubic lattice*, DNAtop (p. 34), ARTS 212
17:00 - 17:30	Haggai Liu (Simon Fraser University), *Moduli Spaces of Weighted Stable Curves and their Fundamental Groups*, ModSpa (p. 80), ARTS 211
17:00 - 17:30	Javad Mashreghi (Laval), *An Application of Finite Blaschke Products in Numerical Range Studies*, OpMaAFS (p. 94), ARTS 108
17:00 - 17:30	Artur Sowa (University of Saskatchewan), *Wielding the Dirichlet series to analyse the physics of bosons*, MAQs (p. 71), ARTS 207
17:00 - 17:30	Yuxuan Sun (University of Toronto), *Approximation Constants and Curves of Best Approximation of Points on Weighted Projective Surfaces*, NumTheo (p. 85), ARTS 210
17:00 - 17:30	Mamoru Ueda (University of Alberta), *Affine Yangians of type A and non-rectangular W-algebras of type A*, QuaAlg (p. 113), ARTS 100
17:00 - 17:30	Peter Zizler (Mount Royal University), *On loading matrices with non negative entries*, InfEigM (p. 63), ARTS 104
17:00 - 17:50	Hans Lundmark (University of Linkoping, Sweden), *Dynamics of peakons and antipeakons in Novikov's equation*, CH30 (p. 43), ARTS 106
17:30 - 18:00	Nicolas Guay (University of Alberta), *Orthosymplectic Yangians.*, QuaAlg (p. 109), ARTS 100
18:30 - 22:00	Awards Banquet / Banquet de prix, Wanuskewin Heritage Park

Sunday June 2 — dimanche 2 juin

8:00 - 8:30	Philic Lam (Brock), *A search for integrable evolution equations with Lax pairs over the octonions*, SymMeth (p. 100), ARTS 109
8:00 - 8:30	Cecile Piret (Michigan Technological University), *Computing generalized hypergeometric functions in the complex plane using an end-corrected trapezoidal rule*, NumMeSF (p. 89), ARTS 200
8:10 - 9:00	Assaf Shani (Concordia University), *Generic dichotomies for Borel homomorphisms for the finite Friedman-Stanley jumps*, MathLog (p. 65), ARTS 101
8:15 - 9:15	Lisa Carbone (Rutgers, The State University of New Jersey), Unveil (p. 114), ARTS 102
8:30 - 9:00	Thomas Baird (Memorial University of Newfoundland), *Anti-symplectic involutions of the Hilbert scheme of points on a symplectic surface*, ModSpa (p. 78), ARTS 211
8:30 - 9:00	Kuntal Banerjee (University of Saskatchewan), *Iterated spectral curves and Lax pairs: A brief overview*, IntSysQ (p. 56), ARTS 206
8:30 - 9:00	Jérémy Champagne (University of Waterloo), *Weyl's equidistribution theorem in function fields*, NumTheo (p. 83), ARTS 210
8:30 - 9:00	Anthony Gruber (Sandia National Laboratories), *Learning metriplectic systems and other bracket-based dynamics*, MachLea (p. 74), ARTS 213
8:30 - 9:00	Mohammad Hamdan (University of New Brunswick), *Polynomials of the Higher Derivatives of the Nield-Kuznetsov Integral Function*, NumMeSF (p. 89), ARTS 200
8:30 - 9:00	Valerio Toledano Laredo (Northeastern University), *On the Finkelberg-Ginzburg monodromy conjecture*, QuaAlg (p. 110), ARTS 100
8:30 - 9:00	Jaskaran Mann (Brock), *mKdV Loop Travelling Waves and Interactions of Loop Solitons*, SymMeth (p. 101), ARTS 109
8:30 - 9:00	Christopher Ramsey (MacEwan University), *The numerical diameter of linear maps*, InfEigM (p. 61), ARTS 104
8:30 - 9:00	James Steele (University of Calgary), *Cohomological Duality in the Local Langlands Correspondence for p-adic Groups*, GeReTh (p. 55), ARTS 108
8:30 - 9:00	Xiaohong Zhang (Université de Montréal), *Multivariate P-polynomial association schemes and m-distance regular graphs*, Asch (p. 40), ARTS 217
8:30 - 9:20	Michael Gekhtman (University of Notre Dame, USA), *Integrable systems and cluster algebras*, CH30 (p. 42), ARTS 106
9:00 - 9:30	Thomas Bothner (University of Bristol), *Universality for random matrices with an edge spectrum singularity*, NumMeSF (p. 88), ARTS 200
9:00 - 9:30	Elana Kalashnikov (University of Waterloo), *Degenerations of Kronecker moduli spaces*, ModSpa (p. 80), ARTS 211
9:00 - 9:30	Shigenori Nakatsuka (University of Alberta), *On the structure of W-algebras*, QuaAlg (p. 111), ARTS 100
9:00 - 9:30	Rajesh Pereira (University of Guelph), *Correlation Matrices: The Inverse Eigenvalue and Other Problems.*, InfEigM (p. 61), ARTS 104
9:00 - 9:30	Puttipong Pongtanapaisan (Arizona State University), *Random 2-component links which span a lattice tube*, DNAtop (p. 35), ARTS 212
9:00 - 9:30	Vakhtang Putkaradze (University of Alberta), *Lie-Poisson Neural Networks (LPNets): Data-Based Computing of Hamiltonian Systems with Symmetries*, MachLea (p. 76), ARTS 213
9:00 - 9:30	Mishty Ray (University of Calgary), *Geometric analogues of local Arthur packets for p-adic GL_n*, GeReTh (p. 54), ARTS 108
9:00 - 9:30	Evan Sundbo (University of Toronto), *Cohomology of Hypertoric Hitchin Systems*, IntSysQ (p. 58), ARTS 206
9:00 - 9:30	Paul Terwilliger (University of Wisconsin), *The S_3-symmetric tridiagonal algebra*, Asch (p. 39), ARTS 217
9:00 - 9:30	William Verreault (University of Toronto), *Moments of random multiplicative functions over functions fields*, NumTheo (p. 85), ARTS 210
9:00 - 9:30	Thomas Wolf (Brock), *Minimal General Octonion Polynomials and Octonion Identities*, SymMeth (p. 102), ARTS 109
9:00 - 9:30	Alex Zagoskin (Loughborough University), *Pechukas-Yukawa approach to quantum systems with discrete energy spectra*, MAQs (p. 72), ARTS 207

9:10 - 9:40	Iian Smythe (University of Winnipeg), *A descriptive approach to manifold classification*, MathLog (p. 66), ARTS 101
9:30 - 10:00	Stephen Anco (Brock), *General symmetry multi-reduction method for partial differential equations with conservation laws*, SymMeth (p. 98), ARTS 109
9:30 - 10:00	José Cruz (University of Calgary), *On the Fourier transform and Vogan's perspective on the Local Langlands Correspondence*, GeReTh (p. 53), ARTS 108
9:30 - 10:00	Timon S. Gutleb (University of British Columbia), *A frame approach for equations involving the fractional Laplacian*, NumMeSF (p. 88), ARTS 200
9:30 - 10:00	Nathan Johnston (Mount Allison University), *The Inverse Eigenvalue Problem for Entanglement Witnesses*, InfEigM (p. 60), ARTS 104
9:30 - 10:00	Samir Karam (Concordia University), *Physics-informed deep learning and compressive collocation for high-dimensional diffusion-reaction equations*, MachLea (p. 75), ARTS 213
9:30 - 10:00	Mohsen Karkheiran (University of Alberta), *Heterotic-II duality from mirror symmetry.*, ModSpa (p. 80), ARTS 211
9:30 - 10:00	Alexis Leroux-Lapierre (McGill University), *Obstructions to quantization of MV cycles using limits of characters*, QuaAlg (p. 110), ARTS 100
9:30 - 10:00	Brady Ali Medina (University of Waterloo), *Co-Higgs Bundles and Poisson Structures*, IntSysQ (p. 57), ARTS 206
9:30 - 10:00	Paul Péringuey (University of British Columbia), *Refinements of Artin's primitive root conjecture*, NumTheo (p. 84), ARTS 210
9:30 - 10:00	Ethan Ross (University of Toronto), *Singular Riemannian Foliations and Foliate Vector Fields*, SymPoiG (p. 106), ARTS 208
9:30 - 10:00	Carlo Maria Scandolo (University of Calgary), *Choi-Defined Resource Theories*, MAQs (p. 71), ARTS 207
9:30 - 10:00	Matthew Schmirler (University of Saskatchewan), *Optimizing Lattice Polygon Models to DNA Experimental Knotting Probabilities*, DNAtop (p. 36), ARTS 212
9:30 - 10:00	Steven Wang (Carleton University), *On constructing bent functions from cyclotomic mappings*, Asch (p. 40), ARTS 217
9:30 - 10:20	Vladimir Novikov (Loughborough University, UK), *Towards the complete classification of integrable Camassa-Holm type equations*, CH30 (p. 44), ARTS 106
9:30 - 10:30	Scott Murray (Rutgers, The State University of New Jersey), Unveil (p. 114), ARTS 102
9:50 - 10:20	Ross Willard (University of Waterloo), *Residually finite equational theories*, MathLog (p. 66), ARTS 101
10:00 - 10:30	Benoit Charbonneau (University of Waterloo), *Deformed Hermitian-Yang-Mills on full flags*, ModSpa (p. 79), ARTS 211
10:00 - 10:30	Dinamo Djounvouna (University of Manitoba), SymPoiG (p. 104), ARTS 208
10:00 - 10:30	Greg Knapp (University of Calgary), *Exponential Relations Among Algebraic Integer Conjugates*, NumTheo (p. 84), ARTS 210
10:00 - 10:30	Sze Hong Kwong (University of Maryland), *Conformal limit of Higgs bundles along singular upward flow*, GeReTh (p. 53), ARTS 108
10:00 - 10:30	Wenjun Niu (Perimeter Institute), *Yangians for Takiff Algebra and Spectral R matrix*, QuaAlg (p. 111), ARTS 100
10:00 - 10:30	Open problem session, MachLea (p. 76), ARTS 213
10:00 - 10:30	Brendan Rooney (Rochester Institute of Technology), *Sparse Graphs with* $q(G) = 2$, InfEigM (p. 62), ARTS 104
10:00 - 10:30	Rob Scharein (Hypnagogic Software), *Minimal Step Numbers for Knotted* θ*-curves and Handcuff Graphs on the Simple Cubic Lattice*, DNAtop (p. 35), ARTS 212
10:00 - 10:30	Alexey Shevyakov (Saskatchewan), *Exact spherical vortex solutions in fluid and plasma dynamics*, SymMeth (p. 101), ARTS 109
10:00 - 10:30	Kaori Tanaka (University of Saskatchewan), *Gapless topological superconductivity identified by the spectral localiser*, MAQs (p. 71), ARTS 207
10:00 - 10:30	Luc Vinet (Université de Montréal), Asch (p. 40), ARTS 217
10:30 - 11:00	Break / Pause, ARTS 241 Foyer

11:00 - 12:00	Stephanie van Willigenburg (University of British Columbia), *De-clawing graph theory*, Plen (p. 27), ARTS 241
13:30 - 14:30	Renate Scheidler (Calgary), *The Ankeny-Artin-Chowla Conjecture in Actual and Fake Real Quadratic Orders*, KN (p. 30), ARTS 241
14:30 - 15:00	Break / Pause, ARTS 241 Foyer
15:00 - 15:30	Matthew Alexander (University of Regina), *Categories Without Explicit Coherence*, STUrea (p. 95), ARTS 210
15:00 - 15:30	Daniel Alvaréz (University of Toronto), *Symplectic double groupoids and generalized Kähler metrics*, SymPoiG (p. 103), ARTS 208
15:00 - 15:30	Himanshu Gupta (University of Regina), *Matrix positivity preservers over finite fields*, InfEigM (p. 60), ARTS 104
15:00 - 15:30	Iva Halacheva (Northeastern University), *Families of maximal commutative subalgebras in quantum groups*, IntSysQ (p. 57), ARTS 206
15:00 - 15:30	Masahiro Hori (University of Saskatchewan), *Multifractal and hyperuniform analysis of quasicrystalline patterns in bosonic systems with and without disorder*, MAQs (p. 70), ARTS 207
15:00 - 15:30	Christopher Kennedy (Queen's), *Interaction between long internal waves and free surface waves in deep water*, SymMeth (p. 100), ARTS 109
15:00 - 15:30	Dan Krause (University of Saskatchewan), *PISA Scores: Grounding Perspectives*, MathEd (p. 31), ARTS 202
15:00 - 15:30	Jonathan Sejr Pedersen (University of Toronto), *Splitting Madsen-Tillmann Spectra*, GeReTh (p. 54), ARTS 108
15:00 - 15:30	Finlay Rankin (Carleton University), *Quantum automorphisms of commuting squares*, FunHarA (p. 49), ARTS 200
15:00 - 15:30	Yvan Saint-Aubin (Université de Montréal), *Bound quiver algebras that are Morita-equivalent to the Temperley-Lieb algebras of type B*, QuaAlg (p. 112), ARTS 100
15:00 - 15:30	Alyssa Sankey (University of New Brunswick), *Strongly regular decompositions derived from regular two-graphs*, Asch (p. 39), ARTS 217
15:00 - 15:50	Bo Xue (Zhengzhou University, China), CH30 (p. 44), ARTS 106
15:00 - 15:50	Andy Zucker (University of Waterloo), *Recurrent big Ramsey structures*, MathLog (p. 66), ARTS 101
15:30 - 16:00	Mandana Bidarvand (University of Saskatchewan), *Analyzing arrays of qubits via a multi-scale approach*, STUrea (p. 95), ARTS 210
15:30 - 16:00	Sachin Gautam (The Ohio State University), *Lattice operators of quantum affine algebras*, QuaAlg (p. 109), ARTS 100
15:30 - 16:00	Vicky Howse (University of Saskatchewan), *Vortex 'molecules', a hydrodynamic analog for hadrons*, MAQs (p. 70), ARTS 207
15:30 - 16:00	Caleb Jonker (University of Toronto), *Graded symplectic geometry and the generalized Kahler-Ricci flow*, SymPoiG (p. 105), ARTS 208
15:30 - 16:00	Reinier Kramer (University of Alberta), *How should we quantise cycles in symmetric groups ?*, IntSysQ (p. 57), ARTS 206
15:30 - 16:00	Paul Lehmkuhl (Saskatchewan Polytechnic), *Financial numeracy: A path towards standardizing financial education*, MathEd (p. 32), ARTS 202
15:30 - 16:00	Pawel Sarkowicz (University of Waterloo), *Embeddings of unitary groups*, FunHarA (p. 49), ARTS 200
15:30 - 16:00	Mahsa Shirazi (University of Manitoba), *Weakly Hadamard Diagonalizable Graphs*, InfEigM (p. 62), ARTS 104
15:30 - 16:00	Grisha Taroyan (University of Toronto), *Equivalent models of derived stacks*, GeReTh (p. 55), ARTS 108
15:30 - 16:00	Meri Zaimi (Université de Montréal), *Bivariate P- and Q-polynomial structures of association schemes based on attenuated spaces*, Asch (p. 40), ARTS 217
16:00 - 16:30	Raphaël Belliard (University of Alberta), *Quantum Riemann bilinear relations.*, IntSysQ (p. 56), ARTS 206
16:00 - 16:30	Shane J. Crerar (University of Regina), *Rank and Separability*, STUrea (p. 96), ARTS 210
16:00 - 16:30	Christopher Eagle (University of Victoria), *Cohomology of co-existentially closed continua*, MathLog (p. 64), ARTS 101

16:00 - 16:30	Sandra Elliott (University of Saskatchewan), *Bass Case: A Case Study of Music in the Mathematics Classroom*, MathEd (p. 31), ARTS 202
16:00 - 16:30	Owen Goff (University of Wisconsin), *A new perspective on the q-Onsager algebra and its presentations*, Asch (p. 37), ARTS 217
16:00 - 16:30	Steve Kirkland (University of Manitoba), *Stochastic matrices and the boundary of the Karpelevich region*, InfEigM (p. 61), ARTS 104
16:00 - 16:30	Christopher Mahadeo (U. of Illinois at Chicago), *Quantization in hyperbolic band theory*, MAQs (p. 71), ARTS 207
16:00 - 16:30	Mykola Matviichuk (Imperial College London), SymPoiG (p. 105), ARTS 208
16:00 - 16:30	Florian Schwarz (University of Calgary), *The Lie Algebra of a group object*, GeReTh (p. 54), ARTS 108
16:00 - 16:30	Erik Seguin (University of Waterloo), *Amenability and stability for discrete groups*, FunHarA (p. 49), ARTS 200
16:00 - 16:30	Harshit Yadav (University of Alberta), *Rigidity of VOAs and their extensions*, QuaAlg (p. 113), ARTS 100
16:00 - 16:50	Stephen Anco (Brock University, Canada), *Peakons: some simple questions with unexpected answers*, CH30 (p. 42), ARTS 106
16:30 - 17:00	Benjamin Anderson-Sackaney (University of Saskatchewan), *Tracial States on Quantum Group C*-algebras*, FunHarA (p. 49), ARTS 200
16:30 - 17:00	Mahmud Azam (University of Saskatchewan), *TQFTs and Quantum Computing*, MAQs (p. 68), ARTS 207
16:30 - 17:00	Casey Blacker (George Mason University), *Geometric and algebraic reduction of multisymplectic manifolds*, SymPoiG (p. 104), ARTS 208
16:30 - 17:00	Alejandro Santacruz Hidalgo (University of Western Ontario), *Generalized monotone functions in measure spaces.*, STUrea (p. 96), ARTS 210
16:30 - 17:00	Avleen Kaur (University of British Columbia), *Estimating the minimum positive eigenvalue of PSD matrices*, InfEigM (p. 60), ARTS 104
16:30 - 17:00	Roghayeh Maleki (University of Primorska), *On the Q-polynomial property of the full bipartite subgraph of a Hamming graph $H(D, n)$*, Asch (p. 38), ARTS 217
16:30 - 17:00	Gale Russell (University of Regina), *Intersections and roadblocks: Disentangling and rebuilding pre-service teachers' combinatoric understandings*, MathEd (p. 32), ARTS 202
16:30 - 17:00	Deni Salja (Dalhousie University), GeReTh (p. 54), ARTS 108
16:30 - 17:00	Aiden Suter (University of Waterloo/Perimiter Institute), *Associated variety for $L_1(\mathfrak{psl}_{N\|N})$ and 3d A-model Higgs Branch*, IntSysQ (p. 58), ARTS 206
17:00 - 17:30	Tatyana Barron (University of Western Ontario), *Kaehler quantization and entropy*, SymPoiG (p. 103), ARTS 208
17:00 - 17:30	Egan J Chernoff (University of Saskatchewan), *The Gateway Approach to Popularizing Mathematics*, MathEd (p. 31), ARTS 202
17:00 - 17:30	Peter Crooks (Utah State University), *Abelianization in integrable systems and quantization*, IntSysQ (p. 57), ARTS 206
17:00 - 17:30	Elias Hassani (University of Saskatchewan), *A post-quantum, post-AI data encryption method*, MAQs (p. 69), ARTS 207
17:00 - 17:30	Venkata Raghu Tej Pantagui (University of Regina), *Erdos-Ko-Rado type results in some Schurian Schemes*, Asch (p. 39), ARTS 217
17:00 - 17:30	Théo Pinet (Université Paris-Cité and Université de Montréal), *Inflations for representations of shifted quantum affine algebras*, QuaAlg (p. 112), ARTS 100
17:30 - 18:00	Terry Gannon (University of Alberta), *The search for exotic vertex operator algebras*, QuaAlg (p. 109), ARTS 100
17:30 - 18:00	Saikia Manimugdha (University of Western Ontario), *Restrictions of holomorphic sections to products*, SymPoiG (p. 105), ARTS 208
17:30 - 18:00	Andriaherimanana Sarobidy Razafimahatratra (University of Primorska), *On the smallest non-diagonalizable vertex-primitive digraphs*, Asch (p. 39), ARTS 217
18:30 - 20:30	Women in Math Panel / Panel des femmes en maths, ARTS 104

Monday June 3 — lundi 3 juin

8:00 - 8:30	Francis Bischoff (University of Regina), *Jets of foliations and b^k-Poisson structures*, SymPoiG (p. 104), ARTS 208
8:00 - 8:30	Karen Meagher (University of Regina), *A brief Introduction to the Erdős-Ko-Rado Theorem*, EKRcomb (p. 46), ARTS 101
8:00 - 8:30	Arnaud Ngopnang Ngompe (University of Regina), *Effect of the change of enrichment on a $\mathcal{V}$-model category*, STUrea (p. 97), ARTS 210
8:30 - 9:00	Raphaël Belliard (University of Alberta), *Casimir conformal blocks from meromorphic connections over curves.*, GeReTh (p. 52), ARTS 108
8:30 - 9:00	Jonas Hartwig (Iowa State University), *Generalized reduction algebras*, QuaAlg (p. 110), ARTS 100
8:30 - 9:00	Allen Herman (University of Regina), *The Terwilliger algebras of tournament and conference graph association schemes*, Asch (p. 38), ARTS 217
8:30 - 9:00	Dan Hudson (University of Toronto), *On deformation spaces of Lie groupoids and Lie algebroids*, SymPoiG (p. 105), ARTS 208
8:30 - 9:00	Manimugdha Saikia (University of Western Ontario), *Multi-qutrit exact synthesis over Clifford+T*, STUrea (p. 97), ARTS 210
8:30 - 9:00	Cody Solie (University of Regina), *Database of Intersection Density for Permutation Groups*, EKRcomb (p. 47), ARTS 101
9:00 - 9:30	Jiahui Huang (University of Waterloo), *Arc-Floer conjecture for homogeneous isolated singularities*, STUrea (p. 96), ARTS 210
9:00 - 9:30	Lord Kavi (University of Ottawa), *Optimal Polynomials for the k-independence Number of Graphs*, EKRcomb (p. 46), ARTS 101
9:00 - 9:30	Ruxandra Moraru (University of Waterloo), *Born geometry*, SymPoiG (p. 105), ARTS 208
9:00 - 9:30	Hadi Salmasian (University of Ottawa), *Mapping a quantum group into a quantum Weyl algebra and applications*, QuaAlg (p. 112), ARTS 100
9:00 - 9:30	Evan Sundbo (University of Toronto), *Twisted Quiver Varieties and Higgs Bundles*, GeReTh (p. 55), ARTS 108
9:00 - 9:30	Hanmeng Zhan (Worcester Polytechnic Institute), *Generating quantum uniform mixing in association schemes*, Asch (p. 40), ARTS 217
9:30 - 10:00	Himanshu Gupta (University of Regina), *The least Euclidean distortion constant of a distance-regular graph*, Asch (p. 38), ARTS 217
9:30 - 10:00	Mark Hamilton (Mount Allison University), *Lagrangian fibrations, quantization, and integral-integral affine geometry*, SymPoiG (p. 104), ARTS 208
9:30 - 10:00	Andrey Kupavskii (Moscow Institute of Physics and Technology), *Forbidden intersections via spread approximations*, EKRcomb (p. 46), ARTS 101
9:30 - 10:00	Christopher Mahadeo (University of Illinois at Chicago), *Quantization through the tautological section*, GeReTh (p. 53), ARTS 108
9:30 - 10:00	Yorck Sommerhauser (Memorial University of Newfoundland), *Hopf Algebras, Cohomology, and Mapping Class Groups*, QuaAlg (p. 113), ARTS 100
10:00 - 10:30	Peter Crooks (Utah State University), *Scheme-theoretic coisotropic reduction*, SymPoiG (p. 104), ARTS 208
10:00 - 10:30	Matthew Koban (University of Toronto), *Moduli of doubled quiver representations*, GeReTh (p. 53), ARTS 108
10:00 - 10:30	Nathan Lindzey (Technion), *Global Hypercontractivity and Forbidden Intersection Theorems*, EKRcomb (p. 46), ARTS 101
10:00 - 10:30	Andrew Misseldine (Southern Utah University), Asch (p. 39), ARTS 217
10:00 - 10:30	Surya Raghavendran (Yale University), *Towards a Dolbeault AGT correspondence*, QuaAlg (p. 112), ARTS 100
10:30 - 11:00	Break / Pause, ARTS 241 Foyer
11:00 - 12:00	Erica Walker (Toronto), *Representations of Mathematical Merit in American Life*, Plen (p. 27), ARTS 241
13:30 - 14:30	Catherine Sulem (Toronto), *Effect of a variable bottom topography on surface water waves*, JW (p. 29), ARTS 241

14:30 - 15:00	Break / Pause, ARTS 241 Foyer
15:00 - 15:30	Francis Bischoff (University of Regina), *Castling Equivalence for Logarithmic Flat Connections*, QuaAlg (p. 108), ARTS 100
15:00 - 15:30	Aidan Lindberg (University of Toronto), *Picard Groups of Holomorphic Poisson Manifolds*, GeReTh (p. 53), ARTS 108
15:00 - 15:30	Sarobidy Razafimahatratra (University of Primorska), *The Erdős-Ko-Rado Theorem for semidirect products of transitive groups*, EKRcomb (p. 47), ARTS 101
15:30 - 16:00	Eric Boulter (University of Saskatchewan), *Moduli Spaces of Sheaves on Kodaira Surfaces*, GeReTh (p. 52), ARTS 108
15:30 - 16:00	Iva Halacheva (Northeastern University), *Bethe subalgebras of the Yangian Y(gl(n)), tame representations, and Gelfand-Tsetlin patterns*, QuaAlg (p. 110), ARTS 100
15:30 - 16:00	Venkata Raghu Tej Pantangi (University of Regina), *Strength of some EKR-type results.*, EKRcomb (p. 47), ARTS 101
16:00 - 16:30	Daniel Alvarez (University of Toronto), *Symplectic groupoids and moduli spaces of flat bundles over surfaces*, GeReTh (p. 52), ARTS 108
16:00 - 16:30	Mahsa Shirazi (University of Manitoba), *A review on the Erdős-Ko-Rado theorem for uniform set partitions and perfect matchings*, EKRcomb (p. 47), ARTS 101
16:30 - 17:00	Marielle Ong (University of Pennsylvania), *Multiplicative global Springer Theory*, GeReTh (p. 54), ARTS 108
16:30 - 17:00	Brett Stevens (Carleton), *Where Karen Meagher first encountered the Erdos-Ko-Rado Theorem*, EKRcomb (p. 48), ARTS 101
17:00 - 17:30	Caleb Ashley (Boston College), *An explicit relationship between the ghost and swapping algebras*, GeReTh (p. 52), ARTS 108
17:00 - 17:30	Glenn Hurlbert (Virginia Commonwealth University), *Recent results on the Holroyd-Talbot Conjecture*, EKRcomb (p. 45), ARTS 101
17:30 - 18:00	Sergey Goryainov (Hebei Normal University), *Erdős-Ko-Rado combinatorics of strongly regular graphs*, EKRcomb (p. 45), ARTS 101

Public Lecture
Conférence publique

Schedule/Horaire **Room/Salle: ARTS 241**

Friday May 31 **vendredi 31 mai**

17:00 - 18:00 PAMELA E. HARRIS (University of Wisconsin - Milwaukee), *Parking Functions: Choose your own adventure* (p. 26)

Abstract/Résumé

PAMELA E. HARRIS, University of Wisconsin - Milwaukee
[Friday May 31 / vendredi 31 mai, 17:00 – ARTS 241]
Parking Functions: Choose your own adventure

Consider a parking lot consisting of n consecutive parking spots along a one-way street labeled 1 to n. Suppose n cars want to park one at a time in the parking lot and each car has a preferred parking spot. Each car coming into the lot initially tries to park in its preferred spot. However, if a car's preferred spot is already occupied, then it will proceed forward in the street parking in the next available spot. Since the parking lot is along a one-way street, it is not guaranteed that every car will be able to park before driving past the parking lot. If we let a_i denote the preference of car i and all of the cars are able to park under these conditions, then the preference list $(a_1, a_2, \ldots, a_n)$ is called a parking function (of length n).

For example, (4,2,1,2,2) is a parking function, but (5,1,2,5,2) is not (you should convince yourself of this!). In this talk, we provide an answer to the question of how many parking functions of length n there are and we consider many new avenues for research stemming from this enumerative question. This talk will be in the style of a "Choose Your Own Adventure" book and the audience will make choices to dictate the routes we take.

Plenary Lectures
Conférences plénières

Schedule/Horaire **Room/Salle: ARTS 241**

Saturday June 1 **samedi 1er juin**

11:00 - 12:00 Michael Gekhtman (Notre Dame), *Generalized Cluster Structures* (p. 27)

Sunday June 2 **dimanche 2 juin**

11:00 - 12:00 Stephanie van Willigenburg (University of British Columbia), *De-clawing graph theory* (p. 27)

Monday June 3 **lundi 3 juin**

11:00 - 12:00 Erica Walker (Toronto), *Representations of Mathematical Merit in American Life* (p. 27)

Abstracts/Résumés

MICHAEL GEKHTMAN, University of Notre Dame
[Saturday June 1 / samedi 1er juin, 11:00 – ARTS 241]
Generalized Cluster Structures

Cluster algebras were discovered by S. Fomin and A. Zelevinsky just over twenty years ago. They quickly found applications in various fields of mathematics and mathematical physics, including representation theory, combinatorics, higher Teichmüller theory, integrable systems and mirror symmetry. Generators of a cluster algebra are subdivided into overlapping subsets (clusters) of the same cardinality subject to certain polynomial relations (exchange relations). These are reminiscent of identities of classical mathematics - Ptolemy's identity, short Plücker relations, Desnanot-Jacobi determinantal identities etc. In fact, all the aforementioned identities and their generalizations were instrumental in constructing cluster structures in rings of regular functions on many varieties of interest in Lie theory. It turns out, however, that the structure of exchange relations postulated in the original definition of a cluster algebra is sometimes too restrictive to include some natural and important geometric examples. The notion of a generalized cluster transformation allows one treat such examples while retaining key features of cluster algebras, such as the Laurent phenomenon.

I will discuss the definition and properties of generalized cluster transformations and examples of their occurrence in various contexts: surfaces with orbifold points, Poisson-Lie groups, periodic difference operators, cyclic symmetry loci in Grassmannians , and representations of quantum affine algebras at roots of unity.

Most of the talk is based on joint projects with M. Shapiro, A. Vainshtein, C. Fraser, K. Trampel and D. Voloshyn.

STEPHANIE VAN WILLIGENBURG, University of British Columbia
[Sunday June 2 / dimanche 2 juin, 11:00 – ARTS 241]
De-clawing graph theory

This talk requires no prior knowledge and will be a gentle introduction to colouring graphs. It will be suitable for a broad audience including undergraduates. We will start with some historical tales, including the four colour map problem and the chromatic polynomial. We will then meet the chromatic symmetric function, dating from 1995, which is a generalization of the chromatic polynomial. A famed conjecture on it, called the Stanley-Stembridge (3+1)-free conjecture, has been the focus of much research lately including resolving another problem of Stanley of whether the (3+1)-free conjecture can be widened. The resulting paper on the latter problem was recently awarded the 2023 David P. Robbins Prize, and we will hear this story too.

ERICA WALKER, University of Toronto
[Monday June 3 / lundi 3 juin, 11:00 – ARTS 241]
Representations of Mathematical Merit in American Life

In this talk, I share insights from an ongoing research study on the narratives and stories we share about mathematics and how they influence the mathematical work and understanding of teachers, students, and the lay public. The talk will include emerging findings from K-16+ students and teachers about the impact of viewing short videos of mathematicians describing formative, educational, and professional experiences with mathematics.

Prize Lectures
Conférence des lauréats

Schedule/Horaire **Room/Salle: ARTS 241**

Saturday June 1 **samedi 1er juin**

13:30 - 14:30 Christopher Eagle (University of Victoria), *Teaching with care* (p. 29)

Sunday June 2 **dimanche 2 juin**

13:30 - 14:30 Renate Scheidler (Calgary), *The Ankeny-Artin-Chowla Conjecture in Actual and Fake Real Quadratic Orders* (p. 30)

Monday June 3 **lundi 3 juin**

13:30 - 14:30 Catherine Sulem (Toronto), *Effect of a variable bottom topography on surface water waves* (p. 29)

Abstract/Résumé

Excellence in Teaching Award
Prix d'excellence en enseignement

CHRISTOPHER EAGLE, University of Victoria
[Saturday June 1 / samedi 1er juin, 13:30 – ARTS 241]
Teaching with care

There are an enormous number of factors to consider when we think about how to teach mathematics effectively. What content will I cover ? What pedagogical methods will I use ? What software tools should I include ? How will I assess the students ? The list is seemingly endless, and it is easy to be swept away by the tide of opinions on each of the decisions we have to make. In this talk I will describe principles for making these decisions based on the recognition that students are people deserving of our care, and give some examples of what this can look like in practice.

Jefferey-Williams Prize
Prix Jefferey-Williams

CATHERINE SULEM, University of Toronto
[Monday June 3 / lundi 3 juin, 13:30 – ARTS 241]
Effect of a variable bottom topography on surface water waves

We investigate the effect of the bottom topography on the evolution of surface waves. It is a problem of significance for ocean dynamics in coastal regions where waves are strongly affected by the topography. The literature on models of free surface water waves over a variable depth is extensive. In the presence of topography, there are several asymptotic scaling regimes of interest, including long-wave hypotheses for the evolution of the free surface, and short scale and/or long scale variations in the variable bottom. A central object in the analysis of the water wave problem is the Dirichlet-Neumann operator and our study concerns its spectrum in the context of the water wave system linearized near equilibrium in a domain with a variable

bottom assumed to be a smooth periodic function. We use the analyticity of the Dirichlet-Neumann operator with respect to the bottom variation and combine it with general properties of elliptic systems and spectral theory for self-adjoint operators to develop a Bloch-Floquet theory and describe the structure of its spectrum. We find that, under some conditions on the bottom varia- tions, the spectrum is composed of bands separated by gaps which are zones of forbidden energies, and we give explicit formulas for their sizes and locations.

Krieger-Nelson Prize
Prix Krieger-Nelson

RENATE SCHEIDLER, University of Calgary
[Sunday June 2 / dimanche 2 juin, 13:30 – ARTS 241]
The Ankeny-Artin-Chowla Conjecture in Actual and Fake Real Quadratic Orders

Quadratic orders exhibit vastly different structural and invariant properties, depending on whether the ambient quadratic field is real or imaginary. In an unpublished note from 2014, Henri Cohen made the surprising observation that a certain subring of an imaginary quadratic order where denominators are restricted to powers of one fixed prime behaves very much like a real quadratic order. Cohen coined the term "fake real quadratic order" for these special structures.

The somewhat controversial Ankeny-Artin-Chowla (AAC) conjecture asserts a certain divisibility condition about fundamental units in real quadratic orders of prime discriminant. Although no counterexamples have been found despite extensive computations, number theorists are divided over the truth of this conjecture. A closely related conjecture, due to Mordell, was recently established to be false by Reinhart who found a counterexample.

In the hopes that an investigation of a "fake" AAC analogue might shed light on the original AAC conjecture, we investigated AAC in fake real quadratic orders. In this talk, which is aimed at a general math audience, I report our findings, consisting of extensive numerical computations, heuristics and asymptotic results. This is joint work with Hongyan Wang (a former Master's student at University of Calgary), Florian Hess (University of Oldenburg, Germany) and Mike Jacobson (University of Calgary).

A Lay of the Land: Mathematics Education in Saskatchewan

Org: Egan Chernoff and/et **Derek Postnikoff** (University of Saskatchewan)

Schedule/Horaire **Room/Salle: ARTS 202**

Sunday June 2	**dimanche 2 juin**
15:00 - 15:30	Dan Krause (University of Saskatchewan), *PISA Scores: Grounding Perspectives* (p. 31)
15:30 - 16:00	Paul Lehmkuhl (Saskatchewan Polytechnic), *Financial numeracy: A path towards standardizing financial education* (p. 32)
16:00 - 16:30	Sandra Elliott (University of Saskatchewan), *Bass Case: A Case Study of Music in the Mathematics Classroom* (p. 31)
16:30 - 17:00	Gale Russell (University of Regina), *Intersections and roadblocks: Disentangling and rebuilding pre-service teachers' combinatoric understandings* (p. 32)
17:00 - 17:30	Egan J Chernoff (University of Saskatchewan), *The Gateway Approach to Popularizing Mathematics* (p. 31)

Abstracts/Résumés

EGAN J CHERNOFF, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 17:00 – ARTS 202]
The Gateway Approach to Popularizing Mathematics

The purpose of this presentation is to contribute to the betterment of the popularization of mathematics. To achieve this goal, I suggest a route that, I contend, is different and could be considered oft-ignored. Popularization of mathematics, as I will detail, should be drawing upon the popularization of the teaching and learning of mathematics, school mathematics and mathematics education. Let's be honest, not many people are familiar with cutting edge mathematics, yet a lot (a lot) of people have dabbled with school mathematics. As such, let us start where everybody has been and see how far we can truly get in bringing mathematics education and mathematics to the masses. As also detailed in this talk, there are many barriers to popularizing the teaching and learning of school mathematics, that but does not mean, of course, that at least some of us (even just a few of us) should not be trying.

SANDRA ELLIOTT, University of Sasktchewan
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 202]
Bass Case: A Case Study of Music in the Mathematics Classroom

This presentation will explore the longstanding connection between music and mathematics, proposing a variety of methods to integrate music into math education to encourage cross-domain learning. We will examine examples of mathematician-musicians, such as Albert Einstein and Manjul Bhargava, and lightly touch on the historical perspectives of the integration of music in mathematical teaching and learning. Through a hands-on exploration of Etude No. 6 by Philip Glass, we will discuss the educational potential of using music to illustrate mathematical principles, leading to deeper understanding and appreciation for both subjects.

