RÉUNION D'HIVER DE LA SMC

CMS WINTER MEETING

2002

Université d'Ottawa
Ottawa (Ontario)
Du 8 au 10 décembre 2002

University of Ottawa
Ottawa, Ontario
December 8-10, 2002

Canadian Mathematical Society
Société mathématique du Canada

Université d'
University of
Ottawa

WELCOME
TO THE
CMS WINTER MEETING
2002, OTTAWA

BIENVENUE
À LA
RÉUNION D'HIVER DE LA SMC
2002, OTTAWA

CMS Winter Meeting 2002 - Réunion d'hiver 2002 de la SMC
Ottawa Marriott Hotel, 100 Kent Street, Ottawa (Ontario)

Time	Friday / vendredi December 6 décembre	Saturday / samedi December 7 décembre	Sunday / dimanche December 8 décembre	Monday / lundi December 9 décembre	Tuesday / mardi December 10 décembre
8:00			8 am - 5 pm Exhibits / Expositions Registration / Inscription	8 am - 5 pm Exhibits / Expositions Registration / Inscription	8 am - 5 pm Registration / Inscription
8:30			Opening / Ouverture		
9:00			9:00 - 10:00 **VICTOR GUILLEMIN**	9:00 - 10:00 **MACIEJ ZWORSKI**	9:00 - 10:00 **DAVID KERR** DOCTORAL PRIZE PRIX DE DOCTORAT
10:00			***Coffee / café***		
10:30			10:30 - 12:30 SESSIONS	10:30 - 12:30 SESSIONS	10:30 - 12:30 SESSIONS
11:00		11:00 - 1:00 CMS Development Group Luncheon / Lunch du Groupe de dévelopement de la SMC (Sussex Salon)			
12:30			12:30 - 2:00 Delegates' Luncheon Lunch des participants	12:30- 2:00 LUNCH	12:30- 2:00 LUNCH
1:30		1:30 - 6:30 CMS Board of Directors Meeting / Réunion du Conseil d'administration de la SMC (Wellington Salon)			
2:00			2:00 - 3:30 SESSIONS	2:00 - 3:00 **LISA JEFFREY** CONFÉRENCIER COXETER-JAMES LECTURE	2:00 - 3:00 **RENE CARMONA**
2:30					
3:00				***Coffee / café***	***Coffee / café***
3:30			***Coffee / café***	3:30 - 6:00 SESSIONS	3:30 - 6:00 SESSIONS
4:00			4:00 - 5:00 **JAMES ARTHUR**		
4:30					
5:00			5:00 - 6:00 SESSIONS		
5:30					
6:00	6:00-10:00 CMS Executive Committee Meeting Réunion du Comité éxecutif de la SMC (Sussex Salon)				BON VOYAGE HAVE A SAFE JOURNEY
6:30			6:30 - 7:30 CASH-BAR RECEPTION BAR-PAYANT		
7:00		7:00 - 9:00 RECEPTION Meeting Registration Inscription pour la réunion (Victoria North Ballroom)		7:00 - 7:30 PUBLIC LECTURE RECEPTION / RÉCEPTION CONFÉRENCE POPULAIRE	
7:30			7:30 - 10:00 BANQUET (Victoria North/South Ballrooms)	7:30 - 8:30 **ROBERT ZUCCHERATO** PUBLIC LECTURE CONFÉRENCE POPULAIRE	

Revised/révisé 11/8/02

Room/salle	#	**SESSION**
Victoria North/South		Plenary/Prize Speakers / Conférenciers pléniers/primés
Mackenzie	1	Financial Mathematics / Mathématiques financières
Capital	2	Finite Elements / Éléments finis
Rideau	3	History of Mathematics / Histoire des mathématiques
Laurier	4	Lie Algebras and Moonshine / Algèbres de Lie et Moonshine
Alta Vista	5	Mathematical Education / Enseignement des mathématiques
Carleton	6	Number Theory / Théorie des nombres
Albert	7	Operator Algebras / Algèbres des opérateurs
Dalhousie	8	Partial Differential Equations / Équations aux dérivées partielles
Sussex	9	"Real-World" Problems in Search of Solutions / Problèmes mathématiques provenant du monde industriel
Cartier	10	Representation Theory of Real and p-adic Groups / Théorie des représentations des groupes Réels et p-adiques
Wellington	11	Symplectic Geometry / Géométrie symplectique
Sussex	12	Theory and Applications of Point Processes / Théorie et applications des processus ponctuels
Alta Vista	13	Contributed Papers / Communications libres

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Mot du président de la société mathématique du Canada

La Société mathématique du Canada est particulièrement heureuse de vous accueillir à la Réunion d'hiver 2002 de la Société mathématique du Canada organisée par l'Université d'Ottawa, dans la ville où loge la société. Dans le maintien de la tradition à la SMC cette réunion est une occasion d'allier activités scientifiques stimulantes et rencontres amicales avec la communauté mathématique, tout en célébrant nos succès.

Cette réunion comporte 14 symposia sur des sujets variés, des communications, quatre conférences plénières, une conférence publique et deux conférences de prix.

Nous aurons le plaisir d'honorer plusieurs de nos membres. Ainsi la *conférence Coxeter-James* sera donnée par Lisa Jeffrey, de l'Université de Toronto. La *conférence du prix de doctorat* sera donnée par David Kerr qui a reçu son doctorat de l'Université de Toronto. Nous aurons aussi l'occasion de remercier Peter Lancaster de l'Université de Calgary de sa contribution importante à l'avancement des mathématiques au pays en lui remettant le *Prix pour service méritoire*. Le(s) récipiendiaire(s) du Prix G. De Robinson sera (seront) annoncé(s) lors du banquet. Les quatre conférenciers pléniers sont James Arthur (Toronto), Rene Carmona (Princeton), Victor Guillemin (MIT) et Maciej Zworski (Berkeley). La conférence publique sera donnée par Robert Zuccherato d'Entrust.

La réunion comprendra plusieurs activités sociales. La réception d'ouverture se tiendra le vendredi 7 décembre de 19 h à 21 h dans le Victoria North Ballroom de l'Hôtel Marriott. Le lunch des participants aura lieu le dimanche 8 décembre de de 12h 30 à 14h 00 dans le Victoria North/South Ballroom de l'Hôtel Marriott. Un billet pour le lunch est inclus dans l'inscription au congrès. Le banquet aura lieu le dimanche 8 décembre à compter de 19 h30 dans le Victoria North/South Ballroom de l'Hôtel Marriott. Les billets pour le banquet sont disponibles au coût de $50.00 chacun.

Toutes les activités pré-réunion et conférences scientifiques auront lieu à l'Hôtel Marriott.

Au nom de tous les participants de cette réunion nous remercions chaleureusement Daniel Daigle, président et coordonnateur de la réunion, Walter D. Burgess et André Dabrowski, présidents du comité local d'organisation, les membres du comité de programme et tous les membres de l'Université d'Ottawa qui ont mis la main à la pâte. Nous remercions aussi le personnel administratif de la SMC qui travaille avec professionalisme et ardeur à la préparation de nos rencontres.

Je vous souhaite une très bonne réunion et un très bon séjour à Ottawa.

Christiane Rousseau, President

Message from the president of the Canadian Mathematical Society

The Canadian Mathematical Society is extremely pleased to welcome you to the Winter 2002 Meeting, hosted by the University of Ottawa, in the Society's home town of Ottawa, Ontario. In keeping with CMS tradition, this meeting is an opportunity to combine stimulating scientific events with friendly get-togethers among members of our mathematical community-and a great chance to celebrate our successes.

The meeting includes 14 symposia on a variety of subjects, contributed papers, four plenary speakers, a public lecture, and two award ceremonies.

We will have the pleasure of honouring several of our members. The Coxeter-James Lecture will be given by Lisa Jeffrey of the University of Toronto. The Doctoral Prize Lecture will be given by David Kerr, a recent PhD from the University of Toronto. We will have the opportunity to honour Peter Lancaster of the University of Calgary for his important contributions to the advancement of mathematics in Canada when we present him with this year's Distinguished Service Award. The recipient(s) of the G. De B. Robinson Award will be announced at the banquet. The four plenary speakers are James Arthur (Toronto), Rene Carmona (Princeton), Victor Guillemin (MIT) and Maceij Zworski (Berkley). The public lecture will be delivered by Robert Zuccherato of Entrust.

The meeting includes a number of social events. The opening reception will be held on December 7 from 7:00 to 10:00 p.m. in the Marriott Hotel's Victoria North Ballroom. The delegates' luncheon will take place on Sunday, December 8 from 12:30 to 2:00 p.m. in the Victoria North/South Ballroom. A luncheon ticket is included with registration. The banquet will take place Sunday, December 8 starting at 7:30 p.m. in the Victoria North/South Ballroom. Tickets for the banquet are available at a cost of $50.00 each.

All pre-meeting events and scientific talks will take place at the Marriott Hotel.

On behalf of all the participants, I would like to sincerely thank Daniel Daigle, Meeting Director, Walter D. Burgess and Andr Dabrowski, co-chairs of the local organizing committee, the members of the programming committee, and all the members of the University of Ottawa who have helped make this event a reality. I would also like to thank the CMS administrative staff, who work tirelessly and professionally to make these meetings possible.

I hope you have an excellent conference and a pleasant stay in Ottawa.

Christiane Rousseau, Présidente

Mot du directeur de la réunion / Message from the Meeting Director

Chers participants,

Il me fait grand plaisir de vous souhaiter la bienvenue à cette *Réunion d'hiver 2002* de la Société mathématique du Canada.

Au nom de tous les organisateurs, je suis heureux de vous proposer un programme scientifique intéressant et varié comprenant quatre conférences principales, deux conférences prononcées par les lauréats des prix Coxeter-James et de Doctorat, une douzaine de symposiums et des communications libres. Notez aussi que la réunion comprend une conférence grand public et quelques événements à caractère social.

Je tiens à remercier tous ceux qui ont participé à l'organisation de cette rencontre, notamment les organisateurs des symposiums, mes collègues du comité organisateur et le personnel aussi dévoué qu'expérimenté de la SMC—en particulier, Graham Wright et Monique Bouchard. Je remercie également les organismes qui ont contribué financièrement ce projet et dont les noms apparaissent ailleurs dans ce programme.

J'espère que cette conférence sera pour vous l'occasion de développer des liens avec d'autres chercheurs, de retrouver de vieux amis et, pourquoi pas, de profiter des charmes de la ville d'Ottawa.

Daniel Daigle

Dear delegates,

It is a great pleasure to welcome you in Ottawa for the *Winter 2002 Meeting* of the Canadian Mathematical Society.

I think that we have put together an interesting scientific program consisting of four plenary lectures, the Coxeter-James and Doctoral Prize lectures, a dozen symposia covering a broad spectrum of mathematics and a session of contributed papers. The meeting also includes a public lecture and a few social events.

I would like to express my thanks to all those who have contributed to the organization of this meeting, in particular the session organizers, the members of the organizing committee and the dedicated and experienced staff of the CMS—in particular, Graham Wright and Monique Bouchard. I also thank the organizations who have contributed financially to this project and whose names appear elsewhere in this programme.

I hope that this conference will give you the opportunity to learn some new mathematics and develop links with other researchers. I wish you all a very enjoyable stay in Ottawa.

Daniel Daigle

Mot du Vice-recteur à la recherche / Message of the Vice-Rector, Research

Le 8 décembre 2002
December 8, 2002

Aux participants de la Réunion d'hiver 2002 de la Société mathématique du Canada
To participants in the Winter 2002 Meeting of the Canadian Mathematical Society

Au nom de l'Université d'Ottawa, il me fait plaisir de souhaiter la bienvenue aux mathématiciens du Canada à l'occasion de la Réunion d'hover 2002 de la Société mathématique du Canada. J'espère que cette conférence sera stimulante et qu'elle sera aussi l'occasion de développer les liens entre chercheurs.

On behalf of the university of Ottawa, it is a pleasure de welcome mathematicians from across Canada and other countries for the Winter 2002 meeting of the Canadian Mathematical Society. I hope that you find this meeting stimulating and that you take this opportunity to further develop links between researchers.

Howard Alper, O.C.
Vice-recteur à la recherche
Vice-Rector, Research

Mot du doyen des sciences / Message of the Dean of Sciences

Le 11 novembre 2002
November 11, 2002

Il me fait plaisir de vous souhaiter la bienvenue à la Réunion d'hiver 2002 de la Société Mathématique du Canada. La Faculté des sciences de l'Université d'Ottawa est trés fière de contribuer au succés de cet événement. Je vous souhaite une fructueuse et intéressante réunion ainsi qu'un agréable séjour à Ottawa.

It is with great pleasure that I welcome you to the Winter 2002 Meeting of the Canadian Mathematical Society. The Faculty of Science of the University of Ottawa is very proud to contribute to the success of this event. I hope that the conference will be productive and stimulating and wish you a very pleasant stay in Ottawa.

Christian Detellier
Doyen des sciences
Dean of sciences

Message from the Chair, Department of Mathematics and Statistics, University of Ottawa

On behalf of the Department of Mathematics and Statistics at the University of Ottawa, I would like to extend a warm welcome to all the participants to the CMS Winter Meeting 2002. The organizing committee has put together an ambitious and diverse program which should appeal to a large audience.

I hope that this will be a springboard meeting for learning new things in Mathematics as well as for renewing and making new friendships. Enjoy the meeting and take advantage of the wonderful amenities in the city of Ottawa.

I would like to take this opportunity to thank the organizing committee for their tremendous effort. They include Daniel Daigle, Walter Burgess, Andr Dabrowski, Abdellah Sebbar, and from the CMS office, Graham Wright and Monique Bouchard.

Mayer Alvo, Chair
Department of Mathematics and Statistics University of Ottawa

Mot du Directeur du Département de mathématiques et de statistique de l'Université d'Ottawa

Au nom du département de mathématiques et de statistique il me fait plaisir de vous souhaiter la bienvenue à la réunion d'hiver de la société mathématique du Canada 2002. Le comité organisateur a élaboré un programme stimulant et varié qui attirera une grande audience.

J'espère que les rencontres vous permettront d'apprendre de nouvelles choses en mathématique tout en vous permettant de fraterniser. Profitez de la réunion et prenez avantage des attraits de la ville d'Ottawa.

J'aimerais profiter de l'occasion pour remercier le comité organisateur pour leurs efforts. De mon département ils sont : Daniel Daigle, Walter Burgess, André Dabrowski and Abdellah Sebbar, de mme que Monique Bouchard et Graham Wright du bureau administratif d'Ottawa.

Mayer Alvo, directeur
Département de mathématiques et de statistique Université d'Ottawa

Message of the local organizing committee / Mot du comité logistique

Welcome to Ottawa. The 2002 Winter Meeting of the CMS has all a mathematician or statistian could ask for – or so the members of the local organizing committee hope. There are special sessions in a variety of topics, pure and applied and in mathematics education, as well as important plenary talks. Some people say that Ottawa is a dull city; these are people who have not been here in recent decades. Ottawa is a lively and cosmopolitan city with fine entertainment, shopping and dining. The national museums and the National Gallery are particularly noteworthy.

The local organizing committee is grateful to the CMS staff who have done a great deal of the logistical work of putting together this meeting. The Department of Mathematics and Statistics of the University of Ottawa has been most cooperative and helpful, as have the other levels of the university structure. The staff of the Marriott Hotel have been very professional as well. Please enjoy the meeting and your visit to the Ottawa.

Nous vous souhaitons la bienvenue àa Ottawa. La Réunion d'hiver de la SMC de l'an 2002 offre un programme trés riche et varié. Il y a des sessions speciales et conférences plénieres portant sur plusieurs domaines des mathématiques pures et appliquées ainsi que la statistique et la pédagogie mathématique. Il y a des gens qui ont la drole d'idee que Ottawa est une ville un peu ennuyeuse. Ceux-la pensent à une Ottawa qui n'existe plus et cela depuis quelques décennies déjà. Il y a des bons restaurants et une vie nocturne variée. Les musées nationaux et le Musée de beaux arts méritent le voyage.

Le comité logistique tient a remercier le personnel de la SMC qui ont fait un excellent travail et qui a donné au comité un appui essentiel. Le département de mathématiques et statistiques de l'Université d'Ottawa a beaucoup fait pour nous aider et les autres niveaux de l'université ont bien fait leur part. Le personnel de l'Hotel Marriott a également été efficace et professionnel. Amusez-vous bien !

Walter Burgess, Andre Dabrowski et Abdellah Sebbar

List of participants / Liste des participants

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Acknowledgments / Remerciements

Support from the following is gratefully acknowledged:

- Department of Mathematics and Statistics, University of Ottawa
- Faculty of Sciences, University of Ottawa
- The National Programme Committee (a joint funding body of the Centre de recherches mathématiques, The Fields Institute for Research in Mathematical Sciences, and The Pacific Institute for the Mathematical Sciences)

The Canadian Mathematical Society would like to acknowledge the contribution of the members of the Meeting Committee for organizing this meeting.

Nous remercions les organismes suivants de leur soutien financier :

- le Département de mathématiques et de statisque de l'Université d'Ottawa
- La faculté des sciences de l'université d'Ottawa
- le Comité du programme national (programme conjoint du Centre de recherches mathématique, de l'Institut Fields et de l'Institut Pacific)

La Société mathématique du Canada tient à remercier les membres du Comité de coordination pour l'organisation de cette Réunion.

Child Care / Service de garde

The following information was provided by the meeting hotels. Advance research and arrangements are recommended.

The Ottawa Marriott Hotel offers onsite a fully equipped unsupervised "Children's Activity Centre", complete with Playstations, a variety of toys and games for all ages. For individual child care, the hotel recommends Gigi's Childcare 613-749-1295.

The Travelodge Hotel by Parliament Hill will also provide recommendations. Please contact the hotel directly to make enquiries.

Les renseignements suivants ont été fournis par les hôtels prévus pour la Réunion. On vous recommande de faire vos démarches et vos réservations è l'avance.

L'Hôtel Ottawa Marriott met à la disposition de ses clients un centre d'activités pour enfants tout équipé (sans surveillance) comprenant des Playstations, des jouets et des jeux pour toute la famille. Pour les services de garde individuels, l'hôtel recommande Gigi's Childcare, au (613) 749-1295.

Le Travelodge Hotel by Parliament Hill peut aussi faire des recommandations au besoin. Prière de communiquer avec l'hôtel directement pour faire une demande.

Meeting Committee / Comité de coordination

Programme
Meeting Director/Président et coordinateur: Daniel Daigle (Ottawa),
Walter Burgess (Ottawa),
André Dabrowski (Ottawa),
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Luis Seco (Toronto),
Ronald Sklar (St. Johns N.Y.),
Thomas Steinke (OCCDSB),
John Toth (Toronto),
Kenneth Williams (Carleton),
Graham Wright (CMS ex-officio).

Local Arrangements / Logistique
Chairs/ Présidents du comité local: Walter D. Burgess (Ottawa), Andr Dabrowski (Ottawa), Monique Bouchard (CMS ex-officio).
Programme editor / Editeur du programme: Abdellah Sebbar (Ottawa).

Schedule for Registration and Social Activities
Horaire pour inscription et activités sociales

Saturday December 7	**samedi 7 décembre**
15:00 - 17:00	Registration and Exhibit area setup / Montage du bureau d'inscription et kiosques, Victoria Foyer and Gallery
17:00 - 19:00	Exhibitor Setup / Montage des expositions, Victoria Gallery
19:00 - 21:00	Welcoming/registration / Bienvenue/inscription, Victoria North

Sunday December 8	**dimanche 8 décembre**
8:00 - 17:00	Exhibits / Expositions, Victoria Gallery
8:00 - 17:00	Registration / Inscription, Victoria Foyer
8:30 - 9:00	Opening Address / Ouverture, Victoria North/South
10:00 - 10:15	Coffee / café, Victoria Gallery
12:30 - 14:00	Delegates' Luncheon / Lunch des participants, Victoria North/South
15:30 - 15:45	Coffee / café, Victoria Gallery
18:30 - 19:30	Cash bar / Bar payant, Victoria North/South
19:30 - 22:00	Banquet, Victoria North/South

Monday December 9	**lundi 9 décembre**
8:00 - 17:00	Exhibits / Expositions, Victoria Gallery
8:00 - 17:00	Registration / Inscription, Victoria Foyer
10:00 - 10:15	Coffee / café, Victoria Gallery
12:30 - 14:00	Lunch (no scheduled event) / Lunch (aucun événement planifié)
15:00 - 15:15	Coffee / café, Victoria Gallery
19:00 - 19:30	Public Lecture Reception / Réception pour la conférence publique, Victoria North

Tuesday December 10	**mardi 10 décembre**
8:00 - 17:00	Registration / Inscription, Victoria Foyer
10:00 - 10:15	Coffee / café, Victoria Gallery
12:30 - 14:00	Lunch (no scheduled event) / Lunch (aucun événement planifié)
15:00 - 15:15	Coffee / café, Victoria Gallery

Schedule for Buisness Meetings
Horaire pour Séances de travail

Thursday December 5	**jeudi 5 décembre**
9:00 - 12:00	Winter Meeting Conference Services Review, Room 620
14:00 - 16:00	Winter Meeting Staff Orientation, 577 King Edward #108

Friday December 6	**vendredi 6 décembre**
18:00 - 22:00	CMS Executive Committee Meeting / Réunion du Comité exécutif de la SMC, Sussex

Saturday December 7	**samedi 7 décembre**
8:00 - 10:30	Meeting of Forum 2003 Organizers / Réunion du comité d'organisation Forum 2003, Sussex
11:00 - 13:00	CMS Development Group Luncheon / Lunch du Groupe de développement de la SMC, Sussex
13:30 - 18:30	CMS Board of Directors Meeting / Réunion du Conseil d'administration de la SMC, Wellington
20:00 - 22:00	CMS Electronic Services Committee Meeting / Comité services électroniques SMC, Sussex
20:00 - 22:00	Meeting of Regional Math Camp Organizers / Réunion des organisateurs des camps maths regionaux, Mackenzie

Sunday December 8 — dimanche 8 décembre

7:15 - 8:30	CMS Nominating Committee Meeting / Réunion du Comité de mises en candidature SMC, Room 621
7:30 - 9:45	CMS Education Committee Meeting / Réunion du Comité d'éducation de la SMC, Room 620
7:30 - 10:30	CMS Student Committee Meeting / Réunion du Comité des étudiants de la SMC, Room 622
10:00 - 12:30	CMS Endowment Grants Committee Meeting / Réunion du Comité d'attribution des bourses du fonds, Room 621
10:00 - 12:30	CMS Research Committee Meeting / Réunion du comité de recherche de la SMC, Room 620
10:30 - 12:00	Crux with Mayhem Editorial Board / Conseil de rédaction pour Crux with Mayhem, Room 622
14:00 - 16:00	CMS Mathematical Competitions Committee Meeting / Réunion du Comité des concours mathématiques SMC, Room 620
14:00 - 16:00	CMS Publications Committee Meeting / Réunion du comité des publications de la SMC, Room 621
17:00 - 18:00	CMS International Affairs Committee Meeting / Réunion du Comité des affaires internationales, Room 622

Monday December 9 — lundi 9 décembre

7:30 - 9:30	CMS Advancement of Mathematics Committee / Comité pour l'avancement des mathématiques, Room 620
10:30 - 12:30	Meeting of CRUX with MAYHEM Editors, Room 621
12:00 - 14:00	CMS Committee on Women in Mathematics Meeting / Réunion du Comité des femmes en mathématiques, Room 620

The CMS 2002 Distinguished Service Award
Le Prix de la SMC pour service méritoire 2002

Peter Lancaster
University of Calgary

Citation and Biography
Présentation et biographie

Peter Lancaster was born in Appleby, England, the third of four children. The family moved around northern England as necessitated by his father's work in insurance and eventually settled in Liverpool. Dr. Lancaster entered Liverpool University's School of Architecture, transferred to the honours mathematics program and completed his first degree in 1952.

From 1952 to 1957, Dr. Lancaster worked as an aerodynamicist at the English Electric Company (now British Aerospace) where he begun a research career in mathematics motivated by physical problems such as aircraft vibration and stability, and related computational problems. Dr. Lancaster was appointed Assistant Lecturer in Mathematics at the University of Malaya (now the National University of Singapore) and advanced through the ranks to become Senior Lecturer in 1961. His dissertation on the theory of lambda matrices led to a Ph.D. from the University of Singapore in 1964.

In 1962, Dr. Lancaster was appointed Associate Professor in the Department of Mathematics at the fledgling Calgary campus of the University of Alberta, which subsequently became the University of Calgary in 1965. He was instrumental in the development and growth of this young department, was promoted to full professor in 1967, and he has remained at Calgary ever since.

Dr. Lancaster's work over the years includes research in the mathematical analysis of vibrations and gyroscopic systems, matrix analysis and spectral theory, matrix and operator polynomials, solution of Riccati equations, systems theory and control, as well as numerical analysis and approximation theory. He has over 160 publications, 11 research monographs and textbooks, and the supervision of 9 doctoral students, 6 master students, and 6 postdoctoral fellows. His text on the Theory of Matrices was translated into Russian and widely circulated in the USSR which resulted in him obtaining significant recognition in the former Soviet Union.

He has given invited talks at over 80 different institutions in 17 countries and held several Visiting Professorships at universities throughout the world. His work has been recognized by many awards, including the Killam Resident Fellow (University of Calgary-1977), Fellow of the Royal Society of Canada (1984), Faculty of Science Award of Excellence in Research (University of Calgary-1991), CMS Jeffery-Williams Prize (1991), Dozor Visiting Fellow (Ben Gurion University-1995), Toeplitz, Lecturer (University of Tel Aviv, 1997), Humboldt Research Award (Technical University of Darmstadt-2000), and recipient of the Hans Schneider Prize of the International Linear Algebra Society (2002)

His outstanding research career is matched with a remarkable history of service to the mathematical community. He has been the Editor for several journals and he has organized over a dozen research conferences. He was CMS Vice-President from 1973 to 1975), CMS President from 1979 to 1981, Vice-President of the Canadian Applied Mathematical Society from 1993 to 1995, he served on several peer-review committees for NSERC , committees for the Royal Society of Canada as well as being a member of the boards of the Fields Institute (1992-1996) and the Pacific Institute for the Mathematical Sciences, since its inception in 1995.

He has been Emeritus Professor at the University of Calgary since 1994. Dr. Lancaster maintains a highly active research program at the University of Calgary and enjoys the fruits of retirement with his wife Diane.

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Peter Lancaster est né à Appleby, au Royaume-Uni, et il est le troisième d'une famille de quatre enfants. Sa famille s'est déplacée à maintes reprises dans le Nord du pays au gré du travail du père, dans les assurances, avant de s'installer à Liverpool. Peter Lancaster s'est d'abord inscrit à l'École d'architecture de l'Université de Liverpool, avant de passer au programme de mathématiques avec spécialisation. Il a obtenu son premier diplôme dans cette discipline en 1952.

De 1952 à 1957, il a occupé un poste d'aérodynamicien dans une société anglaise (l'ancêtre de British Aerospace) où son intérêt pour des problèmes physiques comme la vibration et la stabilité des aéronefs, et les problèmes de calcul qui s'y rattachent, l'on poussé à faire ses premiers pas en recherche mathématique. Il a obtenu un poste de professeur adjoint de mathématiques à l'Université de Malaya (devenue depuis l'Université nationale de Singapour) et a gravi les échelons jusqu'à décrocher un poste de professeur titulaire en 1961. Sa dissertation sur la théorie des matrices lambda lui a valu un doctorat de l'Université de Singapour en 1964.

En 1962, le professeur Lancaster a obtenu un poste de professeur adjoint au Département de mathématiques du tout nouveau campus de Calgary de l'Université de l'Alberta, devenue l'Université de Calgary en 1965. Artisan important de l'essor de ce jeune département, il est devenu professeur titulaire en 1967 et est toujours demeuré rattaché à cet établissement.

Au fil des ans, le professeur Lancaster a mené des recherches dans de dombreux domaines : analyse mathématique des vibrations et des systèmes gyroscopiques; analyse matricielle et théorie des spectres; polynômes matriciels et polynômes d'opérateurs; solution des équations de Riccati; théorie et contrôle des systèmes; analyse numérique et théorie de l'approximation. Il a à son compte plus de 160 publications, 11 monographies scientifiques et manuels. Il a de plus dirigé 9 thèses de doctorat, 6 de maîtrise et 6 stages de recherche postdoctoraux. Son manuel sur la théorie des matrices a été traduit en russe et est très connu dans les pays de l'ex-URSS, où il jouit d'une solide réputation.

Plus de 80 établissements de 17 pays l'ont invité comme conférencier, et plusieurs universités d'un peu partout dans le monde lui ont déjà confié une chaire de professeur invité. Ses travaux lui ont valu de nombreux prix et distinctions : bourse de recherche Killam (Université de Calgary-1977), membre de la Société royale du Canada (1984); prix d'excellence en recherche de la Faculté des sciences (Université de Calgary-1991); prix Jeffery-Williams de la SMC (1991); bourse de chercheur invité Dozor (Université Ben Gurion -1995); conférencier Toeplitz (Université de Tel Aviv -1997); prix de recherche Humboldt (Université technique de Darmstadt-2000) et prix Hans-Schneider de la Société internationale d'algèbre linéaire (2002).

Sa carrière de chercheur exceptionnelle n'a d'égal que son travail au service de la communauté mathématique. Il a été rédacteur en chef de plusieurs revues et a organisé plus d'une douzaine de congrès de chercheurs. Il a été vice-président de la SMC de 1973 à 1975, puis président de 1979 à 1981, et vice-président de la Société canadienne de mathématiques appliquées de 1993 à 1995. Il a siégé à de nombreux comités d'examen par les pairs du CRSNG et à des comités de la Société royale du Canada. Il a en outre été membre du conseil d'administration de l'Institut Fields (1992-1996) et il est membre de celui de l'Institut de sciences mathématiques du Pacifique depuis la création de l'établissement en 1995.

En 1994, le professeur Lancaster a reçu le titre de professeur émérite de l'Université de Calgary, où il poursuit très activement ses activités de recherche. Il profite des beaux jours de sa retraite avec son épouse Diane.

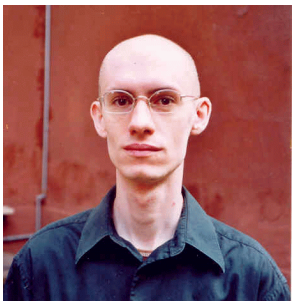
In 1995, the Society established the CMS Distinguished Service Award to recognize individuals who have made sustained and significant contributions to the Canadian mathematical community and, in particular, to the Canadian Mathematical Society.

En 1995, la Société mathématique du Canada a créée le Prix de la SMC pour service méritoire pour récompenser les personnes qui contribuent de façon importante et soutenue à la communauté mathématique canadienne et, notamment, à la SMC.

Recipients / Lauréats

2002	Peter Lancaster	1996	David Borwein	H.S.M. Coxeter
2001	James Timourian		P.G. (Tim) Rooney	G.F.D. Duff
2000	Arthur Sherk	1995	Maurice L'Abbé	Nathan S. Mendelsohn
1999	Michael Doob		A.J. Coleman	
	S. Swaminathan			

The 6th Doctoral Prize / Le 6e Prix de doctorat



David Kerr
University of Toronto

Citation / Présentation

In his doctoral thesis in operator theory ("Pressure for automorphisms of exact C*-algebras and a non-commutative variational principle") Dr. Kerr was concerned with the notion of pressure and dynamical entropy in the context of non-commutative dynamical systems. He proposed the first systematic formulation in the non-commutative setting of the variational principle. The key to his approach was the definition of the dynamical pressure of exact C*-algebras which extended the notion of both topological pressure from ergodic theory and Voiculescu-Brown operator-algebraic approximation entropy. His results have been called a definitive contribution to his field of study.

David Kerr has succeeded in making a significant contribution to a competitive field of research and he is cited for his mastery of a difficult area of research as well as his mathematical maturity and judgement.

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Dans sa thèse de doctorat sur la théorie des opérateurs, intitulée *Pressure for automorphisms of exact C*-algebras and a non-commutative variational principle*, David Kerr s'est intéressé à la notion de pression et d'entropie dynamique dans le contexte des systèmes dynamiques non-commutatifs. Il a proposé la première formulation systématique dans l'environnement non-commutatif du principe de variation. L'élément clé de sa démarche est la définition de la pression dynamique des C*-algèbres exacts, qui étendent à la fois les notions de la pression topologique de la théorie ergodique et l'entropie de l'approximation des algèbres d'opérateurs Voiculescu-Brown. On a dit de ses résultats qu'il s'agissait d'une importante contribution au domaine d'étude.

David Kerr a réussi à contribuer de façon importante à un domaine de recherche où la concurrence est vive. On reconnaît d'emblée sa connaissance exceptionnelle d'un domaine de recherche complexe ainsi que sa maturité et son jugement mathématique.

Biographical Information / Renseignements biographiques

Born in Ottawa, Dr. Kerr obtained his Bachelor's degree from the University of Waterloo in 1994, his Master's degree from the University of Toronto in 1995, and his Ph. D. from the University of Toronto in 2001 under the supervision of Dr. George Elliott.

He received an Ontario Graduate Student Award in 1999 and NSERC post-graduate scholarships from 1994 to 1998. He currently holds an NSERC Postdoctoral Fellowship which is being spent at the University of Tokyo and the University of Rome.

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Originaire d'Ottawa, David Kerr a obtenu son baccalauréat de l'Université de Waterloo en 1994, sa maîtrise de l'Université de Toronto en 1995 et son doctorat de la même université en 2001. Son directeur de thèse était le professeur George Elliott.

Il a reçu une bourse d'études supérieures de l'Ontario en 1999 et des bourses d'études supérieures du CRSNG de 1994 à 1998. Il bénéficie en ce moment d'une bourse de recherche postdoctorale du CRSNG, qu'il utilise pour faire des recherches à l'Université de Tokyo et à l'Université de Rome.

The CMS Doctoral Prize was inaugurated to recognize outstanding performance by a doctoral student who graduated from a Canadian University in the preceding year (January 1st to December 31st). The CMS Doctoral Prize consists of an award of $500, a two-year complimentary membership in the CMS, a framed Doctoral Prize Certificate and a stipend for travel expenses to attend the CMS Winter Meeting to receive the award and present a plenary lecture. The first award was presented in 1997.

La SMC a créé le Prix de doctorat pour récompenser le travail exceptionnel d'un étudiant au doctorat en mathématiques ayant obtenu un diplôme d'une université canadienne entre le 1er janvier et le 31 décembre de l'année précédente. Le lauréat du Prix de doctorat de la SMC reçoit une bourse de 500 $. De plus, la SMC lui offre l'adhésion gratuite à la Société pendant deux ans et lui remet un certificat encadré et une subvention pour frais de déplacements lui permettant d'assister à la réunion d'hiver de la SMC où il recevra son prix et présentera une conférence. Ce prix a été décerné pour la première fois en 1997.

Recipients / Récipiendaires

2002	David Kerr
2001	Nathan Ng
2000	Steven Astels
1999	Jian Shen
1998	Yuri Berest
1997	James Geelen

The 25th Coxeter-James Lecturer – La 25e conférence Coxeter-James

Lisa Jeffrey
University of Toronto

Citation-Présentation

Lisa Jeffrey research involves significant and difficult problems at the forefront of several deep mathematical areas: symplectic geometry, algebraic geometry, mathematical physics and differential geometry. She has made major contributions to all of these fields.

Lisa Jeffrey has been involved in the proof of two of the most important conjectures in equivariant symplectic geometry. The proof of Witten's conjecture, which she obtained in collaboration with Frances Kirwin, introduced the powerful technique of non-abelian localization which has had important applications.

She is the author of "Quantum Fields and Strings: a Course for Mathematicians" - the definitive work for mathematicians on the important recent interaction between theoretical physics and geometry.

Les travaux de Lisa Jeffrey portent sur de grands problèmes complexes à l'avant-plan de plusieurs domaines mathématiques : la géométrie symplectique, la géométrie algébrique, la physique mathématique et la géométrie différentielle. Elle a grandement contribué à chacun de ces domaines.

Lisa Jeffrey a contribué à prouver deux des plus importantes conjectures de la géométrie symplectique équivariante. La preuve de la conjecture de Witten, qu'elle a établie en collaboration avec Frances Kirwin, a lancé la technique puissante de localisation non abélienne, qui a donné lieu à des applications importantes.

Elle est aussi l'auteure de *Quantum Fields and Strings: a Course for Mathematicians*, référence de base des mathématiciens sur l'interaction importante et récente entre la physique et la géométrie théoriques.

Biographical Information / Renseignements biographiques

Dr. Lisa Jeffrey obtained her A.B. from Princeton University in 1986, and her Ph.D. from Oxford University in 1992, under the direction of M.F. Atiyah. Prior to joining the University of Toronto in 1997, she was a faculty member at Princeton University and McGill University. Dr. Jeffrey attained the rank of full professor in 1997. She won the Aisenstadt Prize from the C.RM in 1996, was awarded a Sloan Fellowship in 1997, an Ontario Premier's Research Excellence Award in 1999 and the CMS Krieger-Nelson Prize in 2001.

Lisa Jeffrey a obtenu un baccalauréat ès arts de l'Université Princeton en 1986 et son doctorat de l'Université Oxford en 1992; elle a fait sa thèse avec M. F. Atiyah. Avant son arrivée à l'Université de Toronto en 1997, elle a enseigné à Princeton et à McGill. Devenue professeure titulaire en 1997, Lisa Jeffrey a remporté plusieurs prix et bourses : prix Aisenstadt en 1996, bourse Sloan en 1997, bourse d'excellence en recherche du premier ministre de l'Ontario en 1999 et prix Krieger-Nelson de la SMC en 2001.

The Coxeter-James Lectureship was inaugurated in 1978 to recognize young mathematicians who have made outstanding contributions to mathematical research and is presented at the Canadian Mathematical Society's Winter Meeting.

Le prix de conférence Coxeter-James, créé en 1978, rend hommage aux jeunes mathématicien(ne)s qui se sont distingué(e)s par leur apport exceptionnel à la recherche en mathématiques. La conférence est présentée à la Réunion d'hiver de la Société mathématique du Canada.

Recipients / Récipiendaires

2002	L. Jeffrey	1993	J. Hurtubise	1984	M. Goresky
2001	K. Behrend	1992	J.F. Jardine	1983	M.D. Choi
2000	D. Roy	1991	K. Murty	1982	J. Mallet-Paret
1999	M. Zworski	1990	N. Ghoussoub	1981	J. Millson
1998	H. Darmon	1989	A. Dow	1980	F. Clarke
1997	M. Ward	1988	R. Murty	1979	D. Boyd
1996	N. Higson	1987	J. Borwein	1978	R. Moody
1995	G. Slade	1986	E. Perkins		
1994	M. Spivakovsky	1985	P. Selick		

CMS Summer Meeting 2003
June 14 - 16, 2003
University of Alberta
Edmonton, Alberta

We are happy to announce the provisional outline for the Canadian Mathematical Society Summer Meeting 2003. Look for the First Announcement in the February 2003 issue of the *CMS Notes* or at http://www.cms.math.ca/Events/summer03/

HOST : Department of Mathematical and Statistical Sciences, University of Alberta

PUBLIC LECTURE : **Robert Moody** (University of Alberta).