DAN KRAUSE, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 202]
PISA Scores: Grounding Perspectives

A Lay of the Land: Mathematics Education in Saskatchewan

The Organization for Economic Co-operation and Development (OECD) administers theProgramme International Standard Assessment (PISA) every three years in reading, science, and mathematics. Results of this test are analyzed to calculate a PISA score (along with reports and other data), where the purported achievement of students in mathematics is publicized as a single number. These PISA scores have declined in Canada (and for many of the member states in the OECD) from 2000 - 2022. Do the results on the PISA tests mean that student performance in mathematics is declining in Canada over time? Does this mean that the quality of the mathematics education system is deteriorating? These questions are not as simple to answer as they first seem. PISA is a unique assessment that assesses cumulative student knowledge (not just what students learn in school), and the OECD has made multiple changes to their assessment over time. This talk will include a critical discussion of these changes, an examination of how PISA scores are determined, how these results impact policy making, and how mathematicians can contribute to the critical discussion surrounding the use of PISA scores in Canadian mathematics education.

PAUL LEHMKUHL, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 15:30 – ARTS 202]
Financial numeracy: A path towards standardizing financial education

Research has shown that many individuals are lacking skills related to basic financial concepts, hindering their ability to make sound financial decisions related to investing, debt management, wealth accumulation, and retirement planning. Governments recognize the importance of financial literacy among citizens leading to a push for mandatory financial education across Canadian provinces. Given the federal government's National Financial Literacy Strategy (2021-2026), there remains significant inconsistency in how financial literacy is integrated into school curricula across Canada. Traditional definitions of financial literacy are inadequate for guiding curriculum development effectively and I draw attention to the need for a broader definition of financial literacy to account for socioeconomic, affective, behavioural, and motivational factors of students. Financial numeracy, an emerging concept in the literature, offers a more standardized and comprehensive framework for policymakers, curriculum writers, administrators, and teachers when developing and implementing financial education curricula.

GALE RUSSELL, University of Regina
[Sunday June 2 / dimanche 2 juin, 16:30 – ARTS 202]
Intersections and roadblocks: Disentangling and rebuilding pre-service teachers' combinatoric understandings

In my experience, and the experience of others that I work and dialogue with, combinatorics is either a loved or hated high school mathematics topic for both teachers and students. In my EMTH courses (which focus on mathematics content, pedagogy, and assessment), I use an ever-expanding set of tasks to explore my students' (math majors and minors in a secondary education program) understanding of and thinking about combinatorics. Over the years, I have come to recognize relationships (that I call intersection points within combinatorics) that are key to my students understanding of combinatorics, as well as points of confused entanglements that have created roadblocks to that understanding. This session will briefly look at the tasks I most recently used with my students, what intersection points and roadblocks emerged, and how we worked to create a complex but navigable roadway for combinatoric understanding.

Applied Topology: DNA topology, Material Science, Topological Data Analysis
Topologie appliquée : Topologie de l'ADN, science des matériaux, analyse des données topologiques

Org: Ryan Budney (University of Victoria), **Allison Moore** (Virginia Commonwealth University) and/et **Chris Soteros** (University of Saskatchewan)

This session will bring together mathematicians, physicists, computational scientists and others who are studying topology and its applications. The session will emphasize the two topics of an associated mini-course: applications of knot theory to molecular biology, and persistent homology/topological data analysis. Applications of topology to materials science such as to the design of supermolecules and polymeric materials or to the study of liquid crystals are also of interest.

Cette session réunira des mathématiciens, des physiciens, des informaticiens et d'autres personnes qui étudient la topologie et ses applications. La session mettra l'accent sur les deux sujets d'un mini-cours associé : les applications de la théorie des nœuds à la biologie moléculaire, et l'homologie persistante/l'analyse des données topologiques. Les applications de la topologie à la science des matériaux, telles que la conception de supermolécules et de matériaux polymères ou l'étude des cristaux liquides, sont également d'intérêt.

Schedule/Horaire — Room/Salle: ARTS 212

Saturday June 1 — samedi 1er juin

9:00 - 9:30	Javier Arsuaga (UCDavis), *Using liquid crystal models to study DNA knotting in bacteriophages* (p. 33)
9:30 - 10:00	Koya Shimokawa (Ochanomizu University), *Interlocking molecules and polyhedral links* (p. 36)
10:00 - 10:30	E J Janse van Rensburg (York University), *Knot probabilities in confined lattice knots* (p. 34)
15:00 - 15:30	Martin Frankland (University of Regina), *Multiparameter persistence modules in the large scale* (p. 34)
15:30 - 16:00	Allison Moore (Virginia Commonwealth University), *Unknotting numbers and invariants of trivalent spatial graphs* (p. 35)
16:00 - 16:30	Peter Liu (UCDavis), *Analyzing RNA structure data with tree polynomials* (p. 34)
16:30 - 17:00	Andrew Rechnitzer (UBC), *On BFACF and stick numbers* (p. 35)
17:00 - 17:30	Kai Ishihara (Hiroshima University), *Spatial graphs confined to tubes in the simple cubic lattice* (p. 34)

Sunday June 2 — dimanche 2 juin

9:00 - 9:30	Puttipong Pongtanapaisan (Arizona State University), *Random 2-component links which span a lattice tube* (p. 35)
9:30 - 10:00	Matthew Schmirler (University of Saskatchewan), *Optimizing Lattice Polygon Models to DNA Experimental Knotting Probabilities* (p. 36)
10:00 - 10:30	Rob Scharein (Hypnagogic Software), *Minimal Step Numbers for Knotted θ-curves and Handcuff Graphs on the Simple Cubic Lattice* (p. 35)

Abstracts/Résumés

JAVIER ARSUAGA, University of California, Davis
[Saturday June 1 / samedi 1er juin, 9:00 – ARTS 212]
Using liquid crystal models to study DNA knotting in bacteriophages

Bacteriophages, viruses that propagate in bacteria, packed their genome in a protein container called capsid. Inside the capsid the viral genome is at a such high concentration and pressure that it is best described as a liquid crystal. This liquid crystal structure of DNA is characterized by ordered layers near the capsid and an isotropic phase at the center of the capsid.

Topological studies have shown that DNA extracted from P4 bacteriophages (P4 DNA) is knotted and the observed knots are very complex (i.e. high average crossing number). Interestingly, the distribution of knots of low average crossing number show an absence of the four crossing knot and a prevalence of the toroidal five crossing knot (5_1) over the twist crossing knot (5_2).

Applied Topology: DNA topology, Material Science, Topological Data Analysis
Topologie appliquée : Topologie de l'ADN, science des matériaux, analyse des données topologiques

In this work we use cryo-electron microscopy to determine the layer organization of DNA in bacteriophage P4, and the continuum theory of liquid crystals to model its liquid crystal structure. The model shows that the experimentally observed structure is a minimizer of the proposed energy and that the experimental knot distribution can be reproduced by perturbing the minimizer. We therefore propose a new liquid crystal model based on cryoEM observations that is consistent with topological studies of P4 DNA.

MARTIN FRANKLAND, University of Regina
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 212]
Multiparameter persistence modules in the large scale

A persistence module with m discrete parameters is a diagram of vector spaces indexed by the poset $\mathbb{N}^m$. If we are only interested in the large scale behavior of such a diagram, then we can consider two diagrams equivalent if they agree outside of a "negligeable" region. In the 2-dimensional case, we classify the indecomposable diagrams up to finitely supported diagrams. In higher dimension, we partially classify the indecomposable diagrams up to suitably finite diagrams. We also relate the decomposition to the rank invariant. This is joint work with Don Stanley.

KAI ISHIHARA, Hiroshima University
[Saturday June 1 / samedi 1er juin, 17:00 – ARTS 212]
Spatial graphs confined to tubes in the simple cubic lattice

Knots, links, and spatial graphs in the simple cubic lattice can be considered as models for polymers such as DNA and proteins. Previous research has shown that knots and links confined to a tube in the simple cubic lattice are restricted depending on the size of the tube. In this talk, we will consider spatial theta-curves and spatial handcuff graphs confined to tubes in the simple cubic lattice. This is a joint work with Koya Shimokawa.

E J JANSE VAN RENSBURG, York University
[Saturday June 1 / samedi 1er juin, 10:00 – ARTS 212]
Knot probabilities in confined lattice knots

A lattice knot is a model of ring polymer entropy in three dimensions, and has become a standard theoretical model for quantifying the entropy of a knotted ring polymer. An advantage of the model is that there are efficient Monte Carlo algorithms for sampling lattice knots, even of fixed knot or link type, in various three dimensional lattices. These models may give qualitative insights in the knotting probabilities and entanglement complexity of polymers. For example, the increase in knot probability, as a lattice polygon increases in length, suggests that long ring polymers will likely have a high degree of entanglement complexity. In this talk I shall briefly consider confined lattice knots, and in particular relative knotting probabilities when lattice knots are confined in a cube (as a model of confined knotted ring polymers). I shall review what is known about confined lattice knots, and how to approximately enumerate them using the GAS algorithm. Two ensembles of confined lattice knots will be (briefly) examined, namely a grand canonical ensemble model where lattice knots are weighted by length (by introducing a chemical potential in the model), and secondly, a canonical ensemble model with lattice knots approximately enumerated as a function of concentration in the confining volume. Results on the relative incidence of knots of various types will be presented as a function of the chemical potential, or as a function of concentration.

PETER LIU, UC Davis
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 212]
Analyzing RNA structure data with tree polynomials

Advancements in innovative technology such as high-throughput sequencing, cryogenic electron microscopy and artificial intelligence have enabled production of myriad data of RNA structures. Analyzing these data allows us to better understand

the functions of RNAs and their roles in various biological processes. However, studying extensive RNA structure data poses challenges without proper representations. Polynomial invariants, such as the Tutte polynomial for graphs and the Jones polynomial for knots, are essential mathematical objects in algebraic combinatorics and algebraic topology. They encode structural information and are compatible with modern data analytic tools. In this talk, we introduce a computationally efficient, interpretable and complete polynomial invariant for trees. We apply this tree polynomial and its generalizations to the study of RNA secondary structures.

ALLISON MOORE, Virginia Commonwealth University
[Saturday June 1 / samedi 1er juin, 15:30 – ARTS 212]
Unknotting numbers and invariants of trivalent spatial graphs

The unknotting number of a knot is a topological invariant that is notoriously difficulty to calculate. Unknotting numbers of knots, links, and theta curves (a type of spatial trivalent planar graph) is externally motivated by modeling problems arising in molecular biology. Generalizing the theorem of Scharlemann that unknotting number one knots are prime, we prove that if a composite theta-curve has unknotting number one, then it is the order 2 sum of an unknotting number one knot and a trivial theta-curve. We also will discuss some recent results in which we bound the unknotting numbers of spatial trivalent planar graphs by their signature and a certain slice orbifold Euler characteristic. This reports on works joint with Baker, Buck, O'Donnol and Taylor.

PUTTIPONG PONGTANAPAISAN, Arizona State University
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 212]
Random 2-component links which span a lattice tube

Atapour, Ernst, Soteros, and Whittington showed that all but exponentially few sufficiently large pairs of self-avoiding polygons, each confined to and spanning a lattice tube, are topologically linked. These systems are of interest because they can be used to model the entanglements of ring polymers in nanochannels. In this talk, we turn our attention to small tube sizes that still allow for interesting linking behaviors. These tube size constraints will enable us to compare the exponential growth rates of various families of links. This is joint work with Jeremy Eng, Rob Scharein, and Chris Soteros.

ANDREW RECHNITZER, UBC
[Saturday June 1 / samedi 1er juin, 16:30 – ARTS 212]
On BFACF and stick numbers

The BFACF algorithm has been the standard approach to sampling self-avoiding polygons of fixed topology for over 40 years. In this talk we describe adapting BFACF to random polygons in R3.

One immediate application of this method is to improve bounds on stick-numbers - both for equilateral polygons and non-equilateral polygons. In particular, we find upper bounds for both the stick and equilateral-stick numbers for all knots of 13 or fewer crossings. In some cases these upper bounds on stick-numbers actually give exact stick-number.

In many cases there remains a gap between the equilateral-stick and stick number bounds. By adapting the move set of BFACF we can try to "equilateralise" polygons. This is sometimes sufficient to infer the existence of an equilateral conformation without actually producing it. We also apply the recent CoBarS method of Cantarella and Schumacher to produce equilateral conformations.

This is work together with Jason Cantarella and Clayton Shonkweiler, building on some earlier work with Nick Beaton and Nathan Clisby. Of course, any errors are entirely my own.

ROB SCHAREIN, Hypnagogic Software
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 212]
Minimal Step Numbers for Knotted θ-curves and Handcuff Graphs on the Simple Cubic Lattice

We use Moriuchi's enumeration of prime θ-curves and handcuff graphs up to seven crossings to create instantiations of these on the simple cubic lattice. From there an implementation of the BFACF algorithm on the lattice for trivalent graphs is used to find minimal step number (MSN) candidates. This algorithm implements the exhaustive set of moves found by Tamaki. Preliminary MSN results will be shown.

MATTHEW SCHMIRLER, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 212]
Optimizing Lattice Polygon Models to DNA Experimental Knotting Probabilities

We present here the results of optimizing two different lattice models of DNA, where model parameters are tuned by fitting to DNA experimental knotting probabilities obtained by Shaw and Wang (Science, 1993). The resulting knotting probability fits are of similar quality for both models ; however, we observe that the model containing a short-range bending potential has a persistence length that is much more agreeable to that of DNA. We next study how knotting probabilities in this optimized bending model change with varying DNA length, where we find remarkable agreement with knotting probability results obtained from an optimized off-lattice freely-jointed chain model.

KOYA SHIMOKAWA, Ochanomizu University
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 212]
Interlocking molecules and polyhedral links

Knots and links are ubiquitous in chemical systems. Their structure can be responsible for a variety of physical and chemical properties, making them very important in materials development. We analyze the topological structures of interlocking molecules composed of metal-peptide rings using the concept of polyhedral links. To that end, we discuss the topological classification of alternating polyhedral links. We show that the alternating link diagrams of polyhedral links of certain types do not admit nontrivial flypes. Hence, by the affirmative answer of the Tait flyping conjecture, the classification of the topology of these interlocking structures can be achieved by simply analyzing their alternating diagrams.

Association schemes and their applications
Les schémas d'association et leurs applications

Org: Allen Herman (University of Regina), **Roghayeh Maleki** (University of Primorska) and/et **Andriaherimanana Sarobidy Razafimahatratra** (University of Primorska)

Association schemes are structures that can be viewed as generalizations of algebraic structures such as groups, as well as combinatorial structures such as distance-regular graphs. These structures have been applied to prove various results from a wide range of areas of mathematics which can be of algebraic aspects (representation theory of quantum groups, scaffold calculus, Terwilliger algebras) and combinatorial aspects (Erdős-Ko-Rado type theorems, design and coding theory, finite geometry). This session is dedicated to recent trends in the study of association schemes and their applications.

Les schémas d'association sont des structures qui peuvent être considérées comme des généralisations de structures algébriques telles que les groupes, ainsi que des structures combinatoires telles que les graphes distance-réguliers. Ces structures ont été appliquées pour prouver divers résultats dans un large éventail de domaines des mathématiques qui peuvent être des aspects algébriques (théorie des représentations des groupes quantiques, calcul des échafaudages, algèbres de Terwilliger) et des aspects combinatoires (théorèmes de type Erdős-Ko-Rado, théorie de la conception et du codage, géométrie finie). Cette session est dédiée aux tendances récentes dans l'étude des schémas d'association et leurs applications.

Schedule/Horaire — Room/Salle: ARTS 217

Sunday June 2 — dimanche 2 juin

8:30 - 9:00	Xiaohong Zhang (Université de Montréal), *Multivariate P-polynomial association schemes and m-distance regular graphs* (p. 40)
9:00 - 9:30	Paul Terwilliger (University of Wisconsin), *The S_3-symmetric tridiagonal algebra* (p. 39)
9:30 - 10:00	Steven Wang (Carleton University), *On constructing bent functions from cyclotomic mappings* (p. 40)
10:00 - 10:30	Luc Vinet (Université de Montréal) (p. 40)
15:00 - 15:30	Alyssa Sankey (University of New Brunswick), *Strongly regular decompositions derived from regular two-graphs* (p. 39)
15:30 - 16:00	Meri Zaimi (Université de Montréal), *Bivariate P- and Q-polynomial structures of association schemes based on attenuated spaces* (p. 40)
16:00 - 16:30	Owen Goff (University of Wisconsin), *A new perspective on the q-Onsager algebra and its presentations* (p. 37)
16:30 - 17:00	Roghayeh Maleki (University of Primorska), *On the Q-polynomial property of the full bipartite subgraph of a Hamming graph $H(D, n)$* (p. 38)
17:00 - 17:30	Venkata Raghu Tej Pantagui (University of Regina), *Erdos-Ko-Rado type results in some Schurian Schemes* (p. 39)
17:30 - 18:00	Andriaherimanana Sarobidy Razafimahatratra (University of Primorska), *On the smallest non-diagonalizable vertex-primitive digraphs* (p. 39)

Monday June 3 — lundi 3 juin

8:30 - 9:00	Allen Herman (University of Regina), *The Terwilliger algebras of tournament and conference graph association schemes* (p. 38)
9:00 - 9:30	Hanmeng Zhan (Worcester Polytechnic Institute), *Generating quantum uniform mixing in association schemes* (p. 40)
9:30 - 10:00	Himanshu Gupta (University of Regina), *The least Euclidean distortion constant of a distance-regular graph* (p. 38)
10:00 - 10:30	Andrew Misseldine (Southern Utah University) (p. 39)

Abstracts/Résumés

Association schemes and their applications
Les schémas d'association et leurs applications

OWEN GOFF, University of Wisconsin Madison
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 217]
A new perspective on the q-Onsager algebra and its presentations

When working with association schemes and distance-regular graphs, there arises an associated matrix algebra called the Bose-Mesner Algebra. The generators for this algebra satisfy a pair of tridiagonal commutator relations, and an affine transformation of these relations gives the q-Onsager algebra.

The q-Onsager algebra (O_q) contains several sets of recursively defined elements. Although O_q has only two generators, explicit polynomial forms for these elements are not yet known. Here we give an algebra called the quantum torus (T_q) and show that the images of many of these elements under a homomorphism to T_q have pleasing closed forms; this may allow for some mysteries about O_q to be solved.

HIMANSHU GUPTA, University of Regina
[Monday June 3 / lundi 3 juin, 9:30 – ARTS 217]
The least Euclidean distortion constant of a distance-regular graph

Embedding graphs into Euclidean spaces with least distortion is a topic well-studied in mathematics and computer science. Despite this research, there are just a few graphs for which the precise least distortion and a least distortion embedding is known. In 2008, Vallentin studied this problem for distance-regular graphs and obtained a lower bound for the least distortion of a distance-regular graph. In addition, he showed that this bound is tight for Hamming and Johnson graphs as well as strongly regular graphs and conjectured that his bound is always tight for distance-regular graphs. In this talk, we provide several counterexamples to this conjecture with diameter 4 and larger, but we also prove the conjecture for several families of distance-regular graphs. This is joint work with Sebastian M. Cioaba (University of Delaware), Ferdinand Ihringer (Ghent University), and Hirotake Kurihara (Yamaguchi University).

ALLEN HERMAN, University of Regina
[Monday June 3 / lundi 3 juin, 8:30 – ARTS 217]
The Terwilliger algebras of tournament and conference graph association schemes

In this talk we will consider the Terwilliger algebras of association schemes (X, S) of (odd) order n and class 2 that are self-dual. If $\{A_0 = I, A_1, A_2\}$ are the $n \times n$ adjacency matrices of one of these association schemes, then the graphs represented by A_1 and A_2 are cospectral, with odd valency $2u + 1$ in the non-symmetric doubly-regular tournament case and even valuency $2u$ in the symmetric conference graph case.

For a fixed vertex $x \in X$, and for $i \in \{0, 1, 2\}$, let $E_i(x)$ be the $n \times n$ diagonal matrix whose diagonal vector is equal to the x-th row of A_i. The Terwilliger algebra $T_x(S)$ of (X, S) at the vertex x is the algebra over $\mathbb{C}$ generated by the adjacency matrices of (X, S) together with its dual idempotents $E_0(x)$, $E_1(x)$, and $E_2(x)$. We will begin by showing how the dimension and irreducible modules of T_x are determined by the spectrum of $E_1(x)A_1E_1(x)$.

We will then consider the question of whether or not the full list $(T_x)_{x\in X}$ of Terwilliger algebras up to algebra isomorphism determines the association scheme (X, S) up to combinatorial isomorphism. For tournaments of order 27, the answer turns out to be NO when we consider the Terwilliger algebras over $\mathbb{C}$ but YES when we consider the Terwilliger algebras over $\mathbb{Q}$. To understand the latter, we use tools from rational representation theory, namely, Schur indices and fields of character values.

ROGHAYEH MALEKI, University of Primorska
[Sunday June 2 / dimanche 2 juin, 16:30 – ARTS 217]
On the Q-polynomial property of the full bipartite subgraph of a Hamming graph $H(D, n)$

The Q-polynomial property is an algebraic property of distance-regular graphs, that was introduced by Delsarte in his seminal work on association schemes and coding theory.

In 2023, Paul Terwilliger generalized the Q-polynomial property to graphs that are not necessarily distance regular. In [*J. Combin. Theory Ser. A*, 205:105872, 2024], it was shown that the Hasse diagrams of the so-called attenuated space posets, which can be viewed as the q-analogs of Hamming posets, are Q-polynomial. However, the Hasse diagrams of Hamming posets were not studied in the context of the Q-polynomial property. In this talk, I will show that these are also Q-polynomial.

ANDREW MISSELDINE, Southern Utah University
[Monday June 3 / lundi 3 juin, 10:00 – ARTS 217]

VENKATA RAGHU TEJ PANTAGUI, University of Regina
[Sunday June 2 / dimanche 2 juin, 17:00 – ARTS 217]
Erdos-Ko-Rado type results in some Schurian Schemes

The classical Erdos-Ko-Rado (EKR) theorem and some of its variants can be viewed as characterizations of maximum independent sets of unions of graphs in some commutative Schurian (Orbital) schemes. For example, the classical EKR theorem characterizes independent sets of the Kneser graph, which is graph in the Johnson Scheme. Some other EKR-type results on vertices of Schurian schemes include the EKR theorem on subspaces and the EKR theorem on perfect matchings in a complete graph. Taking inspiration from algebraic proofs of the above-mentioned classical results, we attempt to identify Schurian schemes that are amenable to these algebraic methods and obtain some new EKR-type results in other domains.

ANDRIAHERIMANANA SAROBIDY RAZAFIMAHATRATRA, University of Primorska
[Sunday June 2 / dimanche 2 juin, 17:30 – ARTS 217]
On the smallest non-diagonalizable vertex-primitive digraphs

In 1980, Peter J. Cameron asked whether the adjacency matrices of arc-transitive digraphs are always diagonalizable. In 1985, Babai gave a negative answer to Cameron's question, and asked whether one can find vertex-primitive digraphs whose adjacency matrices are not diagonalizable. Recently, Li, Xia, Zhou, and Zhu gave an infinite family of such vertex-primitive digraphs. They further asked about the smallest such digraphs.

In this talk, I will show using the theory of commutative association schemes that the smallest vertex-primitive digraphs with non-diagonalizable adjacency matrices arise from the action of $\mathrm{PSL}_2(17)$ on the 2-subsets of the projective line $\mathrm{PG}_1(17)$, or equivalently on cosets of the dihedral group D_{16}.

ALYSSA SANKEY, University of New Brunswick
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 217]
Strongly regular decompositions derived from regular two-graphs

A *strongly regular decomposition* is a strongly regular graph admitting a partition of the vertex set into two parts on which the induced graphs are strongly regular. These decompositions provide examples of strongly regular designs or SRDs. We investigate an infinite family of such graphs in which there are two possible decompositions, giving two SRDs, and show that existence of either one implies existence of the other. A graph in this family thus provides a single structure linking 5 (well, actually 7 as will be explained in the talk) strongly regular graphs.

PAUL TERWILLIGER, University of Wisconsin-Madison
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 217]
The S_3-symmetric tridiagonal algebra

The tridiagonal algebra is defined by two generators and two relations called the tridiagonal relations. Special cases of the tridiagonal algebra include the q-Onsager algebra, the Onsager algebra, and the positive part of the quantum affine $\mathfrak{sl}_2$ algebra.

In this talk, we introduce the S_3-symmetric tridiagonal algebra. This algebra has six generators. Any two generators commute or satisfy a pair of tridiagonal relations. The generators can be identified with the vertices of a hexagon, such that nonadjacent generators commute and adjacent generators satisfy a pair of tridiagonal relations. We show that any Q-polynomial distance-regular graph gives a finite-dimensional module for the S_3-symmetric tridiagonal algebra.

LUC VINET, Université de Montréal
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 217]

STEVEN WANG, Carleton University
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 217]
On constructing bent functions from cyclotomic mappings

There have been many developments on construction of associate schemes using nonlinear functions such as p-ary bent functions. A Boolean function f in n variables with $f(0) = 0$ is bent if and only if the Cayley graph defined on $\mathbb{Z}_2^n$ by the support of a Boolean function is a strongly regular with parameters $(2^{2n}, 2^{2n-1} + \epsilon 2^{n-1}, 2^{2n-2} + \epsilon 2^{n-1}, 2^{2n-2} + \epsilon 2^{n-1})$, $\epsilon = \pm 1$. We study a new method of constructing Boolean bent functions from cyclotomic mappings. As a result, several new explicit infinite families of bent functions and their duals are derived.

MERI ZAIMI, Université de Montréal
[Sunday June 2 / dimanche 2 juin, 15:30 – ARTS 217]
Bivariate P- and Q-polynomial structures of association schemes based on attenuated spaces

Recently, bivariate and multivariate generalizations of the P- and Q-polynomial properties of association schemes have been proposed, and several examples of higher rank association schemes have been shown to fit within the generalized framework. In particular, bivariate P- and Q-polynomial structures have been obtained for association schemes based on attenuated spaces. While the bivariate P-polynomial structure can be analyzed using combinatorial arguments with the adjacency matrices, the same cannot be done with the bivariate Q-polynomial structure and the primitive idempotents, which complicates the proof. In this talk, I will explain how both the bivariate P- and Q-polynomial structures of association schemes based on attenuated spaces can be examined using recurrence relations and difference equations of the bivariate polynomials which form the eigenvalues and dual eigenvalues of the scheme. I will furthermore discuss the bispectral algebra associated to the bivariate polynomials as well as the Terwilliger algebra of the scheme.

HANMENG ZHAN, Worcester Polytechnic Institute
[Monday June 3 / lundi 3 juin, 9:00 – ARTS 217]
Generating quantum uniform mixing in association schemes

Some quantum algorithms require a "flat" input state, where all the entries have the same absolute value. This can be generated using certain quantum walks on graphs. In this talk, I will explain how properties of association schemes help us construct quantum walks that admit instantaneous uniform mixing and ϵ-uniform mixing.

XIAOHONG ZHANG, Université de Montréal
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 217]
Multivariate P-polynomial association schemes and m-distance regular graphs

An association scheme is P-polynomial if and only if it consists of the distance matrices of a distance-regular graph. Recently, a generalization to multivariate P-polynomial association schemes has been proposed. In this talk, we will introduce m-distance-regular graphs and show their connection to multivariate P-polynomial association schemes.

CH-Thirty Years Later
CH - trente ans plus tard

Org: Xiangke Chang (AMSS, Institute of Mathematics, Chinese Academy of Sciences) and/et **Jacek Szmigielski** (University of Saskatchewan)

In 1993, Roberto Camassa and Darryl Holm, then at Los Alamos National Laboratory, published a paper, "An integrable shallow water equation with peaked solitons", in a prime physics journal, Physical Review Letters, about a new candidate for the shallow water equation with a non-linear dispersion term. The equation they proposed is called the Camassa-Holm equation, abbreviated below as (CH). The paper has had a monumental impact on a legion of researchers in many different areas of mathematics, ranging from Analysis, Mathematical Physics, Random Matrix Theory, Approximation Theory, and Theory of Orthogonal Polynomials, to name a few. To celebrate this important discovery, our session brings together more than one generation of researchers working on many mathematical theories and problems rooted in the CH paper.

En 1993, Roberto Camassa et Darryl Holm, qui travaillaient alors au Los Alamos National Labora tory, ont publié un article intitulé "An integrable shallow water equation with peaked solitons" dans une revue de physique de premier plan, Physical Review Letters, à propos d'un nouveau candidat pour l'équation des eaux peu profondes (aussi connue sous le nom d'Équations de Barré de Saint-Venant) avec un terme de dispersion non linéaire. L'équation qu'ils ont proposée s'appelle l'équation de Camassa-Holm, abrégée ci-dessous comme (CH). Cet article a eu un impact monumental sur une légion de chercheurs dans de nombreux domaines des mathématiques, tels que l'analyse, la physique mathématique, la théorie des matrices aléatoires, la théorie de l'approximation et la théorie des polynômes orthogonaux, pour n'en citer que quelques-uns. Pour célébrer cette découverte monumentale, notre session rassemble plus d'une génération de chercheurs travaillant sur de nombreuses théories et problèmes mathématiques enracinés dans l'article CH.

Schedule/Horaire **Room/Salle: ARTS 106**

Friday May 31 — vendredi 31 mai

13:00 - 13:50	Roberto Camassa (University of North Carolina-Chapel Hill, USA), *Mathematical modeling of shallow water wave propagation.* (p. 42)
14:00 - 14:50	Alex Himonas (University of Notre Dame, USA), *Analysis of the CH equation and family* (p. 42)
15:00 - 15:50	Andrew Hone (University of Kent, UK), *An elliptic analogue of the Camassa-Holm equation* (p. 43)
16:00 - 16:50	Zhijun Qiao (University of Texas Rio Grande Valley, USA), *Integrable CH hierarchy and beyond* (p. 44)

Saturday June 1 — samedi 1er juin

8:30 - 9:20	Darryl Holm (Imperial College, UK), *Emergent singular solutions (ESS) in nonlinear wave PDEs* (p. 43)
9:30 - 10:20	Helge Holden (Norwegian University of Science and Technology, Norway), *On the stochastic Camassa—Holm equation with transport noise* (p. 43)
15:00 - 15:50	Dmitry Pelinovsky (McMaster, Canada), *Traveling waves in the Camassa-Holm equations: their stability and instability* (p. 44)
16:00 - 16:50	Katrin Grunert (Norwegian University of Science and Technology, Norway), *Uniqueness for the Camassa-Holm equation* (p. 42)
17:00 - 17:50	Hans Lundmark (University of Linkoping, Sweden), *Dynamics of peakons and antipeakons in Novikov's equation* (p. 43)

Sunday June 2 — dimanche 2 juin

8:30 - 9:20	Michael Gekhtman (University of Notre Dame, USA), *Integrable systems and cluster algebras* (p. 42)
9:30 - 10:20	Vladimir Novikov (Loughborough University, UK), *Towards the complete classification of integrable Camassa-Holm type equations* (p. 44)
15:00 - 15:50	Bo Xue (Zhengzhou University, China) (p. 44)
16:00 - 16:50	Stephen Anco (Brock University, Canada), *Peakons: some simple questions with unexpected answers* (p. 42)

CH-Thirty Years Later
CH - trente ans plus tard

Abstracts/Résumés

STEPHEN ANCO, Brock University
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 106]
Peakons: some simple questions with unexpected answers

Peakons are peaked travelling waves which arise as solutions of the integrable Camassa-Holm equation in water wave theory discovered 30 years ago. In the explosion of work on peakons following that discovery, several basic questions have been asked about the nature of peakons —

What is the most general class of nonlinear dispersive wave equations possessing peakon solutions ?

Is integrability necessary for existence of multi-peakon solutions ?

Are peakons best understood as weak solutions or distributional solutions ?

Does the NLS equation have a peakon counterpart ?

How to find integrable peakon equations systematically ?

In this talk, I will review some of my contributions to understanding and attempting to answer these questions over the past decade, which have led to some unexpected and on-going new developments.

ROBERTO CAMASSA
[Friday May 31 / vendredi 31 mai, 13:00 – ARTS 106]
Mathematical modeling of shallow water wave propagation.

Arguably, the mathematical modeling of water waves has given rise to some of the most interesting advances in the study of nonlinear partial differential equations. This talk will revisit some of these models and their derivation from first principle physics, focussing on some results that are possibly less well known, and consider recent extensions of existing models that can cover a wider range of wave phenomena.

MICHAEL GEKHTMAN, University of Notre Damw
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 106]
Integrable systems and cluster algebras

We review several constructions of integrable systems with an underlying cluster algebra structure, in particular the Gekhtman-Shapiro-Tabachnikov-Vainshtein construction based on perfect networks and the Goncharov-Kenyon approach based on the dimer model. Based on a survey joint with A. Izosimov.

KATRIN GRUNERT, Norwegian University of Science and Technology
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 106]
Uniqueness for the Camassa-Holm equation

Weak solutions of the Camassa–Holm equation might not be unique due to various admissible prolongations beyond wave breaking. The two most prominent continuations, whose existence can been established with the help of a generalized method of characteristics, are called conservative and dissipative. Here, we will discuss the uniqueness for these solution concepts by establishing a bijection between the properties specific for each solution type and the corresponding solution operator defined via a generalized method of characteristics.

CH-Thirty Years Later
CH - trente ans plus tard

ALEX HIMONAS, University of Notre Dame
[Friday May 31 / vendredi 31 mai, 14:00 – ARTS 106]
Analysis of the CH equation and family

In this talk we shall examine the various facets of the analysis of the Camassa-Holm (CH) equation and a related family of equations. Our focus will be on the well-posedness and ill-posedness of their initial value problem. In particular, we shall examine a number of interesting properties that they possess (like peakons) and influence their analysis. The talk is based on work with C. Holliman, C. Kenig, G. Misiolek, G. Petronilho, and G. Ponce.

HELGE HOLDEN, Norwegian University of Science and Technology
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 106]
On the stochastic Camassa—Holm equation with transport noise

We will discuss recent work regarding the stochastic Camassa—Holm equation $u_t + uu_x + P_x + \sigma u_x \circ dW = 0$ and $P - P_{xx} = u^2 + u_x^2/2$. În particular, we will show existence of a weak, global, dissipative solution of the Cauchy initial-value problem on the torus. This is joint work with L. Galimberti (King's College), K.H. Karlsen (Oslo), and P.H.C. Pang (NTNU/Oslo).

DARRYL HOLM, Imperial College London
[Saturday June 1 / samedi 1er juin, 8:30 – ARTS 106]
Emergent singular solutions (ESS) in nonlinear wave PDEs

We discuss emergent singular solutions (ESS) in nonlinear wave PDEs.

(1) Start with asymptotic expansion for 1D shallow water waves.

(2) Identify the b-equation in n dimensions, H-Staley [2003]

Integrable in 1D, $b = 2$ Camassa-H [1993], $b = 3$ Degasperis-Processi [2002]

(3) Q: Why is $b = 2$ special ? Is ESS is a property of integrability ?

A: No. The ESS solution Ansatz is a momentum map, H-Marsden [2005]

(4) Are there other geodesic ESS with $b = 2$ in 1D ? Yes ! Fringer-H [2001]

(5) ESS for Stochastic CH ? Yes ! Crisan-H [2019] and Bendall-Cotter-H [2022]

(6) Are there ESS for $b = 2$ and $W^{1,r}$ norm ? Cotter-H-Pryer [2023]

(7) Are there ESS embeddings for PDEs in 2D and 3D ?. H-Staley [2004]

ANDREW HONE, University of Kent
[Friday May 31 / vendredi 31 mai, 15:00 – ARTS 106]
An elliptic analogue of the Camassa-Holm equation

In this talk, an elliptic analogue of the Camassa-Holm equation is described, which was obtained in a classification of nonlocal CH-type equations with a 3rd order local symmetry. The equation contains not only nonlocal terms (like CH), but also coefficients that are implicitly defined in terms of an ordinary differential equation that is solved in elliptic functions. The complete structure and properties of this equation are still somewhat mysterious, so here we present some preliminary observations and describe various open problems. This is based on joint work with Ben Gormley and Vladimir Novikov.

CH-Thirty Years Later
CH - trente ans plus tard

HANS LUNDMARK, Linköping University, Sweden
[Saturday June 1 / samedi 1er juin, 17:00 – ARTS 106]
Dynamics of peakons and antipeakons in Novikov's equation

Novikov's equation is a cubically nonlinear integrable PDE of Camassa–Holm type. It admits globally defined conservative peakon–antipeakon solutions similar to those of the Camassa–Holm equation, but with a much richer variety of possible behaviours, as will be explained and illustrated in this talk.

VLADIMIR NOVIKOV, Loughborough University
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 106]
Towards the complete classification of integrable Camassa-Holm type equations

After 30 years of discovery of the Camassa-Holm equation the complete classification of integrable equations of this type remains an open problem. Camassa-Holm type equations can be viewed as negative flows of hierarchies of integrable evolutionary partial differential equations. There are various approaches to tackle integrability of negative flows. In this talk I will review various integrability tests applicable to such type systems and present the classification results. Some of the thus found equations are new.

DMITRY PELINOVSKY, McMaster University
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 106]
Traveling waves in the Camassa-Holm equations: their stability and instability

The Camassa–Holm equation in one spatial dimension admits traveling solitary and periodic waves with the smooth, peaked, and cusped profiles. I will overview recent results on the stability analysis of the traveling solitary waves in the Camassa–Holm equation and its extensions, the b-family of the Camassa–Holm equations. In particular, we proved the spectral and orbital stability of traveling waves with the smooth profiles. At the same time, we showed that the traveling waves with the peaked profile are linearly and nonlinearly unstable in $H^1 \cap W^{1,\infty}$ despite their orbital stability in H^1. More recently, we proved the transverse stability of one-dimensional solitary waves with the smooth profiles in the two-dimensional generalization of the Camassa–Holm equation.

ZHIJUN QIAO, NCST/UTRGV
[Friday May 31 / vendredi 31 mai, 16:00 – ARTS 106]
Integrable CH hierarchy and beyond

In this talk, we will present one of the CH developments, namely, the Camassa-Holm hierarchy and its integrable structure etc. We will see how the CH hierarchy is related to finite-dimensional integrable systems, and furthermore algebro-geometric solutions of the CH hierarchy are shown on a symplectic submanifold. Other similar peakons models, including the DP, the b-family, and cubic equations (MOCH, FORQ/MCH, Novikov etc) will be mentioned as well. Some results are selected from my 2003 CMP paper, but we will present our recent studies on the higher-order CH type equations as well.

BO XUE, Zhengzhou University, China
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 106]

Erdos-Ko-Rado Combinatorics
Combinatoire Erdos-Ko-Rado

Org: **Karen Meagher** and/et **Venkata Raghu Tej Pantangi** (University of Regina)

The famous Erdos-Ko-Rado (EKR) theorem gives the size and structure of the largest collection of intersecting k-sets. Versions of this theorem exist for many different objects, and there are many extensions and generalization of this result and n recent years the number of results in this area has grown greatly. The purpose of this session is to bring together researchers in this area to share recent results and approaches. The focus will be on algebraic method to prove EKR theorems, recent result on EKR for groups, EKR on designs and in geometry and EKR on graphs. I do not believe that there has been such a meeting in this emerging field.

Le célèbre théorème d'Erdos-Ko-Rado (EKR) donne la taille et la structure de la plus grande collection d'ensembles k intersectés. Des versions de ce théorème existent pour de nombreux objets différents, et il existe de nombreuses extensions et généralisations de ce résultat. Ces dernières années, le nombre de résultats dans ce domaine a considérablement augmenté. Le but de cette session est de rassembler les chercheurs dans ce domaine pour partager les résultats et les approches récentes. L'accent sera mis sur les méthodes algébriques pour prouver les théorèmes EKR, les résultats récents sur EKR pour les groupes, EKR sur les dessins et en géométrie et EKR sur les graphes. Je ne crois pas qu'il y ait eu une telle réunion dans ce domaine émergent.

Schedule/Horaire — Room/Salle: ARTS 101

Monday June 3	lundi 3 juin
8:00 - 8:30	Karen Meagher (University of Regina), *A brief Introduction to the Erdős-Ko-Rado Theorem* (p. 46)
8:30 - 9:00	Cody Solie (University of Regina), *Database of Intersection Density for Permutation Groups* (p. 47)
9:00 - 9:30	Lord Kavi (University of Ottawa), *Optimal Polynomials for the k-independence Number of Graphs* (p. 46)
9:30 - 10:00	Andrey Kupavskii (Moscow Institute of Physics and Technology), *Forbidden intersections via spread approximations* (p. 46)
10:00 - 10:30	Nathan Lindzey (Technion), *Global Hypercontractivity and Forbidden Intersection Theorems* (p. 46)
15:00 - 15:30	Sarobidy Razafimahatratra (University of Primorska), *The Erdős-Ko-Rado Theorem for semidirect products of transitive groups* (p. 47)
15:30 - 16:00	Venkata Raghu Tej Pantangi (University of Regina), *Strength of some EKR-type results.* (p. 47)
16:00 - 16:30	Mahsa Shirazi (University of Manitoba), *A review on the Erdős-Ko-Rado theorem for uniform set partitions and perfect matchings* (p. 47)
16:30 - 17:00	Brett Stevens (Carleton), *Where Karen Meagher first encountered the Erdos-Ko-Rado Theorem* (p. 48)
17:00 - 17:30	Glenn Hurlbert (Virginia Commonwealth University), *Recent results on the Holroyd-Talbot Conjecture* (p. 45)
17:30 - 18:00	Sergey Goryainov (Hebei Normal University), *Erdős-Ko-Rado combinatorics of strongly regular graphs* (p. 45)

Abstracts/Résumés

SERGEY GORYAINOV, Hebei Normal University
[Monday June 3 / lundi 3 juin, 17:30 – ARTS 101]
Erdős-Ko-Rado combinatorics of strongly regular graphs

In their book on Erdős-Ko-Rado combinatorics, Chris Godsil and Karen Meagher proposed several open problems on strongly regular graphs: Paley graphs of square order, block graphs of orthogonal arrays and block graphs of 2-designs. In my talk I will discuss some recent developments on these open problems.

Erdos-Ko-Rado Combinatorics
Combinatoire Erdos-Ko-Rado

GLENN HURLBERT, Virginia Commonwealth University
[Monday June 3 / lundi 3 juin, 17:00 – ARTS 101]
Recent results on the Holroyd-Talbot Conjecture

In 2005 Holroyd and Talbot generalized the Erdős-Ko-Rado realm to graphs by restricting the family of all r-subsets of n elements under consideration to the family $\mathcal{I}^r(G)$ of independent sets of size r in a graph G on n vertices. Say that a subfamily of $\mathcal{I}^r(G)$ is a $star$ if the intersection of its sets (its $center$) is nonempty. Let $\mathcal{F}$ be an intersecting subfamily of $\mathcal{I}^r(G)$ and denote the minimum size of a maximal independent set in G by $\mu(G)$. They conjectured that if $r \leq \mu(G)/2$ then the size of $\mathcal{F}$ is at most the size of some star.

After a brief history of earlier results by Deza-Frankl, Bollobás-Leader, and others, I will present more recent theorems and open problems with various collaborators including Feghali, Frankl, Kamat, and Meagher. Among the results are injective proofs of the Erdős-Ko-Rado and Hilton-Milner theorems, certification of the Holroyd-Talbot conjecture for smaller r on sparse graphs, and partial results and conjectures on trees regarding where the center of a largest star can be.

LORD KAVI, University of Ottawa
[Monday June 3 / lundi 3 juin, 9:00 – ARTS 101]
Optimal Polynomials for the k-independence Number of Graphs

A k-independent set in a graph is a set of vertices such that any two vertices in the set are at distance at least $k+1$ in the graph. The k-independence number of a graph, denoted α_k, is the size of a largest k-independent set in the graph. Abiad et al gave a generalization of the Hoffman ratio bound on α_k, which involves taking polynomials of degree at most k. A good bound therefore depends on making the right choice of a polynomial. In this talk, we highlight the known optimal polynomials for $k = 1, 2, 3$ and their corresponding bounds on α_k, and give a possible generalization of these polynomials.

ANDREY KUPAVSKII, Moscow Institute of Physics and Technology
[Monday June 3 / lundi 3 juin, 9:30 – ARTS 101]
Forbidden intersections via spread approximations

I will speak about the recent progress on the Erdos-Ko-Rado type results for different structures, such as sets, partitions and permutations, that we have managed to obtain using the method of spread approximations. In particular, I will cover the progress on the Frankl-Deza problem about t-intersecting permutations and the resolution of the Meagher-Moura question on partially t-intersecting families of partitions.

NATHAN LINDZEY, Technion
[Monday June 3 / lundi 3 juin, 10:00 – ARTS 101]
Global Hypercontractivity and Forbidden Intersection Theorems

Hypercontractive inequalities play a fundamental role in discrete Fourier analysis over the hypercube and have many applications throughout Discrete Mathematics. Such inequalities continue to hold in other combinatorial domains, but for a restricted class of functions that satisfy a pseudorandomness condition called *globalness*. We give an overview of global hypercontractivity and its application to Erdős–Ko–Rado and Erdős–Sós-type forbidden intersection theorems for various non-Abelian matrix groups. This is joint work with Esty Kelman and Ohad Sheinfeld.

KAREN MEAGHER, University of Regina
[Monday June 3 / lundi 3 juin, 8:00 – ARTS 101]
A brief Introduction to the Erdős-Ko-Rado Theorem

Erdos-Ko-Rado Combinatorics
Combinatoire Erdos-Ko-Rado

My talk will be a short introduction to the Erdős-Ko-Rado (EKR) Theorem. I will start by giving the standard version of the EKR theorem, and state some of the versions for other objects. Next I will give an overview of some of the common proof methods (such as the kernel method, compression, derangement graphs and the ratio bound). Finally, I will end with some result related to the EKR theorem, such as the Hilton-Milner theorem, and new directions in this area.

VENKATA RAGHU TEJ PANTANGI, University of Regina
[Monday June 3 / lundi 3 juin, 15:30 – ARTS 101]
Strength of some EKR-type results.

The classical Erdos-Ko-Rado (EKR) theorem and its variants can be translated into characterizing maximum co-cliques of graphs in Association schemes. For instance, the classical Erdős-Ko-Rado characterizes maximum co-cliques in the Kneser graph. Given a graph G, by G_p, we denote the random subgraph of G in which edges appear independently, each with a probability p. In this talk, we consider the following question: for which probabilities is the independence number of G_p equal to that of G ? Bollabas-Narayanan-Raigorodskii investigated the independence numbers of random subgraphs of the Kneser graph. In this talk, we will investigate the independence numbers of random subgraphs of (i) the derangement graph on permutations ; and (ii) the perfect matching graphs. The derangement graph is associated with the EKR type result on permutations and the perfect matching graph is associated with EKR type result on perfect matchings. This is joint work with the members of the PIMS Collaborative Research Group on Movement and Symmetry in graphs.

SAROBIDY RAZAFIMAHATRATRA, University of Primorska
[Monday June 3 / lundi 3 juin, 15:00 – ARTS 101]
The Erdős-Ko-Rado Theorem for semidirect products of transitive groups

A set of permutations $\mathcal{F}$ of a finite transitive group $G \leq \mathrm{Sym}(\Omega)$ is *intersecting* if any two permutations in $\mathcal{F}$ agree on some elements of Ω. An Erdős-Ko-Rado (EKR) type theorem for the transitive group G in this context gives the size and the structure of the largest intersecting sets.

In 2015, Ahmadi and Meagher asked whether it is possible to give an EKR type theorem for the semidirect product $G \rtimes \mathbb{Z}_2 \leq \mathrm{Sym}(\Omega)$, provided that we have a "nice enough" EKR theorem for the transitive group $G \leq \mathrm{Sym}(\Omega)$. There is no general answer to this question and the structure of the largest intersecting sets vastly depends on the action of G.

In this talk, I will focus on an example of semidirect product with cyclic groups for which the largest intersecting sets are much more complex. In particular, I will talk about the largest intersecting sets for the actions of the general linear group $\mathrm{GL}_2(q)$ and the general semilinear group $\Gamma\mathrm{L}_2(q) = \mathrm{GL}_2(q) \rtimes \mathrm{Aut}(\mathbb{F}_q)$ on non-zero vectors of $\mathbb{F}_q^2$. Note that if p is a prime, then $\Gamma\mathrm{L}_2(p^2) = \mathrm{GL}_2(p^2) \rtimes \mathbb{Z}_2$. In contrast to $\mathrm{GL}_2(q)$ which only has two classes of largest intersecting sets, the group $\Gamma\mathrm{L}_2(q)$ has multiple classes of intersecting sets, and they need not be subgroups.

MAHSA SHIRAZI, University of Manitoba
[Monday June 3 / lundi 3 juin, 16:00 – ARTS 101]
A review on the Erdős-Ko-Rado theorem for uniform set partitions and perfect matchings

A "perfect matching" in a graph, is a set of edges by which every vertex is covered exactly once. A perfect matching is in fact a special case of a "uniform set partition". A uniform set partition is a partition in which all parts have the same size. In this talk, we will review some results on the Erdős-Ko-Rado theorem for perfect matchings and uniform set partitions. Particularly, we focus on 2-intersecting and set-wise 2-intersecting perfect matchings and partially 2-intersecting uniform set partitions.

CODY SOLIE, University of Regina
[Monday June 3 / lundi 3 juin, 8:30 – ARTS 101]
Database of Intersection Density for Permutation Groups

Erdos-Ko-Rado Combinatorics
Combinatoire Erdos-Ko-Rado

The intersection density of a permutation group is the ratio of the size of a largest intersecting set in a permutation group, compared to the size of the stabilizer of a point. Many families of groups have been shown to have intersection density equal to 1. Recent work has tried to find groups with intersection density larger than one. A key tool for this work which has been missing is a centralized, comprehensive database of known intersection density for small groups. We are working to create this database as a public resource, and we will discuss our computational techniques and relevant theory which allow us to gather these results.

BRETT STEVENS, Carleton University
[Monday June 3 / lundi 3 juin, 16:30 – ARTS 101]
Where Karen Meagher first encountered the Erdos-Ko-Rado Theorem

Karen Meagher first encountered the Erdos-Ko-Rado theorem when studying covering arrays. The Erdos-Ko-Rado theorem and Sperner's Lemma form the basis for the only known construction of an infinite family of optimal non-orthogonal covering arrays. I will define covering arrays, talk about their applications but concentrate the talk on the beautiful theorem of Renyi and Katona that determines the optimal size of binary covering arrays of strength 2. This encounter was the beginning of Karen's productive relationship with Erdos-Ko-Rado type problems.

Functional and Harmonic Analysis

Org: Benjamin Anderson-Sackaney and/et **Ebrahim Samei** (University of Saskatchewan)

Schedule/Horaire **Room/Salle: ARTS 200**

Sunday June 2 **dimanche 2 juin**

15:00 - 15:30	Finlay Rankin (Carleton University), *Quantum automorphisms of commuting squares* (p. 49)
15:30 - 16:00	Pawel Sarkowicz (University of Waterloo), *Embeddings of unitary groups* (p. 49)
16:00 - 16:30	Erik Seguin (University of Waterloo), *Amenability and stability for discrete groups* (p. 49)
16:30 - 17:00	Benjamin Anderson-Sackaney (University of Saskatchewan), *Tracial States on Quantum Group C*-algebras* (p. 49)

Abstracts/Résumés

BENJAMIN ANDERSON-SACKANEY, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 16:30 – ARTS 200]
Tracial States on Quantum Group C-algebras*

When working with the tracial states on a group C^*-algebra $C^*_\pi(G)$ of a group G, an indispensable fact is the observation that the tracial states on $C^*_\pi(G)$ are exactly the states that are invariant with respect to the conjugation action of G on $C^*_\pi(G)$. An analogous observation for discrete quantum groups had been missing until quite recently: it was established for unimodular discrete quantum groups in a recent paper by Kalantar, Kasprzak, Skalski, and Vergnioux. In this talk we will present a generalization of this result for arbitrary discrete quantum groups and discuss various consequences of this result on the reduced C^*-algebras of discrete quantum groups.

FINLAY RANKIN, Carleton
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 200]
Quantum automorphisms of commuting squares

Banica defined a compact quantum group of automorphisms for an inclusion of finite-dimensional C^*-algebras and determined its representation theory in certain cases. We generalize Banica's work and assign a compact quantum group of automorphisms to a nondegenerate commuting square consisting of finite-dimensional C^*-algebras and show that it can be realized as a generalized Drinfeld double. Finally, we discuss the representation theory in special cases.

PAWEL SARKOWICZ, University of Waterloo
[Sunday June 2 / dimanche 2 juin, 15:30 – ARTS 200]
Embeddings of unitary groups

We discuss unitary groups of C*-algebras with a focus on group homomorphisms between them, and how such homomorphsisms give relationships between the K-theory and traces. With this information, one can use the state-of-the-art K-theoretic classification of embeddings to conclude that there are certain embeddings between C*-algebras if and only if there are appropriate embeddings between their unitary groups.

ERIK SEGUIN, University of Waterloo
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 200]
Amenability and stability for discrete groups

The notion of a representation of a group G on a Hilbert space $\mathcal{H}$ can be generalized to that of an "approximate representation", in which the usual homomorphism condition $\varphi(xy) = \varphi(x)\,\varphi(y)$ is replaced by some upper bound on $\|\varphi(xy) - \varphi(x)\,\varphi(y)\|$. The supremum over all $x, y \in G$ of this quantity is referred to as the "defect" of the map φ and measures how far φ is from being a genuine representation. It is natural to ask about the stability of this class of maps: namely, when the defect of φ is small, under what conditions is it well-approximated by a genuine representation of G? We discuss the connection between amenability and stability of approximate representations for discrete groups.

Geometry and Representation Theory
Géométrie et théorie des représentations

Org: Mahmud Azam (University of Saskatchewan), **Kuntal Banerjee** (University of Saskatchewan), **Robert Cornea** (University of Waterloo), **Ha Minh Dat** (University of Saskatchewan) and/et **Brady Ali Medina** (University of Waterloo)

Interactions between representation theory and geometry have been a major driving force for both areas. These interactions have been fruitful in computing invariants of important objects in both fields, each benefiting from results obtained in the other. These interactions are mediated by functors between categories relevant to the two fields, which are often homotopically invariant given suitable notions of homotopy on both sides. It is thus no wonder that homotopy theory and homotopical algebra have been applied to geometry and representation theory to great effect resulting in the ongoing generalisation and simplification of many of the most important concepts and results. These continue to facilitate advances in moduli theory and mathematical physics. The theme of the proposed session is this collective picture of geometry, homotopy theory, representation theory, moduli theory and mathematical physics. Furthermore, many recent contributions in these areas have been made by early career researchers, and it is the purpose of this session to highlight these efforts and to encourage mathematical exchanges between these researchers.

Les interactions entre la théorie des représentations et la géométrie ont été une force motrice majeure pour les deux domaines. Ces interactions ont permis de calculer les invariants d'objets importants dans les deux domaines, chacun bénéficiant des résultats obtenus dans l'autre. Ces interactions sont médiées par des foncteurs entre les catégories pertinentes pour les deux domaines, qui sont souvent homotopiquement invariants étant donné des notions appropriées d'homotopie de part et d'autre. Il n'est donc pas étonnant que la théorie de l'homotopie et l'algèbre homotopique aient été appliquées à la géométrie et à la théorie des représentations de manière très efficace, ce qui a permis de généraliser et de simplifier un grand nombre des concepts et des résultats les plus importants. Ceux-ci continuent à faciliter les avancées dans la théorie des modules et la physique mathématique. Le thème de la session proposée est cette image collective de la géométrie, de la théorie de l'homotopie, de la théorie des représentations, de la théorie des modules et de la physique mathématique. En outre, de nombreuses contributions récentes dans ces domaines ont été faites par des chercheurs en début de carrière, et le but de cette session est de mettre en lumière ces efforts et d'encourager les échanges mathématiques entre ces chercheurs.

Schedule/Horaire — Room/Salle: ARTS 108

Sunday June 2 — dimanche 2 juin

8:30 - 9:00	James Steele (University of Calgary), *Cohomological Duality in the Local Langlands Correspondence for p-adic Groups* (p. 55)
9:00 - 9:30	Mishty Ray (University of Calgary), *Geometric analogues of local Arthur packets for p-adic GL_n* (p. 54)
9:30 - 10:00	José Cruz (University of Calgary), *On the Fourier transform and Vogan's perspective on the Local Langlands Correspondence* (p. 53)
10:00 - 10:30	Sze Hong Kwong (University of Maryland), *Conformal limit of Higgs bundles along singular upward flow* (p. 53)
15:00 - 15:30	Jonathan Sejr Pedersen (University of Toronto), *Splitting Madsen-Tillmann Spectra* (p. 54)
15:30 - 16:00	Grisha Taroyan (University of Toronto), *Equivalent models of derived stacks* (p. 55)
16:00 - 16:30	Florian Schwarz (University of Calgary), *The Lie Algebra of a group object* (p. 54)
16:30 - 17:00	Deni Salja (Dalhousie University) (p. 54)

Monday June 3 — lundi 3 juin

8:30 - 9:00	Raphaël Belliard (University of Alberta), *Casimir conformal blocks from meromorphic connections over curves.* (p. 52)
9:00 - 9:30	Evan Sundbo (University of Toronto), *Twisted Quiver Varieties and Higgs Bundles* (p. 55)
9:30 - 10:00	Christopher Mahadeo (University of Illinois at Chicago), *Quantization through the tautological section* (p. 53)
10:00 - 10:30	Matthew Koban (University of Toronto), *Moduli of doubled quiver representations* (p. 53)

Geometry and Representation Theory
Géométrie et théorie des représentations

15:00 - 15:30	Aidan Lindberg (University of Toronto), *Picard Groups of Holomorphic Poisson Manifolds* (p. 53)
15:30 - 16:00	Eric Boulter (University of Saskatchewan), *Moduli Spaces of Sheaves on Kodaira Surfaces* (p. 52)
16:00 - 16:30	Daniel Alvarez (University of Toronto), *Symplectic groupoids and moduli spaces of flat bundles over surfaces* (p. 52)
16:30 - 17:00	Marielle Ong (University of Pennsylvania), *Multiplicative global Springer Theory* (p. 54)
17:00 - 17:30	Caleb Ashley (Boston College), *An explicit relationship between the ghost and swapping algebras* (p. 52)

Abstracts/Résumés

DANIEL ALVAREZ, University of Toronto
[Monday June 3 / lundi 3 juin, 16:00 – ARTS 108]
Symplectic groupoids and moduli spaces of flat bundles over surfaces

I will explain how the theory of decorated moduli spaces of flat bundles over surfaces is the largest source of examples of symplectic (double) groupoids and I will give many examples of this. This is based on the paper "Poisson groupoids and moduli spaces of flat bundles over surfaces", Adv. Math. (2024)

CALEB ASHLEY, Boston College
[Monday June 3 / lundi 3 juin, 17:00 – ARTS 108]
An explicit relationship between the ghost and swapping algebras

The notion of an Anosov representation is based on dynamical properties of discrete and faithful representations of a surface group into a semi-simple Lie group G, up to conjugation. Anosov representations were developed by Labourie and have been used to investigate moduli spaces of higher rank geometric structures on manifolds, themselves open subsets known as Hitchin components, of associated character varieties. Just as trace functions are essential for low dimensional geometry and topology when G is $PSL(2, C)$, fundamental for studying moduli spaces of Anosov representations are natural classes of functions ; for example, "length functions" associated to geodesic currents developed by Bonahon-Dreyer, "correlation functions" developed Bridgeman-Canary-Labourie and further generalized to "projectors" in the context of "uniformily hyperbolic bundles" by Bridgeman-Labourie.

In this talk we rapidly review the work of Bridgeman-Labourie which relates several major results, namely: the symplectic geometry of character varieties (Goldman), to the notions of positivity and cluster algebra coordinates (Fock-Goncharov and Bonahon-Dreyer), and also the "swapping algebra" (Labourie). The main result of our talk is a description of an explicit Lie algebra isomorphism between the "ghost algebra" (Bridgeman-Labourie) and the "swapping algebra" (Labourie) for projective-Anosov representations.

This is joint work with Ming Hong Tee.

RAPHAËL BELLIARD, University of Alberta
[Monday June 3 / lundi 3 juin, 8:30 – ARTS 108]
Casimir conformal blocks from meromorphic connections over curves.

Casimir W-algebras are associative extensions of the Virasoro infinite-dimensional algebra of conformal transformations of the plane at integer central charge, and associated to simply-laced simple Lie algebras. We will describe how to construct families of co-invariants of certain representations of those algebras, so-called conformal blocks, associated to configurations of points on compact Riemann surfaces, together with some Lie theoretic data. To do so, we will consider deformations of meromorphic connections in principal bundles over compact Riemann surfaces, and give a quantum flavour to their geometry.

Geometry and Representation Theory
Géométrie et théorie des représentations

ERIC BOULTER, University of Waterloo
[Monday June 3 / lundi 3 juin, 15:30 – ARTS 108]
Moduli Spaces of Sheaves on Kodaira Surfaces

Moduli spaces of stable sheaves on Kodaira surfaces are examples of compact holomorphic symplectic manifolds. The only other known examples of non-Kähler holomorphic symplectic manifolds are Bogomolov-Guan manifolds or Douady spaces of points on Kodaira surfaces. In this talk we show that there exist compact moduli spaces in each even dimension, and that in the rank-2 case they are non-Kähler but not deformation equivalent to Bogomolov-Guan manifolds. We also discuss some steps toward determining if these moduli spaces are deformation equivalent to Douady spaces of points on Kodaira surfaces.

JOSÉ CRUZ, University of Calgary
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 108]
On the Fourier transform and Vogan's perspective on the Local Langlands Correspondence

Deligne's Fourier transform is an endofunctor defined on the derived category of l-adic sheaves on certain spaces, which maps sheaves with small support to sheaves with large support. It was first applied by Laumon to simplify Deligne's proof of the Weil conjectures, and it has proved to be a fundamental tool in geometric representation theory. In this talk, I am going to introduce the Fourier transform via Grothendieck's function-sheaf dictionary, and I am going to apply it on some small examples that appear in Vogan's persepective of the local Langlands correspondence, just as Cunningham et al. did in their work.

MATTHEW KOBAN, University of Toronto
[Monday June 3 / lundi 3 juin, 10:00 – ARTS 108]
Moduli of doubled quiver representations

A quiver is a finite directed graph. In the early 90's Nakajima used representations of doubled quivers to construct a large class of hyperkähler varieties now known as Nakajima Quiver varieties. These varieties have been the focus of much recent research due to their incredible structure, and their appearance in representation theory and mathematical physics. In this talk I will give a brief introduction to Nakajima quiver varieties and the properties they possess.

SZE HONG KWONG, University of Maryland
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 108]
Conformal limit of Higgs bundles along singular upward flow

Motivated by supersymmetric gauge theory, Gaiotto introduced the notion 'conformal limit' and conjectured that the conformal limit of a Higgs bundle on the Hitchin section exists and is an oper. This conjecture was confirmed by Dumitrescu-Fredrickson-Kydonakis-Mazzeo-Mulase-Neitzke. Later, it was generalized and proved affirmatively by Collier-Wentworth to upward flow through a stable $\mathbb{C}^*$-fixed point in the moduli of Higgs bundles.

In this talk, we will review the definitions and these developments, and then explore various instances of extension to cases where the upward flow is singular. The latter part is based on my ongoing work.

AIDAN LINDBERG, University of Toronto
[Monday June 3 / lundi 3 juin, 15:00 – ARTS 108]
Picard Groups of Holomorphic Poisson Manifolds

Poisson manifolds are the infinitesimal objects associated to symplectic groupoids, which can be thought of as presentations of 1-shifted symplectic stacks. The symplectic automorphisms of this stack therefore give an invariant of the Poisson manifold, called its Picard group. In this talk I will introduce the Picard group of a holomorphic Poisson manifold and show how we can use tools from deformation theory to describe this group as a moduli space.

CHRISTOPHER MAHADEO, University of Illinois at Chicago
[Monday June 3 / lundi 3 juin, 9:30 – ARTS 108]
Quantization through the tautological section

I will discuss some current work related to the quantization of Hitchin systems and topological recursion, specifically, regarding the quantization as a procedure on the spectral curve and tautological section.

MARIELLE ONG, University of Pennsylvania
[Monday June 3 / lundi 3 juin, 16:30 – ARTS 108]
Multiplicative global Springer Theory

Multiplicative affine Springer fibers are group-theoretic analogues of affine Springer fibers. They can be seen as affine Deligne-Lusztig varieties without the Frobenius twist. They were studied by Frenkel and Ngo in 2011 to give a geometric interpretation of orbital integrals of spherical Hecke functions. Since then, there is an on-going program by Bouthier, Chi and Wang to establish their connections to multiplicative Higgs bundles and the multiplicative Hitchin fibration. In this talk, I will introduce parabolic multiplicative affine Springer fibers and use them to develop a multiplicative version of Yun's global Springer theory from 2011.

JONATHAN SEJR PEDERSEN, University of Toronto
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 108]
Splitting Madsen-Tillmann Spectra

We prove that the Madsen-Tillmann spectrum $MT\theta_n := \mathrm{Th}(-\theta_n^*\gamma_{2n} \to BO(2n)\langle n\rangle)$ splits into the sum of spectra $\Sigma^{-2n}MO\langle n\rangle \oplus \Sigma^{\infty-2n}\mathbb{R}P^\infty_{2n}$ after Postnikov trunctation $\tau_{\leq \ell}$ for $\ell = \frac{n}{2} - c$. This is achieved by showing the connecting homomorphism $\tau_{\leq \ell}MO\langle n\rangle \to \tau_{\leq \ell}\Sigma^{\infty+1}\mathbb{R}P^\infty_{2n}$ is nullhomotopic in this range by applying Adams spectral sequence arguments.

We discuss a number of applications, most prominently the computation of $H_2(B\,\mathrm{Diff}(W_g^{2n}, D^{2n}); \mathbb{Z})$ which is connected to moduli spaces of high dimensional manifolds. This is joint work with Andy Senger.

MISHTY RAY, University of Calgary
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 108]
Geometric analogues of local Arthur packets for p-adic GL_n

Local Arthur packets are sets of representations of p-adic groups that help us realize important classes of automorphic forms. They have geometric analogues, called ABV-packets. This was first proposed for p-adic groups by David Vogan following his joint work with Adams and Barbasch for real groups. This theory was then adapted by Cunningham et al. for the non-archimedean case. They defined ABV-packets and formulated the conjecture that ABV-packets generalize local Arthur packets. They called it "Vogan's conjecture" to honour the work that led to it, in addition to providing a wealth of examples as evidence. In this talk, I will introduce ABV-packets and present a proof of Vogan's conjecture for p-adic GL_n .

DENI SALJA, Dalhousie University
[Sunday June 2 / dimanche 2 juin, 16:30 – ARTS 108]

FLORIAN SCHWARZ, University of Calgary
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 108]
The Lie Algebra of a group object

The tangent space of a Lie Group is a Lie Algebra. This is one of the most important basic results of differential geometry, sparking the entire field of Lie theory with its extensive applications to Physics.

Using group objects we will investigate the generalisation of this theorem in the broader setting of Cartesian tangent categories, encompassing among other things classical differential geometry, algebraic geometry and synthetic differential geometry. Tangent categories have been used to generalize various constructions from differential geomtetry, like connections, De Rham cohomology and differential equations.

We will see that (if a certain pullback exists) various results about Lie groups hold for group objects in Cartesian tangent categories. In particular the tangent bundle is trivial and a negation exist for the addition of tangent vectors, even if it was not a priori required to exist. This then allows us to define an external Lie-Algebra structure on the tangent space, generalizing a Lie group's Lie Algebra.

JAMES STEELE, University of Calgary
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 108]
Cohomological Duality in the Local Langlands Correspondence for p-adic Groups

The Langlands Programme seeks to classify the irreducible representations of a connected, reductive algebraic group G over a field k, roughly in correspondence with the representations of Gal $\left(\bar{k}/k\right)$, deemed L-parameters. For local fields, this classification has largely been a successful, and a natural next step is to classify the extensions between these irreducible representations of G. In this talk, we show that, for G split semisimple over a p-adic field, certain classes of extensions can be classified according to the extensions of perverse sheaves on a moduli space built from the L-parameters.

EVAN SUNDBO, University of Toronto
[Monday June 3 / lundi 3 juin, 9:00 – ARTS 108]
Twisted Quiver Varieties and Higgs Bundles

Quivers have a rich history of being used to construct algebraic varieties via their representations in the category of vector spaces. We consider representations in a different category, namely that of vector bundles on some complex variety equipped with a fixed locally free sheaf which twists the morphisms. In this way we construct interesting subvarieties of Hitchin's moduli space of Higgs bundles, finding especially nice descriptions when the quivers are "argyle", cyclic, or when the underlying variety is the Riemann sphere.

GRISHA TAROYAN, University of Toronto
[Sunday June 2 / dimanche 2 juin, 15:30 – ARTS 108]
Equivalent models of derived stacks

Derived differential geometry is an emergent field that uses the ideas of derived algebraic geometry applied to classically "analytic" settings. In our talk, we want to explore one instance of such application: the Dold−Kan correspondence for Fermat theories and the resulting equivalence of various models of derived differentiable stacks. Time permitting, we will also talk about connections with the conjecture of Behrend−Liao−Xu on the homotopy theory of derived manifolds formulated in arXiv:2006.01376.

The talk is based on our paper "Equivalent models of derived stacks," arXiv:2303.12699.

Integrable systems and quantization
Systèmes intégrables et quantification

Org: Eric Boulter (University of Saskatchewan) and/et **Christopher Mahadeo** (University of Illinois at Chicago)

This session delves into the topics of Integrable Systems and Quantization, two pivotal concepts at the forefront of contemporary mathematical research. Quantization is a fundamental process in mathematical physics that lies at the heart of translating classical systems into the language of quantum mechanics. Integrable systems, with their rich symplectic structures and conserved quantities, provide a natural bridge to the quantum realm through the process of quantization. This session will serve as a platform for mathematicians, researchers, and enthusiasts to engage in stimulating discussions, share novel insights, and foster collaboration within these dynamic fields. The goal of this session will be to discuss deep connections between geometry and modern physics that offer insight to further work in both disciplines.

Cette session aborde les thèmes des systèmes intégrables et de la quantification, deux concepts essentiels à la pointe de la recherche mathématique contemporaine. La quantification est un processus fondamental de la physique mathématique qui se trouve au cœur de la traduction des systèmes classiques dans le langage de la mécanique quantique. Les systèmes intégrables, avec leurs riches structures symplectiques et leurs quantités conservées, constituent un pont naturel vers le domaine quantique grâce au processus de quantification. Cette session servira de plateforme pour les mathématiciens, les chercheurs et les enthousiastes afin de lancer des discussions stimulantes, de partager de nouvelles idées et d'encourager la collaboration dans ces domaines dynamiques. L'objectif de cette session est de discuter des liens profonds entre la géométrie et la physique moderne qui permettent d'approfondir les travaux dans les deux disciplines.

Schedule/Horaire — Room/Salle: ARTS 206

Sunday June 2 — dimanche 2 juin

8:30 - 9:00	Kuntal Banerjee (University of Saskatchewan), *Iterated spectral curves and Lax pairs: A brief overview* (p. 56)
9:00 - 9:30	Evan Sundbo (University of Toronto), *Cohomology of Hypertoric Hitchin Systems* (p. 58)
9:30 - 10:00	Brady Ali Medina (University of Waterloo), *Co-Higgs Bundles and Poisson Structures* (p. 57)
15:00 - 15:30	Iva Halacheva (Northeastern University), *Families of maximal commutative subalgebras in quantum groups* (p. 57)
15:30 - 16:00	Reinier Kramer (University of Alberta), *How should we quantise cycles in symmetric groups ?* (p. 57)
16:00 - 16:30	Raphaël Belliard (University of Alberta), *Quantum Riemann bilinear relations.* (p. 56)
16:30 - 17:00	Aiden Suter (University of Waterloo/Perimiter Institute), *Associated variety for $L_1(\mathfrak{psl}_{N\|N})$ and 3d A-model Higgs Branch* (p. 58)
17:00 - 17:30	Peter Crooks (Utah State University), *Abelianization in integrable systems and quantization* (p. 57)

Abstracts/Résumés

KUNTAL BANERJEE, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 206]
Iterated spectral curves and Lax pairs: A brief overview

We appeal to an iterated version of the classical spectral correspondence starting from a composite 'push-pull' projection formula of locally free sheaves and observe further consequences in solving the equation of the Lax pairs. We will limit our discussions to the cyclic spectral covers of the complex projective line.

Integrable systems and quantization
Systèmes intégrables et quantification

RAPHAËL BELLIARD, University of Alberta
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 206]
Quantum Riemann bilinear relations.

Upon a slight extension of Goldman's homology with local coefficients, meromorphic lambda-connections in trivial principal bundles over Riemann surfaces are interpreted as quantisations of certain emergent classical algebraically integrable systems. This allows for a natural notion of quantum periods satisfying quantum counterparts to the classical Riemann bilinear relations.

PETER CROOKS, Utah State University
[Sunday June 2 / dimanche 2 juin, 17:00 – ARTS 206]
Abelianization in integrable systems and quantization

Guillemin and Sternberg's Gelfand-Cetlin systems are related to important topics at the interface of symplectic geometry and representation theory. I will propose and partially substantiate a generalization of these systems and their broader implications. A key technical ingredient will be an abelianization theorem for symplectic quotients in arbitrary Lie type. This represents joint work with Jonathan Weitsman.

IVA HALACHEVA, Northeastern University
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 206]
Families of maximal commutative subalgebras in quantum groups

A useful approach to decomposing a representation of an algebra into manageable pieces is through the action of its maximal commutative subalgebras. I will discuss several families of such subalgebras in the context of Lie theory, in particular the shift-of-argument as well as Bethe algebras. These families are parametrized by interesting geometric spaces, such as the Deligne-Mumford moduli space. For a given representation, their action leads to a covering space with associated monodromy realized by the cactus group acting on the crystal for that representation. The talk will focus on the case of gl(n).

REINIER KRAMER, University of Alberta
[Sunday June 2 / dimanche 2 juin, 15:30 – ARTS 206]
How should we quantise cycles in symmetric groups ?

Hurwitz numbers are counts of covers of Riemann surfaces with given ramification. For maps from the sphere to itself, we may require most ramifications are $(r+1)$-cycles. Generating functions of these numbers naturally live on the spectral curve

$$y - e^{x^r y^r} = 0.$$

We want to quantise this curve to obtain an operator $P(\hat{x}, \hat{y}; \hbar)$ which annihilates the partition function of all-genus covers of the sphere. I will explain that there are at least two natural ways of doing this, with different corrections to the cycles, and different interpretations of the original spectral curve.

This is based on joint works with Gaëtan Borot, Vincent Bouchard, Petr Dunin-Barkowski, Danilo Lewański, Alexandr Popolitov, Sergey Shadrin, and Quinten Weller.

BRADY ALI MEDINA, University of Waterloo
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 206]
Co-Higgs Bundles and Poisson Structures

A co-Higgs bundle on a complex manifold X is defined as a pair (V, Φ), where V represents a holomorphic vector bundle on X, and the co-Higgs field satisfies the integrability condition $\Phi \wedge \Phi = 0$. Co-Higgs bundles induce a Poisson structure on the projectivization $\mathbb{P}(V)$ of the vector bundle. In this talk, we are going to explore the connection between co-Higgs bundles and holomorphic Poisson structures.

EVAN SUNDBO, University of Toronto
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 206]
Cohomology of Hypertoric Hitchin Systems

Hypertoric Hitchin systems are combinatorial cousins of moduli spaces of Higgs bundles whose cohomological structure is governed by unions of toric varieties glued to each other along toric subvarieties. We study these 'broken' toric varieties, proving a Deligne-type decomposition theorem and reducing the calculation of the Betti numbers of hypertoric Hitchin systems to understanding a certain family of examples.