PLENARY SPEAKERS : **Ingrid Daubechies** (Princeton University), **Roland Glowinski** (University of Houston), **Gerhard Huisken** (Tuebingen/Albert Einstein Institute), **James Lepowsky** (Rutgers University), **Dennis Shasha**, (Courant Institute).

PRIZES : **Jeffery-Williams Lecture**: **Ram Murty** (Queen's University), **Krieger-Nelson Lecture**: **Leah Keshet** (University of British Columbia).

SYMPOSIA : **Applied Harmonic Analysis**, Org: RongQing Jia (Alberta) and Bin Han (Alberta); **Combinatorics/Design Theory/Coding Theory**, Org: John van Rees (Manitoba); **Computational and Analytical Techniques in Modern Applications**, Org: Peter Minev (Alberta) and Tony Ware (Calgary); **Computational and Mathematical Finance**, Org: T. Choulli (Alberta); **Conformal Field Theory**, Org: Terry Gannon (Alberta) and Mark Walton (Lethbridge); **Discrete Mathematics**, Org: Vazz Linek (Winnipeg); **Dynamical Systems**, Org: Michael A. Radin (Rochester Institute of Technology); **Geometry and Physics**, Org: Maung Min-Oo (McMaster) and Eric Woolgar (Alberta); **Industrial Mathematics**, Org: B. Huang, Y. Lin and S. Liu (Alberta); **Infinite Dimensional Dynamical Systems**, Org: XiaoQiang Zhao (Memorial) and Thomas Hillen (Alberta); **New and Successful Courses and Programmes in Mathematics**, Org: Ted Lewis (Alberta); **Real Analysis**, Org: Erik Talvila (Alberta).

Contributed Papers, Org: to be announced.

MEETING DIRECTOR : YanPing Lin (Alberta).

LOCAL ARRANGEMENTS : Eric Woolgar (Alberta).

Réunion d'été 2003 de la SMC
du 14 au 16 juin 2003
Université de l'Alberta
Edmonton (Alberta)

Voici le programme provisoire de la Réunion d'été 2003 de la Société mathématique du Canada. La première annonce paraîtra dans le numéro de février 2003 des*Notes de la CMS* ou au site web http://www.cms.math.ca/Reunions/ete03/.

HÔTE : Département des sciences mathématiques et statistiques, Université de l'Alberta

CONFÉRENCE PUBLIQUE : **Robert Moody** (Université de l'Alberta).

CONFÉRENCIERS PRINCIPAUX : **Ingrid Daubechies** (Université Princeton), **Roland Glowinski** (Université de Houston), **Gerhard Huisken** (Tuebingen/Institut Albert Einstein), **James Lepowsky** (Université Rutgers), **Dennis Shasha**, (Institut Courant).

PRIX : **Conférence Jeffery-Williams**: **Ram Murty** (Université Queen's), **Conférence Krieger-Nelson**: **Leah Keshet** (Université de la Colombie-Britannique).

SYMPOSIUMS : **Analyse harmonique appliquée**, Org: RongQing Jia (Alberta) et Bin Han (Alberta); **Combinatoire/Théorie du désign/Théorie des codes**, Org: John van Rees (Manitoba); **Techniques numériques et analytiques dans les applications modernes**, Org: Peter Minev (Alberta) et Tony Ware (Calgary); **L'analyse numérique dans les mathématiques financières**, Org: T. Choulli (Alberta); **Théorie des champs conformes**, Org: Terry Gannon (Alberta) et Mark Walton (Lethbridge); **Mathématiques discrètes**, Org: Vazz Linek (Winnipeg); **Systèmes dynamiques**, Org: Michael A. Radin (Rochester Institute of Technology); **Géométrie et physique**, Org: Maung Min-Oo (McMaster) et Eric Woolgar (Alberta); **Mathématiques industrielles**, Org: B. Huang, Y. Lin et S. Liu (Alberta); **Systèmes dynamiques en dimensions infinies**, Org: XiaoQiang Zhao (Memorial) et Thomas Hillen (Alberta); **Nouveaux programmes de mathématiques et programmes a succes**, Org: Ted Lewis (Alberta) ; **Analyze réel**, Org: Erick Talvila (Alberta). **Communications courtes**, Org: à confirmer.

DIRECTEUR DE RÉUNION : YanPing Lin (Alberta).

LOGISTIQUE LOCALE : Eric Woolgar (Alberta).

Schedule
Horaire

Friday December 6 — vendredi 6 décembre

18:00 - 22:00	CMS Executive Committee Meeting / Réunion du Comité exécutif de la SMC, Sussex

Saturday December 7 — samedi 7 décembre

8:00 - 10:30	Meeting of Forum 2003 Organizers / Réunion du comité d'organisation Forum 2003, Sussex
11:00 - 13:00	CMS Development Group Luncheon / Lunch du Groupe de développement de la SMC, Sussex
13:30 - 18:30	CMS Board of Directors Meeting / Réunion du Conseil d'administration de la SMC, Wellington
15:00 - 17:00	Registration and Exhibit area setup / Montage du bureau d'inscription et kiosques, Victoria Foyer and Gallery
17:00 - 19:00	Exhibitor Setup / Montage des expositions, Victoria Gallery
19:00 - 21:00	Welcoming/registration / Bienvenue/inscription, Victoria North
20:00 - 22:00	CMS Electronic Services Committee Meeting / Comité services électroniques SMC, Sussex
20:00 - 22:00	CMS International Affairs Committee Meeting / Réunion du Comité des affaires internationales, Room 620
20:00 - 22:00	Meeting of Regional Math Camp Organizers / Réunion des organisateurs des camps maths regionaux, Mackenzie

Sunday December 8 — dimanche 8 décembre

7:15 - 8:30	CMS Nominating Committee Meeting / Réunion du Comité de mises en candidature SMC, Room 621
7:30 - 9:45	CMS Education Committee Meeting / Réunion du Comité d'éducation de la SMC, Room 620
7:30 - 10:30	CMS Student Committee Meeting / Réunion du Comité des étudiants de la SMC, Room 622
8:00 - 17:00	Exhibits / Expositions, Victoria Gallery
8:00 - 17:00	Registration / Inscription, Victoria Foyer
8:30 - 9:00	Opening Address / Ouverture, Victoria North/South
9:00 - 10:00	Victor Guillemin, Victoria North/South
10:00 - 10:15	Coffee / café, Victoria Gallery
10:00 - 12:30	CMS Endowment Grants Committee Meeting / Réunion du Comité d'attribution des bourses du fonds, Room 621
10:00 - 12:30	CMS Research Committee Meeting / Réunion du comité de recherche de la SMC, Room 620

10:30 - 12:00	Crux with Mayhem Editorial Board / Conseil de rédaction pour Crux with Mayhem, Room 622
10:30 - 11:00	Mohammed Farhloul, FinEl, Capital
10:30 - 11:00	Dave Saunders, FinMat, Mackenzie
10:30 - 11:00	Joan DeBello, HisMat, Rideau
10:30 - 11:00	Walter Whiteley, MathEd, Alta Vista
10:30 - 11:00	Michel Waldschmidt, NumbTh, Carleton
10:30 - 11:00	George Elliott, OpAlg, Albert
10:30 - 11:00	Wentang Kuo, P-adic, Cartier
10:30 - 11:00	Guenter Uhlmann, PDE, Dalhousie
10:30 - 11:00	Henrique Bursztyn, SymGeo, Wellington
10:30 - 11:30	Chongying Dong, LieAlg, Laurier
11:00 - 11:30	P.D. Minev, FinEl, Capital
11:00 - 11:30	Agnes Tourin, FinMat, Mackenzie
11:00 - 11:30	Christiane Rousseau, HisMat, Rideau
11:00 - 11:30	Tom Steinke, MathEd, Alta Vista
11:00 - 11:30	Jeffrey Lin Thunder, NumbTh, Carleton
11:00 - 11:30	Berndt Brenken, OpAlg, Albert
11:00 - 11:30	Alfred Noël, P-adic, Cartier
11:00 - 11:30	Steve Zelditch, PDE, Dalhousie
11:00 - 11:30	Misha Kogan, SymGeo, Wellington
11:30 - 12:00	Leila Slimane, FinEl, Capital
11:30 - 12:00	Robert Almgren, FinMat, Mackenzie
11:30 - 12:00	Angelo Mingarelli, HisMat, Rideau
11:30 - 12:00	Technology: Small Group Dialogue, MathEd, Alta Vista
11:30 - 12:00	Eric Freeman, NumbTh, Carleton
11:30 - 12:00	Marcelo Laca, OpAlg, Albert
11:30 - 12:00	Paul Mezo, P-adic, Cartier
11:30 - 12:00	Richard Beals, PDE, Dalhousie
11:30 - 12:00	Eugene Lerman, SymGeo, Wellington
11:30 - 12:30	Haisheng Li, LieAlg, Laurier
12:00 - 12:30	Daniel Leroux, FinEl, Capital
12:00 - 12:30	Abel Cadenillas, FinMat, Mackenzie
12:00 - 12:30	Larry Stouder, HisMat, Rideau
12:00 - 12:30	Technology: Whole Group Sharing/Reporting, MathEd, Alta Vista
12:00 - 12:30	Cameron L. Stewart, NumbTh, Carleton
12:00 - 12:30	Ian Putnam, OpAlg, Albert
12:00 - 12:30	Eric Sommers, P-adic, Cartier
12:00 - 12:30	Peter Greiner, PDE, Dalhousie
12:00 - 12:30	David Metzler, SymGeo, Wellington
12:30 - 14:00	Delegates' Luncheon / Lunch des participants, Victoria North/South

14:00 - 16:00	CMS Mathematical Competitions Committee Meeting / Réunion du Comité des concours mathématiques SMC, Room 620
14:00 - 16:00	CMS Publications Committee Meeting / Réunion du comité des publications de la SMC, Room 621
14:00 - 14:30	Ross Ethier, FinEl, Capital
14:00 - 14:30	Michael Makkai, HisMat, Rideau
14:00 - 14:30	Matthew Szczesny, LieAlg, Laurier
14:00 - 14:30	Stewart Craven, MathEd, Alta Vista
14:00 - 14:30	Kumar Murty, NumbTh, Carleton
14:00 - 14:30	Ken Davidson, OpAlg, Albert
14:00 - 14:30	Stephen DeBacker, P-adic, Cartier
14:00 - 14:30	Catherine Sulem, PDE, Dalhousie
14:00 - 14:30	Jonathan Weitsman, SymGeo, Wellington
14:30 - 15:00	Michel Delfour, FinEl, Capital
14:30 - 15:00	Luis Seco, HisMat, Rideau
14:30 - 15:00	Chris Cummins, LieAlg, Laurier
14:30 - 15:00	Peter Taylor, MathEd, Alta Vista
14:30 - 15:00	Eyal Goren, NumbTh, Carleton
14:30 - 15:00	Man Duen Choi, OpAlg, Albert
14:30 - 15:00	Ju-Lee Kim, P-adic, Cartier
14:30 - 15:00	Andrew Comech, PDE, Dalhousie
14:30 - 15:00	Yael Karshon, SymGeo, Wellington
15:00 - 15:30	Yves Bourgault, FinEl, Capital
15:00 - 15:30	Hardy Grant, HisMat, Rideau
15:00 - 15:30	Noriko Yui, LieAlg, Laurier
15:00 - 15:30	Inquiry: Small Group Dialogue, MathEd, Alta Vista
15:00 - 15:30	Yiannis Petridis, NumbTh, Carleton
15:00 - 15:30	Fiona Murnaghan, P-adic, Cartier
15:00 - 15:30	Jim Colliander, PDE, Dalhousie
15:00 - 15:30	Rebecca Goldin, SymGeo, Wellington
15:30 - 15:45	Coffee / café, Victoria Gallery
16:00 - 17:00	James Arthur, Victoria North/South
17:00 - 17:30	Viena Stastna, HisMat, Rideau
17:00 - 17:30	Terry Gannon, LieAlg, Laurier
17:00 - 17:30	Inquiry: Whole Group Sharing/Reporting, MathEd, Alta Vista
17:00 - 17:30	Monica Nevins, P-adic, Cartier
17:00 - 18:00	François Lalonde, SymGeo, Wellington
17:30 - 18:00	Francois Major, HisMat, Rideau
17:30 - 18:00	Adrian Ocneanu, LieAlg, Laurier
17:30 - 18:00	Wrap-Up: Whole Group Sharing, MathEd, Alta Vista
17:30 - 18:00	Fernando Szechtman, P-adic, Cartier

18:30 - 19:30	Cash bar / Bar payant, Victoria North/South
19:30 - 22:00	Banquet, Victoria North/South

Monday December 9 lundi 9 décembre

7:30 - 9:30	CMS Advancement of Mathematics Committee / Comité pour l'avancement des mathématiques, Room 620
8:00 - 17:00	Exhibits / Expositions, Victoria Gallery
8:00 - 17:00	Registration / Inscription, Victoria Foyer
9:00 - 10:00	Maciej Zworski, Victoria North/South
10:00 - 10:15	Coffee / café, Victoria Gallery
10:30 - 10:45	Murray Bremner, Ctrb, Alta Vista
10:30 - 10:45	Driss Drissi, Ctrb, Cartier
10:30 - 11:00	Bruce Simpson, FinEl, Capital
10:30 - 11:00	Matt Davison, FinMat, Mackenzie
10:30 - 11:00	Niky Kamran, HisMat, Rideau
10:30 - 11:00	Yuly Billig, LieAlg, Laurier
10:30 - 11:00	John Friedlander, NumbTh, Carleton
10:30 - 11:00	Nigel Higson, OpAlg, Albert
10:30 - 11:00	Andras Vasy, PDE, Dalhousie
10:30 - 11:00	André Longtin, RealPr, Sussex
10:30 - 11:00	Askold Khovanskii, SymGeo, Wellington
10:50 - 11:05	Martin Argerami, Ctrb, Cartier
11:00 - 11:30	Azzedine Soulaimani, FinEl, Capital
11:00 - 11:30	Ali Lavassani, FinMat, Mackenzie
11:00 - 11:30	Jonathan Borwein, HisMat, Rideau
11:00 - 11:30	Yun Gao, LieAlg, Laurier
11:00 - 11:30	Ram Murty, NumbTh, Carleton
11:00 - 11:30	Masoud Khalkali, OpAlg, Albert
11:00 - 11:30	Jared Wunsch, PDE, Dalhousie
11:00 - 11:30	Liang Chen, RealPr, Sussex
11:00 - 11:30	Ely Kerman, SymGeo, Wellington
11:10 - 11:25	Kunquan Lan, Ctrb, Cartier
11:10 - 11:25	Claude Levesque, Ctrb, Alta Vista
11:30 - 11:45	Ravil Moukhometov, Ctrb, Cartier
11:30 - 11:45	Amritanshu Prasad, Ctrb, Alta Vista
11:30 - 12:00	Kokou Dossou, FinEl, Capital
11:30 - 12:00	Tony Ware, FinMat, Mackenzie
11:30 - 12:00	Michael Barr, HisMat, Rideau
11:30 - 12:00	Georgia Benkart, LieAlg, Laurier
11:30 - 12:00	David McKinnon, NumbTh, Carleton
11:30 - 12:00	Dan Kucerovsky, OpAlg, Albert
11:30 - 12:00	Tanya Christiansen, PDE, Dalhousie

11:30 - 12:00	Michael Rudnicki, RealPr, Sussex
11:30 - 12:00	Tara Holm, SymGeo, Wellington
11:50 - 12:05	Vahid Dabbaghian, Ctrb, Alta Vista
11:50 - 12:05	Ronald Sklar, Ctrb, Cartier
12:00 - 14:00	CMS Committee on Women in Mathematics Meeting / Réunion du Comité des femmes en mathématiques, Room 620
12:00 - 12:30	Alain Charbonneau, FinEl, Capital
12:00 - 12:30	Tahir Choulli, FinMat, Mackenzie
12:00 - 12:30	Gregory Moore, HisMat, Rideau
12:00 - 12:30	Nantel Bergeron, LieAlg, Laurier
12:00 - 12:30	Manfred Kolster, NumbTh, Carleton
12:00 - 12:30	John Phillips, OpAlg, Albert
12:00 - 12:30	Nicolas Burq, PDE, Dalhousie
12:00 - 12:30	General Discussion, RealPr, Sussex
12:00 - 12:30	Jedrzej Sniatycki, SymGeo, Wellington
12:10 - 12:25	Jonathan Sondow, Ctrb, Alta Vista
12:30 - 14:00	Lunch (no scheduled event) / Lunch (aucun événement planifié)
14:00 - 15:00	Lisa Jeffrey, Victoria North/South
14:00 - 14:30	Vladimir Pestov, OpAlg, Albert
14:30 - 15:00	Matthias Neufang, OpAlg, Albert
15:00 - 15:15	Coffee / café, Victoria Gallery
15:00 - 15:30	Remus C. Floricel, OpAlg, Albert
15:30 - 16:00	Dominique Pelletier, FinEl, Capital
15:30 - 16:00	Florin Diacu, HisMat, Rideau
15:30 - 16:00	Bruce Allison, LieAlg, Laurier
15:30 - 16:00	Michael Bennett, NumbTh, Carleton
15:30 - 16:00	Clifton Cunningham, P-adic, Cartier
15:30 - 16:00	Chris Sogge, PDE, Dalhousie
15:30 - 16:00	Mary Hefford, RealPr, Sussex
15:30 - 16:00	Catalin Zara, SymGeo, Wellington
16:00 - 16:30	André Fortin, FinEl, Capital
16:00 - 16:30	Len Berggren, HisMat, Rideau
16:00 - 16:30	Arturo Pianzola, LieAlg, Laurier
16:00 - 16:30	Alina Cojocaru, NumbTh, Carleton
16:00 - 16:30	Heather Betel, P-adic, Cartier
16:00 - 16:30	Dmitry Jakobson, PDE, Dalhousie
16:00 - 16:30	Rejean Munger, RealPr, Sussex
16:00 - 16:30	Ramin Mohammadalikhani, SymGeo, Wellington
16:30 - 17:00	Francois Bertrand, FinEl, Capital
16:30 - 17:00	Don Robinson, HisMat, Rideau
16:30 - 17:00	Yoji Yoshii, LieAlg, Laurier
16:30 - 17:00	Chantal David, NumbTh, Carleton

16:30 - 17:00	Jason Levy, P-adic, Cartier
16:30 - 17:00	Vojkan Jaksic, PDE, Dalhousie
16:30 - 17:00	Eric Dubois, RealPr, Sussex
16:30 - 17:00	Ping Xu, SymGeo, Wellington
17:00 - 17:30	Robert Guenette, FinEl, Capital
17:00 - 17:30	Peter Zvengrowski, HisMat, Rideau
17:00 - 17:30	Yuri Bahturin, LieAlg, Laurier
17:00 - 17:30	Wentang Kuo, NumbTh, Carleton
17:00 - 17:30	Yuanli Zhang, P-adic, Cartier
17:00 - 17:30	General Discussion, RealPr, Sussex
17:00 - 17:30	Liviu Mare, SymGeo, Wellington
17:30 - 18:00	John McKay, HisMat, Rideau
17:30 - 18:00	Jung-Jo Lee, NumbTh, Carleton
19:00 - 19:30	Public Lecture Reception / Réception pour la conférence publique, Victoria North
19:30 - 20:30	Robert Zuccherato, Victoria South