AIDEN SUTER, University of Waterloo & Perimeter Institute
[Sunday June 2 / dimanche 2 juin, 16:30 – ARTS 206]
Associated variety for $L_1(\mathfrak{psl}_{N|N})$ and 3d A-model Higgs Branch

3d mirror symmetry is a research program concerning the equivalence of two topological twists of 3d supersymmetric QFT known as the 3d A-model and 3d B-model. In particular 3d mirror symemtry posits a duality of symplectic varieties known as the "Higgs" and "Coulomb" branches of the moduli space of vacua for the original 3d theory. In this talk, I will describe how these symplectic varieties can be accessed via vertex operator algebras (VOAs) constructed from boundary conditions for these theories. In particular, it is conjectured that the associated variety of the boundary VOA for the 3d A-model is isomorphic to the Higgs branch of the original theory. I will outline recent work of mine on proving this conjecture in the case of $U(1)$ gauge theories which involves identifying the associated variety of the $L_1(\mathfrak{psl}_{N|N})$ VOA.

Inverse Eigenvalue Problems and Matrix Theory
Problèmes inverses des valeurs propres et théorie des matrices

Org: Shaun Fallat and/et **Himanshu Gupta** (University of Regina)

Inverse Eigenvalue Problems encompass a vast array of topics in Matrix Theory and continue to play a significant role in many applications. Research involving various aspects of inverse eigenvalue problems spans subjects including: analysis, combinatorics, algebra, and computing.

Les problèmes inverses de valeurs propres englobent un vaste éventail de sujets dans la théorie des matrices et continuent à jouer un rôle important dans de nombreuses applications. La recherche impliquant divers aspects des problèmes de valeurs propres inverses couvre des sujets tels que l'analyse, la combinatoire, l'algèbre et l'informatique.

Schedule/Horaire **Room/Salle: ARTS 104**

Saturday June 1 — samedi 1er juin

9:00 - 9:30	Shaun Fallat (Univeristy of Regina), *Bordering Matrices and the Inverse Eigenvalue Problem for Graphs* (p. 59)
9:30 - 10:00	Hristo Sendov (Western University), *On the Hadamard-Fischer Inequality, the Inclusion-Exclusion Formula, and Bipartite Graphs* (p. 62)
10:00 - 10:30	Sarah Plosker (Brandon University), *Spectral Inequalities for Factor Width of a Matrix* (p. 61)
15:00 - 15:30	Ahmad Mojallal (University of Regina), *Nonregular Graphs with Three Eigenvalues* (p. 61)
15:30 - 16:00	Hein van der Holst (Georgia State University), *Digraphs with maximum stable nullity at most 1* (p. 63)
16:00 - 16:30	Jacik Szmigielski (University of Saskatchewan), *Peakon inspired spectral and inverse spectral problems* (p. 62)
16:30 - 17:00	Chun-Hua Guo (University of Regina), *On absolute value equations associated with M-matrices* (p. 60)
17:00 - 17:30	Peter Zizler (Mount Royal University), *On loading matrices with non negative entries* (p. 63)

Sunday June 2 — dimanche 2 juin

8:30 - 9:00	Christopher Ramsey (MacEwan University), *The numerical diameter of linear maps* (p. 61)
9:00 - 9:30	Rajesh Pereira (University of Guelph), *Correlation Matrices: The Inverse Eigenvalue and Other Problems.* (p. 61)
9:30 - 10:00	Nathan Johnston (Mount Allison University), *The Inverse Eigenvalue Problem for Entanglement Witnesses* (p. 60)
10:00 - 10:30	Brendan Rooney (Rochester Institute of Technology), *Sparse Graphs with $q(G) = 2$* (p. 62)
15:00 - 15:30	Himanshu Gupta (University of Regina), *Matrix positivity preservers over finite fields* (p. 60)
15:30 - 16:00	Mahsa Shirazi (University of Manitoba), *Weakly Hadamard Diagonalizable Graphs* (p. 62)
16:00 - 16:30	Steve Kirkland (University of Manitoba), *Stochastic matrices and the boundary of the Karpelevich region* (p. 61)
16:30 - 17:00	Avleen Kaur (University of British Columbia), *Estimating the minimum positive eigenvalue of PSD matrices* (p. 60)

Abstracts/Résumés

SHAUN FALLAT

[Saturday June 1 / samedi 1er juin, 9:00 – ARTS 104]

Bordering Matrices and the Inverse Eigenvalue Problem for Graphs

An important parameter tied to the inverse eigenvalue problem for graphs is the fewest number of distinct eigenvalues that can be realized by a given graph. To this end we concentrate on bordering a symmetric matrix associated with a given graph and

endeavor to control the variation in the number of distinct eigenvalues under this operation. We examine numerous results on the study of the minimum number of distinct eigenvalues as vertices are joined to certain classes of graphs.

CHUN-HUA GUO, University of Regina
[Saturday June 1 / samedi 1er juin, 16:30 – ARTS 104]
On absolute value equations associated with M-matrices

We consider the absolute value equation (AVE) $Ax - |x| = b$, where A is an $n \times n$ matrix such that $A - I$ is a nonsingular M-matrix or an irreducible singular M-matrix. We show that the generalized Newton method (GNM) terminates with the exact unique solution in at most $n+2$ iterations when $A - I$ is a nonsingular M-matrix and in at most $n+1$ iterations when $A - I$ is an irreducible singular M-matrix and the AVE has a unique solution. When $A - I$ is an irreducible singular M-matrix, the AVE may have infinitely many solutions. In this case, we show that GNM always terminates (in at most $n+1$ iterations) with a uniquely identifiable solution, as long as the initial guess has at least one nonpositive component. The GNM requires $O(n^3)$ operations each iteration. Linear convergence of a generalized Gauss-Seidel iteration (GGS), which requires $O(n^2)$ operations each iteration, is known when $A - I$ is a nonsingular M-matrix. We show that GGS is still linearly convergent when $A - I$ is an irreducible singular M-matrix and the AVE has a unique solution.

HIMANSHU GUPTA, University of Regina
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 104]
Matrix positivity preservers over finite fields

We resolve an algebraic version of Schoenberg's celebrated theorem characterizing the functions f with the property that the matrix $(f(a_{ij}))$ is positive definite for any positive definite matrix (a_{ij}). Compared to the classical real and complex settings, we consider matrices with entries in a finite field. Here, we say that such a matrix is positive definite if all its leading principal minors are non-zero quadratic residues. We obtain a complete characterization of entrywise positivity preservers in that setting for matrices of a fixed dimension. When the dimension of the matrices is at least 3, we prove that, surprisingly, the positivity preservers are precisely the positive multiples of the field's automorphisms. We also provide a new connection between entrywise positivity preservers and automorphisms of Paley graphs. This is joint work with Dominique Guillot (University of Delaware) and Prateek Kumar Vishwakarma (Indian Institute of Science). The talk is based on the paper: https://arxiv.org/abs/2404.00222.

NATHAN JOHNSTON, Mount Allison University
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 104]
The Inverse Eigenvalue Problem for Entanglement Witnesses

In quantum information theory, a linear operator that can detect entanglement in a quantum system is called an entanglement witnesses. We consider the inverse eigenvalue problem for entanglement witnesses, which asks for a characterization of their possible spectra. Equivalently, we consider the problem of classifying the spectra that can result from applying a positive linear map to a single tensor factor of a positive semidefinite matrix. We completely solve this problem in some low dimensions and we derive a large family of new necessary conditions on the spectra in arbitrary dimensions.

AVLEEN KAUR, The University of British Columbia
[Sunday June 2 / dimanche 2 juin, 16:30 – ARTS 104]
Estimating the minimum positive eigenvalue of PSD matrices

An extensive body of literature addresses the estimation of eigenvalues of the sum of two symmetric matrices, $P+Q$, in relation to the eigenvalues of P and Q. Recently, we introduced two novel lower bounds on the minimum eigenvalue, $\lambda_{\min}(P+Q)$, under the conditions that matrices P and Q are symmetric positive semi-definite (PSD) and their sum $P+Q$ is non-singular.

These bounds rely on the Friedrichs angle between the range spaces of matrices P and Q, which are denoted by $\mathcal{R}(P)$ and $\mathcal{R}(Q)$, respectively. In addition, both results led to the derivation of several new lower bounds on the minimum singular value of full-rank matrices. We extend these insights to estimate the minimum positive eigenvalue of $P+Q$, $\lambda_{\min}(P+Q)$, even if $P+Q$ is singular, in terms of the minimum positive eigenvalues of P and Q, namely $\lambda_{\min}(P)$ and $\lambda_{\min}(Q)$. Our approach leverages angles between specific subspaces of $\mathcal{R}(P)$ and $\mathcal{R}(Q)$, meticulously chosen to yield a positive lower bound. Additionally, we illustrate these concepts through relevant examples.

STEVE KIRKLAND, University of Manitoba
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 104]
Stochastic matrices and the boundary of the Karpelevich region

A square nonnegative matrix with all row sums equal to 1 is known as a stochastic matrix, and the eigenvalues of such matrices are central to the study of Markov chains. Given a natural number n, the corresponding Karpelevich region is the subset of the complex plane consisting of all eigenvalues of arising from stochastic matrices of order n. In this talk we report on some recent progress on the problem of characterizing the stochastic matrices having a complex eigenvalue on the boundary of the corresponding Karpelevich region. Joint work with Helena Smigoc and Priyanka Joshi.

AHMAD MOJALLAL, University of Regina
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 104]
Nonregular Graphs with Three Eigenvalues

In this talk, we study nonregular graphs with three eigenvalues. We look at the well-known results in this area, focusing particularly on addressing a question posed by Muzychuk and Klin in their paper [M. Muzychuk, M. Klin, On graphs with three eigenvalues, Discrete Mathematics 189 (1998) 191-207] "Is there an upper bound for the number of distinct degrees in a graph ? If so, then find it".

RAJESH PEREIRA, University of Guelph
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 104]
Correlation Matrices: The Inverse Eigenvalue and Other Problems.

We examine some problems relating to the convex hull of the rank one correlation matrices. One key problem we look at is the problem of determining the set of all possible spectra of matrices in the convex hull of the real rank one correlation matrices. We show relations between this problem and other areas of mathematics such as the geometry of polynomials and the existence of Hadamard matrices.

We also examine the relationship between the convex hull of $n \times n$ rank one correlation matrices and the set of all $n \times n$ correlation matrices. Relations between this problem and other areas of mathematics such as the theory of positive definite functions on groups and Grothendieck's inequality are explored.

SARAH PLOSKER, Brandon University
[Saturday June 1 / samedi 1er juin, 10:00 – ARTS 104]
Spectral Inequalities for Factor Width of a Matrix

A Hermitian matrix X is called k-locally positve semidefinite if every $k \times k$ principal submatrix of X is positive semidefinite. We develop some bounds on the possible spectra of k-locally PSD matrices, and present a method for numerically constructing a k-locally PSD matrix with a given spectrum. We explore the connection to the concept of k-incoherent states from quantum information theory. This is joint work with Nathaniel Johnston, Shirin Moein, and Rajesh Pereira.

Inverse Eigenvalue Problems and Matrix Theory
Problèmes inverses des valeurs propres et théorie des matrices

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CHRISTOPHER RAMSEY, MacEwan University
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 104]
The numerical diameter of linear maps

The numerical range and the numerical radius are much loved and much studied objects as they extend the eigenvalue information of a matrix into the non-normal setting. In this joint work with Niel de Beaudrap (Sussex) we study the diameter of the numerical range and the induced seminorm on linear maps between operator systems. In particular, the completely bounded numerical diameter is a norm comparable to but distinct from the completely bounded norm.

BRENDAN ROONEY, Rochester Institute of Technology
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 104]
Sparse Graphs with $q(G) = 2$

Given a graph G on n vertices, $\mathcal{S}(G)$ is the set of symmetric $n \times n$ matrices with the same off-diagonal zero pattern as the adjacency matrix of G. We say that a connected graph G has $q(G) = 2$ if there is a matrix $M \in \mathcal{S}(G)$ with exactly 2 distinct eigenvalues.

Recently, Barrett et al. (Barrett et al. *Sparsity of graphs that allow two distinct eigenvalues.* Linear Algebra Appl. 674(2023), 377–395) proved that graphs on n vertices with $q(G) = 2$ must have $|E(G)| \geq 2n - 4$. They also showed that the odd-order graphs with $q(G) = 2$ have $|E(G)| \geq 2n - 3$, and characterized the odd-order graphs that meet this bound. We complete the characterization of graphs with $|E(G)| = 2n-3$ and $q(G) = 2$ by treating the even-order case. As part of our characterization, we resolve an open question of Barrett et al. by determining for each double-ended candle H, the sets of non-edges S for which $q(H + S) = 2$.

HRISTO SENDOV, The University of Western Ontario
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 104]
On the Hadamard-Fischer Inequality, the Inclusion-Exclusion Formula, and Bipartite Graphs

The classical Hadamard-Fischer-Koteljanskii inequality is an inequality between principal minors of positive definite matrices. In this work, we present an extension of the Hadamard-Fischer-Koteljanskii inequality, that is inspired by the inclusion-exclusion formula for sets. We formulate necessary and sufficient conditions for the inequality to hold. We describe general structures of the collection of index sets involved. In analyzing these structures, a graph-theoretical property that applies to bipartite graphs is found. We establish that if the vertices of a bipartite graph satisfy simple conditions, then the bipartite graph contains a vertex subgraph which is a cycle or a complete subgraph missing a matching. This result is reminiscent of the Hall's marriage theorem for bipartite graphs.

MAHSA SHIRAZI, University of Manitoba
[Sunday June 2 / dimanche 2 juin, 15:30 – ARTS 104]
Weakly Hadamard Diagonalizable Graphs

An interesting question in the spectral graph theory is about the structure of the eigenvectors of matrices associated with graphs. A graph is *weakly Hadamard diagonalizable (WHD)* if its Laplacian matrix L can be diagonalized with a weakly Hadamard matrix. In other words, if $L = PDP^{-1}$, where D is a diagonal matrix and P has the property that all entries in P are from $\{0, -1, 1\}$ and that P^tP is a tridiagonal matrix. In this talk, I will present some necessary and sufficient conditions for a graph to be WHD. Also some families of graphs which are WHD, will be presented.

This work is part of a research project done with the discrete math research group (DMRG) at the University of Regina

Inverse Eigenvalue Problems and Matrix Theory
Problèmes inverses des valeurs propres et théorie des matrices

JACIK SZMIGIELSKI, Department of Mathematics and Statistics, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 104]
Peakon inspired spectral and inverse spectral problems

Peakon equations form a class of non-linear PDEs with weak (distributional) solutions akin to solitons but non-smooth. They can be studied using isospectral (spectrum preserving) deformations of boundary value problems, which generally are non-selfadjoint. Yet, these boundary value problems are multifold covers of spectral problems involving oscillatory kernels of the Gantmacher-Krein type. The inverse spectral problems for those lead to mixed Hermite-Padé approximations. In this talk, I will illustrate some of these ideas with two examples of peakon-bearing equations: the Novikov equation and a two-component Novikov equation. This talk is in part based on joint work with X. Chang.

HEIN VAN DER HOLST, Georgia State University
[Saturday June 1 / samedi 1er juin, 15:30 – ARTS 104]
Digraphs with maximum stable nullity at most 1

For a digraph D with vertex-set $V = \{1, \ldots, n\}$ and arc-set A, let $Q(D)$ be the set of all real $n \times n$ matrices $A = [a_{i,j}]$ with $a_{i,j} \neq 0$ if $ij \in A$, $a_{i,i} \neq 0$ for $i \in V$, and $a_{i,j} = 0$ if $i \neq j$ and $ij \notin A$. We say that a matrix $A \in Q(D)$ satisfies the ASAP if for all $A \circ X = 0$, $AX^T = 0$ and $X^T A = 0$ implies $X = 0$. The stable maximum nullity $Ms(D)$ of a digraph D is the maximum nullity of any $A \in Q(D)$ satisfying the ASAP. A digraph D has $M_s(D) = 0$ if and only if D has no directed cycles. If D is a digraph, we denote by $\overleftarrow{D}$ the digraph obtained from D by reversing each arrow. In this talk, we show that the digraphs D with $M_s(D) \leq 1$ are exactly the digraphs D such that D and $\overleftarrow{D}$ have Kelly-width ≤ 1 .

PETER ZIZLER, Mount Royal University
[Saturday June 1 / samedi 1er juin, 17:00 – ARTS 104]
On loading matrices with non negative entries

Loading matrices arising in principal component analysis are not unique. For a given factor loading problem it is desirable to determine whether factor loadings that are all non negative do exist. We give sufficient conditions for the existence of a non negative loading matrix and discuss some of its consequences.

Mathematical Logic in Canada

Org: **Ross Willard** and/et **Andy Zucker** (University of Waterloo)

Mathematical logic has evolved during its 100+ year existence into a number of subfields, including set theory, model theory, and computability theory. In addition, logic interacts with several other areas of mathematics including topology, combinatorics, dynamics, ergodic theory, operator algebras, and universal algebra. This session will showcase recent research in these areas and encourage conversations across disciplines.

Schedule/Horaire **Room/Salle: ARTS 101**

Saturday June 1 **samedi 1er juin**

8:30 - 9:00	Barbara Csima (University of Waterloo), *Measurements of complexity of mathematical notions* (p. 64)
9:10 - 9:40	Bo Peng (McGill University), *The complexity of pointed minimal and transitive systems in different spaces* (p. 65)
9:50 - 10:20	Jananan Arulseelan (McMaster University), *Computability in Continuous Logic with Applications to Operator Algebras* (p. 64)
15:00 - 15:50	Rahim Moosa (University of Waterloo), *Permutation groups in differentially closed fields* (p. 65)
16:00 - 16:30	Elliot Kaplan (McMaster University), *Constant power maps on Hardy fields and Transseries* (p. 65)
16:40 - 17:10	Nicolas Chavarria Gomez (University of Waterloo), *Abelian structures in continuous logic* (p. 65)

Sunday June 2 **dimanche 2 juin**

8:10 - 9:00	Assaf Shani (Concordia University), *Generic dichotomies for Borel homomorphisms for the finite Friedman-Stanley jumps* (p. 65)
9:10 - 9:40	Ian Smythe (University of Winnipeg), *A descriptive approach to manifold classification* (p. 66)
9:50 - 10:20	Ross Willard (University of Waterloo), *Residually finite equational theories* (p. 66)
15:00 - 15:50	Andy Zucker (University of Waterloo), *Recurrent big Ramsey structures* (p. 66)
16:00 - 16:30	Christopher Eagle (University of Victoria), *Cohomology of co-existentially closed continua* (p. 64)

Abstracts/Résumés

JANANAN ARULSEELAN, McMaster University
[Saturday June 1 / samedi 1er juin, 9:50 – ARTS 101]
Computability in Continuous Logic with Applications to Operator Algebras

We study the use of computability theoretic ideas in the framework of continuous logic. To demonstrate the utility of such a study, we explain a few applications to operator algebras. We survey some recent work and new directions in the subject. This is joint work with Isaac Goldbring, Bradd Hart and Thomas Sinclair.

BARBARA CSIMA, University of Waterloo
[Saturday June 1 / samedi 1er juin, 8:30 – ARTS 101]
Measurements of complexity of mathematical notions

As mathematicians, we often strive to quantify and compare different objects. As logicians, we have the tools to quantify and compare various mathematical objects. From Turing degrees to Scott Sentences, and Reverse Mathematics to Algorithmic Randomness, the choices abound. In this talk, we discuss these various tools and their relationships to one another.

CHRISTOPHER EAGLE, University of Victoria
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 101]
Cohomology of co-existentially closed continua

Although traditional model theory is not well-suited for handling topological structures, for a compact Hausdorff space X, Gelfand duality provides a way of studying X by instead studying the C*-algebra $C(X)$ of continuous complex-valued functions on X. Real-valued logic for metric structures then provides a suitable setting for the model-theoretic treatment of these C*-algebras. In this talk I will present some recent results in the model theory of compact connected Hausdorff spaces that have been obtained in this way; in particular, I will describe joint work with J. Lau concerning cohomological properties of X when $C(X)$ is an existentially closed model of the theory of continua.

NICOLAS CHAVARRIA GOMEZ, University of Waterloo
[Saturday June 1 / samedi 1er juin, 16:40 – ARTS 101]
Abelian structures in continuous logic

In classical logic, the 1-based groups are, in some sense, exactly the abelian structures, i.e. abelian groups with distinguished subgroups of its powers. Thanks to B.H. Neumann's lemma, an abelian structure (in fact, the base group need not be abelian) admits elimination of quantifiers down to so-called positive primitive formulas. From this it can be seen that its definable sets are Boolean combinations of cosets of definable subgroups, from which 1-basedness follows. We advance the study of the corresponding notions in continuous first-order model theory. This is joint work with Anand Pillay.

ELLIOT KAPLAN, McMaster University
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 101]
Constant power maps on Hardy fields and Transseries

We study H-fields (certain ordered differential fields generalizing Hardy fields and Transseries) equipped with "constant power maps". We show that this class has a model companion, the models of which include the field of LE-transseries and any maximal Hardy field. We study the induced structure on the constant field, prove a relative decidability result, and give some applications to certain systems of differential equations.

RAHIM MOOSA, Waterloo
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 101]
Permutation groups in differentially closed fields

Within the community of people studying finite Morley rank groups (to which I do not belong), the study of definable permutation groups has become central. They have posed questions and formulated conjectures that are of general interest to model theorists. This talk is about the specialisation of some of these questions (and their answers) to one particular theory: the theory of differentially closed fields. This is joint work with Jim Freitag and Leo Jimenez.

BO PENG, McGill University
[Saturday June 1 / samedi 1er juin, 9:10 – ARTS 101]
The complexity of pointed minimal and transitive systems in different spaces

We will talk about several results regarding classification problems for pointed minimal and transitive systems in symbolic, Hilbert cube and Cantor spaces. Those equivalent relations are intensively connected with "topological type" of sequences. As consequences, we are able to show that conjugacy relation of minimal systems is not classifiable by countable structures, conjugacy relation of transitive symbolic Subshift is not amenable, etc. This is joint work with Konrad Deka, Ruiwen Li and Marcin Sabok.

ASSAF SHANI, Concordia University
[Sunday June 2 / dimanche 2 juin, 8:10 – ARTS 101]
Generic dichotomies for Borel homomorphisms for the finite Friedman-Stanley jumps

Abstract: The talk will begin by discussing the basic definitions and general goals behind the theory of Borel equivalence relations. We focus on the Friedman-Stanley jumps $=^{+n}$, for $n = 1, 2, ...$ and $n = \omega$. These Borel equivalence relations represent the notions of being classifiable using invariants which are countable sets of reals, countable sets of countable sets of reals, and so on.

We consider the problem of constructing a Borel reduction from $=^{+n}$ to some other equivalence relation. For $n = 1$ the situation is well understood and there are many such results. We present a new technique for finding such a reduction, when $n > 1$, based on Baire-category methods.

IIAN SMYTHE, University of Winnipeg
[Sunday June 2 / dimanche 2 juin, 9:10 – ARTS 101]
A descriptive approach to manifold classification

We propose a unified descriptive set-theoretic framework for studying the complexity of classification problems arising in geometric topology. We establish several precise complexity results, such as for the classification of surfaces up to homeomorphism, and for classes of hyperbolic manifolds up to isometry. The latter is intimately connected with the conjugation actions of certain Lie groups on their spaces of discrete subgroups. This work is joint with Jeffrey Bergfalk.

ROSS WILLARD, University of Waterloo
[Sunday June 2 / dimanche 2 juin, 9:50 – ARTS 101]
Residually finite equational theories

An equational theory T is said to be *residually finite* if every model of T can be embedded in a product of finite models of T. Equivalently, T is residually finite if and only if its irreducible models (those that cannot be embedded in products of "simpler" models) are all finite. If one looks "in nature" for equational theories which are residually finite AND have a finite signature, one invariably finds that, except in "extreme" cases, the theory has a stronger property: there is a finite upper bound to the sizes of its irreducible members. In this lecture I will describe some conjectures about this phenomenon and some recent progress on one of them. This is joint work with Keith Kearnes and Agnes Szendrei.

ANDY ZUCKER, University of Waterloo
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 101]
Recurrent big Ramsey structures

This talk primarily serves as an introduction to the concept of a big Ramsey structure, an expansion of a given infinite structure which correctly encodes the big Ramsey degrees of every finite substructure. While a priori there is no reason to expect that finite big Ramsey degrees implies the existence of a big Ramsey structure, this happens in every known example. Not only that, but for almost all known examples, one can build big Ramsey structures with further desirable properties, such as recurrence. In recent joint work with Jan Hubicka, we shed some light on why this is, proving a result of the form that any proof of finite big Ramsey degrees using the "standard" methods is guaranteed to imply the existence of a recurrent big Ramsey structure.

Mathematical aspects of Quantum Science and Technology

Org: Jonas Fransson (Uppsala University) and/et **Artur Sowa** (University of Saskatchewan)

The session aims to bring together researchers interested in exploring innovative approaches to quantum theory, science, and technology. Of interest are all mathematical aspects of systems of bosons, generalized bosons, fermions, and qubits. Applications may include condensed matter theory, quantum measurement, quantum engineering, and postquantum cryptography.

Schedule/Horaire **Room/Salle: ARTS 207**

Saturday June 1 **samedi 1er juin**

9:00 - 9:30	Jonas Fransson (Uppsala University), *Current Induced Spin-Polarization in Chiral Molecules* (p. 69)
9:30 - 10:00	Hubert De Guise (University of Calgary), *The regular representation of S_n in interference of fermions and bosons* (p. 69)
10:00 - 10:30	Rainer Dick (University of Saskatchewan), *Where are the photons ?* (p. 69)
15:00 - 15:30	Gordon Sarty (University of Saskatchewan), *A Concept for Direct MRI using Diamonds with Nitrogen Vacancies* (p. 71)
15:30 - 16:00	Mahta Abdollahzadehzare (University of Saskatchewan), *High-performance spectrum calculation of 3d transition metals in oxide compounds* (p. 67)
16:00 - 16:30	Mandana Bidarvand (University of Saskatchewan), *Analyzing arrays of qubits via a multi-scale approach* (p. 68)
16:30 - 17:00	Madeline Berezowski (University of Saskatchewan), *How Boson Dimers Reproduce Spin Projection Operators* (p. 68)
17:00 - 17:30	Artur Sowa (University of Saskatchewan), *Wielding the Dirichlet series to analyse the physics of bosons* (p. 71)

Sunday June 2 **dimanche 2 juin**

9:00 - 9:30	Alex Zagoskin (Loughborough University), *Pechukas-Yukawa approach to quantum systems with discrete energy spectra* (p. 72)
9:30 - 10:00	Carlo Maria Scandolo (University of Calgary), *Choi-Defined Resource Theories* (p. 71)
10:00 - 10:30	Kaori Tanaka (University of Saskatchewan), *Gapless topological superconductivity identified by the spectral localiser* (p. 71)
15:00 - 15:30	Masahiro Hori (University of Saskatchewan), *Multifractal and hyperuniform analysis of quasicrystalline patterns in bosonic systems with and without disorder* (p. 70)
15:30 - 16:00	Vicky Howse (University of Saskatchewan), *Vortex 'molecules', a hydrodynamic analog for hadrons* (p. 70)
16:00 - 16:30	Christopher Mahadeo (U. of Illinois at Chicago), *Quantization in hyperbolic band theory* (p. 71)
16:30 - 17:00	Mahmud Azam (University of Saskatchewan), *TQFTs and Quantum Computing* (p. 68)
17:00 - 17:30	Elias Hassani (University of Saskatchewan), *A post-quantum, post-AI data encryption method* (p. 69)

Abstracts/Résumés

MAHTA ABDOLLAHZADEHZARE, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 15:30 – ARTS 207]
High-performance spectrum calculation of 3d transition metals in oxide compounds

In the early 20th century, the principles of quantum mechanics revolutionized the study of materials, leading to the invention of the transistor, the key component of modern day technologies. To sustain advancements in technology, innovations in the

discovery of new materials are needed. One family of elements with immense potential in creating new functional materials is the 3d transition elements, especially in the form of oxide compounds. A common method in the study of the electronic structure of such compounds is X-ray Absorption Spectroscopy (XAS). This method yields spectra of the energy-dependent absorption which, for energies near atomic resonances, contains detailed electronic and magnetic information about the materials. However, interpreting experimental spectra can be challenging due to complicated lineshapes arising from quantum many-body interactions. Therefore, theoretical methods are often necessary to extract information and analyze the spectra. This study focuses on quantum double cluster models to simulate spectra, in particular constructing real, symmetric Hamiltonian matrices for oxide compounds containing 3d transition elements with atomic numbers 21 to 29. We employ the SLEPc library to determine the ground state eigenvalues of specific Hamiltonians, and utilize the Lanczos iterative method to calculate the XAS spectra. Our results reveal the range of necessity of this double cluster model over the series of 3d elements via the extracted covalency from the ground state wavefunction and the differences of XAS spectra compared to simpler single cluster models.

MAHMUD AZAM, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 16:30 – ARTS 207]
TQFTs and Quantum Computing

Quantum computing is captured in the formalism of the monoidal subcategory of $\mathbf{Vect}_{\mathbb{C}}$ generated by $\mathbb{C}^2$ – in particular, quantum circuits are diagrams in $\mathbf{Vect}_{\mathbb{C}}$ – while topological quantum field theories, in the sense of Atiyah, are diagrams in $\mathbf{Vect}_{\mathbb{C}}$ indexed by cobordisms. We outline a program to formalize this connection. In doing so, we first equip cobordisms with machinery for producing linear maps by parallel transport along curves under a connection and then assemble these structures into a higher category. Finite dimensional complex vector spaces and linear maps between them are given a suitable higher categorical structure which we call $\mathbb{F}\mathbf{Vect}_{\mathbb{C}}$. Finally, we realize quantum circuits as images of cobordisms under higher monoidal functors from these modified cobordisms to $\mathbb{F}\mathbf{Vect}_{\mathbb{C}}$, which are computed by taking parallel transports of vectors and then combining the results in a pattern encoded in the domain category. This talk reports on joint work with Steven Rayan.

MADELINE BEREZOWSKI, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 16:30 – ARTS 207]
How Boson Dimers Reproduce Spin Projection Operators

The Bose-Hubbard Hamiltonian can be simplified to have only two lattice sites, in which case the system being described is referred to as a dimer. Due to its structure, the hopping term of the dimer Hamiltonian enjoys invariance in a family of subspaces indexed by a whole number k, each subspace corresponding to a system of only k particles. We have invented an inductive argument using the bosonic canonical commutation relations to find the eigenvalues and eigenvectors of the dimer hopping Hamiltonian in its k-particle subspaces. In particular, this Hamiltonian, when restricted to one of the k-particle subspaces, is exactly the spin projection operator along the x-axis, where the number of particles k in the dimer system yields the projection matrix for spin quantum number $s = k/2$. Thus, a new method for computing the eigenvalues and eigenvectors of the x-axis spin projector has been unearthed. In this talk, I will outline the mathematical framework used and discuss our argument and results. This talk represents work done in collaboration with Artur Sowa (University of Saskatchewan) and Jonas Fransson (Uppsala University).

MANDANA BIDARVAND, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 207]
Analyzing arrays of qubits via a multi-scale approach

A quantum metamaterial is an engineered structure whose modes of interaction with the environment depend on its quantum state. A prototypical example of such a material is a structure consisting of an array of qubits interacting with the electromagnetic field. Motivated by the challenges of analyzing such structures, we have developed a custom scale-based approach. It furnishes an alternative albeit formally equivalent model of quantum information. Its framework is naturally analytic, rather

than linear-algebraic. It is especially well-suited for the study of the physics of finite as well as infinite arrays of qubits. Foundational to our approach are the Borel isomorphism and the multiresolution analysis in the Haar basis, both of which appear in classical mathematical literature in non-quantum contexts. We use them as devices that enable an identification between $L_2(0,1]$ and the Hilbert space of an infinite array of qubits. In the resulting framework, quantum operations and observables are represented through geometric integral operators. Prior studies demonstrated that in some cases the dynamics of qubit arrays is solvable in the sense that the spectra of crucial operators can be given explicitly. We extend those results and show a path to further systematic explorations. As an unexpected upshot, we observe that the fundamental concept of calculus is inherent in an infinite array of qubits ; indeed, the antiderivative arises as a natural and indispensable operator in this context. In other words, if a mathematical structure encompasses a full theory of the infinite array of qubits, then it can support calculus.

HUBERT DE GUISE, Lakehead University
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 207]
The regular representation of S_n in interference of fermions and bosons

Using tools from group representation theory, I will discuss the coincidence rate of partially-distinguishable particles in an interferometry experiment. In an experiment with n particles (fermions or bosons) the expressions contain blocks of terms for each partition of n ; Gamas's theorem is used to determine which of these terms are automatically zero based on the pairwise level of distinguishability between particles. The computational complexity of the associated group function is introduced to show that, if the known algorithms are used, the problem of evaluating fermionic coincidence rates will contains, with probably close to 1, some functions with cost exponential in n.

This work was done in collaboration with:

- Dylan Spivak, Department of Mathematical Sciences, Lakehead University,
- Murphy Yuezhen Niu, Department of Physics, MIT
- Barry C. Sanders, Institute for Quantum Science and Technology, University of Calgary

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RAINER DICK, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 10:00 – ARTS 207]
Where are the photons ?

The question for a probability measure for photon location is an old and still controversial topic of quantum theory. However, progress in photonics and quantum technology does not care about this debate. Single-photon sources and detectors have been around for decades, and single-photon diffraction has been observed since 2013. In the talk, I intend to provide a summary of the relevant technologies, a description of the problem of photon location, and an overview of different proposals for probability measures for photon location.

JONAS FRANSSON, Uppsala university
[Saturday June 1 / samedi 1er juin, 9:00 – ARTS 207]
Current Induced Spin-Polarization in Chiral Molecules

The inverse spin-galvanic effect, or, current induced spin-polarization is mainly associated with interfaces between different layers in semiconducting heterostructures, surfaces of metals, and bulk semiconducting materials. Here, we theoretically predict that the inverse galvanic effect should also be present in chiral molecules, as a result of the chiral induced spin selectivity effect. As proof-of-principle, we calculate the non-equilibrium properties of a model system which previously has been successfully used to explain a multitude of aspects related to the chiral induced spin selectivity effect. Here we show that current driven spin-polarization in a chiral molecule gives rise to a magnetic moment which is sensitive to external magnet field. The chiral molecule then behaves like a soft ferromagnet. This, in turn, suggests that magnetic permeability measurement in otherwise non-magnetic systems may be used non-invasively to detect the presence of spin-polarized currents.

ELIAS HASSANI, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 17:00 – ARTS 207]
A post-quantum, post-AI data encryption method

We discuss a new symmetric-key cipher for digital data encryption. Its implementations are fast, memory efficient, and resilient against classical, AI-assisted, and quantum attacks. Let x, k, and c be elements of a finite abelian group G with operation $+$ and the neutral element 0. Suppose one is given ciphertext $c = x + k$. Retrieving the plaintext $x = c - k$ from the ciphertext c is trivial when one knows the key k. However, not knowing the key, the task is a blind search. To recover x, we would require an efficient criterion for distinguishing x by its characteristic features, if such were known, from all other group elements. Furthermore, even if one were availed of such a tool, the average number of trials is prohibitively difficult when the group is sufficiently large. The challenge to achieve a real-life implementation of the said schema is to find a very large G, and to construct algorithms enabling an immersion of *real digital data* in G and efficient operations $\pm$. In real life, even more security considerations need to be addressed. We outline a solution for this challenge, characterized by additional desirable features. This is joint work with Artur Sowa, Francis Bui, Grant Harris, and Jonathan Norton (all based at USASK).

MASAHIRO HORI, University of Saskatchewan and quanTA, Tokyo University of Science
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 207]
Multifractal and hyperuniform analysis of quasicrystalline patterns in bosonic systems with and without disorder

The multifractal and hyperuniform analyses are two of the methods to quantify the properties of a nonuniform spatial pattern. Most of nonuniform spatial patterns are either multifractal or hyperuniform. The vertices of random systems are multifractal, while those of all crystals and most quasicrystals are hyperuniform. A quasicrystal can be obtained as projection of a periodic lattice in higher dimensions called a hypercubic lattice onto lower dimensions. The Ammann-Beenker quasicrystal is an example of a two-dimensional quasicrystal, which is projection of a hypercubic lattice in four dimensions. We investigate the effects of quasiperiodicity on physical quantities by using the multifractal and hyperuniform analyses.

In this study, we consider the physical quantities in the Bose-Hubbard model on the Ammann-Beenker tilings. The system shows Mott insulating phase and superfluid phase. In both of these phases, the distribution of the physical quantities is found to be hyperuniform. Moreover, analyzing the order metric that quantifies the complexity of nonuniform spatial patterns, we find that the Ammann-Beenker tilings show a significantly large order metric at a phase boundary, in stark contrast to periodic square lattices. Our results suggest that hyperuniformity is a useful method to differentiate crystalline and quasicrystalline systems.

Next, we introduce on-site random potentials in our model, leading to a Bose glass phase. Contrary to the Mott insulating and superfluid phases, we find that the Bose glass phase is multifractal. To the best of our knowledge, this is the first report of a phase transition between hyperuniform and multifractal phases.

VICKY HOWSE, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 15:30 – ARTS 207]
Vortex 'molecules', a hydrodynamic analog for hadrons

Hydrodynamic analogs constitute a rich field with ties to every area of physics – including quantum foundations, via the walking droplet pilot-wave system and the nascent field of hydrodynamic quantum analogs. Vortex 'molecules', theoretical bound states of fractionally-quantized vortices in multi-component Bose-Einstein condensates (BECs), provide a hydrodynamic analog for hadrons in a theory of SU(2) quantum chromodynamics in 2+1 space-time dimensions. Similarly to the walking droplet system, an oscillatory driving field leads to the unique dynamics: when each component of a BEC is a different hyperfine state of the same atom, one can introduce a Rabi (Josephson) coupling between them, allowing for these states with hadron-like properties. In a two-component BEC, a vortex will be attached by a sine-Gordon soliton to either an antivortex in the same component or to a vortex in the other component, creating a 'meson' or 'baryon', respectively, by analogy. When the connecting soliton is stretched to a critical length, it breaks creating a vortex-antivortex pair, demonstrating confinement of the fractionally-

quantized vortices similarly to quark confinement in QCD. One can identify topological quantities with quantum numbers, i.e. the total circulation or winding with the baryon number, and the winding of the relative phase between the two components with the color charge. The low-energy effective theory of two-component BECs is an extension of Polyakov's dual photon model in 2+1 dimensions, a model which can be obtained as a low-energy effective theory of an SU(2) gauge field similar to QCD.

CHRISTOPHER MAHADEO, University of Illinois at Chicago
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 207]
Quantization in hyperbolic band theory

Recent work by the quanTA center has pioneered the idea of hyperbolic band theory, the mathematical formulation of a new class of quantum materials. In this talk, I will discuss how techniques borrowed from random matrix theory have the potential to produce fascinating results about these materials.

GORDON SARTY, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 207]
A Concept for Direct MRI using Diamonds with Nitrogen Vacancies

Magnetic Resonance Imaging (MRI) is currently achieved by preparing a distribution of phases into the magnetization of the object you want to image. An MRI signal point is then the integration of the magnetization from the object. Many of these spatially encoded signal points are required which are then subsequently Fourier transformed into an image. The many measurements required for this process makes the MRI imaging process slow. However, an object with unencoded magnetization produces a magnetization field in the space surrounding it. Using small sensitive magnetometers, made with Diamonds with Nitrogen Vacancies, we could measure that field and infer the distribution of the magnetization in the object we want to image by solving the inverse problem. The inverse problem is generally ill-posed but the severity of that ill-posed-ness might be reduced with an appropriate distribution of the magnetometers. With that design and an appropriate inverse problem based image reconstruction, instantaneous MRI with only one measurement becomes conceivable and we'd have an MRI version of fluoroscopy.

CARLO MARIA SCANDOLO, University of Calgary
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 207]
Choi-Defined Resource Theories

The resource theories of separable entanglement, non-positive partial transpose entanglement, magic, and imaginarity share an interesting property: an operation is free if and only if its renormalized Choi matrix is a free state. In this talk, I refer to resource theories exhibiting this property as Choi-defined resource theories. I demonstrate how and under what conditions one can construct a Choi-defined resource theory, and I prove that when such a construction is possible, the free operations are all and only the completely resource non-generating operations.

ARTUR SOWA, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 17:00 – ARTS 207]
Wielding the Dirichlet series to analyse the physics of bosons

I will discuss a new mathematical approach to the physics of an infinite array of boson sites. It crucially relies on the Dirichlet series and harmonic analysis on the group of positive rationals. This framework yields nonlocal coherent states (NCS) for the bosonic Fock space. The NCS enable rigorous calculations for a quantum system with infinitely many degrees of freedom. The research has been conducted in collaboration with Jonas Fransson (Department of Physics and Astronomy, Uppsala University).

KAORI TANAKA, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 207]
Gapless topological superconductivity identified by the spectral localiser

Ever since the first discovery of a topological insulator in the integer quantum Hall effect in 1980, topological band theory has played a pivotal role in the discovery and classification of topological insulators, semimetals, and superconductors. Furthermore, recent advances in real-space topological theory has enabled one to calculate local topological markers and identify topological phases in disordered or aperiodic systems such as quasicrystals. However, in metals or other gapless systems, any topological energy eigenstate would be a member of highly degenerate zero-energy eigenstates and thus be mixed strongly with bulk states, making it impossible to identify topological edge states. In this work, we demonstrate the occurrence of gapless topological superconductivity in Ammann-Beenker quasicrystals. Utilising a recently developed, general theory of gapless topological materials, we show that topological states can be characterised by a local Chern number derived from the system's spectral localiser. We explore topological phase diagrams in terms of the local Chern number and possible interplay of topological edge states and confined states in the bulk.

ALEX ZAGOSKIN, Loughborough Universityy
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 207]
Pechukas-Yukawa approach to quantum systems with discrete energy spectra

The success of a perturbation theory expansion is determined by the appropriate choice of the zero-order approximation. The Pechukas-Yukawa formalism provides a promising alternative approach to the description of perturbed quantum systems with discrete energy spectra. It implicitly uses the matrix elements of the Hamiltonian in the basis of exact instantaneous eigenstates rather than the eigenstates of the unperturbed Hamiltonian. In this formalism, the evolution of the energy spectrum due to the perturbation is reduced to the classical dynamics of a 1D gas with cubic repulsion (a modified Calogero-Sutherland model). We develop the kinetic theory of this gas (BBGKY chain of equations for the probability distribution functions), which serves at the basis for the equations for the density matrix of the underlying quantum system.

Mathematics of Machine Learning
Mathématiques de l'apprentissage automatique

Org: Simone Brugiapaglia (Concordia University), **Vakhtang Putkaradze** (University of Alberta) and/et **Hamid Usefi** (Memorial University of Newfoundland)

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, notamment la recherche scientifique, l'industrie et l'élaboration des politiques, ses fondements mathématiques sont encore loin d'être bien compris. En réunissant des chercheurs d'horizons divers, cette session explore les idées émergentes visant à réduire le fossé entre la théorie et la pratique dans ce domaine passionnant et en plein essor.

Schedule/Horaire — Room/Salle: ARTS 213

Saturday June 1 — samedi 1er juin

8:30 - 9:00	Maxim Bazhenov (University of California, San Diego), *Sleep: from biological to artificial systems* (p. 74)
9:00 - 9:30	Martina Neuman (University of Vienna), *Efficient Learning Using Spiking Neural Networks Equipped With Affine Encoders and Decoders* (p. 76)
9:30 - 10:00	Yifan Sun (Stony Brook University), *Learning over very large graphs* (p. 76)
10:00 - 10:30	Anastasis Kratsios (McMaster University), *Pathwise Generalization bounds for Transformers* (p. 75)
15:00 - 15:30	Sandra Zilles (University of Regina), *Formal Models of Active Learning from Contrastive Examples* (p. 77)
15:30 - 16:00	Nick Dexter (Florida State University), *Sample-Efficient Active Learning Strategies for Deep Learning in Scientific Computing* (p. 74)
16:00 - 16:30	Kamyar Khodamoradi (University of Regina), *Parameterized Approximation for Robust Clustering in Discrete Geometric Spaces* (p. 75)
16:30 - 17:00	Osama Bataineh (University of Saskatchewan), *Imprecise Probabilities for Cybersecurity Applications* (p. 73)

Sunday June 2 — dimanche 2 juin

8:30 - 9:00	Anthony Gruber (Sandia National Laboratories), *Learning metriplectic systems and other bracket-based dynamics* (p. 74)
9:00 - 9:30	Vakhtang Putkaradze (University of Alberta), *Lie-Poisson Neural Networks (LPNets): Data-Based Computing of Hamiltonian Systems with Symmetries* (p. 76)
9:30 - 10:00	Samir Karam (Concordia University), *Physics-informed deep learning and compressive collocation for high-dimensional diffusion-reaction equations* (p. 75)
10:00 - 10:30	Open problem session (p. 76)

Abstracts/Résumés

OSAMA BATAINEH, Univ. of Saskatchewan
[Saturday June 1 / samedi 1er juin, 16:30 – ARTS 213]
Imprecise Probabilities for Cybersecurity Applications

In cybersecurity and cryptanalysis, the measurement of cyber-risk is important and crucial for protection against cyberattacks. In cyber threats, probabilistic models can be thought of, and selected to measure the risk of occurrence of cyberattacks and

threats. Imprecise probabilities are used to present the differences in prior beliefs amongst cryptanalysts, on cyber breaches and their probabilities of occurrence. Imprecise probabilities do capitalize the prediction margin of several types of cyber-risk, and can also give the cryptanalyst the opportunity to reduce it. For each threat/attack, there will be lower and upper bound probability estimates, based on implementing Bayesian methods with sets of prior probability distributions. Prior changes will be investigated to test on their impact on posterior distributions of risky cyberattacks. Furthermore, with imprecise probabilities, there is a window to evolve higher Bayesian methods for reducing uncertainty on protection and prediction against cyberattacks.

MAXIM BAZHENOV, UC San Diego
[Saturday June 1 / samedi 1er juin, 8:30 – ARTS 213]
Sleep: from biological to artificial systems

Artificial neural networks are known to exhibit a phenomenon called catastrophic forgetting, where their performance on previously learned tasks deteriorates when learning new tasks sequentially. In contrast, human and animal brains possess the remarkable ability of continual learning, enabling them to incorporate new information while preserving past memories. Empirical evidence indicates that sleep plays a crucial role in the consolidation of recent memories and safeguarding against catastrophic forgetting of previously acquired knowledge. Here we tested the hypothesis that implementing a sleep-like phase in artificial neural networks can protect old memories during new training and alleviate catastrophic forgetting. Sleep was implemented as off-line training with local unsupervised Hebbian plasticity rules and noisy input. In an incremental learning framework, sleep was able to recover old tasks that were otherwise forgotten. Previously learned memories were replayed spontaneously during sleep, forming unique representations for each class of inputs. Representational sparseness and neuronal activity corresponding to the old tasks increased while new task related activity decreased. In the weight space, sleep moved the system towards the region representing the intersection of the loss function minima for individual tasks. Our study sheds light on a potential synaptic weight dynamics strategy employed by the brain during sleep to enhance memory performance for continual learning.

NICK DEXTER, Florida State University
[Saturday June 1 / samedi 1er juin, 15:30 – ARTS 213]
Sample-Efficient Active Learning Strategies for Deep Learning in Scientific Computing

We consider active learning strategies for recovering an unknown object from training data using a given model class. In the active learning scenario, one has the flexibility to choose where to sample the ground truth (or oracle) so as to enhance the generalization performance of the learning algorithm. We introduce a unified framework for this problem that allows for objects in Hilbert spaces, general types of (random) linear measurements as training data and general types of nonlinear model classes. We establish learning guarantees for this framework which provide explicit relations between the amount of training data and properties of the model class to ensure near-best generalization bounds. We demonstrate the efficacy of our framework for gradient-augmented learning with polynomials, Magnetic Resonance Imaging (MRI) using generative models, adaptive sampling for solving PDEs using Physics-Informed Neural Networks (PINNs), and operator learning for uncertainty quantification.

ANTHONY GRUBER, Sandia National Laboratories
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 213]
Learning metriplectic systems and other bracket-based dynamics

The metriplectic formalism is a useful framework for constructing and explaining phenomenological models of physical phenomena. However, general metriplectic equations of motion are highly complicated, relying on delicate compatibility conditions involving the kernels of algebraic brackets. This talk discusses a recent method for machine-learning provably metriplectic dynamics from data in a way that is (1) universally approximating, (2) admits an error estimate, and (3) scales optimally with respect to the number of learnable parameters. Through finite-dimensional benchmark examples, it is shown that the proposed

method is fully expressive and capable of reliably learning metriplectic dynamics, even in cases where only partial state data is observed.

SAMIR KARAM, Concordia University
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 213]
Physics-informed deep learning and compressive collocation for high-dimensional diffusion-reaction equations

On the forefront of scientific computing, Deep Learning (DL), i.e., machine learning with Deep Neural Networks (DNNs), has emerged a powerful new tool for solving Partial Differential Equations (PDEs). It has been observed that DNNs are particularly well suited to weakening the effect of the curse of dimensionality, a term coined by Richard E. Bellman in the late '50s to describe challenges such as the exponential dependence of the sample complexity, i.e., the number of samples required to solve an approximation problem, on the dimension of the ambient space. However, although DNNs have been used to solve PDEs since the '90s, the literature underpinning their mathematical efficiency in terms of numerical analysis (i.e., stability, accuracy, and sample complexity) is only recently beginning to emerge. In this talk, we leverage recent advancements in function approximation using sparsity-based techniques and random sampling to develop and analyze an efficient high-dimensional PDE solver based on DL. We show, both theoretically and numerically, that it can compete with a novel stable and accurate compressive spectral collocation method. In particular, we demonstrate a new practical existence theorem, which establishes the existence of a class of trainable DNNs with suitable bounds on the network architecture and a sufficient condition on the sample complexity, with logarithmic scaling in dimension, such that the resulting networks stably and accurately approximate a diffusion-reaction PDE with high probability.

KAMYAR KHODAMORADI, University of Regina
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 213]
Parameterized Approximation for Robust Clustering in Discrete Geometric Spaces

We consider the well-studied Robust (k, z)-Clustering problem, which generalizes the classic k-Median, k-Means, and k-Centre problems. Given a constant $z \geq 1$, the input to Robust (k, z)-Clustering is a set P of n weighted points in a metric space (M, δ) and a positive integer k. Further, each point belongs to one (or more) of the m many different groups $S_1, S_2, \ldots, S_m$. Our goal is to find a set X of k centres such that $\max_{i\in[m]}\{\sum_{p\in S_i} w(p)\delta(p, X)^z\}$ is minimized. This problem arises in the domains of robust optimization [Anthony, Goyal, Gupta, Nagarajan, Math. Oper. Res. 2010] and in algorithmic fairness, for which a tight (under GAP-ETH) $(3^z + \epsilon)$-approximation algorithm exists [Goyal, Jaiswal, Inf. Proc. Letters, 2023].

Motivated by the tight lower bounds for general discrete metrics, we focus on geometric spaces such as the (discrete) high-dimensional Euclidean setting and metrics of low doubling dimension, which play an important role in data analysis applications. First, for a universal constant $\eta_0 > 0.0006$, we devise a $3^z(1 - \eta_0)$-factor FPT approximation algorithm for discrete high-dimensional Euclidean spaces thereby bypassing the lower bound for general metrics. We complement this result by showing that even the special case of k-Centre in dimension $\Theta(\log n)$ is $(\sqrt{3/2} - o(1))$-hard to approximate for FPT algorithms. Finally, we complete the FPT approximation landscape by designing an FPT $(1 + \epsilon)$-approximation scheme (EPAS) for the metric of sub-logarithmic doubling dimension.

ANASTASIS KRATSIOS, McMaster University and the Vector Institute
[Saturday June 1 / samedi 1er juin, 10:00 – ARTS 213]
Pathwise Generalization bounds for Transformers

We derive non-asymptotic statistical guarantees in this setting through bounds on the *generalization* of a transformer network at a future-time t, given that it has been trained using $N \leq t$ observations from a single perturbed trajectory of a Markov process. Under the assumption that the Markov process satisfies a log-Sobolev inequality, we obtain a generalization bound which effectively converges at the rate of $\mathcal{O}(1/\sqrt{N})$. Our bound depends explicitly on the activation function (Swish, GeLU, or $\tanh$ are considered), the number of self-attention heads, depth, width, and norm-bounds defining the transformer architecture.

Joint work: Blanka Horvath and Yannick Limmer (Oxford Math), Xuwei Yang (McMaster), and Raeid Saqur (U. Toronto and Princeton).

MARTINA NEUMAN, University of Vienna
[Saturday June 1 / samedi 1er juin, 9:00 – ARTS 213]
Efficient Learning Using Spiking Neural Networks Equipped With Affine Encoders and Decoders

We study the learning problem associated with spiking neural networks. Specifically, we consider hypothesis sets of spiking neural networks with affine temporal encoders and decoders and simple spiking neurons having only positive synaptic weights. We demonstrate that the positivity of the weights continues to enable a wide range of expressivity results, including an efficient sorting property, a rate-optimal approximation of smooth functions or approximation without the curse of dimensionality. Moreover, positive-weight spiking neural networks are shown to depend continuously on their parameters which facilitates classical covering number-based generalization statements. Finally, we observe that from a generalization perspective, contrary to feedforward neural networks or previous results for general spiking neural networks, the depth has little to no adverse effect on the generalization capabilities.

OPEN PROBLEM SESSION,
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 213]

VAKHTANG PUTKARADZE, University of Alberta
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 213]
Lie-Poisson Neural Networks (LPNets): Data-Based Computing of Hamiltonian Systems with Symmetries

Physics-Informed Neural Networks (PINNs) have received much attention recently due to their potential for high-performance computations for complex physical systems, including data-based computing, systems with unknown parameters, and others. However, applications of these methods to predict the long-term evolution of systems with little friction, such as many systems encountered in space exploration, oceanography/climate, and many other fields, need extra care as the errors tend to accumulate, and the results may quickly become unreliable. We provide a solution to the problem of data-based computation of Hamiltonian systems utilizing symmetry methods. Many Hamiltonian systems with symmetry can be written as a Lie-Poisson system, where the underlying symmetry defines the Poisson bracket. For data-based computing of such systems, we design the Lie-Poisson neural networks (LPNets). We consider the Poisson bracket structure primary and require it to be satisfied exactly, whereas the Hamiltonian, only known from physics, can be satisfied approximately. By design, the method preserves all special integrals of the bracket (Casimirs) to machine precision. LPNets yield an efficient and promising computational method for many particular cases, such as rigid body or satellite motion (the case of SO(3) group), Kirchhoff's equations for an underwater vehicle (SE(3) group), and others. We also discuss symmetry-reduced computations for cases of incomplete symmetry reduction, such as the dynamics of coupled rigid bodies.

Joint work with Chris Eldred (Sandia National Lab), Francois Gay-Balmaz (CNRS and ENS, France), and Sophia Huraka (U Alberta). The work was partially supported by an NSERC Discovery grant.

YIFAN SUN, Stony Brook Institution
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 213]
Learning over very large graphs

Today, many important learning applications harness data in the form of large graphs. Companies like Amazon, Google, and Facebook use graphs to link similar or related entities; these graphs often have millions or billions of nodes, and are not stored on a single server, but over distributed systems. On the other hand, many graph learning methods today rely on an offline large matrix inversion, where the matrix is the size of the graph itself; this is computationally infeasible in the aforementioned application.

In this talk, we will consider graph learning through the lens of online node label prediction, and its close relationship to fast Laplacian matrix inversion. We introduce *local methods*, of whose complexity is independent of the graph size, and show its promise in large graph learning ; the most famous is the approximate page-rank algorithm used in many web applications. We then discuss the fundamental issues in developing local graph methods, such as acceleration, parallelization, and their integration in scalable large graph learning.

SANDRA ZILLES, University of Regina
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 213]
Formal Models of Active Learning from Contrastive Examples

Machine learning can greatly benefit from providing learning algorithms with pairs of contrastive training examples—typically pairs of instances that differ only slightly, yet have different class labels. Intuitively, the difference in the instances serves as a means of explaining the difference in the class labels. This presentation proposes a theoretical framework in which the effect of various types of contrastive examples on active learners is studied formally. The focus is on the sample complexity of learning concept classes and how it is influenced by the choice of contrastive examples. Specific concept classes we study consist either of geometric concepts or of Boolean functions. Interestingly, we reveal a connection between learning from contrastive examples and the classical model of self-directed learning. (Joint work with Yuxin Chen, Farnam Mansouri, Hans U. Simon, and Adish Singla.)

Moduli Spaces in Complex and Algebraic Geometry: Recent Developments
Espaces de modules en géométrie complexe et algébrique : Développements récents

Org: Robert Cornea and/et **Ruxandra Moraru** (University of Waterloo)

Moduli spaces serve as fundamental objects of study in geometry, providing a framework for understanding the space of solutions to geometric and algebraic problems. These spaces encapsulate the diverse geometric and algebraic structures that arise naturally in mathematics and physics, offering insights into their behavior. The purpose of this session is to explore recent developments in the study of moduli spaces in both complex and algebraic geometry.

Les espaces de modules sont des objets d'étude fondamentaux en géométrie, fournissant un cadre pour comprendre l'espace des solutions aux problèmes géométriques et algébriques. Ces espaces englobent les diverses structures géométriques et algébriques qui apparaissent naturellement en mathématiques et en physique, offrant un aperçu de leur comportement. Le but de cette session est d'explorer les développements récents dans l'étude des espaces de modules en géométrie complexe et algébrique.

Schedule/Horaire **Room/Salle: ARTS 211**

Saturday June 1 — samedi 1er juin

8:30 - 9:00	Lisa Jeffrey (University of Toronto), *Character Varieties* (p. 80)
9:00 - 9:30	Francis Bischoff (University of Regina), *The derived moduli stack of logarithmic flat connections* (p. 79)
9:30 - 10:00	Steve Rayan (University of Saskatchewan), *Resolutions of finite quotient singularities and quiver varieties* (p. 81)
10:00 - 10:30	Emily Cliff (Universite de Sherbrooke), *Moduli spaces of principal 2-group bundles and a categorification of the Freed–Quinn line bundle* (p. 79)
15:00 - 15:30	Derek Krepski (University of Manitoba), *Lie 2-algebras of infinitesimal symmetries of bundle gerbes* (p. 80)
15:30 - 16:00	Eric Boulter (University of Saskatchewan), *Co-Higgs bundles on Hopf surfaces* (p. 79)
16:00 - 16:30	Kuntal Banerjee (University of Saskatchewan), *A generalized spectral correspondence* (p. 79)
16:30 - 17:00	Christopher Mahadeo (University of Illinois at Chicago), *Topological recursion and twisted Higgs bundles* (p. 81)
17:00 - 17:30	Haggai Liu (Simon Fraser University), *Moduli Spaces of Weighted Stable Curves and their Fundamental Groups* (p. 80)

Sunday June 2 — dimanche 2 juin

8:30 - 9:00	Thomas Baird (Memorial University of Newfoundland), *Anti-symplectic involutions of the Hilbert scheme of points on a symplectic surface* (p. 78)
9:00 - 9:30	Elana Kalashnikov (University of Waterloo), *Degenerations of Kronecker moduli spaces* (p. 80)
9:30 - 10:00	Mohsen Karkheiran (University of Alberta), *Heterotic-II duality from mirror symmetry.* (p. 80)
10:00 - 10:30	Benoit Charbonneau (University of Waterloo), *Deformed Hermitian-Yang-Mills on full flags* (p. 79)

Abstracts/Résumés

THOMAS BAIRD, Memorial University
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 211]
Anti-symplectic involutions of the Hilbert scheme of points on a symplectic surface

Let S be a smooth quasi-projective complex surface. The Hilbert scheme of n points in S, denoted $S^{[n]}$, is a smooth $2n$-dimensional variety which contains the variety of n distinct unordered points as a dense open subvariety.

If S is a symplectic, then $S^{[n]}$ is naturally symplectic. Given an anti-symplectic involution of S, there is an induced involution on $S^{[n]}$ whose fixed point locus is a smooth Lagrangian submanifold. In this talk I explain how to calculate its cohomology and mixed Hodge structure. For the special case $S = \mathbb{C}^2$, this is done using a Morse theory argument borrowed from Ellingsrud-Stromme. For the general case, we adapt an approach due to Gottsche-Soergel involving perverse sheaves.

KUNTAL BANERJEE, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 211]
A generalized spectral correspondence

We explore a strong categorical correspondence between isomorphism classes of sheaves of arbitrary rank on a given algebraic curve and twisted pairs on another algebraic curve. We aim to generalize the language of classical spectral correspondence by the annihilating polynomials of pairs. In a particular application, we realize a generic elliptic curve as a spectral cover of the complex projective line and then construct examples of cyclic twisted pairs and co-Higgs bundles on the same curve. Afterwards, by appealing to a composite push-pull projection formula, we explore an iterated version of spectral correspondence for a particular class of spectral covers of the complex projective line through Galois-theoretic arguments. Our explanation relies upon a classification of Galois groups into primitive and imprimitive types. In this context, we revisit a classical theorem of Ritt. This is a joint work with Steven Rayan.

FRANCIS BISCHOFF, University of Regina
[Saturday June 1 / samedi 1er juin, 9:00 – ARTS 211]
The derived moduli stack of logarithmic flat connections

I will present an explicit finite-dimensional model for the derived moduli stack of flat connections on $\mathbb{C}^k$ with logarithmic singularities along a weighted homogeneous Saito free divisor. I will focus in particular on the example of plane curve singularities of the form $x^p = y^q$ and I will discuss the relationship of these moduli spaces with the character varieties of hypersurface complements.

ERIC BOULTER, University of Waterloo
[Saturday June 1 / samedi 1er juin, 15:30 – ARTS 211]
Co-Higgs bundles on Hopf surfaces

Co-Higgs bundles are a variant of Higgs bundles where the twisting bundle is chosen to be the holomorphic tangent bundle instead of the cotangent bundle. We will look at the classification of co-Higgs bundles on a particular family of complex surfaces and discuss how co-Higgs bundles on these surfaces lead to examples of compact holomorphic Poisson 3-folds. Based on joint work with Ruxandra Moraru.

BENOIT CHARBONNEAU, University of Waterloo
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 211]
Deformed Hermitian-Yang-Mills on full flags

With Gonçalo Oliveira and Rosa Sena-Dias, we study the deformed Hermitian-Yang-Mills equation on the full flag manifold, both in rank one and in higher rank.

EMILY CLIFF, Université de Sherbrooke
[Saturday June 1 / samedi 1er juin, 10:00 – ARTS 211]
Moduli spaces of principal 2-group bundles and a categorification of the Freed–Quinn line bundle

A 2-group is a categorified version of a group: a category with a multiplication operator, for which all group axioms hold up to natural isomorphism. Similarly, there is a notion of principal bundle for a 2-group. We define the moduli space of principal 2-group bundles, and prove that it is gives a 2-fibration over the moduli space of principal bundles for an ordinary group G. Moreover, when G is finite, this 2-fibration provides a categorification of the Freed–Quinn line bundle, a mapping class group equivariant line bundle arising in Dijkgraaf–Witten theory for the finite group G. This is joint work with Daniel Berwick-Evans, Laura Murray, Apurva Nakade, and Emma Phillips.

LISA JEFFREY, University of Toronto
[Saturday June 1 / samedi 1er juin, 8:30 – ARTS 211]
Character Varieties

Character varieties can be regarded in terms of flat connections on oriented 2-manifolds, or in terms of representations of the fundamental group of a 2-manifold into a Lie group. They have a Poisson structure. The Poisson structure was originally defined by Bill Goldman (1984) or Atiyah-Bott (1983).

I will outline the origin of the Poisson structure. I will also describe how to define an almost complex structure on the symplectic leaves, in some situations.

Some parts of the material presented are joint with Indranil Biswas, Jacques Hurtubise and Sean Lawton. Other parts are joint with Yukai Zhang.

ELANA KALASHNIKOV, University of Waterloo
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 211]
Degenerations of Kronecker moduli spaces

Kronecker moduli spaces are simple, and yet much more complicated, generalizations of type A Grassmannians. In this talk, I'll explain recent joint work with Liana Heuberger on the structure of the Cox ring of Kronecker moduli spaces, and applications to degenerations and mirror symmetry.

MOHSEN KARKHEIRAN, University of Alberta
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 211]
Heterotic-II duality from mirror symmetry.

The four dimensional duality between type IIA and Heterotic string theories is well known for decades. This duality involves the degeneration of Calabi-Yau manifolds which are similar to the DHT conjecture in mirror symmetry. In this work we show this duality is indeed closely related to mirror symmetry, and we investigate the consequences of that.

DEREK KREPSKI, University of Manitoba
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 211]
Lie 2-algebras of infinitesimal symmetries of bundle gerbes

In this talk, we discuss how the infinitesimal symmetries of a bundle gerbe over a smooth manifold M naturally form a Lie 2-algebra. These symmetries are closely related to Lie 2-algebras naturally associated to a closed 3-form $\chi \in \Omega^3(M)$: the Poisson Lie 2-algebra of observables on a 2-plectic manifold (M, χ), the Lie 2-algebra of sections of the exact Courant algebroid $TM \oplus T^*M$ with χ-twisted Courant bracket, and the so-called Atiyah Lie 2-algebra associated to the Lie algebra action of vector fields on smooth functions. This is joint work with Jennifer Vaughan and Dinamo Djounvouna.

Moduli Spaces in Complex and Algebraic Geometry: Recent Developments
Espaces de modules en géométrie complexe et algébrique : Développements récents

HAGGAI LIU, Simon Fraser University
[Saturday June 1 / samedi 1er juin, 17:00 – ARTS 211]
Moduli Spaces of Weighted Stable Curves and their Fundamental Groups

The Deligne-Mumford compactification, $\overline{M_{0,n}}$, of the moduli space of n distinct ordered points on $\mathbb{P}^1$, has many well understood geometric and topological properties. For example, it is a smooth projective variety over its base field. Many interesting properties are known for the manifold $\overline{M_{0,n}}(\mathbb{R})$ of real points of this variety. In particular, its fundamental group, $\pi_1(\overline{M_{0,n}}(\mathbb{R}))$, is related, via a short exact sequence, to another group known as the cactus group. Henriques and Kamnitzer gave an elegant combinatorial presentation of this cactus group.

In 2003, Hassett constructed a weighted variant of $\overline{M_{0,n}}(\mathbb{R})$: For each of the n labels, we assign a weight between 0 and 1; points can coincide if the sum of their weights does not exceed one. We seek combinatorial presentations for the fundamental groups of Hassett spaces with certain restrictions on the weights. In particular, we express the Hassett space as a blow-down of $\overline{M_{0,n}}$ and modify the cactus group to produce an analogous short exact sequence. The relations of this modified cactus group involves extensions to the braid relations in S_n. To establish the sufficiency of such relations, we consider a certain cell decomposition of these Hassett spaces, which are indexed by ordered planar trees.

CHRISTOPHER MAHADEO, University of Illinois at Chicago
[Saturday June 1 / samedi 1er juin, 16:30 – ARTS 211]
Topological recursion and twisted Higgs bundles

Prior works relating meromorphic Higgs bundles to topological recursion have considered non-singular models that allow the recursion to be carried out on a smooth Riemann surface. I will discuss some recent work where we define a "twisted topological recursion" on the spectral curve of a twisted Higgs bundle, and show that the g=0 components of the twisted recursion relate to the Taylor expansion of the period matrix of the spectral curve, mirroring a result of for ordinary Higgs bundles and topological recursion.

STEVE RAYAN, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 211]
Resolutions of finite quotient singularities and quiver varieties

Finite quotient singularities have a long history in mathematics, intertwining algebraic geometry, hyperkähler geometry, representation theory, and integrable systems. I will highlight the correspondences at play here and how they culminate in Nakajima quiver varieties, a class of moduli spaces that provide a useful testing ground for ideas in geometric representation theory and physics. I will motivate some recent work of G. Bellamy, A. Craw, T. Schedler, H. Weiss, and myself in which we show that, remarkably, all of the resolutions of a particular finite quotient singularity are realized as a certain Nakajima quiver variety, namely that of the 5-pointed star-shaped quiver. I will place this work in the wider context of the search for McKay-type correspondences for finite subgroups of SL(n,$\mathbb{C}$) on the one hand, and of the construction of finite-dimensional-quotient approximations to meromorphic Hitchin systems and their integrable systems on the other hand. The Hitchin system perspective draws upon my prior joint works with each of J. Fisher and L. Schaposnik, respectively. Time permitting, I will speculate upon the symplectic duality of Higgs and Coulomb branches in this setting.

Number theory by early career researchers
Théorie des nombres par les chercheurs en début de carrière

Org: Félix Baril Boudreau (University of Lethbridge) and/et **Nicolo Fellini** (Queen's University)

This session aims to give a platform to graduating PhD students, recently graduated PhD holders and postdocs to showcase their research in the field of Number Theory. We hope that this will be a great opportunity to exchange ideas, network and gain exposure to different subjects in number theory. We plan to consider all contributions in algebraic, analytic, computational and elementary number theory, as well as arithmetic geometry.

Cette session a pour but de donner une plateforme aux doctorants en fin d'études, aux titulaires de doctorats récemment diplômés et aux postdocs pour présenter leurs recherches dans le domaine de la théorie des nombres. Nous espérons que ce sera une excellente occasion d'échanger des idées, de travailler en réseau et de se familiariser avec les différents sujets de la théorie des nombres. Nous prévoyons d'examiner toutes les contributions en théorie algébrique, analytique, computationnelle et élémentaire des nombres, ainsi qu'en géométrie arithmétique.

Schedule/Horaire **Room/Salle: ARTS 210**

Saturday June 1 **samedi 1er juin**

8:30 - 9:00	Nic Fellini (Queen's University), *Congruence relations for class numbers of real quadratic fields* (p. 83)
9:00 - 9:30	Fatemeh Jalavand (University of Calgary), *Geometry of log-unit lattices* (p. 83)
9:30 - 10:00	Alexander Slamen (University of Toronto), *A Twisted Variant of Malle's Conjecture* (p. 84)
10:00 - 10:30	Naik Sunil (Queen's University), *On some problems in Matsuda monoids* (p. 85)
15:00 - 15:30	Abhishek Bharadwaj (Queen's University), *On a conjecture of Erdős* (p. 82)
15:30 - 16:00	Enrique Nuñez Lon-wo (University of Toronto), *On the Density of Quadratic Fields with Group of Units in Non-Maximal Orders* (p. 84)
16:00 - 16:30	Zhenchao Ge (University of Waterloo), *Irregularities of Dirichlet L-functions and a parity bias in gaps of zeros* (p. 83)
16:30 - 17:00	Shuyang Shen (University of Toronto), *Enumerative Galois Theory for Trinomials* (p. 84)
17:00 - 17:30	Yuxuan Sun (University of Toronto), *Approximation Constants and Curves of Best Approximation of Points on Weighted Projective Surfaces* (p. 85)

Sunday June 2 **dimanche 2 juin**

8:30 - 9:00	Jérémy Champagne (University of Waterloo), *Weyl's equidistribution theorem in function fields* (p. 83)
9:00 - 9:30	William Verreault (University of Toronto), *Moments of random multiplicative functions over functions fields* (p. 85)
9:30 - 10:00	Paul Péringuey (University of British Columbia), *Refinements of Artin's primitive root conjecture* (p. 84)
10:00 - 10:30	Greg Knapp (University of Calgary), *Exponential Relations Among Algebraic Integer Conjugates* (p. 84)

Abstracts/Résumés

ABHISHEK BHARADWAJ, Queen's University
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 210]
On a conjecture of Erdős

In a written communication to Livingston, Paul Erdős proposed the following conjecture:
If N is a positive integer and f is an arithmetic function with period N and $f(n) \in \{-1, 1\}$ when $n = 1, 2, \ldots, N-1$ and $f(n) = 0$ whenever $n \equiv 0 \bmod N$ then $\sum_{n \geq 1} \frac{f(n)}{n} \neq 0$.

We describe the literature around this conjecture, and mention some new results. This is an ongoing joint work with Ram Murty and Siddhi Pathak.

JÉRÉMY CHAMPAGNE, University of Waterloo
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 210]
Weyl's equidistribution theorem in function fields

Finding a proper function field analogue to Weyl's theorem on the equidistribution of polynomial sequences is a problem that was originally considered by Carlitz in 1952. As noted by Carlitz, Weyl's classical differencing methods can only handle polynomials with degree less than the characteristic of the field. In this talk, we discuss some recent methods which avoid this "characteristic barrier", and we show the existence of polynomials with extremal equidistributive behaviour.

This is joint work with Yu-Ru Liu, Thái Hoàng Lê and Trevor D. Wooley.

NIC FELLINI, Queen's University
[Saturday June 1 / samedi 1er juin, 8:30 – ARTS 210]
Congruence relations for class numbers of real quadratic fields

In 1951, Ankeny, Artin, and Chowla released a short note containing four congruence relations involving the arithmetic invariants of $\mathbb{Q}(\sqrt{d})$ for $d = 1 \bmod 4$. They proved three of these relations the following year, in a paper published in the Annals of Mathematics. Their proof uses a combination of p-adic and group ring theoretic methods. In this talk I will indicate how p-adic L-functions can be used to obtain congruence relations involving the arithmetic invariants of $\mathbb{Q}(\sqrt{d})$ for an arbitrary squarefree integer $d > 2$. Specialization of the main result will yield the congruences of Ankeny, Artin, and Chowla as well as a stronger version of a theorem of Mordell.

ZHENCHAO GE, University of Waterloo
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 210]
Irregularities of Dirichlet L-functions and a parity bias in gaps of zeros

The integral of Hardy's Z-function from 0 to T measures the occurrence of its sign changes. Hardy proved that this integral is $o(T)$ from which he deduced that the Riemann zeta-function has infinitely many zeros on the critical line. A. Ivić conjectured this integral is $O(T^{1/4})$ and $\Omega_{\pm}(T^{1/4})$ as $T \to \infty$. These estimates were proved, independently, by M. A. Korolev and M. Jutila.

In this talk, we will show that the analogous conjecture is false for the Z-functions of certain "special" Dirichlet L-functions. In particular, we show that the integral of the Z-function of a Dirichlet L-functions from 0 to T is asymptotic to $c_\chi T^{3/4}$ and we classify precisely when the constant c_χ is nonzero. Experimentally, we find that the L-functions in this (thin) family have a significant and previously undetected bias in the distribution of gaps between their zeros. These phenomena appear to have an arithmetic explanation that corresponds to the non-vanishing of a certain Gauss- type sum.

This is joint work with Jonathan Bober and Micah Milinovich.

FATEMEH JALAVAND, University of Calgary
[Saturday June 1 / samedi 1er juin, 9:00 – ARTS 210]
Geometry of log-unit lattices

The log-unit lattice of a number field is the image of the units of the ring of integers under Minkowski embedding in $\mathbb{R}^n$. Computing the log unit lattice (or a fundamental unit) of a number field is a hard problem and is linked to the problem of computing class numbers which is one of the main tasks of computational algebraic number theory. Knowing the geometry of these lattices may help us to find better ways to compute them.

In this talk, we will discuss the geometry of these lattices. Among different properties, orthogonality and well-roundedness of these lattices are two properties that are more interesting to us. As an example, we will discuss the geometry and shortest vectors of log-unit lattices of totally real biquadratic fields. This is an ongoing project with Jose Cruz.