Tuesday December 10 mardi 10 décembre

8:00 - 17:00	Registration / Inscription, Victoria Foyer
9:00 - 10:00	David Kerr, Victoria North/South
10:00 - 10:15	Coffee / café, Victoria Gallery
10:30 - 10:45	Hans Heinig, Ctrb, Alta Vista
10:30 - 11:00	Tom Salisbury, FinMat, Mackenzie
10:30 - 11:00	Dragomir Djokovic, LieAlg, Laurier
10:30 - 11:00	Kwok-Kwong Stephen Choi, NumbTh, Carleton
10:30 - 11:00	Roland Speicher, OpAlg, Albert
10:30 - 11:00	Richard Serfozo, PntPro, Sussex
10:30 - 11:00	Siye Wu, SymGeo, Wellington
10:50 - 11:05	Vladlen Timorin, Ctrb, Alta Vista
11:00 - 11:30	Ian Buckley, FinMat, Mackenzie
11:00 - 11:30	Marcelo Pereira De Oliveira, LieAlg, Laurier
11:00 - 11:30	Greg Martin, NumbTh, Carleton
11:00 - 11:30	Claus Koestler, OpAlg, Albert
11:00 - 11:30	Francois Baccelli, PntPro, Sussex
11:00 - 11:30	Jacques Hurtubise, SymGeo, Wellington
11:10 - 11:25	Valentina Kiritchenko, Ctrb, Alta Vista
11:30 - 12:00	Eric Renault, FinMat, Mackenzie
11:30 - 12:00	Stephen Berman, LieAlg, Laurier
11:30 - 12:00	Douglas C. Bowman, NumbTh, Carleton
11:30 - 12:00	Jamie Mingo, OpAlg, Albert
11:30 - 12:00	Raluca Balan, PntPro, Sussex
11:30 - 12:00	Megumi Harada, SymGeo, Wellington
11:50 - 12:05	Trevor Jones, Ctrb, Alta Vista
12:00 - 12:30	George Stoica, FinMat, Mackenzie

12:00 - 12:30	Werner Georg Nowak, NumbTh, Carleton
12:00 - 12:30	Reg Kulperger, PntPro, Sussex
12:00 - 12:30	Anton Alekseev, SymGeo, Wellington
12:30 - 14:00	Lunch (no scheduled event) / Lunch (aucun événement planifié)
14:00 - 15:00	Rene Carmona, Victoria North/South
15:00 - 15:15	Coffee / café, Victoria Gallery
15:30 - 16:00	Jiashan Tang, PntPro, Sussex
16:00 - 16:30	Gail Ivanoff, PntPro, Sussex
16:30 - 17:00	David McDonald, PntPro, Sussex

Schedule for Plenary Speakers
Horaire pour Conférenciers principaux

Sunday December 8	**dimanche 8 décembre**
9:00 - 10:00	Victor Guillemin, Victoria North/South
16:00 - 17:00	James Arthur, Victoria North/South

Monday December 9	**lundi 9 décembre**
9:00 - 10:00	Maciej Zworski, Victoria North/South

Tuesday December 10	**mardi 10 décembre**
14:00 - 15:00	Rene Carmona, Victoria North/South

Plenary Speakers / Conférenciers principaux

JAMES ARTHUR, Department of Mathematics, University of Toronto Toronto, Ontario
[Sunday December 8 / dimanche le 8 décembre, 16:00 – Victoria North/South]
Universal groups in the theory of automorphic forms

It is believed that there are universal groups that govern fundamental processes in number theory, automorphic forms and algebraic geometry. Some such groups are well known, while others are only hypothetical. We shall use these groups as a means of discussing some of the basic questions in the theory of automorphic forms.

RENE CARMONA, ORFE, Princeton University, Princeton, New Jersey 08544
[Tuesday December 10 / mardi le 10 décembre, 14:00 – Victoria North/South]
Mathematical challenges of the energy markets

The complexity of the instruments traded in the energy markets, together with the extreme volatility of electricity prices offer challenging problems to the mathematicians. We shall review some of the practical issues with the gas and power markets (spark spread options and plant valuation, gas storage, weather derivatives, swing options), and we shall formulate the corresponding mathematical problems. After discussing the mathematics involved in the existing solutions, we will concentrate on options with multiple American exercises, and we will present new mathematical results for the pricing of these options.

VICTOR GUILLEMIN, MIT, Cambridge, Massachusetts 02139, USA
[Sunday December 8 / dimanche le 8 décembre, 9:00 – Victoria North/South]
Cutting and gluing in symplectic geometry

Surgery operations like "connected sum" have been standard tools in differential geometry for many years. In the last decade two operations of this type: "cutting" and "gluing" have become standard tools in symplectic geometry as well. In this lecture I will describe a

number of recent developments in which these operations have played a role, among them the solution of the "quantization commutes with reduction" conjecture, an elementary proof of the Kirwan convexity theorem and the construction of many interesting examples of non-Kaehlerizable symplectic manifolds.

MACIEJ ZWORSKI, University of California, Berkeley, USA
[Monday December 9 / lundi le 9 décembre, 9:00 – Victoria North/South]
Quantum resonances in chaotic scattering

In mathematical work on quantum mechanics we are often interested in the density of states in the semi-classical limit. The work of Sjöstrand on modified Weyl upper bounds showed a relation between the density of states in quantum chaotic scattering and the dimension of the classical trapped set.

This work motivated recent rigorous and numerical work on quantum resonances in chaotic scattering, in particular estimates on classical dynamical zeta functions for Schottky groups, where the trapped set is related to the limit set of the group.

In my talk I will explain these concepts and present the recent numerical results in potential, obstacle, and geometric scattering (joint work with L. Guillopé, K. Lin, W. Lu, and S. Sridhar).

Schedule for Prize Lectures
Horaire pour Conférence des lauréats

Monday December 9	**lundi 9 décembre**
14:00 - 15:00	Lisa Jeffrey, Victoria North/South

Tuesday December 10	**mardi 10 décembre**
9:00 - 10:00	David Kerr, Victoria North/South

Prize Lectures / Conférence des lauréats

CMS Coxeter-James Lecture / Conférence Coxeter-James de la SMC

LISA JEFFREY, Department of Mathematics, University of Toronto, Toronto, Ontario M5S 3G3
[Monday December 9 / lundi le 9 décembre, 14:00 – Victoria North/South]
Symplectic quotients and their cohomology

Suppose M is a manifold equipped with a nondegenerate closed 2-form (a symplectic manifold, the generalization of the phase spaces of classical mechanics). If M has a symmetry group which acts preserving the symplectic form, it is often possible to divide out the symmetry group and form a new symplectic manifold, the symplectic quotient. In this lecture I shall talk about one problem which has occupied my recent research, which is the determination of the cohomology of the symplectic quotient: as a group (dimensions of cohomology groups) and as a ring (cup product or intersection pairing).

CMS Doctoral Prize / Prix de doctorat

DAVID KERR, University of Rome "La Sapienza," 00185 Rome, Italy
[Tuesday December 10 / mardi le 10 décembre, 9:00 – Victoria North/South]
C^*-dynamics and entropy

A basic problem in dynamics is to determine whether or not a given system has positive entropy, *i.e.*, whether or not it is "chaotic." While there is a vast collection of results addressing this issue in topological dynamics, the phenomenon of positive entropy remains by and large a mystery within the broader noncommutative domain of C^*-algebraic dynamics. To shed some light on the noncommutative situation we propose a geometric perspective inspired by work of Glasner and Weiss on topological entropy.

Schedule for Public Lecture
Horaire pour Conférence publique

Monday December 9 lundi 9 décembre

19:30 - 20:30 Robert Zuccherato, Victoria South

Public Lecture / Conférence publique

ROBERT ZUCCHERATO, Entrust Inc.
[Monday December 9 / lundi le 9 décembre, 19:30 – Victoria South]
Passwords: are they the weakest link?

Passwords are commonly used for identifying users of computers. However, since passwords must be remembered by human beings, in general they are easy to remember and thus easy for an attacker to guess or to exhaust all possibilities. For this reason, they are often seen as a "weak link" in the security protecting most computer systems. In fact, in the time it's taken you to read the title of this talk, your password may have been compromised. Fortunately, this tragedy did not have to happen. Attend this session and learn how to ensure the security of your password, and perhaps more importantly, learn how to ensure that the scheme that is protecting your information with a password, is actually secure. This talk will examine methods for securely using "insecure" passwords and show why passwords do not necessarily need to be the "weakest link".

Schedule for Financial Mathematics
Horaire pour Mathématiques financières

Sunday December 8	**dimanche 8 décembre**
10:30 - 11:00	Dave Saunders, FinMat, Mackenzie
11:00 - 11:30	Agnes Tourin, FinMat, Mackenzie
11:30 - 12:00	Robert Almgren, FinMat, Mackenzie
12:00 - 12:30	Abel Cadenillas, FinMat, Mackenzie

Monday December 9	**lundi 9 décembre**
10:30 - 11:00	Matt Davison, FinMat, Mackenzie
11:00 - 11:30	Ali Lavassani, FinMat, Mackenzie
11:30 - 12:00	Tony Ware, FinMat, Mackenzie
12:00 - 12:30	Tahir Choulli, FinMat, Mackenzie

Tuesday December 10	**mardi 10 décembre**
10:30 - 11:00	Tom Salisbury, FinMat, Mackenzie
11:00 - 11:30	Ian Buckley, FinMat, Mackenzie
11:30 - 12:00	Eric Renault, FinMat, Mackenzie
12:00 - 12:30	George Stoica, FinMat, Mackenzie

Financial Mathematics / Mathématiques financières
(Org: Luis Seco)

ROBERT ALMGREN, University of Toronto, Toronto, Ontario
[Sunday December 8 / dimanche le 8 décembre, 11:30 – Mackenzie]
Continuous-time model for household portfolios

We develop a continuous-time model for a Merton-like household portfolio choice problem in which the investor is subject to undiversifiable income risk. A mean-reverting factor predicts excess return of the stock, and wealth must be allocated among investments and consumption. The investor's goal is to maximize the utility of lifetime consumption in the presence of short-sales and borrowing constraints. Using techniques of stochastic optimal control, we derive a non-linear PDE with an internal free boundary. For a reduced problem, we obtain numerical solution for the value function and thus for the optimal portfolio policies. [Joint work with Raymond Cheng]

IAN BUCKLEY, Imperial College
[Tuesday December 10 / mardi le 10 décembre, 11:00 – Mackenzie]

ABEL CADENILLAS, Department of Mathematical and Statistical Sciences, University of Alberta, Edmonton, Alberta T6G 2G1
[Sunday December 8 / dimanche le 8 décembre, 12:00 – Mackenzie]
Optimal stochastic impulse control of the free cash flow

We apply the theory of stochastic impulse control to the determination of the optimal policy for cash disbursements and seasonal equity offerings of a financial corporation.

TAHIR CHOULLI, Alberta
[Monday December 9 / lundi le 9 décembre, 12:00 – Mackenzie]
Minimal Hellinger martingale measures in incomplete markets

In incomplete markets, one of the crucial problem that we face is concerned with the choice of an "appropiate" risk-neutral measure to price any payoff. Via Hellinger processes, optimal criterions are proposed. These criterions are charaterized by the explicite forms for the extremal martingale measures as well as the control of markets' information dynamically. Hence the methodology illustrates an interplay between control and information theories. The relationship of the obtained martingale measures and the existing ones is investigated. The existence and comparison results are detailed in the general semimartingale framework.

MATT DAVISON, University of Western Ontario, London, Ontario N6A 5B7
[Monday December 9 / lundi le 9 décembre, 10:30 – Mackenzie]
A bias correction method for Monte Carlo pricing of Bermudan options

Monte Carlo, or simulation, methods are a popular way of valuing financial options. They are easy to code and easily implemented in parallel, and are flexible with respect to the random processes governing the underlying asset price.

Until quite recently it was thought that Monte Carlo methods were not well suited to pricing options which permitted early exercise. This is because pricing such options requires the simulataneous determination of an early exercise boundary. The problem of determining this boundary is best determined backwards—by proceeding from option expiry back through successive early exercise dates to the present. Monte Carlo simulation, on the other hand, works forward in time. The tension between these requirements makes naive application of Monte Carlo methods to early exercise problems exponentially expensive in computer time.

In the last few years, work has been done which allows these computational problems to be overcome. Monte Carlo estimation of upper and lower bounds for prices of early exercise options is now possible. However, these bounds are often not only widely but also asymetrically spaced about the true price.

In this talk I will present joint work with Whitehead and MacIsaac on a method for determining the systematic biases in Monte Carlo methods for Bermudan Options. Using only simulation results, we can calculate the expected value of these biases and so remove them. We present both results and a probabilistic justification for these results.

ALI LAVASSANI, Calgary
[Monday December 9 / lundi le 9 décembre, 11:00 – Mackenzie]

ERIC RENAULT, Université de Montréal, CIREQ, CIRANO
[Tuesday December 10 / mardi le 10 décembre, 11:30 – Mackenzie]
Stochastic volatility models

(Joint work with F. Comte and L. Coutin).

In this paper, we study a classical extension of the Black and Scholes model for asset prices and option pricing, generally known as the Heston model. In our specification, the volatility is a fractional integral of a Cox, Ingersoll, Ross process (also known as an "affine" model): this implies that it is not only stochastic but also admits long memory features. We study the volatility and the integrated volatility processes and prove their long memory properties. We address the issue of option pricing and we study discretizations of the model. Lastly, we provide an estimation strategy and simulation experiments in order to test this methodology.

TOM SALISBURY, Department of Mathematics and Statistics, York University, Toronto, Ontario M3J 1P3
[Tuesday December 10 / mardi le 10 décembre, 10:30 – Mackenzie]
Liquidity premiums for variable annuities

A significant level of US retirement savings are housed in variable annuity accounts. Such accounts typically impose restrictions on how funds can be moved around. What premium should these accounts pay in order to compensate the investor for the resulting lack of liquidity? The problem can be solved by reformulating it in such a way that techniques from the theory of American Options can be applied. This is joint work with Moshe Milevsky, Sid Browne, and Shannon Kennedy.

DAVE SAUNDERS, University of Pittsburgh, Pittsburgh, Pennsylvania 15260, USA
[Sunday December 8 / dimanche le 8 décembre, 10:30 – Mackenzie]
Optimal structuring of asset portfolios for insurance products with minimum guarantee provisions

Modern insurance products are becoming increasingly complex, offering various guarantees, surrender options and bonus provisions. Typical products allow investors to participate in the returns of a reference portfolio, subject to some minimum guaranteed floor on the level of returns. The option-like nature of the payout to the investor is evident, and much work has been done on finding appropriate pricing algorithms under various assumptions on the stochastic behaviour of the reference portfolio and market risk factors. Little effort has been devoted to the problem of optimally structuring the reference portfolio. We consider this problem from the point of view of the firm offering the product. The resulting optimization problem is a nonlinear stochastic programming problem. We discuss properties of its solution and different solution algorithms. Examples illustrate how the model can be used to analyze different policy features and offer the optimally structured product for investors and shareholders.

GEORGE STOICA, University of New Brunswick, Saint John, New Brunswick
[Tuesday December 10 / mardi le 10 décembre, 12:00 – Mackenzie]
Market completeness: a return to order

We define a trading strategy operator in a two-times stochastic economy and investigate market completeness with respect to the order relation on a linear lattice of functions describing, in a two-times economy, the associated cash flow space. The study is leading us

towards alternative definitions for market completeness, in terms of trading strategy operators and approximate uniformly integrable martingales spanning on such linear lattices. In particular, we study the almost everywhere convergence situation on the space of cash flows given by the space of all equivalence classes of real valued random variables.

AGNES TOURIN, Department of Mathematics and Statistics,
McMaster University, Hamilton, Ontario L8S 4L8
[Sunday December 8 / dimanche le 8 décembre, 11:00 – Mackenzie]
Maximizing the probability of being solvent in the presence of transaction costs

It is a well known result that, in the presence of transaction costs, the writer of a European option may not be solvent. Here, we present a stochastic control problem which consists in maximizing the probability of being solvent. We compute the optimal probability and the free boundaries characterizing the optimal policies. This is a joint work with Thaleia Zariphopoulou.

TONY WARE, University of Calgary, Calgary, Alberta
[Monday December 9 / lundi le 9 décembre, 11:30 – Mackenzie]
Numerical explorations of swing options

We describe some partial differential equation models for swing option pricing, and discuss the issue of calibrating those models to the relevant markets. We also describe a finite element scheme for solving the equations and illustrate the characteristics of these options by means of a set of numerical explorations.

Schedule for Finite Elements
Horaire pour Éléments finis

Sunday December 8	**dimanche 8 décembre**
10:30 - 11:00	Mohammed Farhloul, FinEl, Capital
11:00 - 11:30	P.D. Minev, FinEl, Capital
11:30 - 12:00	Leila Slimane, FinEl, Capital
12:00 - 12:30	Daniel Leroux, FinEl, Capital
14:00 - 14:30	Ross Ethier, FinEl, Capital
14:30 - 15:00	Michel Delfour, FinEl, Capital
15:00 - 15:30	Yves Bourgault, FinEl, Capital

Monday December 9	**lundi 9 décembre**
10:30 - 11:00	Bruce Simpson, FinEl, Capital
11:00 - 11:30	Azzedine Soulaimani, FinEl, Capital
11:30 - 12:00	Kokou Dossou, FinEl, Capital
12:00 - 12:30	Alain Charbonneau, FinEl, Capital
15:30 - 16:00	Dominique Pelletier, FinEl, Capital
16:00 - 16:30	André Fortin, FinEl, Capital
16:30 - 17:00	Francois Bertrand, FinEl, Capital
17:00 - 17:30	Robert Guenette, FinEl, Capital

Finite Elements / Éléments finis
(Org: Roger Pierre)

FRANCOIS BERTRAND, Department of Chemical Engineering, École Polytechnique de Montréal, Montreal, Quebec H4R 2V3
[Monday December 9 / lundi le 9 décembre, 16:30 – Capital]
A local refinement based fictitious domain method for the simulation of fluid flow in complex geometries

The simulation of fluid flow in industrial processes often involves geometries that may contain mobile internal parts. The use of classical finite element (or finite volume) methods to tackle such problems is far from trivial since a new mesh is needed at each time iteration owing to the motion of these internal parts. The objective of this work is to combine a fictitious domain method with a mesh refinement technique that relies upon one single reference mesh. The method will be discussed in detail and two-dimensional and three-dimensional applications will be presented. In particular, it will be shown that the proposed strategy is quite efficient for the simulation of fluid flow in geometries with moving parts and small gaps.

YVES BOURGAULT, University of Ottawa, Ottawa, Ontarion K1N 6N5
[Sunday December 8 / dimanche le 8 décembre, 15:00 – Capital]
A mortar element for coupling hyperbolic and parabolic problems

The mortar element method is now very popular to decompose elliptic problems on multiple sub-domains. The main feature of this method is its ability to deal with nonmatching grids on sub-domain interfaces without loosing any accuracy of the global solution, while allowing the parallel computing of the solution. As far as we know, the mortar method has been introduced for elliptic or parabolic PDEs only. Its extension to hyperbolic problems (such as the Euler equations for inviscid flows) or mixed-type equations (such as the Navier-Stokes equations for compressible flows) would be a definite asset.