GREG KNAPP, University of Calgary
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 210]
Exponential Relations Among Algebraic Integer Conjugates

Products of the form $\alpha_1^{c_1} \cdots \alpha_n^{c_n}$ where the α_i are algebraic are of interest across much of number theory, especially since Baker's results on linear forms in logarithms are widely applicable. In this talk, we explore the scenario where $\alpha_1, \ldots, \alpha_n$ consist only of algebraic integer conjugates, though the α_i need not comprise a full set of algebraic integer conjugates. In particular, for some integers $d \geq 2$ and $1 \leq k \leq d-1$ we describe the set $E_{k,d}$ of all tuples $(c_2, \ldots, c_{k+1}) \in (\mathbb{R}_{\geq 0})^k$ for which $|\alpha_1||\alpha_2|^{c_2} \cdots |\alpha_{k+1}|^{c_{k+1}} \geq 1$ for every tuple of degree d algebraic integer conjugates $\alpha_1, \ldots, \alpha_d$ which are written in descending order of absolute value. Furthermore, for any fixed tuple $(c_2, \ldots, c_{k+1}) \in E_{k,d}$, we ask whether or not there exists a tuple of degree d algebraic integer conjugates $\alpha_1, \ldots, \alpha_d$ (written in descending order of absolute value) so that $|\alpha_1||\alpha_2|^{c_2} \cdots |\alpha_{k+1}|^{c_{k+1}} = 1$. If there does not exist such a tuple, we ask if we can find lower bounds on the quantity $|\alpha_1||\alpha_2|^{c_2} \cdots |\alpha_{k+1}|^{c_{k+1}} - 1$. This talk features joint work with Seda Albayrak, Samprit Ghosh, and Khoa Nguyen.

ENRIQUE NUÑEZ LON-WO, University of Toronto
[Saturday June 1 / samedi 1er juin, 15:30 – ARTS 210]
On the Density of Quadratic Fields with Group of Units in Non-Maximal Orders

For a quadratic number field $K = \mathbf{Q}(\sqrt{d})$ we explore how often $\mathcal{O}_K$ has its group of units in a sub-order $\mathcal{O}$. In particular, when $d \equiv 1 \pmod 4$, we find a lower bound on the lower density of the square-free d such that $\mathbf{Z}[\frac{1+\sqrt{d}}{2}]^\times \neq \mathbf{Z}[\sqrt{d}]^\times$.

PAUL PÉRINGUEY, University of British Columbia
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 210]
Refinements of Artin's primitive root conjecture

Let $\mathrm{ord_p(a)}$ be the order of a in $(\mathbb{Z}/p\mathbb{Z})^*$. In 1927 Artin conjectured that the set of primes p for which an integer $a \neq -1, \square$ is a primitive root (i.e. $\mathrm{ord_p(a)} = \mathrm{p} - 1$) has a positive asymptotic density among all primes. In 1967 Hooley proved this conjecture assuming the Generalized Riemann Hypothesis.

In this talk we will study the behaviour of $\mathrm{ord_p(a)}$ as p varies over primes, in particular we will show, under GRH, that the set of primes p for which $\mathrm{ord_p(a)}$ is "k prime factors away" from $p-1$ has a positive asymptotic density among all primes except for particular values of a and k. We will interpret being "k prime factors away" in three different ways, namely $k = \omega(\frac{p-1}{\mathrm{ord_p(a)}})$, $k = \Omega(\frac{p-1}{\mathrm{ord_p(a)}})$ and $k = \omega(p-1) - \omega(\mathrm{ord_p(a)})$, and present conditional results analogous to Hooley's in all three cases and for all integer k.

This is joint work with Leo Goldmakher and Greg Martin.

SHUYANG SHEN, University of Toronto
[Saturday June 1 / samedi 1er juin, 16:30 – ARTS 210]
Enumerative Galois Theory for Trinomials

Much work has been dedicated to studying the frequency of polynomials with given Galois groups. In this talk, we will discuss our approach to this problem for trinomials in particular, and prove bounds for the density of trinomials with certain Galois groups.

Number theory by early career researchers
Théorie des nombres par les chercheurs en début de carrière

ALEXANDER SLAMEN, University of Toronto
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 210]
A Twisted Variant of Malle's Conjecture

This talk is based on joint work with Brandon Alberts, Helen Grundman, Shilpi Mandal, and Amanda Tucker. Malle's conjecture predicts an asymptotic growth rate for the count of number fields (with a particular Galois group) ordered by discriminant. In the twisted variant, we further stratify the count by demanding that certain fields arise as fixed subfields. This is "twisted" because such extensions are parametrized by particular Galois cohomologies with twisted coefficients. In this talk, I will explore Galois cohomological and embedding-theoretic approaches to the twisted form of Malle's conjecture. We focus on the case of D_8-fields with particular quadratic field fixed by D_4.

YUXUAN SUN, University of Toronto
[Saturday June 1 / samedi 1er juin, 17:00 – ARTS 210]
Approximation Constants and Curves of Best Approximation of Points on Weighted Projective Surfaces

Traditionally, the study of Diophantine approximation involves measuring how well a real number may be approximated by rational numbers using a quantity called the approximation exponent. Over the nineteenth and early twentieth centuries, the approximation exponent of irrational algebraic numbers was refined by many mathematicians, and Klaus Roth (1955) determined that the approximation exponent is 2 for all irrational algebraic numbers. In 2015, David McKinnon and Mike Roth introduced approximation constants for points on algebraic varieties, thereby generalizing the idea of Diophantine approximation via approximation exponents to arbitrary varieties. Further, the approximation constant of a point may be associated to its curves of best approximation, which is a program proposed by McKinnon in 2007.

In this talk, I will present results from a joint project with David McKinnon, Rindra Razafy and Matthew Satriano computing lower bounds of approximation constants of points on a class of weighted projective surfaces. Our technique was based on estimating a related geometric invariant called the effective threshold. I will explain how our lower bounds give useful information about approximation constants of points on the respective surfaces, as well as how one may use these bounds to construct good estimates of curves of best approximation to the respective points. Finally, if I have time, I will present an example where our construction gives a curve of best approximation, as well as an example where the curve of best approximation does not match our construction.

NAIK SUNIL, Queen's University
[Saturday June 1 / samedi 1er juin, 10:00 – ARTS 210]
On some problems in Matsuda monoids

Let F be a field and M be a commutative, torsion-free, cancellative monoid. Let $F[X;M]$ denote the ring of all polynomials with coefficients in F and exponents in M. We say that M is a Matsuda monoid if for every indivisible element α in M, the polynomial $X^\alpha - 1$ is irreducible in $F[X;M]$ for any field F. In this talk, we will discuss recent work on Matsuda monoids that leads to questions in analytic number theory.

WILLIAM VERREAULT, University of Toronto
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 210]
Moments of random multiplicative functions over functions fields

Little is known about the distribution of the partial sums of random multiplicative functions defined over integers, but the order of magnitude of all moments has been recently determined by Harper. Building on recent work extending multiplicative and probabilistic number theory to the function field setting, we study the even natural moments of partial sums of Steinhaus and Rademacher random multiplicative functions defined over function fields. Using analytic arguments that parallel previous work

over the integers as well as new combinatorial arguments special to the function field setting, we obtain an exact expression for the fourth moment and an asymptotic expression for the higher natural moments in the limit as $qN \to \infty$.

Numerical Methods for and with Special Functions
Méthodes numériques pour et avec des fonctions spéciales

Org: James Bremer (University of Toronto), **Timon Gutleb** (University of British Columbia) and/et **Richard Slevinsky** (University of Manitoba)

Special functions are ubiquitous in mathematical applications and play a key role in many numerical algorithms. This session provides an overview of the state-of-the-art in computing special functions, hypergeometric functions and more and presents novel ways to utilize them in a computational context.

Les fonctions spéciales sont omniprésentes dans les applications mathématiques et jouent un rôle clé dans de nombreux algorithmes numériques. Cette session donne un aperçu des avancées en matière de calcul des fonctions spéciales, des fonctions hypergéométriques et autres, et présente de nouvelles façons de les utiliser dans un contexte informatique.

Schedule/Horaire **Room/Salle: ARTS 200**

Saturday June 1 — samedi 1er juin

8:00 - 8:30	James Bremer (University of Toronto), *Frequency-indepedent solvers for linear ODEs* (p. 88)
8:30 - 9:00	Amparo Gil (University of Cantabria (Universidad de Cantabria (UniCan))), *Computation and inversion of some cumulative distribution functions* (p. 88)
9:00 - 9:30	Javier Segura (University of Cantabria (Universidad de Cantabria (UniCan)), *Computation of classical Gaussian quadratures and associated barycentric interpolation* (p. 90)
9:30 - 10:00	Diego Ruiz-Antolín (University of Cantabria (Universidad de Cantabria (UniCan)), *Asymptotic and numerical approximations to the zeros of parabolic cylinder functions* (p. 89)
10:00 - 10:30	Richard M. Slevinsky (University of Manitoba), *Fast and stable rational approximation of generalized hypergeometric functions* (p. 90)
15:00 - 15:30	Tom Trogdon (University of Washington), *Some old and new perspectives on the convergence of spectral methods* (p. 90)
16:00 - 16:30	Cade Ballew (University of Washington), *Numerical solutions of Riemann–Hilbert problems on disjoint intervals* (p. 87)
16:30 - 17:00	Mohan Zhao (University of Toronto), *The Approximation of Singular Functions by Series of Non-integer Powers* (p. 90)

Sunday June 2 — dimanche 2 juin

8:00 - 8:30	Cecile Piret (Michigan Technological University), *Computing generalized hypergeometric functions in the complex plane using an end-corrected trapezoidal rule* (p. 89)
8:30 - 9:00	Mohammad Hamdan (University of New Brunswick), *Polynomials of the Higher Derivatives of the Nield-Kuznetsov Integral Function* (p. 89)
9:00 - 9:30	Thomas Bothner (University of Bristol), *Universality for random matrices with an edge spectrum singularity* (p. 88)
9:30 - 10:00	Timon S. Gutleb (University of British Columbia), *A frame approach for equations involving the fractional Laplacian* (p. 88)

Abstracts/Résumés

CADE BALLEW, University of Washington
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 200]
Numerical solutions of Riemann–Hilbert problems on disjoint intervals

We present a general approach to numerically compute the solutions of Riemann–Hilbert problems with jump conditions supported on disjoint intervals. Applied to the Fokas–Its–Kitaev Riemann–Hilbert problem, this enables the computation of Chebyshev-like polynomials on multiple intervals, requiring only $\mathrm{O}(N)$ arithmetic operations to compute the first N recurrence coefficients. Moreover, expansions in these orthogonal polynomials yield a novel iterative method for solving indefinite linear systems and computing matrix functions. This method applies in settings where classical polynomial approximations behave poorly and are therefore not applicable. We also discuss an application to the computation of finite-genus and soliton gas solutions of the Korteweg–de Vries equation.

THOMAS BOTHNER, University of Bristol
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 200]
Universality for random matrices with an edge spectrum singularity

We study invariant random matrix ensembles defined on complex Hermitian matrices with a single root type singularity and one-cut regular density of states. Assuming that the singularity lies within the soft edge boundary layer we compute asymptotics of the model's generating functional by using Riemann-Hilbert problems for orthogonal polynomials and integrable operators. This extends an old result by Forrester and Witte and is based on ongoing joint work with Toby Shepherd (Bristol).

JAMES BREMER, University of Toronto
[Saturday June 1 / samedi 1er juin, 8:00 – ARTS 200]
Frequency-indepedent solvers for linear ODEs

I will discuss a class of solvers for linear scalar ordinary differential equations which run in time bounded independent of frequency. They operate by producing exponential representations of a basis in the space of solutions of the equation. These exponential representations can be used to rapidly evaluate any desired solution of the differential equation at any point in the solution domain with accuracy on the order of the condition number of the problem. I will also present a theorem which bounds the complexity of the exponential representations as a function of a measure of the complexity of the equation's coefficients.

I will discuss applications of this work to the numerical evaluation of special functions and the numerical solution of Sturm-Liouville problems.

AMPARO GIL, Universidad de Cantabria
[Saturday June 1 / samedi 1er juin, 8:30 – ARTS 200]
Computation and inversion of some cumulative distribution functions

Some special functions hold particular importance in Applied Probability and Statistics. Notably, the incomplete gamma and beta functions serve as (with normalization factors) the cumulative central gamma and beta distribution functions, respectively. Additionally, the corresponding noncentral distributions—like the Marcum-Q function and the cumulative noncentral beta distribution function—play significant roles across various applications. These functions' inversion proves valuable in hypothesis testing and random sample generation following the respective probability density functions.

In this talk we describe developments in the asymptotic and numerical computation and inversion of the beta cumulative distribution function (both central and non-central). The effectiveness of these methods will be demonstrated through numerical examples.

Joint work with Javier Segura and Nico M. Temme.

TIMON S. GUTLEB, University of British Columbia
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 200]
A frame approach for equations involving the fractional Laplacian

Exceptionally elegant hypergeometric formulae exist for the fractional Laplacian operator applied to weighted classical orthogonal polynomials. We utilize these results to construct a spectral method based on frame properties for solving equations involving the fractional Laplacian on whole space.

MOHAMMAD HAMDAN, University of New Brunswick
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 200]
Polynomials of the Higher Derivatives of the Nield-Kuznetsov Integral Function

M.H. Hamdan and T.L. Alderson Abstract Airy's functions of the first and second kinds represent two linearly independent solutions to the homogeneous Airy's equation. Airy's polynomials arise when one considers higher derivatives of Airy's functions or derivatives of their products. Airy's functions and associated polynomials are of importance in the study of circuit theory, systems theory and signal processing and arise in solutions to Stark, Schrodinger, and Tricomi's equations. Many differential equations in quantum theory can be reduced to Airy's equation by an appropriate change of variables, thus adding to the importance of studies of Airy's and related functions.

The inhomogeneous Airy's equation has been shown to have a particular solution expressible in terms of the Nield-Kuznetsov integral function, defined in terms of Airy's functions and their integrals. Associated with higher derivatives of the Nield-Kuznetsov function are three sets of polynomials of non-equal degrees that are functions of the order of the derivative involved. Two of the arising sets of polynomials are Airy's polynomials, while the third set arises from coefficients of the Wronskian of Airy's functions. This Wronskian appears in the Nield-Kuznetsov function and its derivatives. Our objective are: 1) Analyze the Nield-Kuznetsov polynomials and express them in terms of the Nield-Kuznetsov first derivative. 2) Implement the resulting polynomials in expressing the Nield-Kuznetsov function in terms of Bessel functions. 3) Derive ascending series and asymptotic series expressions of the Nield-Kuznetsov function in terms of arising polynomials and use them in computations of these functions.

CECILE PIRET, Michigan Technological University
[Sunday June 2 / dimanche 2 juin, 8:00 – ARTS 200]
Computing generalized hypergeometric functions in the complex plane using an end-corrected trapezoidal rule

Generalized hypergeometric functions ${}_pF_q$ are ubiquitous in the scientific and engineering fields, for which their accurate evaluation is essential. Although a myriad of algorithms exists for their evaluation in the complex plane, most commonly with low parameters p and q, no general framework exists that is adaptable to low and high p and q values, wide ranges of coefficients, and small to large evaluation domains. This results in an intricate patchwork of algorithms with sometimes radically different orders of accuracy and computational cost. We introduce a high order method ($> 20^{th}$ order) which addresses this issue by its wide ranging validity. It is based on the Euler's integral transformation of the hypergeometric functions formula, and therefore shares its parameters ($p \leq q+1$) and coefficient constraints. The method is based on an end-corrected trapezoidal rule applied to singular integrals, first introduced in [1] in the context of fractional derivatives.

[1] B. Fornberg and C. Piret, Computation of Fractional Derivatives of Analytic Functions. J Sci Comput 96, 79 (2023).

DIEGO RUIZ-ANTOLÍN, Universidad de Cantabria
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 200]
Asymptotic and numerical approximations to the zeros of parabolic cylinder functions

The zeros of parabolic cylinder functions find applications in different areas of science and engineering. For example, they are needed in the design and optimization of waveguides, including the determination of cutoff frequencies and propagation characteristics of different modes. In this talk, uniform asymptotic approximations to the zeros of the parabolic cylinder function $U(a,z)$ involving certain combinations of the zeros of Airy functions are discussed. The accuracy of the expansions is tested using a numerical implementation of a method for finding the complex zeros of solutions of second order ODEs described in [2]. For the numerical algorithm, we use the recent results obtained in [1].

[1] T.M. Dunster, A. Gil, J. Segura. Computation of parabolic cylinder functions having complex argument. Appl. Numer. Math. 197 (2024), 230-242.
[2] J. Segura. Computing the complex zeros of special functions. Numer. Math. 124 (4) (2013) 723-752.

JAVIER SEGURA, Universidad de Cantabria
[Saturday June 1 / samedi 1er juin, 9:00 – ARTS 200]
Computation of classical Gaussian quadratures and associated barycentric interpolation

Algorithms for computing the three classical Gaussian rules based on asymptotic methods and globally convergent iterative methods are presented. The Gauss-Radau and Gauss-Lobatto variants are also considered, alongside the computation of barycentric weights for Lagrange interpolation. The asymptotic and iterative algorithms offer distinct advantages: asymptotic methods are highly accurate for large degrees, while iterative methods are generally faster and valid for a broader range of parameters. The combination of both methods provides the fastest and most accurate double precision methods to date, with an extended range of validity compared to previous methods. We also discuss how the iterative methods can be used for arbitrary precision computations, and this is illustrated with some Maple implementations of the algorithms.

RICHARD M. SLEVINSKY, University of Manitoba
[Saturday June 1 / samedi 1er juin, 10:00 – ARTS 200]
Fast and stable rational approximation of generalized hypergeometric functions

Rational approximations of generalized hypergeometric functions ${}_pF_q$ of type $(n+k, k)$ are constructed by the Drummond and factorial Levin-type sequence transformations. We derive recurrence relations for these rational approximations that require $\mathcal{O}[\max\{p, q\}(n + k)]$ flops. These recurrence relations come in two forms: for the successive numerators and denominators; and, for an auxiliary rational sequence and the rational approximations themselves. Numerical evidence suggests that these recurrence relations are much more stable than the original formulae for the Drummond and factorial Levin-type sequence transformations. Theoretical results on the placement of the poles of both transformations confirm the superiority of factorial Levin-type transformation over the Drummond transformation.

TOM TROGDON, University of Washington
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 200]
Some old and new perspectives on the convergence of spectral methods

This talk will concern the convergence theory for Fourier and Chebyshev (ultraspherical) spectral methods for operator equations. The classical convergence theory typically succeeds by showing that the operator under consideration is relatively compact with respect to an operator that is sufficiently simple. In this vein, we discuss the results of G. M. Vainikko [Krasnosel'skii et al., 1972] and a modern reimplementation of the ideas for the convergence of the Fourier-Floquet-Hill method. The ideas are also applicable to the Riemann–Hilbert (Wiener–Hopf) problem on the circle. We then consider the convergence of Chebyshev collocation methods for boundary-value problems and use yet another result of G. M. Vainikko [Krasnosel'skii et al., 1972] to establish convergence of the rectangular collocation method [Driscoll and Hale, 2016], for a special class of boundary conditions. Lastly, building on these ideas, and the work of Olver and Townsend, we develop an ultraspherical collocation method for boundary-value problems that is provably convergent for all (reasonable) boundary conditions.

MOHAN ZHAO, University of Toronto
[Saturday June 1 / samedi 1er juin, 16:30 – ARTS 200]
The Approximation of Singular Functions by Series of Non-integer Powers

In this talk, we describe an algorithm for approximating functions of the form $f(x) = \langle \sigma(\mu), x^\mu \rangle$ over the interval $[0, 1]$, where $\sigma(\mu)$ is some distribution supported on $[a, b]$, with $0 < a < b < \infty$. Given a desired accuracy and the values of a and b, our

method determines a priori a collection of non-integer powers, so that functions of this form are approximated by expansions in these powers, and a set of collocation points, such that the expansion coefficients can be found by collocating a given function at these points. Our method has a small uniform approximation error which is proportional to the desired accuracy multiplied by some small constants, and the number of singular powers and collocation points grows logarithmically with the desired accuracy. This method has applications to the solution of partial differential equations on domains with corners.

Operators, Matrices, and Analytic Function Spaces
Opérateurs, matrices et espaces de fonctions analytiques

Org: Ludovick Bouthat (Université Laval), **Javad Mashreghi** (Université Laval) and/et **Frédéric Morneau-Guérin** (Université TÉLUQ)

The session will concentrate on topics such as composition operators between analytic spaces, Toeplitz and Hankel operators and matrices, and stochastic matrices.

La session se concentrera sur des sujets tels que les opérateurs de composition entre espaces analytiques, les opérateurs et matrices de Toeplitz et de Hankel, et les matrices stochastiques.

Schedule/Horaire **Room/Salle: ARTS 108**

Saturday June 1 **samedi 1er juin**

8:30 - 9:00	Mahishanka Withanachchi (Laval), *Lebesgue Constants in Local Dirichlet Spaces* (p. 94)
9:00 - 9:30	Ilia Binder (University of Toronto), *Harmonic measure: can it be computed ?* (p. 92)
9:30 - 10:00	Poornendu Kumar (University of Manitoba), *On Caratheodory's Approximation Theorem.* (p. 93)
10:00 - 10:30	Ludovick Bouthat (Laval), *Matrix Norms Induced by Random Vectors* (p. 92)
15:00 - 15:30	Matthew Kreitzer (University of Guelph), *Matrix methods to construct De Bruijn Tori and Families* (p. 93)
15:30 - 16:00	Douglas Farenick (University of Regina), *Operator systems of Laurent polynomials of bounded degree* (p. 93)
16:00 - 16:30	Shafiqul Islam (UPEI), *Finite dimensional approximations of the Frobenius-Perron operator for piecewise convex maps with countable number of branches* (p. 93)
16:30 - 17:00	Hridoyananda Saikia (University of Manitoba), *A non-commutative boundary for the dilation order* (p. 94)
17:00 - 17:30	Javad Mashreghi (Laval), *An Application of Finite Blaschke Products in Numerical Range Studies* (p. 94)

Abstracts/Résumés

ILIA BINDER, University of Toronto
[Saturday June 1 / samedi 1er juin, 9:00 – ARTS 108]
Harmonic measure: can it be computed ?

This talk discusses using Computability in Analysis. More specifically, it is concerned with the computability of the harmonic measure of a given domain. It will partially answer two key questions - "What is the requisite knowledge about a domain to compute its harmonic measure ?" and "Can one always use the same algorithm to compute the harmonic measure for all points of the domain ?" The speaker will provide precise definitions and explore open computability questions in Complex Analysis. The talk is based on joint work with Adi Glucksam, Cristobal Rojas, and Michael Yampolsky.

LUDOVICK BOUTHAT, Université Laval
[Saturday June 1 / samedi 1er juin, 10:00 – ARTS 108]
Matrix Norms Induced by Random Vectors

In a recent article, Chávez, Garcia and Hurley introduced a new family of norms $\|\cdot\|_{\mathbf{X},d}$ on the space of $n \times n$ complex matrices which are induced by random vectors $\mathbf{X}$ having finite d-moments. In this talk, the interesting properties of these norms are

exhibited, and recent progress concerning the submultiplicativity of these norms is presented. In particular, we shall see that they are submultiplictive, as long as the entries of $\mathbf{X}$ have finite p-moments for $p = \max\{2 + \varepsilon, d\}$.

DOUGLAS FARENICK, University of Regina
[Saturday June 1 / samedi 1er juin, 15:30 – ARTS 108]
Operator systems of Laurent polynomials of bounded degree

A Fejér-Riesz operator system is a vector space, denoted $C(S^1)_{(n)}$ for a positive integer $n \geq 2$, of continuous complex-valued functions on the unit circle S^1 in the complex plane such that the Fourier coefficients $\hat{f}(k)$ of $f \in C(S^1)_{(n)}$ vanish for every integer k satisfying $|k| \geq n$. Thus, $C(S^1)_{(n)}$ is the space of Laurent polynomials of degree bounded above by $n - 1$. The vector spaces $C(S^1)_{(n)}$ are function systems in the unital abelian C*-algebra $C(S^1)$ of all continuous $f : S^1 \to \mathbb{C}$. In this lecture, I will consider $C(S^1)_{(n)}$ not as a function system, but as an operator system, thereby accessing the additional structure inherent to matrices over $C(S^1)_{(n)}$. The Toeplitz and Fejér-Riesz operator systems–the former being operator systems of Toeplitz matrices–are related in the operator system category through duality. Through duality, one obtains the C*-nuclearity of Toeplitz and Fejér-Riesz operator systems, as well as their unique operator system structures when tensoring with injective operator systems. I will also mention two applications: (i) a matrix criterion, similar to the one involving the Choi matrix, for a linear map of the Fejér-Riesz operator system to be completely positive ; (ii) a completely positive extension theorem for positive linear maps of $n \times n$ Toeplitz matrices into arbritary von Neumann algebras, thereby showing that a similar extension theorem of Haagerup (1983) for 2×2 Toeplitz matrices holds for Toeplitz matrices of higher dimension.

SHAFIQUL ISLAM, University of Prince Edward Island
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 108]
Finite dimensional approximations of the Frobenius-Perron operator for piecewise convex maps with countable number of branches

Fixed points of the Frobenius-Perron operator of a dynamical system are stationary densities of invariant measures of the system. However, the Frobenius-Perron equation is a functional equation and it is difficult to solve. Using Ulam's method one can find finite dimensional approximations (Ulam's matrices) of the Frobenius-Perron operator. Ulam's matrices are stochastic matrices and their fixed points are approximations of the unique stationary density function of the system. In this talk, we consider a class of piecewise convex maps with countably infinite number of branches which possesses a unique stationary density f^* of an invariant measure. We develop an Ulam method for approximation of f^*. Convergence analysis is presented. We provide examples with errors between f^* and approximate stationary densities via Ulam's method.

MATTHEW KREITZER, University of Guelph
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 108]
Matrix methods to construct De Bruijn Tori and Families

A de Bruijn torus is a two dimensional extension of a de Bruijn sequence. While methods exist to generate these tori, only a few such methods are known. One method involves using a generalization of de Bruijn sequences known as de Brujin families, however generation of these de Bruijn families is difficult. We have developed a novel method to generate de Bruijn families for an arbitrary alphabet and window size using certain matrices over finite fields known as Affine Shifters.

In this talk, we describe this novel generation method. We will also give an analysis on limitations with this generation method. Time permitting, we will describe their extension in generating de Bruijn families of higher dimension.

POORNENDU KUMAR, University of Manitoba
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 108]
On Caratheodory's Approximation Theorem.

Operators, Matrices, and Analytic Function Spaces
Opérateurs, matrices et espaces de fonctions analytiques

In 1926, Carathéodory, in his study of holomorphic functions from the open unit disc $\mathbb{D}$ of the complex plane to the closed unit disc $\mathbb{D}$, proved that any holomorphic self-map on $\mathbb{D}$ can be approximated by finite Blaschke products (uniformly on compact subsets). Afterward, Rudin generalized this result to the polydisc as well as the open unit ball.

In this talk, we will explore extended versions of this theorem, specifically Carathéodory's approximation theorem for matrix-valued functions on the disc, the bidisc, and multi-connected domains. Our discussion will primarily focus on two perspectives: one rooted in operator theory and the other viewed through the lens of operator algebra. We will delve into the limitations and benefits inherent in both approaches. Finally, we will see a few applications of this result.

JAVAD MASHREGHI, Laval University
[Saturday June 1 / samedi 1er juin, 17:00 – ARTS 108]
An Application of Finite Blaschke Products in Numerical Range Studies

Let T be an operator on a Hilbert space H with numerical radius $w(T) \leq 1$. According to a theorem of Berger and Stampfli, if f is a function in the disk algebra such that $f(0) = 0$, then $w(f(T)) \leq \|f\|_\infty$. We give a new and elementary proof of this result using finite Blaschke products. A well-known result relating numerical radius and norm says $\|T\| \leq 2w(T)$. We obtain a local improvement of this estimate, namely,

$$\|Tx\|^2 \leq 2 + 2\sqrt{1 - |\langle Tx, x\rangle|^2}, \qquad (x \in H,\ \|x\| \leq 1),$$

Whenever $w(T) \leq 1$. Using this refinement, we give a simplified proof of Drury's teardrop theorem, which extends the Berger-Stampfli theorem to the case $f(0) \neq 0$.

Joint work with T. Ransford and H. Klaja

HRIDOYANANDA SAIKIA, University of Manitoba
[Saturday June 1 / samedi 1er juin, 16:30 – ARTS 108]
A non-commutative boundary for the dilation order

Arveson's hyperrigidity conjecture focuses on the unique extension property (UEP) of representations of C^*-algebras with respect to a generating operator system. The states that are maximal in the dilation order fully encapsulate the cyclic representations of a C^*-algebra with the UEP. The set of all maximal states form a norm-closed set which remains stable under absolute continuity. In this talk, we will discuss an equivalent characterization of the dilation maximal states in terms of a *boundary projection*. Subsequently, we will state a reformulation of Arveson's hyperrigidity conjecture in terms of the non-commutative topological properties of this boundary projection. This is a joint work with Raphaël Clouâtre.

MAHISHANKA WITHANACHCHI, Laval University
[Saturday June 1 / samedi 1er juin, 8:30 – ARTS 108]
Lebesgue Constants in Local Dirichlet Spaces

This study delves into the analysis of partial Taylor sums S_n, $n \geq 0$, as finite rank operators on any Banach space of analytic functions on the open unit disc. In the classical disc algebra setting, these operators are known as Lebesgue constants, with their precise norm remaining unresolved. However, our focus shifts to the local Dirichlet spaces $\mathcal{D}_\zeta$, where we accurately determine the norm of S_n. This exploration involves three distinct norms on $\mathcal{D}_\zeta$, each providing unique values for the norm of S_n as an operator on $\mathcal{D}_\zeta$. Notably, these findings stand in sharp contrast to the classical disc algebra. Moreover, we extend our investigation to Cesaro means σ_n on local Dirichlet spaces, aiming to precisely determine their norm for the three introduced metrics.

Lebesgue constants in local Dirichlet spaces are vital for guiding the selection of optimal finite-dimensional approximations in numerical solutions of partial differential equations with Dirichlet boundary conditions in mathematical physics.

Student Research Session
Session de recherche des étudiants

Org: William Verreault (University of Toronto) and/et **Daniel Zackon** (McGill University)

This session aims to get students to present their research at the CMS Meeting. The presentations should introduce the student's research to a general mathematical audience.

Cette session a pour but d'inciter les étudiants à présenter leurs recherches lors de la réunion de la SMC. Les présentations doivent présenter les recherches de l'étudiant à un public mathématique général.

Schedule/Horaire **Room/Salle: ARTS 210**

Sunday June 2 / dimanche 2 juin

15:00 - 15:30	Matthew Alexander (University of Regina), *Categories Without Explicit Coherence* (p. 95)
15:30 - 16:00	Mandana Bidarvand (University of Saskatchewan), *Analyzing arrays of qubits via a multi-scale approach* (p. 95)
16:00 - 16:30	Shane J. Crerar (University of Regina), *Rank and Separability* (p. 96)
16:30 - 17:00	Alejandro Santacruz Hidalgo (University of Western Ontario), *Generalized monotone functions in measure spaces.* (p. 96)

Monday June 3 / lundi 3 juin

8:00 - 8:30	Arnaud Ngopnang Ngompe (University of Regina), *Effect of the change of enrichment on a $\mathcal{V}$-model category* (p. 97)
8:30 - 9:00	Manimugdha Saikia (University of Western Ontario), *Multi-qutrit exact synthesis over Clifford+T* (p. 97)
9:00 - 9:30	Jiahui Huang (University of Waterloo), *Arc-Floer conjecture for homogeneous isolated singularities* (p. 96)

Abstracts/Résumés

MATTHEW ALEXANDER, University of Regina
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 210]
Categories Without Explicit Coherence

Category theory provides a unifying framework for studying a large variety of mathematical structures, by viewing them through the lens of objects and the morphisms between them. However there are naturally arising categories that contain even more data: higher order morphisms-between-morphisms. These are the focus of higher category theory. There are two standard ways of modeling higher categories. In the algebraic approach, compositions of morphisms are subject to "coherence conditions", which grow quickly in complexity, making working with these categories difficult in dimensions higher than 2 or 3. The geometric approach avoids explicit coherence conditions by viewing higher dimensional morphisms as higher dimensional topological spaces, and encodes the coherence conditions in the contractibility of these spaces. Unfortunately, reasoning about morphisms as high dimensional spaces can be quite delicate, and intuition quickly falls away.

In this talk we present a model for higher categories that avoids both explicit coherence conditions and dimensional growth of its morphisms, by relaxing the axioms of higher categories involving consistent choices of morphisms, to ones that only require the *existence* of morphisms. We will show how ordinary models of higher categories and their tools arise in this new setting and how certain constructions in category theory can be generalized to this model.

Student Research Session
Session de recherche des étudiants

MANDANA BIDARVAND, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 15:30 – ARTS 210]
Analyzing arrays of qubits via a multi-scale approach

A quantum metamaterial is an engineered structure whose modes of interaction with the environment depend on its quantum state. A prototypical example of such a material is a structure consisting of an array of qubits interacting with the electromagnetic field. Motivated by the challenges of analyzing such structures, we have developed a custom scale-based approach. It furnishes an alternative albeit formally equivalent model of quantum information. Its framework is naturally analytic, rather than linear-algebraic. It is especially well-suited for the study of the physics of finite as well as infinite arrays of qubits. Foundational to our approach are the Borel isomorphism and the multiresolution analysis in the Haar basis, both of which appear in classical mathematical literature in non-quantum contexts. We use them as devices that enable an identification between $L_2(0,1]$ and the Hilbert space of an infinite array of qubits. In the resulting framework, quantum operations and observables are represented through geometric integral operators. Prior studies demonstrated that in some cases the dynamics of qubit arrays is solvable in the sense that the spectra of crucial operators can be given explicitly. We extend those results and show a path to further systematic explorations. As an unexpected upshot, we observe that the fundamental concept of calculus is inherent in an infinite array of qubits ; indeed, the antiderivative arises as a natural and indispensable operator in this context. In other words, if a mathematical structure encompasses a full theory of the infinite array of qubits, then it can support calculus.

SHANE J. CRERAR, University of Regina
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 210]
Rank and Separability

The problem of determining whether a given quantum state is entangled is np-hard. By restricting the problem to extensions of a fixed faithful state, the determination of separability becomes a matter of finding the rank of associated operators. But that doesn't seem to make the calculations any easier. This talk will discuss the reasons why and the methods used, in particular how this extends the concept of Schmidt rank to mixed bipartite states.

ALEJANDRO SANTACRUZ HIDALGO, University of Western Ontario
[Sunday June 2 / dimanche 2 juin, 16:30 – ARTS 210]
Generalized monotone functions in measure spaces.

Monotone functions over the real numbers are very well-behaved compared to general measurable functions. Consequently, a wide variety of techniques and applications are in place for working with them. In this talk, we explore the notion of an ordered core, which allows us to define core decreasing functions and generalize monotone functions to general measure spaces without reliance on a strict ordering among elements.

Through various examples, we illustrate the versatility and adaptability of this generalized perspective on decreasing functions. Furthermore, we demonstrate its practical utility by exploring its connection to the study of abstract Hardy's inequalities. This approach provides a uniform treatment of many different types of Hardy operators. In particular, we use the theory of core decreasing functions to prove a new characterization for the boundedness of an abstract Hardy operator between L^1 to L^q with general measures.

JIAHUI HUANG, University of Waterloo
[Monday June 3 / lundi 3 juin, 9:00 – ARTS 210]
Arc-Floer conjecture for homogeneous isolated singularities

Given an isolated hypersurface singularity, one may associate to it algebraic invariants by studying the space of arcs and jets, or topological invariants via its Milnor fiber. The arc-Floer conjecture predicts an isomorphism between the cohomology of the contact loci of arcs and the Floer homology of iterates of the monodromy on the Milnor fiber. The case of plane curve

singularities has been proven by de la Bodega and de Lorenzo Poza. In this talk we explain the history of this conjecture and present the first class of examples in higher dimensions, which are the homogeneous isolated singularities. This is joint work with de Lorenzo Poza.

ARNAUD NGOPNANG NGOMPE, University of Regina
[Monday June 3 / lundi 3 juin, 8:00 – ARTS 210]
Effect of the change of enrichment on a $\mathcal{V}$-model category

The work we present here is motivated by the observation that for a category $\mathcal{C}$ that is enriched, tensored, and cotensored over the category of simplicity (left) R-modules sMod_R (the category of non-negatively graded (left) R-modules $\mathrm{Ch}_{\leq 0}(R)$, respectively), the $\mathrm{Ch}_{\leq 0}(R)$-enriched category $N_*\mathcal{C}$ (the sMod_R-enriched category $\Gamma_*\mathcal{C}$, respectively) does not inherit a tensoring nor a cotensoring over $\mathrm{Ch}_{\leq 0}(R)$ (sMod_R, respectively). In this talk, we generalize this observation, and we give an insight of which properties are preserved and which are weakened after changing the enrichment of a $\mathcal{V}$-enriched model category $\mathcal{C}$ along a right adjoint $G : \mathcal{V} \to \mathcal{W}$.

MANIMUGDHA SAIKIA, University of Western Ontario
[Monday June 3 / lundi 3 juin, 8:30 – ARTS 210]
Multi-qutrit exact synthesis over Clifford+T

Unitary matrices in quantum computing play a similar role to Boolean functions in classical computing, meaning that quantum gates are represented by unitary matrices. For practical classical computers, we choose a set of special gates (known as a universal gate set) and make circuits using these gates to generate any other Boolean function. However, the quantum version of circuit synthesis is a bit more complicated. In this talk, we will introduce what a universal gate set means in quantum computing.

There are various universal gate sets for both single and multi-qubit (two-level quantum system) cases. Due to various advantages, researchers have a growing interest in finding universal gate sets for higher-level quantum systems. To this end, in our joint work with Kalra, Valluri, Winnick, and Yard, we present an algorithm to exactly synthesize a circuit corresponding to qutrit (3-level quantum system) unitaries using the multi-qutrit Clifford+T universal gate set.

Symmetry Methods and Analytical Techniques for Nonlinear Partial Differential Equations
Méthodes de symétrie et techniques analytiques pour les équations différentielles partielles non linéaires

Org: Stephen Anco (Brock University), **Jean-Francois Ganghoffer** (Université de Lorraine) and/et **Alexey Shevyakov** (University of Saskatchewan)

Mathematical models given by nonlinear partial differential equations (PDE) are fundamental in theoretical and applied science. The session will focus on areas of development and application of symmetry analysis, methods for conservation laws, and other analytical techniques for construction of exact and approximate solutions. Talks on both new theoretical advances and applications of novel methods to nonlinear PDE problems, in particular, in the areas of nonlinear mechanics and integrable equations, will be included.

Les modèles mathématiques donnés par des équations aux dérivées partielles non linéaires (EDP) sont fondamentaux dans les sciences théoriques et appliquées. La session se concentrera sur les domaines de développement et d'application de l'analyse de symétrie, des méthodes pour les lois de conservation, et d'autres techniques analytiques pour la construction de solutions exactes et approximatives. Des interventions sur les nouvelles avancées théoriques et les applications de nouvelles méthodes aux problèmes d'EDP non linéaires, en particulier dans les domaines de la mécanique non linéaire et des équations intégrables, seront incluses.

Schedule/Horaire — Room/Salle: ARTS 109

Saturday June 1 — samedi 1er juin

8:00 - 8:30	Shawn McAdam (Saskatchewan), *Symmetry and numerical analysis of nonlinear Love wave model* (p. 101)
8:30 - 9:00	Kostya Druzhkov (Saskatchewan), *Stationary-action principle and the intrinsic geometry of PDEs* (p. 99)
9:00 - 9:30	Nicoleta Bila (Fayetteville), *Symmetry Reduction Operators for Monge-Ampère Equations* (p. 99)
9:30 - 10:00	George Bluman (UBC), *The natural extension of Lie's reduction of order algorithm for ODES to PDEs* (p. 99)
10:00 - 10:30	Subhankar Sil (UBC), *Revisit of differential invariant method for finding nonlocal symmetries of nonlinear partial differential equations* (p. 102)
15:00 - 15:30	Thomas Hillen (Alberta), *Symmetries in Non-local Adhesion Models* (p. 100)
15:30 - 16:00	Cristina Stoica (Wilfrid Laurier), *Super-integrable systems with stochastic perturbations* (p. 102)
16:00 - 16:30	Alexandr Chernyavskiy (Buffalo), *Dark-bright soliton perturbation theory for the Manakov system* (p. 99)
16:30 - 17:00	Matthew Farkas (Washington) (p. 100)

Sunday June 2 — dimanche 2 juin

8:00 - 8:30	Philic Lam (Brock), *A search for integrable evolution equations with Lax pairs over the octonions* (p. 100)
8:30 - 9:00	Jaskaran Mann (Brock), *mKdV Loop Travelling Waves and Interactions of Loop Solitons* (p. 101)
9:00 - 9:30	Thomas Wolf (Brock), *Minimal General Octonion Polynomials and Octonion Identities* (p. 102)
9:30 - 10:00	Stephen Anco (Brock), *General symmetry multi-reduction method for partial differential equations with conservation laws* (p. 98)
10:00 - 10:30	Alexey Shevyakov (Saskatchewan), *Exact spherical vortex solutions in fluid and plasma dynamics* (p. 101)
15:00 - 15:30	Christopher Kennedy (Queen's), *Interaction between long internal waves and free surface waves in deep water* (p. 100)

Abstracts/Résumés

Symmetry Methods and Analytical Techniques for Nonlinear Partial Differential Equations
Méthodes de symétrie et techniques analytiques pour les équations différentielles partielles non linéaires

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STEPHEN ANCO, Brock University
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 109]
General symmetry multi-reduction method for partial differential equations with conservation laws

A powerful application of symmetries is finding symmetry-invariant solutions of nonlinear partial differential equations (PDEs). For a given symmetry, these solutions satisfy a reduced differential equation with one fewer independent variable. It is well known that a double reduction occurs whenever the starting nonlinear PDE possesses a conservation law that is invariant with respect to the symmetry.

Recent work has developed a broad generalization of the double-reduction method by considering the space of invariant conservation laws with respect to a given symmetry. In its simplest formulation, the generalization is able to reduce a nonlinear PDE in 2 variables to an ODE with m first integrals where m is the dimension of the space of invariant conservation laws. Nonlinear PDEs in 3 or more variables can be reduced to an ODE similarly by using an algebra of given symmetries. Importantly, the algebra does not need to be solvable.

The general method employs multipliers and is fully algorithmic. In particular, no a priori knowledge of conservation laws of the nonlinear PDE is necessary, and the multi-reduction is carried out in one step.

In this talk, a summary of the general multi-reduction method will be presented for obtaining invariant solutions of physically interesting PDEs. Examples will be shown for quadruple reduction from a single symmetry ; complete integration from a solvable algebra in one step ; reduction via a non-solvable algebra.

NICOLETA BILA, Fayetteville State University
[Saturday June 1 / samedi 1er juin, 9:00 – ARTS 109]
Symmetry Reduction Operators for Monge-Ampère Equations

In this talk, reduction operators related to two-dimensional Monge-Ampère equations are discussed. A degenerated case that occurs while applying the nonclassical method (due to Bluman and Cole) to these types of nonlinear partial differential equations is studied. It is shown that specific Monge-Ampère equations may be reduced to systems of first-order partial differential equations, and, additionally, their solutions are related to Monge and Bateman nonlinear partial differential equations. The connection of these results with the direct method (by Clarkson and Kruskal) is also presented.

GEORGE BLUMAN, University of British Columbia, Vancouver
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 109]
The natural extension of Lie's reduction of order algorithm for ODES to PDEs

In the 19th Century, Sophus Lie initiated his study of continuous groups (Lie groups) to put order to the hodgepodge of heuristic techniques for solving ODEs. Lie's algorithm showed how the invariance of an ODE under a one-parameter Lie group of point transformations (point symmetry) leads systematically to its reduction of order. By looking at Lie's algorithm from a different point of view, it is shown how it extends naturally to PDEs.

ALEXANDR CHERNYAVSKIY, SUNY Buffalo
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 109]
Dark-bright soliton perturbation theory for the Manakov system

A direct perturbation method for studying dynamics of dark-bright solitons of the Manakov system in the presence of perturbations is presented. We combine multiscale expansion method, perturbed conservation laws, and a boundary layer approach, which breaks the problem into an inner region, where the bulk of the soliton resides, and an outer region, which evolves independently of the soliton. We show that a shelf develops around the dark soliton component, with speed of the shelf proportional to the background intensity. Conservation laws of the Manakov system are used to determine the properties of the shelf and perturbed solutions. Our analytical predictions are corroborated by numerical simulations.

Symmetry Methods and Analytical Techniques for Nonlinear Partial Differential Equations
Méthodes de symétrie et techniques analytiques pour les équations différentielles partielles non linéaires

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KOSTYA DRUZHKOV, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 8:30 – ARTS 109]
Stationary-action principle and the intrinsic geometry of PDEs

One usually formulates the principle of stationary action in terms of Lagrangians on jet bundles. However, at least in classical mechanics, the Lagrangian formalism can be described using only the intrinsic geometry of equations of motion (and the result is the Hamiltonian formalism). We will show that in the general case, the situation is similar. Each Lagrangian of a system of differential equations generates a unique element of the cohomology of some cochain complex produced by the intrinsic geometry of the system. Such cohomology elements can be considered variational principles. Using a non-covariant approach (the spatial part of a space+time decomposition), one can interpret variational principles of this type as a direct reformulation of the Hamiltonian formalism in terms of the intrinsic geometry of variational equations.

MATTHEW FARKAS, Washington
[Saturday June 1 / samedi 1er juin, 16:30 – ARTS 109]

THOMAS HILLEN, University of Alberta
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 109]
Symmetries in Non-local Adhesion Models

Non-local Models for Cellular Adhesion

Cellular adhesion is one of the most important interaction forces between cells and other tissue components. In 2006, Armstrong, Painter and Sherratt introduced a non-local PDE model for cellular adhesion, which was able to describe known experimental results on cell sorting and cancer growth. The analysis becomes challenging through non-local cell-cell interaction and interactions with boundaries. In this talk I will use symmetry methods to analyse aggregations and pattern formation of the non-local adhesion model. (joint work with A. Buttenschoen).

CHRISTOPHER KENNEDY, Queen's University
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 109]
Interaction between long internal waves and free surface waves in deep water

We present a study of the two-dimensional water wave problem consisting of a density-stratified fluid composed of two immiscible layers separated by a sharp interface. A goal is to describe the interaction between long, larger amplitude, nonlinear waves on the interface and modulated, smaller amplitude, free wave packets on the surface when the lower fluid is infinitely deep. In the first part, starting from the Hamiltonian formulation of this problem and using techniques from Hamiltonian transformation theory, we describe the resonant interaction of the waves by a system of equations where the internal wave solves a high-order Benjamin-Ono equation coupled to a linear Schroedinger equation for the time evolution of the wave envelope of the free surface. In the second part, we establish a local well-posedness result for the BO-Schroedinger system in the physical regime where the densities of the two fluid layers are close. Neglecting the higher-order coupling terms, we perform a gauge transformation to eliminate the higher-order non-linear terms and reformulate our BO equation, from which our proof follows by a fixed-point argument. This is a joint work with A. Kairzhan and C. Sulem.

PHILIC LAM, MSc Mathematics and Statistics ,Brock University
[Sunday June 2 / dimanche 2 juin, 8:00 – ARTS 109]
A search for integrable evolution equations with Lax pairs over the octonions

This talk reports on work searching for octonion evolution equations of KdV type and mKdV type that have a Lax pair.

We consider $u(t,x)$ as an octonion variable in evolution equations $u_t = F(u, u_x, u_{xx}, u_{xxx})$, and we aim to find a Lax pair $L_t = [M, L]$ where L and M are linear differential operators in terms of ∂_x with coefficients involving u and x-derivatives of u. For F, we assume it is homogeneous under a scaling of t, x, u which is either the scaling in the KdV equation or the mKdV equation. This gives a polynomial ansatz with undetermined (real) coefficients. Similarly, for L and M, we assume they are scaling homogeneous, where the scaling weight of M is the same as that of ∂_t while the scaling weight of L can be chosen freely.

The determining condition is $\big(L_t - [M, L]\big)\big|_{u_t=F} = 0$. We split this condition in the jet space of u, and do a further splitting with respect to a real basis (8-dimensional) for the octonions. This gives a large overdetermined system in the undetermined (real) coefficients in ansatz for F, L, M. We use Maple to do the splittings, and depending on the complexity of the system, we solve it using 'rifsimp' in Maple or a package called 'Crack' in Reduce.

As a main result, we obtain a single KdV octonion equation, three mKdV octonion equations, and also a single potential-KdV octonion equation, each of which has more than one Lax pair.

JASKARAN MANN, Brock University
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 109]
mKdV Loop Travelling Waves and Interactions of Loop Solitons

The modified Korteweg-de Vries(mKdV) equation is an integrable non-linear evolution equation which has applications in modeling various physical phenomena. It also describes the curvature of curve which undergoes a certain non-stretching geometrical evolution in the Euclidean plane. This curve motion finds applications in various areas, such as describing the dynamics of inelastic rope, modeling the evolution of the boundary of vortex patch(swirling region) in thin, sheet-like layer of incompressible fluid, and understanding the behavior of electrons quantized in thin-layered materials by studying the boundaries of electron cloud densities under strong electromagnetic fields. This talk focuses on mKdV curve motions called loop solutions. One class arise from soliton, heavy-tail(rational), and periodic solutions of the mKdV equation. These loop solutions exhibit intriguing symmetrical shapes: the soliton and heavy-tail cases describe a single loop which is open, and asymptotically straight or circular, respectively ; the periodic case describes both open and closed loops which can have multiple crossings. Additionally, a class of colliding loop solutions are obtained from the 2-soliton solution of the mKdV equation. The collisions show interesting interaction patterns. A summary of different types of patterns will be given by categorizing the various shapes that occur during the interaction, which depend on the speed ratio of the initial two loops. Analytical and numerical methods are employed to determine the loop solutions for both classes, as well as the conditions determining interaction type in the case of collision. These findings contribute to a deeper understanding of the mKdV equation and solitons

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SHAWN MCADAM, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 8:00 – ARTS 109]
Symmetry and numerical analysis of nonlinear Love wave model

Love waves are horizontally polarized transverse waves (SH waves) that form from the constructive interference of SH waves reflecting off the surface of the Earth. In this talk, I motivate a nonlinear model of SH waves and apply it to numerically study the qualitative behaviour of Love waves near the focus of an earthquake. I then compare these numerical solutions to solutions (and approximate solutions) obtained via symmetry methods.

ALEXEY SHEVYAKOV, University of Saskatchewan
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 109]
Exact spherical vortex solutions in fluid and plasma dynamics

We revisit Hill's solution, which characterizes a self-propelling spherical vortex within nested toroidal pressure surfaces, confined by a spherical boundary in an ideal Eulerian fluid. The re-derivation employs Galilei symmetry alongside the Bragg-Hawthorne equation in spherical coordinates. Using the equivalence between the equilibrium Euler equations in fluid dynamics and the static

magnetohydrodynamic equations, we derive a generalized type of vortex solution applicable to both dynamic fluid equilibria and static plasma equilibria with a nonzero azimuthal vector field component, while satisfying physical boundary conditions. By applying the separation of variables to the Bragg-Hawthorne equation in spherical coordinates, we develop new fluid and plasma equilibria characterized by nested toroidal flux surfaces and boundary vorticity sheets and current sheets, respectively. Additionally, we analytically demonstrate and numerically illustrate the instability of the original Hill's vortex when subjected to certain radial perturbations of the spherical flux surface.

SUBHANKAR SIL, University of British Columbia
[Saturday June 1 / samedi 1er juin, 10:00 – ARTS 109]
Revisit of differential invariant method for finding nonlocal symmetries of nonlinear partial differential equations

In this talk, we consider examples using the symmetry-based differential invariant method for finding nonlocally related systems of DEs. In particular, through the DI method, we obtain nonlocal symmetries for nonlinear wave equations, telegraph equations, diffusion-convection equations and reaction-diffusion equations. We recover previously known nonlocal symmetries of these equations obtained by the conservation-law based method. (Previous work showed that the CL-based method is a special case of the DI method).

CRISTINA STOICA, Wlifrid Laurier University
[Saturday June 1 / samedi 1er juin, 15:30 – ARTS 109]
Super-integrable systems with stochastic perturbations

In the physical world, many systems are subject to stochastic perturbations. The latter are often responsible for removing the symmetries of the ideal unperturbed systems. However, within the class of Hamiltonian systems, the framework of J-M. Bismut ("Mecanique Aleatoire", Springer 1981) permits stochastic inputs while preserving the Hamiltonian structure and, under appropriate constraints, some or even all of the symmetries of the deterministic system. Developed further in the last decades, the theory of stochastic geometric mechanics displays many interesting features and open questions. In this talk I will present the case study of two super-integrable systems: the two-dimensional harmonic oscillator and the Kepler problem.

This work is joint with Archishman Saha (University of Ottawa).

THOMAS WOLF, Brock University
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 109]
Minimal General Octonion Polynomials and Octonion Identities

To classify polynomial integrable evolutionary PDEs up to some degree over octonions an approach is to compute Lax pairs satisfying the condition $L_t = [M, L]$ as discussed in the talk presented by Philic Lam.

This talk describes the first step of computing polynomial identities for octonions and their use in generating a minimal ansatz for general homogeneous polynomials L and M.

The computational complexity and methods to overcome it are discussed.

Symplectic and Poisson geometry
Géométrie symplectique et de Poisson

Org: Lisa Jeffrey (University of Toronto) and/et **Derek Krepski** (University of Manitoba)

This session will focus on recent advances in symplectic and Poisson geometry and related areas, such as Lie theory, Lie groupoids/stacks, generalized geometry, quantization, reduction, and moment maps.

Cette session se concentrera sur les avancées récentes en géométrie symplectique et de Poisson et dans les domaines connexes, tels que la théorie de Lie, les groupoïdes/empilements de Lie, la géométrie généralisée, la quantification, la réduction et les applications de moment.

Schedule/Horaire **Room/Salle: ARTS 208**

Sunday June 2 **dimanche 2 juin**

9:30 - 10:00	Ethan Ross (University of Toronto), *Singular Riemannian Foliations and Foliate Vector Fields* (p. 106)
10:00 - 10:30	Dinamo Djounvouna (University of Manitoba) (p. 104)
15:00 - 15:30	Daniel Alvaréz (University of Toronto), *Symplectic double groupoids and generalized Kähler metrics* (p. 103)
15:30 - 16:00	Caleb Jonker (University of Toronto), *Graded symplectic geometry and the generalized Kahler-Ricci flow* (p. 105)
16:00 - 16:30	Mykola Matviichuk (Imperial College London) (p. 105)
16:30 - 17:00	Casey Blacker (George Mason University), *Geometric and algebraic reduction of multisymplectic manifolds* (p. 104)
17:00 - 17:30	Tatyana Barron (University of Western Ontario), *Kaehler quantization and entropy* (p. 103)
17:30 - 18:00	Saikia Manimugdha (University of Western Ontario), *Restrictions of holomorphic sections to products* (p. 105)

Monday June 3 **lundi 3 juin**

8:00 - 8:30	Francis Bischoff (University of Regina), *Jets of foliations and b^k-Poisson structures* (p. 104)
8:30 - 9:00	Dan Hudson (University of Toronto), *On deformation spaces of Lie groupoids and Lie algebroids* (p. 105)
9:00 - 9:30	Ruxandra Moraru (University of Waterloo), *Born geometry* (p. 105)
9:30 - 10:00	Mark Hamilton (Mount Allison University), *Lagrangian fibrations, quantization, and integral-integral affine geometry* (p. 104)
10:00 - 10:30	Peter Crooks (Utah State University), *Scheme-theoretic coisotropic reduction* (p. 104)

Abstracts/Résumés

DANIEL ALVARÉZ, University of Toronto
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 208]
Symplectic double groupoids and generalized Kähler metrics

I'll explain how the generalized Kähler class can be defined in terms of Morita equivalences of symplectic double groupoids and I'll explain how this framework allows us to determine the fundamental degrees of freedom of a generalized Kähler metric in full generality. If time permits I'll describe how these ideas can be explicitly illustrated in the case of compact Lie groups. This is joint work with Marco Gualtieri and Yucong Jiang.

TATYANA BARRON, University of Western Ontario
[Sunday June 2 / dimanche 2 juin, 17:00 – ARTS 208]
Kaehler quantization and entropy

In geometric quantization, Lagrangian states or coherent states on a symplectic manifold M are sections of the prequantum line bundle on M determined by an appropriate submanifold of M. What are the entanglement properties of these states? Or, to pose a different question, is the entanglement entropy (a concept from quantum information theory) a useful invariant? I will report on recent joint results with A. Kazachek and with M. Saikia.

FRANCIS BISCHOFF, University of Regina
[Monday June 3 / lundi 3 juin, 8:00 – ARTS 208]
Jets of foliations and b^k-Poisson structures

The b^k-tangent bundle, first introduced by Scott, is a Lie algebroid consisting of vector fields tangent to a hypersurface D to order k. Although this algebroid depends on the choice of a local defining function for D, all functions give rise to isotopic Lie algebroids. In this talk I will introduce a wider class of Lie algebroids that are locally of b^k-type but which are classified, up to isotopy, by a local system on D. These algebroids allow us to define a new class of Poisson structures which are symplectic away from D. I will discuss the properties of these Poisson structures and the ways they differ from ordinary b^k-Poisson structures. This is joint work with Álvaro del Pino and Aldo Witte.

CASEY BLACKER, George Mason University
[Sunday June 2 / dimanche 2 juin, 16:30 – ARTS 208]
Geometric and algebraic reduction of multisymplectic manifolds

A symplectic Hamiltonian manifold consists of a Lie group action on a symplectic manifold, together with the additional structure of a moment map, which encodes the group action in terms of the assignment of Hamiltonian vector fields. In special cases, the moment map determines a smooth submanifold to which the Lie group action restricts and the resulting quotient inherits the structure of symplectic manifold. In every case, it is possible to construct a reduced Poisson algebra that plays the role of the space of smooth functions on the reduced symplectic manifold.

In this talk, we will discuss an adaptation of these ideas to the multisymplectic setting. Specifically, we will exhibit a geometric reduction procedure for multisymplectic manifolds in the presence of a Hamiltonian action, an algebraic reduction procedure for the associated L-infinity algebras of classical observables, and a comparison of these two construction. This is joint work with Antonio Miti and Leonid Ryvkin.

PETER CROOKS, Utah State University
[Monday June 3 / lundi 3 juin, 10:00 – ARTS 208]
Scheme-theoretic coisotropic reduction

I will present a purely scheme-theoretic version of Hamiltonian reduction along a coisotropic subvariety. This will yield algebro-geometric counterparts of certain results in symplectic geometry. If time permits, I will outline the importance of these counterparts to Moore-Tachikawa topological quantum field theories. This represents joint work with Maxence Mayrand.

DINAMO DJOUNVOUNA, University of Manitoba
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 208]

MARK HAMILTON, Mount Allison University
[Monday June 3 / lundi 3 juin, 9:30 – ARTS 208]
Lagrangian fibrations, quantization, and integral-integral affine geometry

The geometry of Lagrangian fibrations has been studied by a number of authors, and turns out to be quite rigid ; as one example, the Arnold-Liouville theorem implies that the base B of a Lagrangian fibration $M \to B$ can be equipped with an integral affine structure. In the presence of a prequantization $L \to M$, more can be said. In this talk we will review some facts about Lagrangian fibrations and describe an "Enhanced Arnold-Liouville Theorem" that equips B with what we call an *integral-integral affine* structure. We will also discuss some results from "integral-integral affine geometry" and their relation to quantization.

DAN HUDSON, University of Toronto
[Monday June 3 / lundi 3 juin, 8:30 – ARTS 208]
On deformation spaces of Lie groupoids and Lie algebroids

Deformation spaces of Lie groupoids are an important tool in the index theory of pseudodifferential operators. In this talk I will describe the geometric data needed to define a deformation space in the context of Lie groupoids and Lie algebroids, and how differentiation and integration works in this setting. If time permits, I will also explain a related blow-up procedure and describe a "tangent groupoid" for a filtered manifold with boundary.

CALEB JONKER, University of Toronto
[Sunday June 2 / dimanche 2 juin, 15:30 – ARTS 208]
Graded symplectic geometry and the generalized Kahler-Ricci flow

Bi-Hermitian geometry, initally discovered by physicists in their investigation of supersymmetric string theory, was later rediscovered by Gualtieri as part of Hitchin's generalized geometry program. This discovery unearthed many beautiful connections to Poisson and Dirac geometry. One of these that has only recently begun to be investigated is the connection of bi-Hermitian (also known as generalized Kahler geometry) to graded symplectic geometry. I will give an overview of these developments. In particular, I will explain how the generalized Kahler-Ricci flow, which also has origins in string theory, can be described as the flow by a Hamiltonian vector field on a graded symplectic manifold.

SAIKIA MANIMUGDHA, University of Western Ontario
[Sunday June 2 / dimanche 2 juin, 17:30 – ARTS 208]
Restrictions of holomorphic sections to products

In this talk, we explore how quantum states relate to subsets of a product of two compact connected Kahler manifolds. We shall introduce a few concepts from quantum information theory, such as separable and entangled quantum states. Then, we shall see a particular way to associate quantum states with subsets using the techniques of geometric quantization. In the end, we shall present a result which states that the quantum states associated this way are separable when the subset is a finite union of products.

MYKOLA MATVIICHUK, Imperial College London
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 208]

RUXANDRA MORARU, University of Waterloo
[Monday June 3 / lundi 3 juin, 9:00 – ARTS 208]
Born geometry

A Born structure on a $2n$-manifold M consists of a quadruple (I, J, K, g) where g is a pseudo-Riemannian metric on M of split signature (n, n) and (I, J, K) is a para-hypercomplex structure on M such that gI and gJ are both symmetric, and gK is skew-symmetric. Born structures are thus para-hypercomplex structures together with special types of pseudo-Riemannian metrics. These structures were introduced in 2014 by L. Freidel, R. G. Leigh and D. Minic as a geometric background for a duality symmetric formulation of string theory called metastring theory. In this talk, I will describe some of their geometry and explain how they fit into the context of generalized geometry.

ETHAN ROSS, University of Toronto
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 208]
Singular Riemannian Foliations and Foliate Vector Fields

Singular Riemannian Foliations (SRFs) are a class of reasonably well-behaved singular foliations (in the sense of Stefan-Sussmann) which appear quite naturally when studying isometric group actions or riemannian submersions with singularities. One nice feature of SRFs is that they induce a canonical decomposition of the underlying manifold into embedded submanifolds equipped with regular Riemannian foliations. In this talk, I will demonstrate that this additional decomposition is in fact a singular foliation and provide a new proof that the pieces of this decomposition form a stratification.

The Representation Theory and Geometry of Quantum Algebras
Théorie des représentations et géométrie des algèbres quantiques

Org: Anne Dranowski (University of Southern California), **Matthew Rupert** (University of Saskatchewan), **Alex Weekes** (University of Saskatchewan) and/et **Curtis Wendlandt** (University of Saskatchewan)

In today's mathematical landscape, the theory of quantum algebras is a vast area which intersects with numerous sub-branches of algebra, geometry, and mathematical physics. The goal of this scientific session is to provide a forum where mathematicians working on various problems with direct ties to quantum algebras can interact and share state-of-the-art developments. The session will put a strong emphasis on algebraic and geometric constructions arising in connection with those quantum algebras associated to Kac–Moody algebras and their generalizations.

Dans le paysage mathématique actuel, la théorie des algèbres quantiques est un vaste domaine qui recoupe de nombreuses sous-branches de l'algèbre, de la géométrie et de la physique mathématique. L'objectif de cette session scientifique est de fournir un forum où les mathématiciens travaillant sur divers problèmes directement liés aux algèbres quantiques peuvent interagir et partager les développements les plus récents. La session mettra l'accent sur les constructions algébriques et géométriques liées aux algèbres quantiques associées aux algèbres de Kac-Moody et à leurs généralisations.

Schedule/Horaire **Room/Salle: ARTS 100**

Saturday June 1 — samedi 1er juin

8:30 - 9:00	Manish Patnaik (University of Alberta), *Metaplectic Groups and Quantum Groups* (p. 111)
9:00 - 9:30	Peter Crooks (Utah State University), *Topological quantum field theories in the Moore-Tachikawa category* (p. 108)
9:30 - 10:00	Meng Guo (University of Illinois Urbana-Champaign), *On the spectrification of Khovanov arc algebras* (p. 109)
10:00 - 10:30	Niklas Garner (University of Washington), *Raviolo vertex algebras* (p. 109)
15:00 - 15:30	Noah Friesen (University of Saskatchewan), *Braid groups and Baxter polynomials* (p. 108)
15:30 - 16:00	Dinushi Munasinghe (University of Toronto), *Schur Algebras in Type B* (p. 111)
16:00 - 16:30	Emily Cliff (University of Sherbrooke), *Quasi-universal sheaves and generic bricks* (p. 108)
17:00 - 17:30	Mamoru Ueda (University of Alberta), *Affine Yangians of type A and non-rectangular W-algebras of type A* (p. 113)
17:30 - 18:00	Nicolas Guay (University of Alberta), *Orthosymplectic Yangians.* (p. 109)

Sunday June 2 — dimanche 2 juin

8:30 - 9:00	Valerio Toledano Laredo (Northeastern University), *On the Finkelberg-Ginzburg monodromy conjecture* (p. 110)
9:00 - 9:30	Shigenori Nakatsuka (University of Alberta), *On the structure of W-algebras* (p. 111)
9:30 - 10:00	Alexis Leroux-Lapierre (McGill University), *Obstructions to quantization of MV cycles using limits of characters* (p. 110)
10:00 - 10:30	Wenjun Niu (Perimeter Institute), *Yangians for Takiff Algebra and Spectral R matrix* (p. 111)
15:00 - 15:30	Yvan Saint-Aubin (Université de Montréal), *Bound quiver algebras that are Morita-equivalent to the Temperley-Lieb algebras of type B* (p. 112)
15:30 - 16:00	Sachin Gautam (The Ohio State University), *Lattice operators of quantum affine algebras* (p. 109)
16:00 - 16:30	Harshit Yadav (University of Alberta), *Rigidity of VOAs and their extensions* (p. 113)
17:00 - 17:30	Théo Pinet (Université Paris-Cité and Université de Montréal), *Inflations for representations of shifted quantum affine algebras* (p. 112)
17:30 - 18:00	Terry Gannon (University of Alberta), *The search for exotic vertex operator algebras* (p. 109)

Monday June 3 — lundi 3 juin

The Representation Theory and Geometry of Quantum Algebras
Théorie des représentations et géométrie des algèbres quantiques

8:30 - 9:00	Jonas Hartwig (Iowa State University), *Generalized reduction algebras* (p. 110)
9:00 - 9:30	Hadi Salmasian (University of Ottawa), *Mapping a quantum group into a quantum Weyl algebra and applications* (p. 112)
9:30 - 10:00	Yorck Sommerhauser (Memorial University of Newfoundland), *Hopf Algebras, Cohomology, and Mapping Class Groups* (p. 113)
10:00 - 10:30	Surya Raghavendran (Yale University), *Towards a Dolbeault AGT correspondence* (p. 112)
15:00 - 15:30	Francis Bischoff (University of Regina), *Castling Equivalence for Logarithmic Flat Connections* (p. 108)
15:30 - 16:00	Iva Halacheva (Northeastern University), *Bethe subalgebras of the Yangian Y(gl(n)), tame representations, and Gelfand-Tsetlin patterns* (p. 110)

Abstracts/Résumés

FRANCIS BISCHOFF, University of Regina
[Monday June 3 / lundi 3 juin, 15:00 – ARTS 100]
Castling Equivalence for Logarithmic Flat Connections

Castling is an operation on linear representations which arises from the phenomenon of dual Grassmanians. In this talk, I will explain its relevance to the problem of extending a logarithmic flat connection across the singular locus of a hypersurface.

EMILY CLIFF, Université de Sherbrooke
[Saturday June 1 / samedi 1er juin, 16:00 – ARTS 100]
Quasi-universal sheaves and generic bricks

This is based on joint work with Colin Ingalls and Charles Paquette. For a quiver $Q = (Q_0, Q_1)$ and dimension vector $d = (d_i)_{i \in Q_0}$ we study a coarse moduli M space of quiver representations. Let d be the greatest common divisor of the numbers d_i. In the case that $d = 1$, it is known that M admits a universal family U of representations, and hence is a fine moduli space: that is, U is a sheaf of kQ-modules on M such that for every point $m \in M$ corresponding to a kQ-module V_m, the fibre U_m of U at m is isomorphic to the representation V_m. However, this fails when $d > 1$ (Reineke–Schröer, Hoskins–Schaffhauser) ; instead M admits a *quasi-universal* family $\tilde{U}$ whose fibre $\tilde{U}_m$ is isomorphic to a direct sum of copies of the representation V_m. In this talk, I will introduce the notion of twisted sheaves and sketch the construction of the sheaf $\tilde{U}$. I will explain how we can use the quasi-universal sheaf $\tilde{U}$ to construct generic bricks for the path algebra kQ.

PETER CROOKS, Utah State University
[Saturday June 1 / samedi 1er juin, 9:00 – ARTS 100]
Topological quantum field theories in the Moore-Tachikawa category

I will briefly review Moore and Tachikawa's conjectural topological quantum field theory (TQFT), as well as the representation theory underlying its formulation. This will lead to an outline of recent, affirmative evidence for the conjecture. I will also detail a systematic association of TQFTs to Lie-theoretic data. A distinguished role will be played by the partial Grothendieck-Springer resolutions and their Poisson-geometric relatives. This represents joint work with Maxence Mayrand.

NOAH FRIESEN, University of Saskatchewan
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 100]
Braid groups and Baxter polynomials

It is a classical result in representation theory that the braid group of a simple Lie algebra $\mathfrak{g}$ acts on any integrable representation of $\mathfrak{g}$ via products of exponentials of Chevalley generators of $\mathfrak{g}$. In this talk, we show that modifying this action induces an action on the commutative subalgebra $Y_\hbar^0(\mathfrak{g})$ of the Yangian. Dualizing this modified action gives us a new factorization of the Baxter polynomials of any irreducible representation of the Yangian, whose zeros encode information about the tensor products of such representations.

TERRY GANNON, U Alberta
[Sunday June 2 / dimanche 2 juin, 17:30 – ARTS 100]
The search for exotic vertex operator algebras

A frustrating aspect of our current understanding of vertex operator algebras (VOAs) is a lack of examples. More precisely, there are very few if any examples of VOAs which are independent of classical math like Lie algebras or lattices or finite groups. Is this because that is all the VOAs there are ? Or are there whole worlds of new families of VOAs, and we are just too dumb (too classical) to find them ? If we look at some shadows cast by VOAs (e.g. their tensor categories), we find several hints that such exotic VOAs should exist, and in fact be numerous. In my talk I'll sketch this story, and apply it to the most interesting exotic candidate: the so-called Haagerup CFT, which has been pursued by both mathematicians and physicists for well over a decade.

NIKLAS GARNER, University of Washington, Seattle
[Saturday June 1 / samedi 1er juin, 10:00 – ARTS 100]
Raviolo vertex algebras

I will describe work with B. Williams developing an algebraic structure modeling local observables in mixed holomorphic-topological quantum field theories in three dimensions. The resulting algebraic structure is directly analogous to a vertex algebra, but where holomorphic functions on a punctured complex curve are replaced by (derived) functions on a punctured 3-manifold that are constant along the leaves of chosen transverse holomorphic foliation. Time permitting, I will describe a construction appearing in work with S. Raghavendran and B. Williams on how Higgs and Coulomb branches of 3d $N = 4$ theories are encoded in this structure.

SACHIN GAUTAM, The Ohio State University
[Sunday June 2 / dimanche 2 juin, 15:30 – ARTS 100]
Lattice operators of quantum affine algebras

Let g be a finite-dimensional, simple Lie algebra over the field of complex numbers, and U be the quantum, untwisted affine algebra, associated to g. It is well known that the affine braid group of g acts on any integrable representation of U. In particular, one obtains an action of the coroot lattice of g on such a representation. In this talk, I will present an explicit formula for these lattice operators on finite-dimensional representations of U, in terms of the generators of its maximal commutative subalgebra in Drinfeld's loop presentation. This formula was obtained in a joint work in progress with V. Toledano Laredo.

NICOLAS GUAY, University of Alberta
[Saturday June 1 / samedi 1er juin, 17:30 – ARTS 100]
Orthosymplectic Yangians.

This talk will provide a summary of what is currently known about the representation theory of orthosymplectic Yangians, in particular the classification of their finite dimensional representations.

MENG GUO, University of Illinois Urbana-Champaign
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 100]
On the spectrification of Khovanov arc algebras

Leveraging skew Howe duality, we show that Lawson-Lipshitz-Sarkar's spectrification of Khovanov's arc algebra gives rise to 2-representations of categorified quantum groups over $\mathbb{F}_2$ that we call spectral 2-representations. These spectral 2-representations take values in the homotopy category of spectral bimodules over spectral categories. We view this as a step toward a higher representation theoretic interpretation of spectral enhancements in link homology. Following this idea, we hope to use this idea to construct a spectrum whose homology realized the Blanchet-Khovanov algebra. This is an ongoing project with Anne Dranowski, Aaron Lauda, and Andrew Manion.

IVA HALACHEVA, Northeastern University
[Monday June 3 / lundi 3 juin, 15:30 – ARTS 100]
Bethe subalgebras of the Yangian Y(gl(n)), tame representations, and Gelfand-Tsetlin patterns

The Bethe subalgebras of the Yangian Y(gl(n)) form a family of maximal commutative subalgebras indexed by points of the Deligne-Mumford compactification of the moduli space M(0,n+2). When considering a point C in the real locus of this parameter space, the corresponding Bethe subalgebra B(C) acts with simple spectrum on a given tame representation of Y(gl(n)). This results in an unramified covering, whose fiber over C is the set of eigenlines for the action of B(C). I will discuss the identification of each fiber with a collection of Gelfand-Tsetlin keystone patterns, which carry a gl(n)-crystal structure, as well as the monodromy action realized by a type of cactus group. This is joint work with Anfisa Gurenkova and Leonid Rybnikov.

JONAS HARTWIG, Iowa State University
[Monday June 3 / lundi 3 juin, 8:30 – ARTS 100]
Generalized reduction algebras

Reduction algebras are known by many names, including step algebras, Mickelsson algebras, Zhelobenko algebras, and transvector algebras. They are constructed out of an algebra map $U(\mathfrak{g}) \to A$ from an enveloping algebra of a reductive Lie algebra to an associative algebra. There are also super and quantum analogs. Their defining property is that they act on the space of singular vectors V^+ in any A-modules V. They are therefore closely related to the branching rule $A \downarrow U(\mathfrak{g})$ and intertwining operators.

In this talk we present some recent work on a generalization of the notion of reduction algebras where the enveloping algebra can be replaced by some other algebra without a triangular decomposition, such as the $\imath$quantum group $U_q'(\mathfrak{so}_n)$.

VALERIO TOLEDANO LAREDO, Northeastern University
[Sunday June 2 / dimanche 2 juin, 8:30 – ARTS 100]
On the Finkelberg-Ginzburg monodromy conjecture

Ginzburg and Finkelberg defined a mirabolic $\mathcal{D}$-module on the product of $SL_n(\mathbb{C})$ and its vector representation and conjectured that its monodromy on the open stratum is a covariant representation of the affine Hecke algebra of type A_{n-1}. We compute this monodromy for all values of the parameters (θ, c) in rank 1, and outside an explicit codimension 2 set of values in ranks 2 and higher. This shows in particular that the Finkelberg-Ginzburg conjecture, which was known to hold for generic values of (θ, c), fails at special values even in rank 1. Our main tools are Opdam's shift operators and Cherednik's intertwiners for the affine Weyl group, which allow for the resolution of resonances of the mirabolic connection. This is joint work with Robin Walters (Northeastern).