The present work is an initial step into the development of an "all-at-once" mortar methods that works for all type of equations, first concentrating on its development for the linear advection equation. The proposed mortar method works for hyperbolic equations, through a combination of streamline-diffusion up-winding, discontinuous and mortar finite element terms in the Galerkin formulation. A weak flux continuity condition at the sub-domain interface is enforced by means of Lagrange multipliers which yields a solution with optimal accuracy even with non-matching grids at sub-domain interfaces. The method can be consistently applied to the advection-diffusion equation. The method has been implemented using MPI and numerical results will be shown for the pure advection as well as the advection-diffusion equations.

ALAIN CHARBONNEAU, Université du Québec en Outaouais, Saint-Jean-Bosco, Hull, Québec J8Y 3G5
[Monday December 9 / lundi le 9 décembre, 12:00 – Capital]
Une méthode adaptative d'éléments finis permettant le calcul des modes propres d'un guide d'ondes optiques

Les guides d'ondes optiques (GOO) sont des composants fondamentaux de certains dispositifs de transmission de données par ondes lumineuses utilisés dans les secteurs des télécommunications et du génie (instruments de mesure de paramètres physiques tels la température, la pression, ...).

Dans cet exposé, nous nous intéressons au calcul des modes propres des GOO qui présentent un axe longitudinal d'invariance. Puisque nous cherchons aussi à modéliser la biréfringence de certains types de GOO, nous sommes conduits à résoudre un problème aux valeurs propres issu des équations de Maxwell, dans le cadre de l'optique guidée, dites pleinement vectorielles.

C'est dans ce contexte que nous présentons une méthode adaptative d'éléments finis qui permet de calculer de façon précise les composantes des modes propres d'un champ électro–magnétique se propageant dans un GOO composé de matériaux diélectriques isotropes ou anisotropes. Des applications de cette méthode de calcul seront présentées.

MICHEL DELFOUR, Centre de Recherches Mathématiques et Département de Mathématiques et de Statistique, Université de Montréal
[Sunday December 8 / dimanche le 8 décembre, 14:30 – Capital]
Approximation of the dose for thin coated stents in interventional cardiology

Stents are used in interventional cardiology to keep a diseased vessel open. New stents are coated with a medicinal agent to prevent early reclosure due to the proliferation of smooth muscle cells. It is the dose of the agent which effectively acts on the cells in the wall of the vessel. This paper gives mathematical models of the dose for a periodic stent and an asymptotic stent. It studies the effect of the number of struts and the ratio between the area of the coated struts and the targeted area of the vessel. Theoretical and numerical results are

presented with emphasis on the critical choice of finite element approximations for diffusion-transport equations in the presence of the stent which behaves as a Neumann sieve at the interface between the lumen and the wall of the vessel. (joint paper with A. Garon (Ecole Polytechnique and Vito Longo (Université de Montreal)

KOKOU DOSSOU, Département de mathématiques et de statistique, Université Laval, Québec G1K 7P4
[Monday December 9 / lundi le 9 décembre, 11:30 – Capital]
Higher order vector edge finite element analysis of optical waveguides

We will present some applications of vector edge finite element methods to the analysis of optical fiber such as the computation of the propagation constant and propagation mode and that of the birefringence. To address the need for a more accurate finite element approximation we develop a higher order vector edge finite element model. It is well known that the use of standard nodal finite element methods does not work well for electromagnetic problems. Although edge elements appear to be reliable, some care must be taken in order to avoid spurious modes. We will discuss some observations and mathematical properties which ensure that the higher order vector finite element converges and is free of spurious modes.

ROSS ETHIER, University of Toronto, Toronto, Ontario M5S 3G8
[Sunday December 8 / dimanche le 8 décembre, 14:00 – Capital]
Finite element modelling of coronary artery hemodynamics

The coronary arteries are responsible for supplying blood to the heart muscle and are a common site of arterial disease, which leads in its end stages to heart attack. Development of arterial disease in these arteries appears to be strongly influenced by biomechanical factors, including blood flow (hemodynamic) features. To better understand the disease process we therefore desire to model flow patterns in the coronary arteries. The modelling challenges in these arteries include very large deformations of the artery over the cardiac cycle, complex 3D geometries, and significant flow unsteadiness. Here we review some of the techniques used to overcome these challenges. In brief, coronary artery geometries are determined based on post-mortem casts and movies of beating hearts (cineangiograms). Flow modelling uses the Arbitrary Lagrangian-Eulerian (ALE) approach; mesh updating is based on a spring analogy model modified to preserve element quality during complex 3D motions. Flow unsteadiness is based on intra-operative measurements of blood flow wave forms in the affected arteries. An overview of our results will be given, demonstrating the primary effects of arterial geometry (particularly complex, compound curvature), with smaller effects due to flow pulsation and arterial motion.

MOHAMMED FARHLOUL, Université de Moncton, Moncton, New Brunswick E1A 3E9
[Sunday December 8 / dimanche le 8 décembre, 10:30 – Capital]
Une méthode d'éléments finis mixtes pour des écoulements de fluides viscoélastiques

Nous proposons et analysons une méthode d'éléments finis mixtes pour l'écoulement de fluides viscoélastiques obéissant au modèle d'Oldroyd. Cette méthode est basée sur une formulation mixte où la composante newtonienne σ_N du tenseur des extra-contraintes est introduite en tant que variable auxiliaire. L'approximation de la composante viscoélastique

σ du tenseur des extra-contraintes est P_1 discontinue et la méthode de Lesaint-Raviart est utilisée pour la convection de σ. Nous montrons, à l'aide du théorème de point fixe de Brouwer, que le problème approché possède une solution et nous donnons des estimations d'erreurs.

ANDRÉ FORTIN, Université Laval, Québec G1K 7P4
[Monday December 9 / lundi le 9 décembre, 16:00 – Capital]
Reconstruction géométrique, estimation d'erreur et remaillage adaptatif: application à la mise en forme des polymères

Dans cet exposé, nous présenterons brièvement les outils de reconstruction géométrique, d'estimation d'erreurs et de remaillage adaptatif développés au GIREF au cours des dernières années. La reconstruction géométrique consiste, à partir uniquement d'un maillage donné, à identifier les frontières et à recréer la géométrie du problème de manière à être totalement indépendant de quelque logiciel de CAD que ce soit. On peut ensuite résoudre le problème par une méthode numérique quelconque et estimer l'erreur commise. Le maillage est ensuite rafiné ou dérafiné suivant l'importance de l'erreur estimée de maniére à respecter la géométrie reconstruite au préalable.

Nous présenterons par la suite quelques applications à la mise ne forme des polyméres: écoulement dans une contraction de rapport 18 à 1, écoulement dans des mélangeurs statiques, *etc.*

ROBERT GUENETTE, Université Laval, Québec G1K 7P4
[Monday December 9 / lundi le 9 décembre, 17:00 – Capital]
Méthodes de dualité convexe pour la résolution par éléments finis de problèmes de contact en mécanique des solides

De nombreux problèmes industriels exigent de tenir compte du contact mécanique et/ou thermique entre divers matériaux. Le présent exposé est motivé par des applications dans le secteur de l'aluminium et celui de la conception de moteurs d'avion. La résolution de problèmes de contact pose des défis de taille pour le numéricien. Ceci est principalement dû à la nature non différentiable des lois de contact conduisant des inéquations variationnelles. De plus, les méthodes classiques de résolution du contact ne sont pas efficaces pour les problèmes de grande taille visés dans les applications.

On posera le problème dans le contexte général de l'lasticité en grande déformation incluant le frottement mécanique entre les différents corps élastiques. On utilisera les méthodes de dualité convexe pour le traitement de la non différentiabilité des lois de contact. On proposera une linéarisation des inéquations non linéaires et une discrétisation par éléments finis. Pour les problèmes de contact sans frottement, le système discret sera résolu par un algorithme de gradient conjugué projeté appliqué au problme dual. Des résultats numériques seront présentés pour le calcul approch des dplacements de deux corps élastiques discrétisés par des maillages incompatibles à l'interface de contact.

DANIEL LEROUX, Université Laval, Québec G1K 7P4
[Sunday December 8 / dimanche le 8 décembre, 12:00 – Capital]
An appropriate finite-element pair to simulate inertia-gravity waves

Most of atmospheric, oceanic and hydrological models typically employ gridpoint, finite and spectral-element techniques. For all these numerical methods the coupling between the

momentum and continuity equations usually leads to spurious solutions in the representation of inertia-gravity waves. The spurius modes have a wide range of characteristics and may take the form of pure inertia oscillations, Coriolis modes and pressure modes. The spurius modes are small-scale artifacts which are trapped within the model grid, and can cause aliasing and an accumulation of energy in the smallest-resolvable scale, leading to noisy solutions. Their appearance is mainly due to an inappropriate placement of variables on the grid and/or a bad choice of approximation function spaces. We present a triangular finite-element pair candidate, which 'properly' models the dispersion of the inertia-gravity waves. In particular, the discrete frequency increases monotonically with wavenumbers as in the continuum case, contrarily to most of other finite-element pairs (if not all). It will also be shown that, like for most other pairs, this finite element candidate should be employed when a precise calculation of the Rossby modes is not an issue. Results of test problems to simulate the propagation of inertia-gravity waves with the proposed finite-element pair are presented and they are compared with results of other grids. They illustrate the promise of the proposed approach.

P.D. MINEV, Department of Mathematics, Statistics and Sciences, University of Alberta, Edmonton, Alberta
[Sunday December 8 / dimanche le 8 décembre, 11:00 – Capital]
Analysis of a projection/characteristic scheme for incompressible flow

The paper presents the convergence analysis of a characteristic/projection scheme for the incompressible Navier-Stokes equations. This scheme is a modification of the scheme analyzed in [1] which does not eliminate the projected velocity field from the system but rather uses it as the advecting field in the explicit characteristic advection. This field has a zero (generalized) divergence and is therefore more suitable for this purpose. It appears that this scheme has the same convergence rate as the one in [1] but on a given grid seems to produce more accurate results. The computational cost is not significantly higher since it requires only one extra inversion of the mass matrix which can be done relatively efficiently. We present numerical results which illustrate the properties of the scheme.

References

[1] Y. Achdou and J.-L. Guermond, *Convergence analysis of a finite element projection/Lagrange-Galerkin method for the incompressible Navier-Stokes equations.* SIAM J. Numer. Anal. (3) **37**(2000), 799–826.

DOMINIQUE PELLETIER, École Polytechnique de Montréal
[Monday December 9 / lundi le 9 décembre, 15:30 – Capital]

BRUCE SIMPSON, School of Computer Science, University of Waterloo, Waterloo, Ontario N2L 3G1
[Monday December 9 / lundi le 9 décembre, 10:30 – Capital]
Computing the deltas; efficiency-accuracy trade offs in solving Black Scholes equations

Pricing functions for financial options are routinely computed as numerical solutions of partial differential equations of Black Scholes type. The risk associated with issuing an option can be reduced by various hedging strategies for portfolio management. In theory, a zero-risk strategy is possible, which requires continuously modifying the portfolio. These modifications depend on the derivatives of the dynamically changing price function, *i.e.* the so-called delta hedging parameters. In practice, the ideal hedging strategy may be approximately followed which results in the issuer incurring some risk.

We will look at finite element computation of pricing functions $V(S_1, S_2, t)$ that depend on two underlying assets, and estimation of the the gradient from the numerical solution for hedging parameters. The goal is to determine

a) a level of accuracy that incurs an acceptable risk

b) techniques of meshing and gradient estimation which can efficiently meet the accuracy requirement of a).

LEILA SLIMANE, GIREF, Laval
[Sunday December 8 / dimanche le 8 décembre, 11:30 – Capital]
Méthodes mixtes pour la résolution des inéquations variationnelles

La méthode des éléments finis mixtes permet de remedier de façon efficace aux phénomènes de verrouillage numérique pouvant apparaître dans la résolution numérique d'équations variationnelles dépendant d'un petit paramètre. Dans le présent exposé nous étendons le champ d'application de cette méthode aux inéquations variationnelles, tout particulièrement au problème de transmission raide avec des conditions aux limites de type Signorini, et au problème de contact unilatéral en élasticité presque incompressible.

Nous commençons par dégager les propriétés communes aux formulations mixtes de ces derniers problèmes. Ensuite, nous nous plaçons dans un cadre abstrait, regroupant les propriétés des exemples précédents, et dans lequel nous établissons des résultats d'existence, d'unicité et de stabilité. Nous donnons aussi des résultats de convergence et des estimations d'erreur dans le cadre d'approximation du problème. Finalement, nous appliquons cette étude à l'approximen élasticité presque incompressible, où nous obtenons des résultats de convergence uniforme pour ces schémas.

AZZEDINE SOULAIMANI, École de technologie supérieure
[Monday December 9 / lundi le 9 décembre, 11:00 – Capital]
On the solution of free surface flows with the SPH *and related methods*

SPH (Smoothed Particle Hydrodynamics) is a Lagrangian mesh free method used since the end of the seventeen in the simulation of astrophysics problems. Monaghan proposed extensions to gas dynamics and free surface problems. Original SPH regain more popularity in the nineties, especially for impact and large deformation mechanical problems. In the first part of the talk, a state of the art on SPH will be given. A relationship between SPH and the finite element-finite volume method will be emphasized with application to the solution of the Shallow-water equations. This formulation gives the possibility to introduce well-known finite elements or finite volume stabilization techniques for high speed flows. The problem of dam break in various two-dimensional configurations is used as the benchmark test. The result obtained depends on the concerned problem. For the cases of standard and circular dams, the results are quiet encouraging. The capture of shocks and the shape of the waves were successfully revealed. The success of the SPH in the solution of free surface

flows depends on the optimisation of its parameters, a smart choice of particles number, type of the kernel and the smoothing of irregularities in the geometry. In case of irregular boundaries, some difficulties are encountered for imposing proper boundary conditions, and require additional investigations.

Schedule for History of Mathematics
Horaire pour Histoire des mathématiques

Sunday December 8	**dimanche 8 décembre**
10:30 - 11:00	Joan DeBello, HisMat, Rideau
11:00 - 11:30	Christiane Rousseau, HisMat, Rideau
11:30 - 12:00	Angelo Mingarelli, HisMat, Rideau
12:00 - 12:30	Larry Stouder, HisMat, Rideau
14:00 - 14:30	Michael Makkai, HisMat, Rideau
14:30 - 15:00	Luis Seco, HisMat, Rideau
15:00 - 15:30	Hardy Grant, HisMat, Rideau
17:00 - 17:30	Viena Stastna, HisMat, Rideau
17:30 - 18:00	Francois Major, HisMat, Rideau

Monday December 9	**lundi 9 décembre**
10:30 - 11:00	Niky Kamran, HisMat, Rideau
11:00 - 11:30	Jonathan Borwein, HisMat, Rideau
11:30 - 12:00	Michael Barr, HisMat, Rideau
12:00 - 12:30	Gregory Moore, HisMat, Rideau
15:30 - 16:00	Florin Diacu, HisMat, Rideau
16:00 - 16:30	Len Berggren, HisMat, Rideau
16:30 - 17:00	Don Robinson, HisMat, Rideau
17:00 - 17:30	Peter Zvengrowski, HisMat, Rideau
17:30 - 18:00	John McKay, HisMat, Rideau

History of Mathematics / Histoire des mathématiques
(Org: Richard O'Lander and/et Ronald Sklar)

MICHAEL BARR, Department of Mathematics and Statistics, McGill University, Montreal, Quebec H3A 2K6
[Monday December 9 / lundi le 9 décembre, 11:30 – Rideau]
The Chu construction: history of an idea

The Chu construction started out as a way of constricting easy examples of $*$-autonomous categories. It first became more widely known as a way of providing easy models of linear logic and then as a way of simplifying the construction of $*$-autonomous categories. It actually originates in the construction of "dual pairs" in the topological vector spaces, which goes back ultimately in George Mackey's dissertation.

LEN BERGGREN, Simon Fraser University, British Columbia
[Monday December 9 / lundi le 9 décembre, 16:00 – Rideau]
A tenth-century mathematician: Abu al-Jud, his life and work

Although the standard biographical sources are silent on Abu al-Jud, Omar Khayyam tells us he solved an algebra problem, leading to a cubic equation, that none of his contemporaries had been able to solve. Our survey of his works, which we report in this talk, suggests that he was indeed a talented mathematician. But he was also one who occasionally 'rushed into print' he had checked all the details of his argument and who was embroiled in a nasty controversy with a contemporary on the solution of a major unsolved problem.

JONATHAN BORWEIN, CECM, Simon Fraser University, British Columbia
[Monday December 9 / lundi le 9 décembre, 11:00 – Rideau]
Digitizing the entire mathematical literature: what wild surmise!

The Digital Mathematics Library. The 'DML' project proposes over the next decade to put on line (scanned images) the entire printed corpus of Mathematics and to make it generally available. It is estimated that between five and ten percent is already available, though hard to find or access! A good idea of some of the progress already made can be gathered at the European Math Society's website (`http://elib.uni-osnabrueck.de/EMIS/`). As was clear from a meeting I attended at NSF in late July, the project has significant support from NSF and from its German counterpart. NRC-CISTI was also present, and seems likely to assist in digitizing our own Canadian content.

It is generally agreed that the greatest obstacle to success is neither financial[1] nor technical but lies in the incredibly complicated intellectual property and rights management issues that will have to be addressed. For example, in some settings one may have to request permission from the estate of authors deceased as much as 70 years ago, as they certainly never anticipated such a use of their work.[2] More surely, while Springer-Verlag is already 'on-board', we shall have to come to some 'modus vivendi' with other large publishers such as Elsvier.

That said, success would represent an epochal event in cultural history. The material will, with caveats, be assured for posterity, it will be searchable (eventually the mathematics as well as the text), and we (mathematicians and others) will discover many things we do not know that we know.

JOAN DEBELLO, St. John's University, Jamaica, New York 11439, USA
[Sunday December 8 / dimanche le 8 décembre, 10:30 – Rideau]
The history of the Magic Square in mathematics

The Magic Square has been a wonderful mathematics puzzle for years. It has shown up in many ancient architectural sites and in many mathematics writings. This discussion will trace the roots of the magic square and go through the steps of creating different dimensions of the magic square. There will also be visuals of where the magic square appears throughout history.

FLORIN DIACU, University of Victoria
[Monday December 9 / lundi le 9 décembre, 15:30 – Rideau]
Spiru Haretu and the stability of the solar system

[1] Though the cost is likely to be somewhere between $100 and $200 million US.

[2] A recent US Supreme Court ruling told the New York Times that it had to pay free-lancers again when it put pre-digital material on its website.

We discuss the contributions of Spiru Haretu to the problem of the solar system's stability and show their importance relative to the mathematics research of the late 19th century. We also give a brief survey of the subsequent developments and the consequences of Haretu's results.

HARDY GRANT, York University, Toronto, Ontario M3J 1P3
[Sunday December 8 / dimanche le 8 décembre, 15:00 – Rideau]
Mathematics in the thought of Nicholas Cusanus

The famous 15th-century cardinal appears on at least one list of "great" mathematicians; on the other hand his contemporary Regiomontanus dismissed his efforts in mathematics as "ridiculous". But whatever his technical competence, it is quite certain that Cusanus's perception of mathematics coloured deeply his influential views on such issues as the limits of human knowledge and the relation of man to God. I shall try to sketch from both perspectives—the technical and the philosophical—the place of mathematics in the world-view of this fascinating figure.

NIKY KAMRAN, Department of Mathematics and Statistics, University of McGill, Montreal, Quebec H3A 2K6
[Monday December 9 / lundi le 9 décembre, 10:30 – Rideau]
The scientific correspondence between Einstein and Cartan—Letters on absolute parallelism

Between 1929 and 1932, Einstein and Elie Cartan carried an intense scientific correspondence on the geometric and analytic aspects of a unified field theory of gravitation and electromagnetism which had been proposed by Einstein in 1929. This correspondence was edited by Robert Debever, and published by Princeton University Press in 1979 on the occasion of Einstein's centenary. The framework of this theory is that of a differentiable manifold endowed with a connection for which all frames are parallel. Such a connection has necessarily zero curvature, but it will in general have non-zero torsion. The issues that Einstein and Cartan discussed in great detail dealt mostly with the local existence of analytic solutions to the field equations, and their degree of generality in the sense of Cartan-Kaehler theory. We will present some of the mathematical and historical highlights of this fascinating (and sometimes frustrating) correspondence.

FRANCOIS MAJOR, Montreal
[Sunday December 8 / dimanche le 8 décembre, 17:30 – Rideau]

MICHAEL MAKKAI, McGill University, Montreal, Quebec H3A 2K6
[Sunday December 8 / dimanche le 8 décembre, 14:00 – Rideau]
Category theory used as a language: a selective history

Inspired by Florian Cajori's classic "A history of Mathematical Notations" (1928 and 1929), the talk will focus on the notational innovations, in particular, the language of diagrams, that category theory has brought and consolidated in mathematics. Saunders Mac Lane, the founder, with Samuel Eilenberg, of the theory of categories, states at the beginning of

his 1971 book "Categories for the Working Mathemtician": "Category theory starts with the observation that many properties of mathematical systems can be unified and simplified by a presentation with diagrams of arrows". The diagrammatic notations of category theory reflect important conceptual features enabling category theory to serve as a distinctive foundational language for mathematics.

JOHN MCKAY, Concordia University, Montreal, Quebec H3G 1M8
[Monday December 9 / lundi le 9 décembre, 17:30 – Rideau]
The j-function and its natural generalization

I shall follow the development of ideas originating from elliptic integrals to the j-function and its natural generalization in recent years to the class of replicable functions.

ANGELO MINGARELLI, Faculty of Graduate Studies and Research, Carleton University, Ottawa, Ontario K1S 5B6
[Sunday December 8 / dimanche le 8 décembre, 11:30 – Rideau]
R.G.D. Richardson, Canadian born mathematician

We give a brief preliminary survey of the life and times of Roland George Dwight Richardson, Canadian born mathematician of the last century who, among his many contributions, served as Dean at Brown University and was ultimately responsible for attracting John D. Tamarkin there.

GREGORY MOORE, McMaster University, Hamilton, Ontario L8S 4K1
[Monday December 9 / lundi le 9 décembre, 12:00 – Rideau]
Cantor, Bettazzi, and Peano: an Italian debate about infinitesimals

Soon after 1890 there was a lively debate in an Italian journal, Peano's *Rivista de matematica*, about whether infinitesimals exist. Cantor and Peano both took the position that infinitesimals are self-contradictory and offered "proofs" to that effect, while Bettazzi engaged in an extended defense of infinitesimals, and Vivanti took a position in the middle. This paper explores the arguments used in the debate and its connection with work on infinitesimals in Germany a decade earlier by du Bois-Reymond and Stolz.

DON ROBINSON, St. Thomas University, Fredericton, New Brunswick
[Monday December 9 / lundi le 9 décembre, 16:30 – Rideau]
Anomaly cancelation in the standard model of particle physics part II

An anomaly is the failure of a classical symmetry to survive the processes of quantization and regularization. In the electroweak sector of the standard model of particle physics, anomalies in external symmetries lead to improved empirical results, whereas anomalies in internal symmetries spoil the renormalizability of the theory. The topic of Part I (CMS 2001 Winter Meetings) was the impressive phenomenon of anomaly cancelation in the case of internal symmetries. The present paper examines what happens in the strong sector where particles are put on a discrete lattice. In this case, the relevant symmetries are exact but at the price of the

CHRISTIANE ROUSSEAU, Département de mathématiques et de statistique, Université de Montréal, Montréal, Québec
[Sunday December 8 / dimanche le 8 décembre, 11:00 – Rideau]
Divergent series: past, present, future

Divergent series have been used successfully in mathematics for centuries and have occupied an important place in mathematics until the middle of the 19th century. During this period mathematicians could not explain their success. In the 20th century mathematicians have justified rigorously the use of divergent series and also explained why they are so powerful. However divergent series remain a relatively marginal subject in contemporary mathematics. In this lecture I will present some history of divergent series related to differential equations and explain why they are not so marginal in the subject. This will bring me to the future.

LUIS SECO, University of Toronto
[Sunday December 8 / dimanche le 8 décembre, 14:30 – Rideau]
A historical prespective of mathematics in the financial industry

This talk will overview the past history and current situation of the use of mathematics in the financial industry.

VIENA STASTNA, University of Calgary, Calgary, Alberta T2N 1N4
[Sunday December 8 / dimanche le 8 décembre, 17:00 – Rideau]
B. Bolzano: life and work

Life amidst politics, religion and mathematics. Deposed by the emperor Franz I. His contribution in philosophy, theology, logic, and mainly his example of continous nowhere differentiable function 40 years before Weierstrass.

LARRY STOUDER, St. John's University, New York, USA
[Sunday December 8 / dimanche le 8 décembre, 12:00 – Rideau]
Network computing—past, present, and future

In order to envision the future of network computing it is important to understand its past. How did we get from a world dominated by large-scale monolithic mainframe computers with few, if any, interconnections to a world where the personal computer and the Internet reign supreme? Understanding key evolutionary events can provide insight into the future of network computing and its impact on our futures.

Looking back in time, the invention and development of the telegraph, telephone, radio and computer formed the building blocks for unprecedented integration of capabilities. In its short history, the Internet has revolutionized the computer and communications world like nothing before. A scant 10 years ago, the World Wide Web didn't exist. The idea of doing business over the Internet was ludicrous. There was no Windows operating system, no Fast Ethernet or Gigabit Ethernet, no laptops, no PDA's no e-mail, not even shopping at home.

This session reviews some of the significant events in the origins, history, and evolution of the Internet. In addition, this session reviews some major trends identified by leading futurists and pundits, that may shape the industry over the next decade.

PETER ZVENGROWSKI, Department of Mathematics and Statistics, University of Calgary, Calgary, Alberta T2N 1N4
[Monday December 9 / lundi le 9 décembre, 17:00 – Rideau]
Olinde Rodrigues, a mathematician "in the shadow"

Olinde Rodrigues lived in the first half of the 19th century, and was an outstanding mathematician whose achievements are only being fully recognized today. He was Portugese by birth but French by training and education. Even his most famous contribution, the Rodrigues formula for the Legendre polynomials (which appears nowadays in most texts on differential equations, advanced calculus, *etc.*), was not attributed to him until about 50 years after his death. In this talk we will discuss his mathematical contributions which are in diverse fields such as analysis, rotation groups (in particular what we now call SO(3) and Spin(3)), group theory, and combinatorics. We will also discuss his contributions to an amazingly broad collection of other disciplines: philosophy (in particular socialism), music, women's rights, and racial equality. In the latter half of the 19th century France named a ship in his honour. We will conclude by showing that recently Rodrigues is finally getting some of the recognition he deserves, in both mathematics and theoretical physics.

Schedule for Lie Algebras and Moonshine
Horaire pour Algèbres de Lie et Moonshine

Sunday December 8	**dimanche 8 décembre**
10:30 - 11:30	Chongying Dong, LieAlg, Laurier
11:30 - 12:30	Haisheng Li, LieAlg, Laurier
14:00 - 14:30	Matthew Szczesny, LieAlg, Laurier
14:30 - 15:00	Chris Cummins, LieAlg, Laurier
15:00 - 15:30	Noriko Yui, LieAlg, Laurier
17:00 - 17:30	Terry Gannon, LieAlg, Laurier
17:30 - 18:00	Adrian Ocneanu, LieAlg, Laurier

Monday December 9	**lundi 9 décembre**
10:30 - 11:00	Yuly Billig, LieAlg, Laurier
11:00 - 11:30	Yun Gao, LieAlg, Laurier
11:30 - 12:00	Georgia Benkart, LieAlg, Laurier
12:00 - 12:30	Nantel Bergeron, LieAlg, Laurier
15:30 - 16:00	Bruce Allison, LieAlg, Laurier
16:00 - 16:30	Arturo Pianzola, LieAlg, Laurier
16:30 - 17:00	Yoji Yoshii, LieAlg, Laurier
17:00 - 17:30	Yuri Bahturin, LieAlg, Laurier

Tuesday December 10	**mardi 10 décembre**
10:30 - 11:00	Dragomir Djokovic, LieAlg, Laurier
11:00 - 11:30	Marcelo Pereira De Oliveira, LieAlg, Laurier
11:30 - 12:00	Stephen Berman, LieAlg, Laurier

Lie Algebras and Moonshine / Algèbres de Lie et Moonshine
(Org: Abdellah Sebbar and/et Erhard Neher)

BRUCE ALLISON, Department of Mathematical and Statistical Sciences, University of Alberta, Edmonton T6G 2G1
[Monday December 9 / lundi le 9 décembre, 15:30 – Laurier]
Isomorphism of loop algebras

The (twisted) loop algebra $L(\mathfrak{g}, \sigma)$ of a Lie algebra $\mathfrak{g}$ relative to an automorphism σ of finite order is an important construction in the theory of infinite dimensional Lie algebras. When the base algebra $\mathfrak{g}$ is a finite dimensional simple Lie algebra, loop algebras provide explicit constructions of affine Kac-Moody Lie algebras. When the base algebra is affine, loop algebras are used to construct extended affine Lie algebras of nullity two. In this talk, based on joint work with Stephen Berman and Arturo Pianzola, we describe necessary and sufficient conditions for two loop algebras of symmetrizable Kac-Moody Lie algebras to be

isomorphic. Our approach is to view loop algebras as forms of untwisted loop algebras.

YURI BAHTURIN, Memorial University, St. John's, Newfoundland A1C 5S7
[Monday December 9 / lundi le 9 décembre, 17:00 – Laurier]
Locally finite simple Lie algebas

We discuss the possibility of describing some simple locally finite Lie algebras L in the language used in the theory of root graded algebras and its generalizations. This is at least possible in the case of the so called "pure" and "one-sided" direct limits of finite-dimensional simple Lie algebras of type A (terminology due to Baranov-Zhilinski). The coordinate algebra in this case is a locally finite simple associative algebra. Some recent results of Baranov-Zalesski on so called finite-dimensional plain Lie algebras form a basis for representing some locally finite simple Lie algebras (of which our algebras are a particular case) as the Lie commutator subalgebras of appropriate locally finite simple associative algebras. Thus, our results and those of Baranov-Zalesski establish even closer connection between locally finite simple Lie algebras and locally finite simple associative algebras. One of the application of our description is the possibility of constructing new L-modules.

The results of this talk are joint with Georgia Benkart.

GEORGIA BENKART, University of Wisconsin-Madison, Department of Mathematics, Madison, Wisconsin 53706, USA
[Monday December 9 / lundi le 9 décembre, 11:30 – Laurier]
Temperley-Lieb combinatorics

Temperley-Lieb algebras have appeared in many diverse settings in connection with statistical mechanics, subfactors of von Neumann algebras, and knot and link invariants. They are subalgebras of Brauer algebras and are closely related to the representation theory of orthogonal and symplectic Lie algebras. This talk will focus on some representations of Temperley-Lieb algebras, their centralizing algebras, and their combinatorics. This is joint work with Dongho Moon.

NANTEL BERGERON, York University, Toronto, Ontario M3J 1P3
[Monday December 9 / lundi le 9 décembre, 12:00 – Laurier]
Temperley Lieb invariants and covariants

Hivert defined an action of the symmetric group on polynomials in n variables for which the quasi-symmetric polynomials correspond to the invariants of the action. The symmetric group algebra mod out by the kernel of this action can be identified with the temperley-Lieb algebra TL_n, an algebra of dimension equal to the nth Catalan number C_n. The quasi-symmetric polynomials are thus identified as the polynomial invariants of the algebra TL_n.

The action of Hivert is not compatible with multiplication and does not preserve the ideal generated by non-constant homogeneous quasi-symmetric polynomials. Yet we can still consider the quotient R_n of the polynomial ring by this ideal. This yields some striking facts related to TL_n-invariants: The quasi-symmetric functions are closed under multiplication in particular they form a subring of polynomials. Moreover, if we let n go to infinity, there is a graded Hopf algebra structure on quasi-symmetric functions that is free and cofree with cogenerators in every degree. Moreover, the space R_n of TL_n-covariants has dimension equal to C_n, the dimension of TL_n.

These facts are very similar to the classical theory of group invariants. Unfortunately the analogy is incomplete as Hivert's action does not induce an action on R_n. This raises new open questions for future investigation...

STEPHEN BERMAN, University of Saskatchewan, Saskatchewan
[Tuesday December 10 / mardi le 10 décembre, 11:30 – Laurier]
Some Factorizations of U.E.A.'s of 3 *dimensional Lie algebras and some generalizations*

This is a report of joint work with J. Morita and Y. Yoshi. We say a Lie algebra L has a plus-minus pair if it has two subalgebras P, M whose sum is not all of L which satisfy $U(L) = U(P)U(M)U(P)$. We show a 3 dimensional Lie algebra over a field of characteristic zero has a plus-minus pair if and only if it is two generated and then use this to show there are only two 3 dimensional Lie algebras which do not have a plus-minus pair. Related results for more general Lie algebras are discussed.

YULY BILLIG, Carleton University, Ottawa, Ontario
[Monday December 9 / lundi le 9 décembre, 10:30 – Laurier]
Representations of the full toroidal Lie algebras

This talk will be an introduction to the theory of the toroidal Lie algebras and their representations. Toroidal Lie algebras are the natural multi-variable generalizations of the affine Kac-Moody algebras. We will present two approaches to the representation theory of these algebras - an abstract construction using the Verma module technique, and an approach based on the theory of the vertex operator algebras, which allows us to give explicit realizations for the irreducible modules and obtain their characters. For the subalgebra of the toroidal Lie algebra, corresponding to the divergence-free vector fields, we obtain a result that has a striking resemblance to the formula for the critical dimension in bosonic string theory. Let $V_{\mathrm{aff}}(c)$ be an affine vertex algebra at level c, V^+_{hyp} be a subalgebra of the hyperbolic lattice vertex algebra and let $V_{\mathrm{Vir}}(c_1)$ be a Virasoro vertex algebra of rank c_1. Then the tensor product

$$V_{\mathrm{aff}}(c) \otimes V^+_{\mathrm{hyp}} \otimes V_{\mathrm{Vir}}(c_1)$$

has a structure of an irreducible module for an $(N+1)$-toroidal Lie algebra when

$$\frac{c\dim(g)}{c+\tilde{h^\vee}} + 2(N+1) + c_1 = 26.$$

CHRIS CUMMINS, Concordia
[Sunday December 8 / dimanche le 8 décembre, 14:30 – Laurier]
Congruence subgroups of the modular group

In recent years modular invariance has played an increasing important role in many areas of mathematics and physics. In this talk I shall discuss the computation and classification of congruence subgroups of the modular group of small genus. This is joint work with Sebastian Pauli.

MARCELO PEREIRA DE OLIVEIRA, Department of Mathematics, University of Toronto, Toronto, Ontario M5S 3G3
[Tuesday December 10 / mardi le 10 décembre, 11:00 – Laurier]
A universal Bergman element

We present new developments in 3-graded Lie algebras, more precisely, results in which such a Lie algebra is generated by a pair: a construction of the free case over a field of characteristic zero, and also over a field of characteristic $p > 3$ (following suggestion of E. Zelmanov). A comparison with KKT algebras is provided. Finally, we introduce the formal canonical kernel and explain why this is a natural candidate for a universal Bergman element, to be defined on the formal completion of the universal enveloping algebra of the above free 3-graded Lie algebra. Its expression reduces to the usual Bergman operator for the adjoint representation; all of this is also motivated by recent analytic expressions for Bergman kernels of holomorphic discrete series representations obtained in terms of the canonical kernel function.

DRAGOMIR DJOKOVIC, University of Waterloo, Waterloo, Ontario
[Tuesday December 10 / mardi le 10 décembre, 10:30 – Laurier]
The closure diagram for nilpotent orbits of the split real form of E_8

We have constructed the Hasse diagram for the partially ordered set whose elements are the nilpotent adjoint orbits of the split real form of the simple complex Lie algebra of type E_8. The partial order is defined via the closure relation. The construction is based on the fact that the Kostant-Sekiguchi correspondence preserves the closure relation. The proof uses in an essential way two kinds of prehomogeneous vector spaces which are naturally attached to each of the above orbits.

CHONGYING DONG, University of California, Santa Cruz, California 95064, USA
[Sunday December 8 / dimanche le 8 décembre, 10:30 – Laurier]
The monstrous moonshine and permutation orbifolds

This talk will discuss a connection between the monstrous moonshine and permutation orbifolds.

TERRY GANNON, University of Alberta, Edmonton, Alberta
[Sunday December 8 / dimanche le 8 décembre, 17:00 – Laurier]
CFT *and subfactors*

Conformal field theory (CFT) has motivated some very pretty questions. In this talk I will focus on the ones which have also arisen naturally in the subfactor theory of von Neumann algebras, as developed by Ocneanu and others. The simplest case not yet fully understood is related to affine sl(3). The affine sl(3) NIM-reps (*i.e.* fusion ring representations) arising in subfactor theory have recently been classified by Ocneanu, and the natural question is to what extent is his classification mirrored by CFT. It appears that if one adds some additional structure to the CFT, then Ocneanu's classification should be recovered. But is this extra structure necessary or even desirable? I try to probe this question by addressing the affine sl(3) NIM-rep classification in its purest form, *i.e.* without imposing additional (perhaps spurious) conditions.

YUN GAO, York University, Toronto, Ontario M3J 1P3
[Monday December 9 / lundi le 9 décembre, 11:00 – Laurier]
A 'quantized Tits-Kantor-Koecher' algebra

We will discuss a Tits-Kantor-Koecher algebra arising from the extended affine Lie algebra of type A_1. Then we propose a quantum anologue of the Tits-Kantor-Koecher algebra by looking at the vertex operator construction over a Fock space. This is a joint work with Naihuan Jing.

HAISHENG LI, Rutgers University-Camden, New Jersey, USA
[Sunday December 8 / dimanche le 8 décembre, 11:30 – Laurier]
Vertex algebras and vertex poisson algebras

In this talk, we shall review the definitions of vertex Lie algebras and vertex poisson algebras, which are "stringy" analogues of Lie algebras and poisson algebras while vertex algebras are "stringy" analogues of associative algebras. We shall introduce the notion of filtered vertex algebra and then associate a vertex poisson algebra to each filtered vertex algebra. We shall discuss how to determine and construct filtrations for a vertex operator algebra. At the end, we shall discuss formal deformation of vertex poisson algebras and present some basic results.

ADRIAN OCNEANU, The Pennsylvania State University, University Park, Pennsylvania 16802, USA
[Sunday December 8 / dimanche le 8 décembre, 17:30 – Laurier]
Quantum subgroups, lattices and canonical bases of Lie groups

We show that from a quantum subgroup of SU(2), or the corresponding subfactor, one can construct in a canonical manner the quantum simple Lie group with the same Coxeter graph. The construction yields in a simple and elementary way the roots, weights, the quantum universal enveloping algebra with a canonical basis and the irreducible representations of the quantum Lie group. The basis, which is shown to be as canonical as possible, does not depend on a choice of a simple basis for the Lie group.

From the quantum subgroups of other simple Lie groups we construct new finite dimensional Euclidean unimodular lattices of weights and roots. Even in the simplest cases, these lattices appear to be new.