ALEXIS LEROUX-LAPIERRE, McGill University
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 100]
Obstructions to quantization of MV cycles using limits of characters

The apparently elementary question of writing down perfect bases for the irreducible representations of semisimple Lie algebras is a problem which finds its source in surprisingly involved mathematical tools. Two such sources are a version of the geometric Satake equivalence (giving rise to the so-called Mirkovic-Vilonen bases) and a categorification of U_q^- using KLR algebras (giving rise to the so-called dual canonical bases). It has been shown that those two families of bases do not coincide, raising the question of understanding the change of basis matrix. We introduce an algebraic equivariant multiplicity for modules over truncated shifted Yangians through limits of characters, effectively providing a tool to study this change of basis. Moreover, we apply this new notion to study whether, for given MV cycle, there exists a module over a truncated shifted Yangian whose caracteristic cycle is precisely this MV cycle. This is joint work with Joel Kamnitzer.

DINUSHI MUNASINGHE, University of Toronto
[Saturday June 1 / samedi 1er juin, 15:30 – ARTS 100]
Schur Algebras in Type B

Summary: We compare two type B generalizations of the q-Schur algebra: the cyclotomic q-Schur algebra of Dipper, James, and Mathas, and the algebra of endomorphisms commuting with the natural generalization of the Hecke action to type B, introduced by Lai and Luo. By writing the latter algebra as an idempotent truncation of the former, we leverage its properties to establish cellularity and study the crystal graph structure of the simples of the endomorphism algebra, investigating parameter values at which these algebras are Morita equivalent.

SHIGENORI NAKATSUKA, University of Alberta
[Sunday June 2 / dimanche 2 juin, 9:00 – ARTS 100]
On the structure of W-algebras

The W-algebras are a basic class of vertex algebras that non-linearly generalize the affine Lie algebras and the Virasoro Lie algebra. They have appeared prominently in various areas of mathematics. In this talk, we discuss hidden relations among W-algebras, which can be understood from various points of view: Whittaker models of p-adic group representations, boundary conditions on N=4 super Yang-Mills theories, and the affine Yangians.

WENJUN NIU, Perimeter Institute for Theoretical Physics
[Sunday June 2 / dimanche 2 juin, 10:00 – ARTS 100]
Yangians for Takiff Algebra and Spectral R matrix

Let $\mathfrak{g}$ be a Lie algebra and $\mathfrak{d} := T^*\mathfrak{g} = \mathfrak{g} \ltimes \mathfrak{g}^*$, which we call the Takiff algebra of $\mathfrak{g}$. In this talk, I will explain how one can construct a natural quantization of $U(\mathfrak{d}[t])$ as a Hopf algebra, which I will denote by $\mathcal{A}_\hbar(\mathfrak{d})$. This will be a Hopf algebra with an action of the translation operator T, and moreover possess a spectral R matrix $R(z)$, such that:

$$\tau_z \otimes 1(\Delta_\hbar^{op}) = R(z)(\tau_z \otimes 1\Delta_\hbar)R(z)^{-1},$$

where $\tau_z = e^{zT}$ and $R(z)$ satisfies spectral quantum Yang-Baxter equation. I will explain how this construction is inspired by the study of holomorphic topological twists of 4d $\mathcal{N} = 2$ theories, as well as the construction of Gautam-Toledano-Laredo-Wendlandt.

MANISH PATNAIK, University of Alberta
[Saturday June 1 / samedi 1er juin, 8:30 – ARTS 100]
Metaplectic Groups and Quantum Groups

The study of Whittaker functions on metaplectic groups arose from a desire to understand certain phenomenon in analytic number theory (distributions of Gauss sums, moments of L-functions). Motivated by ideas in the geometric Langlands program, we explain how this Whittaker theory on a ℓ-fold cover of a p-adic groups can be connected to the representation theory of quantum groups at a ℓ-th root of unity.

Joint work with Valentin Buciumas.

THÉO PINET, Université Paris Cité and Université de Montréal
[Sunday June 2 / dimanche 2 juin, 17:00 – ARTS 100]
Inflations for representations of shifted quantum affine algebras

Fix a finite-dimensional simple Lie algebra $\mathfrak{g}$ and let $\mathfrak{g}_J \subseteq \mathfrak{g}$ be a Lie subalgebra coming from a Dynkin diagram inclusion. Then, the corresponding restriction functor is not essentially surjective on finite-dimensional simple $\mathfrak{g}_J$-modules. In this talk, we will study Finkelberg-Tsymbaliuk's shifted quantum affine algebras $U_q^\mu(\mathfrak{g})$ and the associated categories $\mathcal{O}^\mu$ (defined by Hernandez). In particular, we will introduce natural subalgebras $U_q^\nu(\mathfrak{g}_J) \subseteq U_q^\mu(\mathfrak{g})$ and obtain a functor $\mathcal{R}_J$ from $\mathcal{O}^{sh} = \bigoplus_\mu \mathcal{O}^\mu$ to $\bigoplus_\nu (U_q^\nu(\mathfrak{g}_J)\text{-Mod})$ using the canonical restriction functors. We will then establish that $\mathcal{R}_J$ is essentially surjective on finite-dimensional simple objects by constructing notable preimages (called *inflations*) and will use these preimages to deduce certain *R-matrices* and examples of *cluster structures over Grothendieck rings*.

SURYA RAGHAVENDRAN, Yale University
[Monday June 3 / lundi 3 juin, 10:00 – ARTS 100]
Towards a Dolbeault AGT correspondence

In seminal work, Grojnowski-Nakajima constructed an action of the Heisenberg algebra on equivariant cohomology of Hilbert schemes. I will describe two holomorphic factorization algebras in three complex dimensions that furnish higher dimensional uplifts of the Heisenberg and Virasoro vertex algebras respectively. Conjecturally, mode algebras of these factorization algebras act on coherent cohomology of moduli of twisted Higgs sheaves on surfaces, and in a particular example, the action admits a cohomological deformation to the one studied by Grojnowski-Nakajima. I will describe motivation and evidence for this conjecture, rooted in a new mathematical understanding of a nebulous superconformal field theory in six dimensions.

YVAN SAINT-AUBIN, Université de Montréal
[Sunday June 2 / dimanche 2 juin, 15:00 – ARTS 100]
Bound quiver algebras that are Morita-equivalent to the Temperley-Lieb algebras of type B

Bound quiver algebras are in a sense the simplest (non-semisimple) algebras: their simple modules are one-dimensional, and indecomposable projective and injective ones can be read from their quiver presentation. Finding a path algebra that captures the representation theory of another given algebra is however very difficult. The family of Temperley-Lieb algebras TLb_n of type B (also known as the blob algebras) has a rich representation theory and is related to several important ones in both mathematics and physics: the affine Temperley-Lieb, the cyclotomic affine Hecke and the KLR algebras. Using Elias-Soergel-Williamson diagrammatic calculus we obtain bounded quiver algebras that are Morita-equivalent to the blocks of the algebras TLb_n. This is work in progress with Alexis Leroux-Lapierre and Théo Pinet. The relations on the bound quiver were also checked independently by Philippe Petit using KLR diagrammatics.

HADI SALMASIAN, University of Ottawa
[Monday June 3 / lundi 3 juin, 9:00 – ARTS 100]
Mapping a quantum group into a quantum Weyl algebra and applications

The representation of a reductive Lie algebra on a polynomial space by differential operators plays a pivotal role in classical invariant theory. In this talk, we describe a quantum analogue of this idea. We present some results, a conjecture, and an

application to the quantum First Fundamental Theorem. This talk is based on joint work with Gail Letzter and Siddhartha Sahi.

YORCK SOMMERHAUSER, Memorial University
[Monday June 3 / lundi 3 juin, 9:30 – ARTS 100]
Hopf Algebras, Cohomology, and Mapping Class Groups

It follows from the general principles of topological field theory that mapping class groups of surfaces act on certain spaces of homomorphisms between certain representations of factorizable ribbon Hopf algebras. These homomorphism spaces, the so-called spaces of conformal blocks, or briefly block spaces, can be viewed as cohomology groups of degree zero. In the talk, we explain how this construction can be extended to cohomology groups of higher degree. The talk is based on joint work with S. Lentner, S. N. Mierach, and C. Schweigert.

MAMORU UEDA, University of Alberta
[Saturday June 1 / samedi 1er juin, 17:00 – ARTS 100]
Affine Yangians of type A and non-rectangular W-algebras of type A

We will talk about how to construct a homomorphism from the affine Yangian of type A to the universal enveloping algebra of a non-rectangular W-algebra of type A. This homomorphism is an affine analogue of the one given by De Sole-Kac-Valeri and is surjective in the rectangular case. It is constructed by using the coproduct for the affine Yangian of type A and the Miura map for a W-algebra. As a consequence, we can obtain the compatibility between the coproduct for the affine Yangian and the parabolic induction for a non-rectangular W-algebra are compatible through this homomorphism. We expect that this homomorphism will be helpful for the generalization of the AGT conjecture, which will give a geometric representation of a W-algebra of type A.

HARSHIT YADAV, University of Alberta
[Sunday June 2 / dimanche 2 juin, 16:00 – ARTS 100]
Rigidity of VOAs and their extensions

I will start by motivating the study of non-semisimple modular tensor categories (ns MTC) using logarithmic vertex operator algebras (log VOAs). Among the most well understood techniques of obtaining new log-VOAs is by VOA extensions. The categorical counterpart of VOA extensions is the local module construction. We prove that given a ns MTC and a suitable commutative algebra A, the category of local modules is a ns MTC. This generalizes the results of Kirillov-Ostrik. Applying our result to VOA extensions allows us to prove that the extension of strong rational (resp., finite) VOA is strong rational (resp., finite). This talk is based on joint works with Kenichi Shimizu, Thomas Creutzig and Robert Mcrae.

Unveiling Infinite Symmetries

Org: Abid Ali (University of Saskatchewan), **Lisa Carbone** (Rutgers University) and/et **Steven Rayan** (University of Saskatchewan)

Infinite-dimensional Lie algebras, including Kac-Moody algebras, Monstrous Lie algebras, and more generally, Borcherds algebras, play a crucial role in various branches of mathematics and theoretical physics. The mini-course will cover fundamental concepts related to these infinite-dimensional Lie algebras and their associated groups, share the latest developments on these topics, and discuss potential future projects on the new constructions.

Les algèbres de Lie à dimension infinie, y compris les algèbres de Kac-Moody, les algèbres de Lie monstrueuses et, plus généralement, les algèbres de Borcherds, jouent un rôle crucial dans diverses branches des mathématiques et de la physique théorique. Le mini-cours couvrira les concepts fondamentaux liés à ces algèbres de Lie à dimension infinie et leurs groupes associés, partagera les derniers développements sur ces sujets, et discutera des projets futurs potentiels sur les nouvelles constructions.

Schedule/Horaire **Room/Salle: ARTS 102**

Saturday June 1 **samedi 1er juin**

8:15 - 9:15	Darlayne Addabbo (University of Arizona) (p. 114)
9:30 - 10:30	Maryam Khaqan (University of Toronto) (p. 114)
15:00 - 16:00	Elizabeth Jurisich (The College of Charleston) (p. 114)

Sunday June 2 **dimanche 2 juin**

8:15 - 9:15	Lisa Carbone (Rutgers, The State University of New Jersey) (p. 114)
9:30 - 10:30	Scott Murray (Rutgers, The State University of New Jersey) (p. 114)

Abstracts/Résumés

DARLAYNE ADDABBO, University of Arizona
[Saturday June 1 / samedi 1er juin, 8:15 – ARTS 102]

LISA CARBONE, Rutgers, The State University of New Jersey
[Sunday June 2 / dimanche 2 juin, 8:15 – ARTS 102]

ELIZABETH JURISICH, The College of Charleston
[Saturday June 1 / samedi 1er juin, 15:00 – ARTS 102]

MARYAM KHAQAN, University of Toronto
[Saturday June 1 / samedi 1er juin, 9:30 – ARTS 102]

SCOTT MURRAY, Rutgers, The State University of New Jersey
[Sunday June 2 / dimanche 2 juin, 9:30 – ARTS 102]

Canadian Journal of Mathematics

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: cambridge.org/CJM

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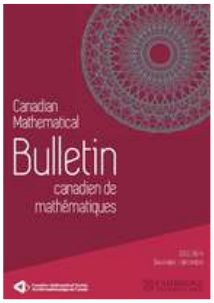
Canadian Mathematical Bulletin



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: cambridge.org/BCM

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Canadian Mathematical Society
Société mathématique du Canada

Call for nominations
Appel de mises en candidature

2025 CMS

Prix Krieger-Nelson Prize

2025 de la SMC

In recognition of outstanding research by a woman or a female-identifying mathematician.

En reconnaissance d'une excellente contribution à la recherche mathématique par une mathématicienne s'identifiant au genre féminin.

Submit all documentation to knprize@cms.math.ca
no later than September 30, 2024

Soumettez tous les documents à prixkn@smc.math.ca
au plus tard le 30 septembre 2024

Canadian Mathematical Society
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Call for nominations
Appel de mises en candidature

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Prix Coxeter-James Prize

2025 de la SMC

In recognition of young mathematicians who have made outstanding contributions to mathematical research.

En reconnaissance d'un.e jeune mathématicien.ne qui s'est distingué.e par l'excellence de sa contribution à la recherche mathématique.

Submit all documentation to cjprize@cms.math.ca
no later than September 30, 2024

Soumettez tous les documents à prixcj@smc.math.ca
au plus tard le 30 septembre 2024

Canadian Mathematical Society
Société mathématique du Canada

Call for nominations
Appel de mises en candidature

2025 CMS

Prix Jeffery-Williams Prize

2025 de la SMC

In recognition of mathematicians who have made outstanding contributions to mathematical research.

En reconnaissance d'un.e mathématicien.ne ayant fait une contribution exceptionnelle et soutenue à la recherche mathématique.

Submit all documentation to jwprize@cms.math.ca
no later than September 30, 2024

Soumettez tous les documents à prixjw@smc.math.ca
au plus tard le 30 septembre 2024

Canadian Mathematical Society
Société mathématique du Canada

Call for nominations
Appel de mises en candidature

2025 CMS

Prix Cathleen Synge Morawetz Prize

2025 de la SMC

In recognition of outstanding research publication by one or more author(s). A series of closely related publications can be considered if they are clearly connected and focused on the same topic. Subject area for 2025: Algebra, Number theory, Algebraic geometry.

En reconnaissance d'un article de recherche exceptionnel ou d'une série d'articles interreliés et axés sur un même sujet par un ou plusieurs auteur(s). Domaine de recherche pour 2025 : L'algèbre, la théorie des nombres, la géométrie algébrique.

Submit all documentation to csmprize@cms.math.ca
no later than September 30, 2024

Soumettez tous les documents à prixcsm@smc.math.ca
au plus tard le 30 septembre 2024

The Canadian Mathematical Society (CMS) welcomes and invites **scientific session** proposals for the 2024 CMS Winter Meeting in Vancouver/Richmond, BC from November 29 – December 2, 2024.

- 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 November 30 to December 2. 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 session blocks requested (morning blocks are 2.5 hours, afternoon blocks are 2 hours).
4. A pdf file including a description of the topic and purpose of the session (1-2 paragraphs), for consideration by the Scientific Committee, not to be posted.
5. A spreadsheet including a 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.

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 session’s subject. 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 place great value on your contributions as organizers. Our primary goal is to provide the best possible experience for all attendees, and this is often better achieved by dedicating your efforts to a single, impactful session. As such, we recommend that each potential organizer only propose a single session.

Submission Form and Deadlines:

Please submit proposals by filling out this form. There will be two rounds of submissions. Proposals submitted by **June 15, 2024**, will be considered in the first round, with responses ongoing. The deadline for the second round will be **September 15, 2024**.

La Société mathématique du Canada (SMC) invite les participants à soumettre des propositions de **sessions scientifiques** pour la Réunion d'hiver 2024 de la SMC, qui se tiendra à Vancouver/Richmond, en Colombie-Britannique, du 29 novembre au 2 décembre 2024.

- L'objectif des séances scientifiques est de partager la recherche de pointe sur un sujet mathématique donné, tel que suggéré par les organisateurs.
- Les sessions sont programmées en blocs, chaque bloc ayant une durée de 2 à 2,5 heures, et se déroulent du 30 novembre au 2 décembre. Les sessions scientifiques typiques comportent entre 10 et 20 exposés de 20 minutes chacun, avec 10 minutes entre les exposés, mais des exposés de 50 minutes sont possibles. En effet, les organisateurs sont invités à suggérer une utilisation non traditionnelle des horaires et du format des blocs.
- Conformément au mandat de la SMC de proposer des conférences accessibles et accueillantes pour tous les groupes, la diversité parmi les organisateurs et les orateurs est fortement encouragée. Afin de soutenir les organisateurs 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 organisateurs 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'un appel distinct sera lancé 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 comporter les éléments suivants :

1. Noms, affiliations et coordonnées de deux ou trois organisateurs : Un organisateur principal et un ou deux co-organisateurs.
2. Un titre et un résumé de deux à trois phrases qui seront affichés sur le site Web à l'intention des orateurs potentiels.
3. Le nombre de blocs de sessions demandés (les blocs du matin sont de 2,5 heures, ceux de l'après-midi de 2 heures).
4. Un fichier pdf comprenant une description du sujet et de l'objectif de la session (1 à 2 paragraphes), pour examen par le comité scientifique, qui ne sera pas publié en ligne.
5. Un tableur comprenant la liste des orateurs possibles. Les colonnes « Nom », « Prénom », « Affiliation », « Stade de carrière » et « Page web » doivent contenir autant d'informations que possible sur les orateurs potentiels.

Les propositions seront sélectionnées par le comité d'organisation scientifique, dans la limite des places disponibles dans les salles de classe, avec une priorité pour les sessions qui montrent l'intention d'inclure un mélange de chercheurs seniors et juniors, de rendre certaines parties de leur session accessibles aux étudiants diplômés, et d'inclure des orateurs issus de groupes sous-représentés désignés.

Note à propos des organisateurs

L'organisateur principal doit être titulaire d'un doctorat ou d'un diplôme équivalent dans le domaine d'expertise correspondant au sujet de la session. L'idéal serait qu'un chercheur chevronné (par exemple, un professeur ou un professeur associé titulaire) soit associé à une personne en début de carrière (par exemple, un professeur assistant titulaire ou un boursier postdoctoral).

Nous accordons une grande importance à vos contributions en tant qu'organisateurs. Notre objectif premier est d'offrir la meilleure expérience possible à tous les participants, et il est souvent plus facile d'y parvenir en consacrant vos efforts à une seule session à fort impact. C'est pourquoi nous recommandons à chaque organisateur potentiel 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 séries de soumissions. Les propositions soumises avant le **15 juin 2024** seront examinées lors de la première série, avec des réponses continues. La date limite pour le deuxième tour sera le **15 septembre 2024**.

The Canadian Mathematical Society (CMS) welcomes and invites **education session** proposals for the 2024 CMS Winter Meeting in Richmond, British Columbia, from November 29 to December 2, 2024.

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.

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 welcome to propose sessions.
2. The education session's title, and a two to three-sentence summary that will be posted on the CMS Meeting website if your proposal is selected.
3. A brief description of the topic and purpose of the session (1-2 paragraphs), for consideration by the CMS Education Meetings Committee, not to be 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 CMS Education Meetings Committee.

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 November 29 to December 2, 2024.

Submission Form and Deadlines:
Please submit proposals by filling out this form. There will be two rounds of submissions. Proposals submitted by **June 15, 2024**, will be considered in the first round, where preference will be given to first round submissions. The deadline for the second round will be **September 15, 2024**.

La Société mathématique du Canada (SMC) sollicite des propositions de **sessions éducatives** pour la Réunion d'hiver 2024 de la SMC, qui se tiendra à Richmond, en Colombie-Britannique, du 29 novembre au 2 décembre 2024. 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-organisateurs de la session.

Conformément au mandat de la SMC de proposer des conférences accessibles et accueillantes pour tous les groupes, la diversité parmi les organisateurs et les conférenciers est fortement encouragée. Afin de soutenir les organisateurs 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 organisateurs 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 y aura un appel séparé 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-organisateurs de sessions. Les chercheurs en début de carrière sont invités à proposer des sessions.
2. Le titre de la session d'éducation et un résumé de deux à trois phrases qui sera affiché sur le site Web de la réunion de la SMC 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'orateurs avec leur nom complet et leur affiliation, qui ont confirmé ou qui ont exprimé leur intérêt et ont été approchés, avant de soumettre la proposition. Il est vivement recommandé de faire appel à un ensemble d'orateurs inclusifs et diversifiés.
6. La structure de votre session. Traditionnellement, chaque intervenant 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.

La SMC demande aux organisateurs de sessions de prendre en considération toutes les soumissions de résumés éligibles pour leur session, étant donné que jusqu'à 30 orateurs par session peuvent être accueillis. Toutes les sessions auront lieu du 29 novembre au 2 décembre 2024.

Formulaire de soumission et dates limites :

Les propositions doivent être soumises en remplissant ce formulaire. Il y aura deux séries de soumissions. Les propositions soumises avant le **15 juin 2024** seront examinées lors du premier tour, où la préférence sera donnée aux soumissions du premier tour. La date limite pour le deuxième tour sera le **15 septembre 2024**.

Canadian Mathematical Society
Société mathématique du Canada

See you in December

SAVE THE DATE

RÉSERVEZ LA DATE

On se voit en décembre

2024 CMS Winter Meeting
Réunion d'hiver 2024 de la SMC

Nov 29 to Dec 2 | Du 29 nov au 2 déc

RICHMOND, BC

Canadian Mathematical Society
Société mathématique du Canada

See you next year

SAVE THE DATE
RÉSERVEZ LA DATE

À l'année prochaine

2025 CMS Summer Meeting
Réunion d'été 2025 de la SMC

June 6 to 9 | Du 6 au 9 juin

QUÉBEC, QC

Option 1: Eduroam

We highly encourage participants based at universities to use the Eduroam network when they arrive at USask, which uses their home university credentials to negotiate access to our campus' secure wi-fi-network. The SSID for the network is just "eduroam". If participants have their Eduroam access properly configured, they should be able to connect automatically to the network.

We encourage participants to ensure that their Eduroam access is configured properly before they depart for Saskatoon. Most universities maintain their own instructions and information about how to connect to Eduroam.

More Information in general about Eduroam: https://eduroam.org/about/connect-yourself/

Option 2: University of Saskatchewan Public

USask also maintains a free public wi-fi network that requires no login credentials or password. The SSID is "uofs-public". Participants without Eduroam access are able to use this network to connect to the Internet. Participants will have to agree to USask IT usage policies when they first connect.

Option 1 : Eduroam

Nous encourageons vivement les participants basés dans des universités à utiliser le réseau Eduroam à leur arrivée à USask, ce qui leur permet de se connecter au réseau wi-fi sécurisé de notre campus en utilisant les données d'identification de leur université d'origine. Le SSID du réseau est simplement "eduroam". Si les participants ont correctement configuré leur accès Eduroam, ils devraient pouvoir se connecter automatiquement au réseau.

Nous encourageons les participants à s'assurer que leur accès Eduroam est correctement configuré avant leur départ pour Saskatoon. La plupart des universités disposent de leurs propres instructions et informations sur la manière de se connecter à Eduroam.

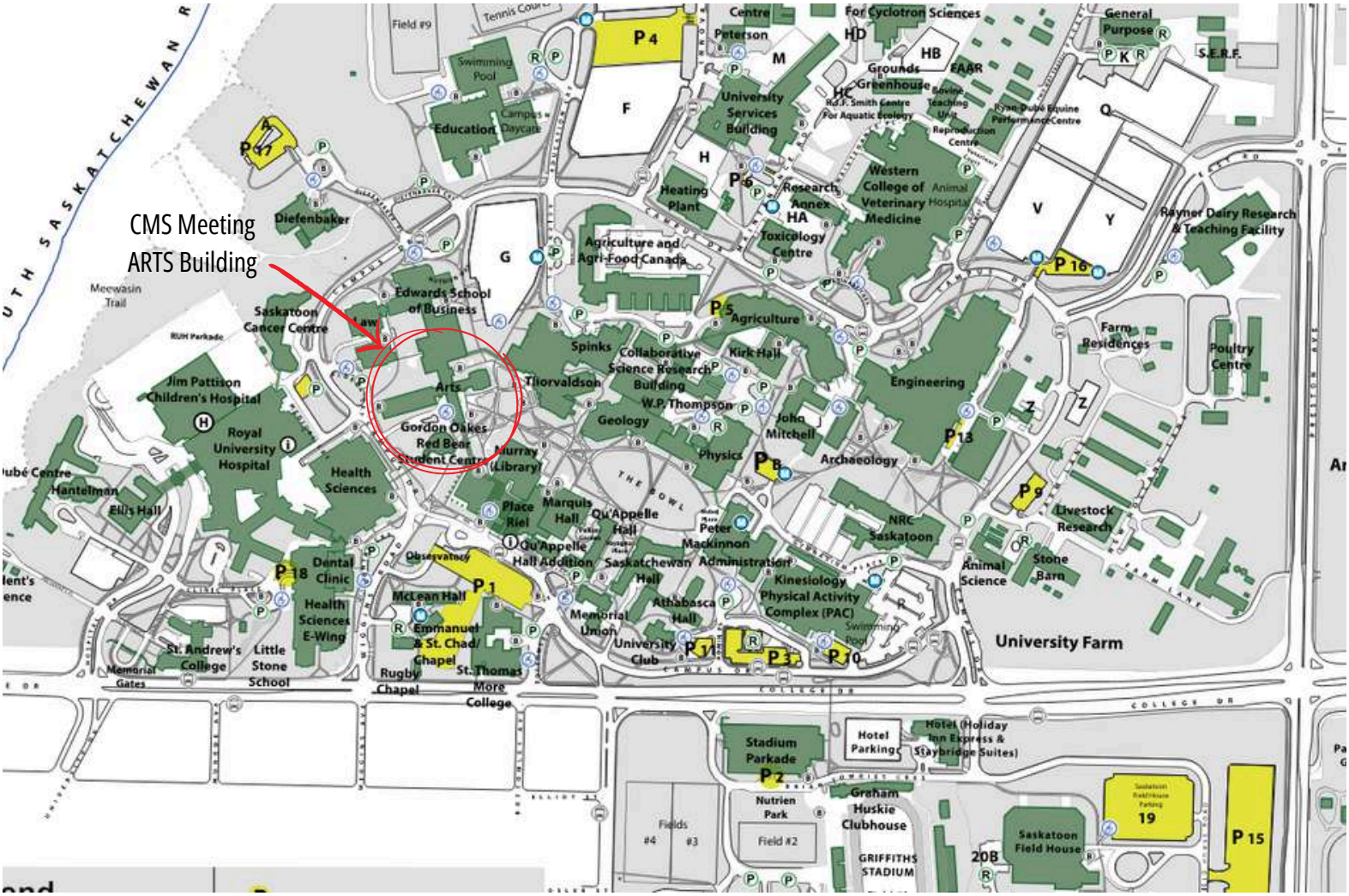
Plus d'informations générales sur Eduroam : https://eduroam.org/about/connect-yourself/

Option 2 : Réseau public de l'Université de la Saskatchewan

USask dispose également d'un réseau wi-fi public gratuit qui ne nécessite pas d'identifiant ni de mot de passe. Le SSID est "uofs-public". Les participants qui n'ont pas accès à Eduroam peuvent utiliser ce réseau pour se connecter à Internet. Les participants devront accepter les politiques d'utilisation des technologies de l'information de l'USask lors de leur première connexion.

UNIVERSITY OF SASKATCHEWAN

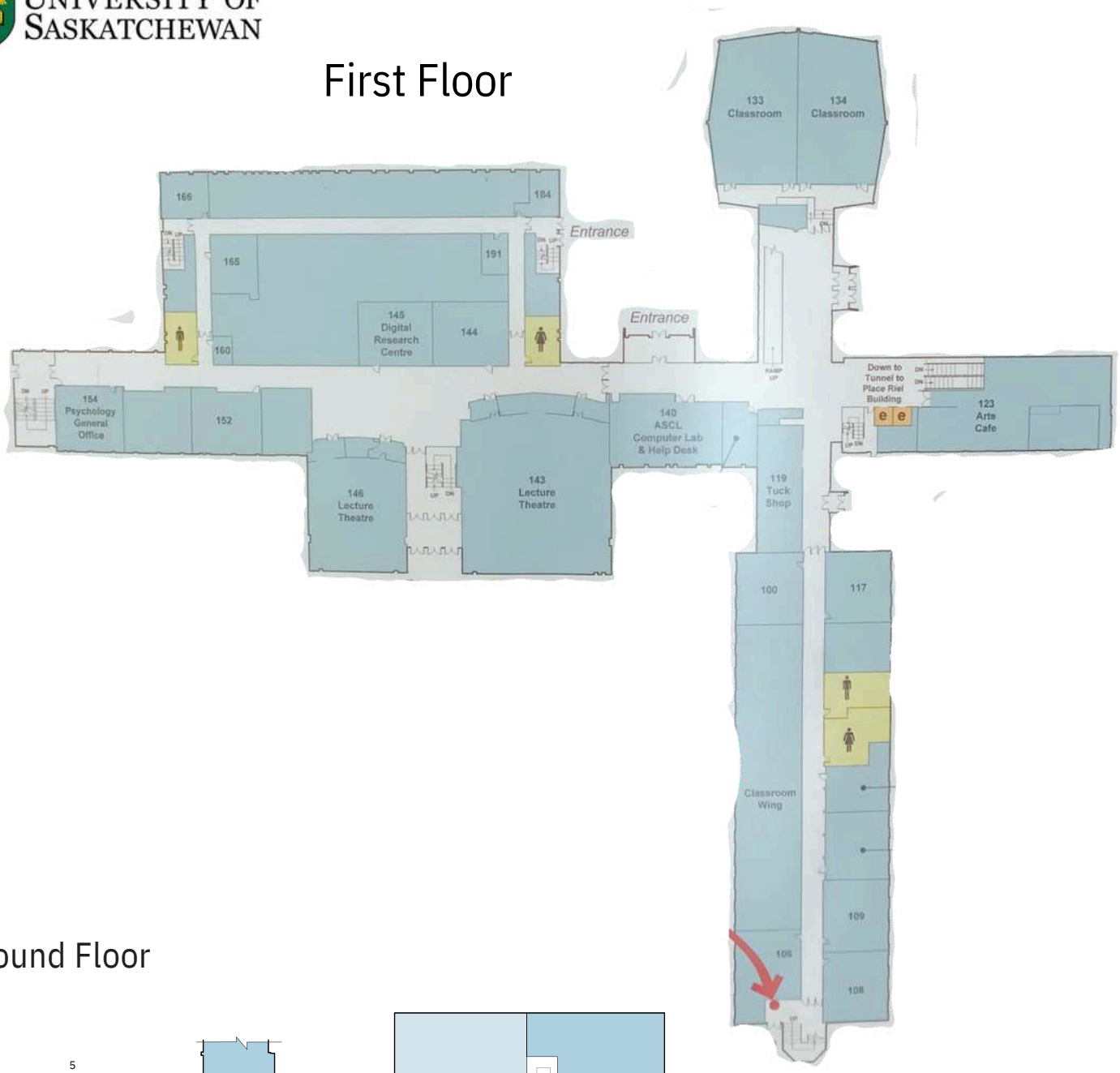
Campus Map



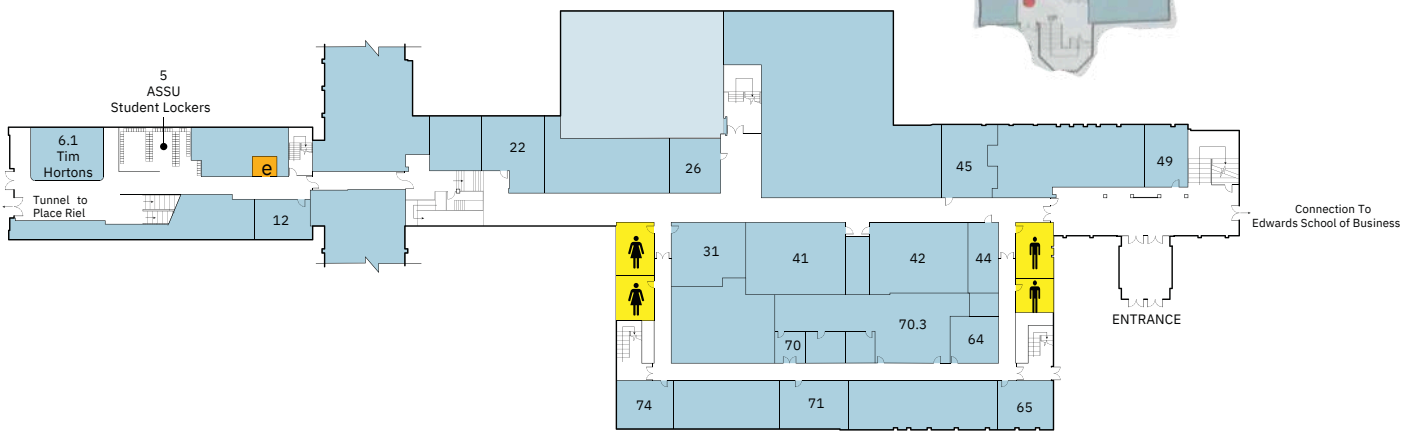
Floorplans

UNIVERSITY OF SASKATCHEWAN

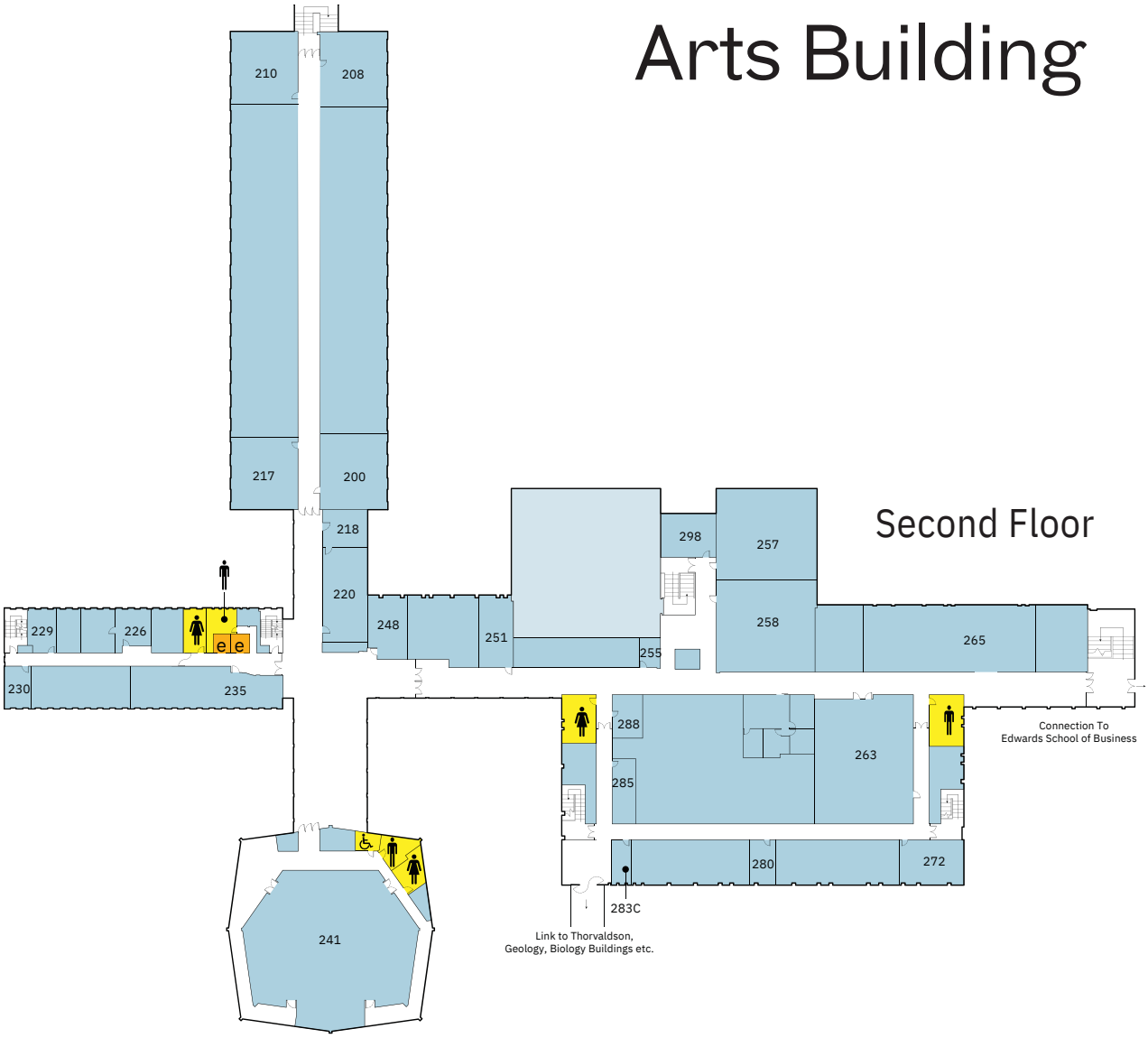
First Floor



Ground Floor



Arts Building



Canadian Mathematical Society
Société mathématique du Canada

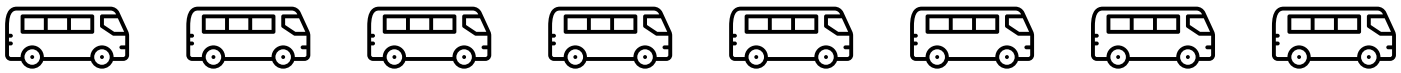
SHUTTLE

A shuttle will be available between
Holiday Inn Express & Suites Saskatoon East - University
Staybridge Suites Saskatoon - University
and the
ARTS building of the University of Saskatchewan

Every 30 minutes

To use the shuttle, please book your time with the personnel at the front desk of the hotel.

Please note that the shuttle schedule is not guaranteed and may change.



NAVETTE

Une navette sera disponible entre
Holiday Inn Express & Suites Saskatoon East - University
Staybridge Suites Saskatoon - University
et
Édifice des ARTS de l'Université de la Saskatchewan

Toutes les 30 minutes

Pour utiliser la navette, veuillez réserver votre créneau horaire auprès du personnel de la réception de l'hôtel.

Veuillez noter que l'horaire des navettes n'est pas garanti et qu'il peut être modifié.