We provide the classification of the quantum subgroups of SU(2), SU(3) and SU(4). While the number of exceptional usual subgroups grows rapidly, the number of exceptional quantum subgroups is small: 2 for SU(2), 3 for SU(3) and 3 for SU(4).

ARTURO PIANZOLA, University of Alberta, Edmonton, Alberta
[Monday December 9 / lundi le 9 décembre, 16:00 – Laurier]
Automorphisms of Chevalley Lie algebras

We start with a commutative ring k (the base), a Chevalley Lie algebra over k, a (commutative unital associative) k-algebra R, and the Lie algebra $g(R)$ obtained from g by base ring extension. The talk will focus on the description of the group of automorphisms of $g(R)$ viewed as a Lie algebra over k (for example if k is the complex numbers and R is Laurent polynomials we are dealing with untwisted affine Kac-Moody Lie algebras).

We will also also compare our results and methods (which exploit that conjugacy holds locally for the étale topology of Spec(R)) with what is known in the case of Chevalley groups.

MATTHEW SZCZESNY, University of Pennsylvania, Philadelphia, Pennsylvania, USA
[Sunday December 8 / dimanche le 8 décembre, 14:00 – Laurier]
Twisted modules, conformal blocks, and Prym varieties

We give a geometric approach to twisted vertex operators on an algebraic curve. This allows us to define a notion of conformal block valued in twisted modules for a vertex algebra. In certain cases these conformal blocks can be realized as Prym theta functions. They also give rise to localization functors from representations of twisted affine Lie algebras to twisted D-modules on Prym-like varieties. This is joint work with Edward Frenkel.

YOJI YOSHII, Wisconsin-Madison
[Monday December 9 / lundi le 9 décembre, 16:30 – Laurier]
Lie tori and structurable tori

We report some recent progress on Lie tori. Lie n-tori are certain $\mathbb{Z}^n$-graded Lie algebras which coincide with the cores of extended affine Lie algebras. Lie 1-tori of type A_1 and BC_1 are exactly affine Kac-Moody Lie algebras of type $A_1^{(1)}$ and $A_2^{(2)}$ respectively. We discuss Lie 2-tori of type A_1 and BC_1 which are coordinatized by analogs of the algebra of Laurent polynomials in 2 variables. It turns out that the coordinate algebras for type A_1 include one infinite family containing the algebra of Laurent polynomials in 2 variables and precisely one other algebra. For type BC_1 the situation is rather different. There are precisely 5 different coordinate algebras in that case.

NORIKO YUI, Queen's University
[Sunday December 8 / dimanche le 8 décembre, 15:00 – Laurier]
The modularity of Calabi-Yau threefolds with $K3$ fibrations

We consider certain Calabi-Yau threefolds which are fibered by non-constant semi-stable $K3$ surfaces. These are non-rigid Calabi-Yau threefolds, reaching the Arakelov-Yau bound. We address the modularity of these Calabi-Yau threefolds.

Schedule for Mathematical Education: Now I See !!!! Dynamic Visualisations in Canadian Mathematics Education Horaire pour Enseignement des mathématiques: Maintenant je vois !!!! Visualisations dynamiques dans l'enseignement des mathématiques au Canada

Sunday December 8	**dimanche 8 décembre**
10:30 - 11:00	Walter Whiteley, MathEd, Alta Vista
11:00 - 11:30	Tom Steinke, MathEd, Alta Vista
11:30 - 12:00	Technology: Small Group Dialogue, MathEd, Alta Vista
12:00 - 12:30	Technology: Whole Group Sharing/Reporting, MathEd, Alta Vista
14:00 - 14:30	Stewart Craven, MathEd, Alta Vista
14:30 - 15:00	Peter Taylor, MathEd, Alta Vista
15:00 - 15:30	Inquiry: Small Group Dialogue, MathEd, Alta Vista
17:00 - 17:30	Inquiry: Whole Group Sharing/Reporting, MathEd, Alta Vista
17:30 - 18:00	Wrap-Up: Whole Group Sharing, MathEd, Alta Vista

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Mathematical Education: Now I See !!!!
Dynamic Visualisations in Canadian Mathematics Education
Enseignement des mathématiques: Maintenant je vois !!!!
Visualisations dynamiques dans l'enseignement des mathématiques au Canada
(Org: Thomas Steinke)

STEWART CRAVEN, Toronto District School Board
[Sunday December 8 / dimanche le 8 décembre, 14:00 – Alta Vista]

TOM STEINKE, Ottawa-Carleton Catholic School Board
[Sunday December 8 / dimanche le 8 décembre, 11:00 – Alta Vista]

PETER TAYLOR, Queen's University
[Sunday December 8 / dimanche le 8 décembre, 14:30 – Alta Vista]

WALTER WHITELEY, York University
[Sunday December 8 / dimanche le 8 décembre, 10:30 – Alta Vista]

Schedule for Number Theory
Horaire pour Théorie des nombres

Sunday December 8	**dimanche 8 décembre**
10:30 - 11:00	Michel Waldschmidt, NumbTh, Carleton
11:00 - 11:30	Jeffrey Lin Thunder, NumbTh, Carleton
11:30 - 12:00	Eric Freeman, NumbTh, Carleton
12:00 - 12:30	Cameron L. Stewart, NumbTh, Carleton
14:00 - 14:30	Kumar Murty, NumbTh, Carleton
14:30 - 15:00	Eyal Goren, NumbTh, Carleton
15:00 - 15:30	Yiannis Petridis, NumbTh, Carleton

Monday December 9	**lundi 9 décembre**
10:30 - 11:00	John Friedlander, NumbTh, Carleton
11:00 - 11:30	Ram Murty, NumbTh, Carleton
11:30 - 12:00	David McKinnon, NumbTh, Carleton
12:00 - 12:30	Manfred Kolster, NumbTh, Carleton
15:30 - 16:00	Michael Bennett, NumbTh, Carleton
16:00 - 16:30	Alina Cojocaru, NumbTh, Carleton
16:30 - 17:00	Chantal David, NumbTh, Carleton
17:00 - 17:30	Wentang Kuo, NumbTh, Carleton
17:30 - 18:00	Jung-Jo Lee, NumbTh, Carleton

Tuesday December 10	**mardi 10 décembre**
10:30 - 11:00	Kwok-Kwong Stephen Choi, NumbTh, Carleton
11:00 - 11:30	Greg Martin, NumbTh, Carleton
11:30 - 12:00	Douglas C. Bowman, NumbTh, Carleton
12:00 - 12:30	Werner Georg Nowak, NumbTh, Carleton

Number Theory / Théorie des nombres
(Org: Damien Roy and/et Kenneth Williams)

MICHAEL BENNETT, University of British Columbia
[Monday December 9 / lundi le 9 décembre, 15:30 – Carleton]
Elliptic curves with prescribed torsion and good reduction outside a small set

We consider the problem of classifying elliptic curves over $\mathbb{Q}$ with prescribed torsion group and conductor of the form $p^a q^b$ where p and q are arbitrary primes. This can be achieved under certain technical conditions, using results from the theory of Galois representations and modular forms. This is joint work with Nike Vatsal and Soroosh Yazdani.

DOUGLAS C. BOWMAN, Northern Illinois University, USA
[Tuesday December 10 / mardi le 10 décembre, 11:30 – Carleton]
Integers n for which the integer parts of $n \times \alpha + s$ are not equal to the integer parts of $n \times \beta + s$

(Joint work with Alexandru Zaharescu)

Let α and β be positive real numbers and s a real number satisfying $0 \leq s < 1$. Let $\lfloor x \rfloor$ denote the greatest integer $\leq x$. Define $\Psi_k(\alpha, \beta\ ;\ s)$ to be the k-th positive integer n such that $\lfloor n\alpha + s \rfloor \neq \lfloor n\beta + s \rfloor$. For $i = 1, 2$ we compute asymptotics for the probability that $\Psi_i(\alpha, \beta\ ;\ 0) > Q$ for Q large as α and β range independently over a subinterval of $[0, 1)$. We find the expected value of $\Psi_1(\beta, \alpha\ ;\ 0)$ as α and β range independently over $[0, 1)$. When α, β, and s are fixed, the algebraic structure of the set of natural numbers $\{\Psi_i(\beta, \alpha\ ;\ s) \mid i \in \mathbf{Z}^+\}$ is characterized.

KWOK-KWONG STEPHEN CHOI, Simon Fraser University, Burnaby, British Columbia V5A 1S6
[Tuesday December 10 / mardi le 10 décembre, 10:30 – Carleton]
Binary sequences with merit factors greater than 6.34

For decades the merit factor problem of binary sequences has been stuck at a value of 6 for the maximum asymptotic merit factor and indeed a number of authors speculated that this was best possible. We construct an infinite family of binary sequences that we conjecture have merit factors greater than 6.34. The numerical experimentation that led to this example is a significant and interesting part of the story. This problem is related to finding small L_4 norm of polynomials with $+1$ or -1 coefficients.

This is a joint work with Peter Borwein and Jonathan Jedwab.

ALINA COJOCARU, Fields Institute
[Monday December 9 / lundi le 9 décembre, 16:00 – Carleton]
The square sieve and the Lang-Trotter conjecture

Let E be an elliptic curve defined over the rationals and without complex multiplication. Let K be a fixed imaginary quadratic field. We use the square sieve to find nontrivial upper bounds for the number of primes p of ordinary reduction for E such that $Q(\pi_p) = K$, where π_p is the Frobenius endomorphism of E at p. This represents progress towards a 1976 Lang-Trotter conjecture.

(This is joint work with E. Fouvry and M. Ram Murty)

CHANTAL DAVID, Concordia University
[Monday December 9 / lundi le 9 décembre, 16:30 – Carleton]
On the vanishing of twisted L-functions of elliptic curves

(joint work with J. Fearnley and H. Kisilevsky)

Let E be an elliptic curve over the rationals with L-function $L_E(s)$. Let χ be a Dirichlet character, and let $L_E(s, \chi)$ be the L-function of E twisted by the character χ. For quadratic characters χ, $L_E(1, \chi)$ vanishes for at least half of the characters (where the sign of the functional equation is -1), and Goldfeld conjectured that the density of vanishing is exactly $1/2$ in this case. For higher order characters, the functional equation now relates $L_E(1, \chi)$

and $L_E(1, \bar{\chi})$, and there is no reason to predict a positive density of vanishing. We present in this talk some evidence for the case of twists by cubic character χ, based on empirical computations and random matric theory.

ERIC FREEMAN, Carleton University, 4302 Herzberg Laboratories, Ottawa, Ontario K1S 5B6
[Sunday December 8 / dimanche le 8 décembre, 11:30 – Carleton]
Systems of cubic diophantine inequalities

We consider systems of cubic Diophantine inequalities. In particular, we have that if s is any integer with $s \geq (10R)^\gamma$, where $\gamma = (10R)^5$, then given any R real cubic forms $C_1, \ldots, C_R$ in s variables, there is a nonzero integral solution $\mathbf{x}$ of the simultaneous Diophantine inequalities $|C_1(\mathbf{x})| < 1, |C_2(\mathbf{x})| < 1, \ldots, |C_R(\mathbf{x})| < 1$.

JOHN FRIEDLANDER, Department of Mathematics, University of Toronto, Toronto Ontario M5S 3G3
[Monday December 9 / lundi le 9 décembre, 10:30 – Carleton]
On some exponential sums over Mersenne numbers

Let m be a positive integer, a and g integers relatively prime to m. We give estimates for the exponential sum

$$\sum_{n \leq N} \Lambda(n) \exp(2\pi i a g^n / m),$$

where Λ is the von Mangoldt function, and for a number of similar sums. In particular, our results yield bounds for exponential sums of the form

$$\sum_{p \leq N} \exp(2\pi i a M_p / m),$$

where p runs through primes and M_p is the Mersenne number $M_p = 2^p - 1$. These results are joint work with W. Banks, A. Conflitti, and I. Shparlinski.

EYAL GOREN, Department of Mathematics and Statistics, McGill University, Montreal, Quebec H3A 2K6
[Sunday December 8 / dimanche le 8 décembre, 14:30 – Carleton]
Local structure of PEL *moduli spaces*

We shall discuss the local structure of PEL moduli spaces—the moduli spaces parameterizing abelian varieties with polarization, endomorphism and level structure. Two main techniques will be exposed: local models and displays. Both very geometric in nature, though eventually very algebraic.

We shall explain a general theorem, due to Andreatta and the speaker, that allows calculation of universal displays and show how it recaptures also previously known cases.

MANFRED KOLSTER, Department of Mathematics, McMaster University, Hamilton, Ontario L8S 4K1
[Monday December 9 / lundi le 9 décembre, 12:00 – Carleton]
Divisibility properties of special values of L-functions for quadratic characters

For a quadratic character χ over $\mathbb{Q}$ and an integer $n > 0$ the values of the L-function of χ at $1 - n$ are non-zero rational numbers if χ has parity $(-1)^n$. Most of the time the values are 2-integral, and in these cases one can prove general divisibility properties by powers of 2. This has been done by Fox, Urbanowicz and K. S. Willia ms using sophisticated identities for generalized Bernouilli numbers. We will discuss a purely algebraic approach a la Gauss, which also allows to generalize the results to quadratic characters over arbitrary abelian fields.

WENTANG KUO, Queen's University, Kingston, Ontario
[Monday December 9 / lundi le 9 décembre, 17:00 – Carleton]
Summatory functions of elements in Selberg's class

Let $F(s)$ be a Dirichlet series, $F(s) = \sum_{n=1} a_n n^{-s}$, $\Re s > 1$. Define the the summatory function $S(x)$ to be $\sum_{n \le x} a_n$. We assume that $F(s)$ satisfies the following conditions. First, for all $\epsilon > 0$, $|a_n| = O(n^\epsilon)$. In addition, it admits analytic continuations and functional equations. More precisely, there is a function $\Delta(s) = Q^s \prod \Gamma(\alpha_i s + \gamma_i)$, $Q > 0$, $\alpha_i > 0$, $\Re\gamma_i > 0$, such that $F(s)\Delta(s) = \omega \bar{F}(1-s)\bar{\Delta}(1-s)$, $|\omega| = 1$. Furthermore, assume that $F(s)$ is entire. Twice of the summation of α_i is called the *degree* d_F of F. In this talk, I will derive an estimation of $S(x)$ without extra conditions. The trivial estimation is $S(x) = O(x^{1+\epsilon})$, $\forall \epsilon > 0$.

I will provide two estimations of $S(x)$. One is a joint work with Ram Murty; we prove that for $d_F \ge 1$, $S(x) = O(Q^{1-\theta+\epsilon} x^{\theta+\epsilon})$, where $\theta = d/(d+2)$. For the larger $d_F \ge 2$, I can get a better result: $S(x) = O(Q^{1-\theta'+\epsilon} x^{\theta'+\epsilon})$, where $\theta = (d-1)/(d+1)$. In both cases, the implied constants are independent of Q.

JUNG-JO LEE, Queen's University, Kingston, Ontario
[Monday December 9 / lundi le 9 décembre, 17:30 – Carleton]
Twists of elliptic curves

Let E be an elliptic curve defined over $\mathbb{Q}$. We construct cohomology classes from quadratic twists of E and apply the local-global duality theorem (a reformulation of the reciprocity law) to these cohomology classes. As a result, we get a bound for rank of E. The technique of using the reciprocity law was used by Kolyvagin to bound the size of Selmer group and study Tate-Shafarevich group. This work was discussed with V. Kolyvagin, R. Murty and J. Shalika.

GREG MARTIN, Department of Mathematics, University of British Columbia, Vancouver, British Columbia V6T 1Z2
[Tuesday December 10 / mardi le 10 décembre, 11:00 – Carleton]
Sidon sets and symmetric sets of real numbers

A set S of integers is called a $B^*[g]$ *set* if for any given m there are at most g ordered pairs $(s_1, s_2) \in S \times S$ with $s_1 + s_2 = m$; in the case $g = 2$, these are better known as Sidon sets. It is trivial to show that any $B^*[g]$ set contained in $\{1, 2, \ldots, n\}$ has at most $\sqrt{2gn}$ elements, but proving a lower bound of the same order of magnitude is more difficult. This problem, surprisingly, is intimately related to the following problem concerning measurable subsets of the real numbers: given $0 < \varepsilon < 1$, estimate the supremum of those real numbers δ such that every subset of $[0, 1]$ with measure ε contains a symmetric subset with measure δ. Using

harmonic analysis and relationships among L^p norms as well as methods from combinatorial and probabilistic number theory, we establish fairly tight upper and lower bounds for these two interconnected problems.

DAVID MCKINNON, University of Waterloo, Waterloo, Ontario
[Monday December 9 / lundi le 9 décembre, 11:30 – Carleton]
Counting rational points on ruled varieties

In this talk, I will describe a general result computing the number of rational points of bounded height on an algebraic variety V which is covered by lines. The main technical result used to achieve this is an upper bound on the number of rational points of bounded height on a line. This bound varies in an pleasantly controllable manner as the line varies, and hence can be used to sum the counting functions of the lines which cover V.

KUMAR MURTY, Department of Mathematics, University of Toronto, Toronto, Ontario M5S 3G3
[Sunday December 8 / dimanche le 8 décembre, 14:00 – Carleton]
Splitting of Abelian varieties

It is well known that an irreducible polynomial over the integers may become reducible mod p for every prime p. In this talk, we shall discuss the analogue for Abelian varieties. Given an absolutely simple Abelian variety over a number field, does it stay absolutely simple modulo infinitely many primes?

RAM MURTY, Queen's University, Kingston, Ontario K7L 3N6
[Monday December 9 / lundi le 9 décembre, 11:00 – Carleton]
Irreducible elements and irreducible polynomials

If f is a polynomial with integer coefficients which is a prime number for infinitely many specializations, then it is clear that f must be irreducible over the rational number field. An analogous result over number fields is not true due to the possible presence of infinitely many units. However, using Siegel's theorem on integral points of curves of genus ≥ 1, we show that an analogous result is "almost true" and the obstruction is the presence of "Mersenne-like" primes in a number field. We also discuss the case of a function field over a finite field. (This is joint work with Jasbir Chahal.)

WERNER GEORG NOWAK, Universität für Bodenkultur Wien, A-1190 Vienna, Austria
[Tuesday December 10 / mardi le 10 décembre, 12:00 – Carleton]
The distribution of powers of integers in number fields

A natural question in the number theory of the Gaussian ring $\mathbf{Z}[i]$ is to ask for the number of perfect p-th powers up to some large real parameter X, the size of a complex number z being measured by $\mu(z) := \max\big(|\Re(z)|, |\Im(z)|\big)$, and $p \geq 2$ a fixed integral exponent. This problem leads to the enumeration of the integer points in a certain non-convex planar domain. Using recent general results from planar lattice point theory, H. Müller (Hamburg) and the speaker were able to show that

$$\#\{\gamma^p : \mu(\gamma^p) \leq X, \gamma \in \mathbf{Z}[i]\} = c_p X^{2/p} + R_p(X),$$

where the remainder $R_p(X)$ satisfies the estimates

$$R_p(X) \ll X^{\frac{1}{p}\frac{46}{73}}(\log X)^{315/146} \quad \text{and} \quad \limsup_{X\to\infty} \frac{R_p(X)}{X^{1/(2p)}(\log X)^{1/4}} > 0.$$

Furthermore, $R_p(X) \ll X^{1/(2p)}$ *in mean-square*, even if the average is taken over a relatively short interval.

The question has been generalized to hypercomplex number systems, like quaternions and octonions, by G. Kuba (Vienna) in his Habilitation Thesis.

Returning to commutativity, J. Schoißengeier (Klagenfurt) and the speaker considered the following (apparently natural) generalization of the original problem to an arbitrary (not totally real) number field K of degree $n = [K : \mathbf{Q}] \geq 3$: For fixed $p \geq 2$ and large X, how many perfect powers γ^p exist (γ an algebraic integer in K), such that $\mu\big(\tau(\gamma^p)\big) \leq X$ for each embedding τ of K into $\mathbf{C}$? This quantity can be evaluated asymptotically in the form $c_{p,K}X^{n/p} + R_{p,K}(X)$, with the remainder estimations

$$R_{p,K}(X) \ll \begin{cases} X^{\frac{1}{p}(n-1-\frac{3}{2n-5})+\epsilon} & \text{for } n \leq 6, \\ X^{\frac{1}{p}(n-\frac{4}{3})} & \text{for } n > 6, \end{cases}$$

if there is no real embedding of K into $\mathbf{C}$, and

$$R_{p,K}(X) \ll X^{\frac{1}{p}(n-1-\frac{1}{n-2})+\epsilon}$$

else. The proof uses, along with other tools, W. Schmidt's multivariate extension of K. F. Roth's result on the approximation of algebraic numbers by rationals.

YIANNIS PETRIDIS, City University of New York, Lehman College, New York 10458-1589, USA
[Sunday December 8 / dimanche le 8 décembre, 15:00 – Carleton]
The distribution of modular symbols

Eisenstein series twisted by modular symbols were introduced by Goldfeld to study the distribution of modular symbols in connection to a weak form of the ABC conjecture. I will present distribution results that follow from the study of the pole at $s = 1$ of such series. The proof uses families of Eisenstein series twisted by characters and perturbation methods of the Laplace operator.

CAMERON L. STEWART, University of Waterloo, Waterloo, Ontario
[Sunday December 8 / dimanche le 8 décembre, 12:00 – Carleton]
On sums which are powers

Erdos and Moser investigated the problem of finding sets of positive integers A with the property that $a + b$ is a square whenever a and b are distinct elements of A. With Rivat and Sarkozy we showed that if A is a subset of the first N positive integers then A has cardinality at most $37 \log N$ provided that N is large enough. We shall discuss recent joint work with Gyarmati and Sarkozy where we replace the requirement that $a + b$ be a square with the requirement that $a + b$ be a pure power.

JEFFREY LIN THUNDER, Northern Illinois University, USA
[Sunday December 8 / dimanche le 8 décembre, 11:00 – Carleton]
Asymptotic estimates for some Diophantine inequalites

We estimate the number of integer solutions to inequalities of the form $|F(x)| \leq m$, where $F(X)$ is a homogeneous polynomial with integer coefficients which factors completely over the complex field as a product of linear forms. We give asymptotic estimates as the parameter $m \to \infty$ which have a good dependency on F.

MICHEL WALDSCHMIDT, Université P. et M. Curie (Paris VI), Thorie des nombres
Case 247, 75013 Paris, France
[Sunday December 8 / dimanche le 8 décembre, 10:30 – Carleton]
Algebraic values of analytic functions

Given an analytic function of one complex variable f, we investigate the arithmetic nature of the values of f at algebraic points. A typical question is whether $f(\alpha)$ is a transcendental number for each algebraic number α. Since there exist transcendental entire functions f such that $f^{(k)}(\alpha) \in \mathbf{Q}[\alpha]$ for any $k \geq 0$ and any algebraic number α, one needs to restrict the situation by adding hypotheses, either on the functions, or on the points, or else on the set of values.

Among the topics we discuss are recent results due to Andrea Surroca on algebraic values of analytic functions and Diophantine properties of special values of polylogarithms.

`http://www.institut.math.jussieu.fr/~miw/`

Schedule for Operator Algebras
Horaire pour Algèbres des opérateurs

Sunday December 8	**dimanche 8 décembre**
10:30 - 11:00	George Elliott, OpAlg, Albert
11:00 - 11:30	Berndt Brenken, OpAlg, Albert
11:30 - 12:00	Marcelo Laca, OpAlg, Albert
12:00 - 12:30	Ian Putnam, OpAlg, Albert
14:00 - 14:30	Ken Davidson, OpAlg, Albert
14:30 - 15:00	Man Duen Choi, OpAlg, Albert

Monday December 9	**lundi 9 décembre**
10:30 - 11:00	Nigel Higson, OpAlg, Albert
11:00 - 11:30	Masoud Khalkali, OpAlg, Albert
11:30 - 12:00	Dan Kucerovsky, OpAlg, Albert
12:00 - 12:30	John Phillips, OpAlg, Albert
14:00 - 14:30	Vladimir Pestov, OpAlg, Albert
14:30 - 15:00	Matthias Neufang, OpAlg, Albert
15:00 - 15:30	Remus C. Floricel, OpAlg, Albert

Tuesday December 10	**mardi 10 décembre**
10:30 - 11:00	Roland Speicher, OpAlg, Albert
11:00 - 11:30	Claus Koestler, OpAlg, Albert
11:30 - 12:00	Jamie Mingo, OpAlg, Albert

Operator Algebras / Algèbres des opérateurs
(Org: Thierry Giordano and/et David Handelman)

BERNDT BRENKEN, University of Calgary, Calgary, Alberta T2N 1N4
[Sunday December 8 / dimanche le 8 décembre, 11:00 – Albert]
C^*-algebras associated with topological relations

With a closed relation on a locally compact Hausdorff space X arising from a continuous positive map of X to the space of Radon measures on X we associate a C^*-algebra, namely the Cuntz-Pimsner algebra of a particular Hilbert bimodule constructed from the relation. The relations may have branch points and there are no local homeomorphism requirements. This family of C^*-algebras contains the C^*-algebras of directed graphs, and the crossed product C^*-algebras of topological dynamical systems. Some examples are considered.

MAN DUEN CHOI, Department of Mathematics, University of Toronto, Toronto, Ontario M5S 3G3
[Sunday December 8 / dimanche le 8 décembre, 14:30 – Albert]
The ultimate norm estimate for complex matrices

It is often a complicated matter to estimate the C^*-norm (the usual Hilbert-space operator-norm) of a complex matrix. Nevertheless, an ultimate answer (without hard computation) can be sought for the best bound of the norm of $T = A + iB$ where A and B are (non-commuting) hermitian operators with known eigenvalues. Moreover, the main result can be extended to cover the case of the sum of two normal matrices.

(This is a joint work with Chi-Kwong Li.)

KEN DAVIDSON, Department of Pure Mathematics, University of Waterloo, Waterloo, Ontario N2l 3G1
[Sunday December 8 / dimanche le 8 décembre, 14:00 – Albert]
Spans and sums of unitary and similarity orbits of a single operator

If T is a bounded operator on a separable Hilbert space $\mathcal{H}$ which is not of the form scalar plus compact, then every bounded linear operator on $\mathcal{H}$ can be written as a linear combination of 14 or fewer operators unitarily equivalent to T, as a linear combination of 6 or fewer operators similar to T, and as a sum of 8 or fewer operators similar to T. When T is not polynomially compact, the set of all sums of 2 operators similar to T is dense in $\mathcal{B}(\mathcal{H})$, while if T is polynomially compact, but not of the form scalar plus compact, then the set of sums of 3 operators similar to T is dense in $\mathcal{B}(\mathcal{H})$.

GEORGE ELLIOTT, University of Toronto, Toronto, Ontario M5S 3G3
[Sunday December 8 / dimanche le 8 décembre, 10:30 – Albert]
Recent progress in the classification of amenable C^*-algebras

A summary is given of recent progress in the classification of separable amenable C^*-algebras.

REMUS C. FLORICEL, University of Ottawa, Ottawa, Ontario
[Monday December 9 / lundi le 9 décembre, 15:00 – Albert]
E_0-semigroups of von Neumann algebras

The study of E_0-semigroups of a type I_∞ factor was initated by R. Powers and W. Arveson, and many interesting classification results were obtained in the last years. Our purpose, in this talk, is to investigate the structure of E_0-semigroups that act on arbitrary von Neumann algebras. We show that such a semigroup can be canonically decomposed as the direct sum of an inner E_0-semigroup and a properly outer E_0-semigroup. This decomposition is stable under conjugacy and cocycle conjugacy. We also show that the class of inner E_0-semigroups can be completely characterized in terms of product systems.

NIGEL HIGSON, Penn State University, University Park, Pennsylvania 16802, USA
[Monday December 9 / lundi le 9 décembre, 10:30 – Albert]
The residue cocycle of Connes and Moscovici

The index theorem of Connes and Moscovici provides a formula for Chern character in cyclic cohomology involving residues of zeta functions associated to elliptic operators. I shall give a streamlined account of the 'residue cocycle' discovered by Connes and Moscovici and the associated Fredholm index formula.

MASOUD KHALKALI, University of Western Ontario, London, Ontario
[Monday December 9 / lundi le 9 décembre, 11:00 – Albert]
Invariant cyclic homology

I will present joint work with B. Rangipour on invariant cyclic homology. This theory extends cyclic homology of Hopf algebras defined by Connes and Moscovici and its dual theory defined by present authors. I will also give several computations and conjectures regarding this new theory.

CLAUS KOESTLER, Queen's University
[Tuesday December 10 / mardi le 10 décembre, 11:00 – Albert]
L^p-martingales on q-white noises

A q-white noise is the von Neumann algebra generated by q-Brownian motion on q-Fock space. In the case $-1 < q < 1$ we characterize bounded L^p-martingales ($1 < p < \infty$) w.r.t a canonical filtration as non-commutative Hardy spaces. This result generalizes work of Pisier and Xu on Itô-Clifford martingales which correspond to the case $q = -1$.

DAN KUCEROVSKY, Department of Mathematics and Statistics, University of New Brunswick, Fredericton, New Brunswick E3B 5A3
[Monday December 9 / lundi le 9 décembre, 11:30 – Albert]
Locally absorbing extensions

Absorbing extensions are C^*-algebra extensions having the property that their sum with a trivial extension are unitarily equivalent to the given extension. It can be shown that an extension that is absorbing in this sense must necessarily be full. In this talk, we attempt to modify the absorption property so that fullness is replaced, in a natural way, by a weaker condition we call local fullness.

MARCELO LACA, University of Victoria, Victoria, British Columbia
[Sunday December 8 / dimanche le 8 décembre, 11:30 – Albert]
KMS *states of Pimsner algebras*

I will discuss the structure of the equilibrium state space of quasi-free dynamics on the C^*-algebras associated by M. Pimsner to a Hilbert bimodule. (Current joint work with S. Neshveyev.)

JAMIE MINGO, Queen's University
[Tuesday December 10 / mardi le 10 décembre, 11:30 – Albert]
Two Point functions for families of random matrices and non-crossing annular partitions

(joint work with A. Nica)

Let (Ω, P) be a probability space and X be self-adjoint Gaussian random matrix, *i.e.* $X\colon \Omega \to M_n(\mathbf{C})_{s.a.}$ is a matrix valued random variable with independent and normally distributed entires. If we write $X = (f_{i,j})_{i,j=1}^n$ and X is normalized so that $\mathcal{E}(f_{i,j}) = 0$ for all i and j, and $\mathcal{E}\big(\Re(f_{i,j})^2\big) = \mathcal{E}\big(\Im(f_{i,j})^2\big) = 1/(2n)$ for $i \neq j$ and $\mathcal{E}(f_{i,i}^2) = 1/n$, then E. Wigner showed that

$$\mathcal{E}\big(\mathrm{tr}(X^{2p})\big) = c_p + O(1/n^2)$$

where tr is the normalized trace and c_p is the p-th Catalan number.

We shall show that

$$\mathcal{E}\big(\mathrm{tr}(X^p)\,\mathrm{tr}(X^q)\big) - \mathcal{E}\big(\mathrm{tr}(X^p)\big)\mathcal{E}\big(\mathrm{tr}(X^q)\big) = \frac{\alpha_{p,q}}{n^2} + O(1/n^4)$$

where $\alpha_{p,q}$ is the number of non-crossing annular partitions of an annulus with p vertices on the inner circle and q vertices on the outer circle.

MATTHIAS NEUFANG, Carleton University, Ottawa, Toronto K1S 5B6
[Monday December 9 / lundi le 9 décembre, 14:30 – Albert]
Amplification of completely bounded operators and applications

It is a characteristic feature of completely bounded operators on $B(H)$ to admit an amplification to the level of $B(H \otimes_2 K)$, where H and K are Hilbert spaces. Using Wittstock's Hahn-Banach principle and Tomiyama's slice map theorem, one deduces that, more generally, any completely bounded map on M can be amplified to a map on the von Neumann tensor product $M \bar{\otimes} N$, whenever M and N are either von Neumann algebras or dual operator spaces with at least one of them sharing the w^* operator approximation property. Our aim is to show that there is a simple and explicit formula of an amplification of completely bounded operators for all such pairs (M, N), thus providing a *constructive* approach to the amplification problem. The key idea is to combine two fundamental concepts in the theory of operator algebras, one being classical, the other one fairly modern: Tomiyama's slice maps on the one hand, and the description of the predual of $M \bar{\otimes} N$ given by Effros-Ruan in terms of the projective operator space tensor product, on the other hand.

We will further discuss the question of uniqueness of such an amplification, but mainly focus on various applications of our construction, such as:

- a generalization of the so-called Ge-Kadison Lemma;
- the amplification of completely bounded module homomorphisms;
- an *algebraic* characterization of normality for completely bounded maps in terms of a commutation relation for the associated amplification.

In particular, the latter result leads us to a new concept in operator algebra theory which may be viewed as a tensor product version of Arens regularity.

VLADIMIR PESTOV, University of Ottawa, Ottawa, Ontario K1N 6N5
[Monday December 9 / lundi le 9 décembre, 14:00 – Albert]
The fixed point on compacta property of some topological groups related to operator algebras and ergodic theory

A topological group G has the fixed point on compacta (f.p.c.) property if there is a fixed point in each compact space upon which G acts continuously. This is a very strong version of amenability, which is why such groups are also called extremely amenable. The property is closely linked to Ramsey theory and to geometry of high-dimensional structures. Among a number of known groups with the f.p.c. property, many are linked to operator algebras and ergodic theory, and we will dwell on some of the recent developments in this direction.

JOHN PHILLIPS, University of Victoria, Victoria, British Columbia V8W 3P4
[Monday December 9 / lundi le 9 décembre, 12:00 – Albert]
Centre-valued index of Toeplitz operators with noncommuting symbols

We begin with a unital C^*-algebra A and a unital C^*-subalgebra, Z of the centre of A. We assume that we have a faithful, unital Z-trace τ and a continuous action $\alpha\colon \mathbf{R} \to \mathrm{Aut}(A)$ leaving τ and hence Z invariant. We let δ be the infinitesimal generator of α on A.

We have in this setting a *largest* (in the sense of quasi-containment) $*$-representation of A on a Hilbert space which carries a *faithful*, unital u.w.-continuous $Z^{-u.w.}$-trace $\bar{\tau}\colon A^{-u.w.} \to Z^{-u.w.}$ extending τ. We assume that A is concretely represented on this Hilbert space. We denote by $\mathfrak{A}$ and $\mathfrak{Z}$ respectively, the ultraweak closures of A and Z. One shows that there is an u.w.-continuous action $\bar{\alpha}\colon \mathbf{R} \to \mathrm{Aut}(\mathfrak{A})$ extending α and leaving $\bar{\tau}$ and $\mathfrak{Z}$ invariant.

At this point we construct a representation, $\mathrm{Ind} = \tilde{\pi} \times \lambda$ of $A \rtimes \mathbf{R}$ on a certain self-dual Hilbert-$\mathfrak{Z}$ module $H_{\mathcal{A}}$ constructed from a certain "$\mathfrak{Z}$-Hilbert Algebra," $\mathcal{A}$. We let $\mathcal{M} = \mathrm{Ind}(A \rtimes \mathbf{R})''$ which contains $\mathfrak{Z}$ in its centre and has a faithful, normal semifinite $\mathfrak{Z}$-trace $\hat{\tau}$. *This construction is half the battle.* We let H denote the image of the Hilbert Transform in $\mathcal{M}$ and let $P = \frac{1}{2}(H+1)$ in $\mathcal{M}$. We then consider the semifinite von Neumann algebra,

$$\mathcal{N} := P\mathcal{M}P$$

with the faithful, normal, semifinite $\mathfrak{Z}$-trace obtained by restricting $\hat{\tau}$. For $a \in A$ we define the *Toeplitz* operator

$$T_a := P\tilde{\pi}(a)P \in \mathcal{N}.$$

We prove the following theorem.

Theorem 1 *Let A be a unital C^*-algebra and let $Z \subseteq Z(A)$ be a unital C^*-subalgebra of the centre of A. Let $\tau\colon A \to Z$ be a faithful, unital Z-trace which is invariant under a continuous action α of $\mathbf{R}$. Then for any $a \in A^{-1} \cap dom(\delta)$, the Toeplitz operator T_a is Fredholm relative to the trace $\hat{\tau}$ on $\mathcal{N} = P\big(\mathrm{Ind}(A \rtimes \mathbf{R})''\big)P$, and*

$$\hat{\tau}\text{-}\mathrm{ind}(T_a) = \frac{-1}{2\pi i}\tau\big(\delta(a)a^{-1}\big).$$

IAN PUTNAM, University of Victoria, Victoria, British Columbia
[Sunday December 8 / dimanche le 8 décembre, 12:00 – Albert]
Recent results on topological orbit equivalence

I will describe recent work with T. Giordano (Ottawa) and C. Skau (Trondheim) on topological orbit equivalence for actions of higher rank free abelian groups on the Cantor set.

ROLAND SPEICHER, Queen's University, Kingston, Ontario K7L 3N6
[Tuesday December 10 / mardi le 10 décembre, 10:30 – Albert]
Free probability

I will present some recent results from free probability theory.

Schedule for Partial Differential Equations
Horaire pour Équations aux dérivées partielles

Sunday December 8	dimanche 8 décembre
10:30 - 11:00	Guenter Uhlmann, PDE, Dalhousie
11:00 - 11:30	Steve Zelditch, PDE, Dalhousie
11:30 - 12:00	Richard Beals, PDE, Dalhousie
12:00 - 12:30	Peter Greiner, PDE, Dalhousie
14:00 - 14:30	Catherine Sulem, PDE, Dalhousie
14:30 - 15:00	Andrew Comech, PDE, Dalhousie
15:00 - 15:30	Jim Colliander, PDE, Dalhousie

Monday December 9	lundi 9 décembre
10:30 - 11:00	Andras Vasy, PDE, Dalhousie
11:00 - 11:30	Jared Wunsch, PDE, Dalhousie
11:30 - 12:00	Tanya Christiansen, PDE, Dalhousie
12:00 - 12:30	Nicolas Burq, PDE, Dalhousie
15:30 - 16:00	Chris Sogge, PDE, Dalhousie
16:00 - 16:30	Dmitry Jakobson, PDE, Dalhousie
16:30 - 17:00	Vojkan Jaksic, PDE, Dalhousie

Partial Differential Equations / Équations aux dérivées partielles
(Org: Victor Ivrii and/et John Toth)

RICHARD BEALS, Yale University, New Haven, Connecticut, USA
[Sunday December 8 / dimanche le 8 décembre, 11:30 – Dalhousie]
Propagators for some degenerate hyperbolic equations

Exact propagators for two classes of degenerate hyperbolic equations can be obtained from explicit Green's functions for certain degenerate elliptic equations. The latter, in turn, trace back to analogous results for some subelliptic operators associated to weakly pseudoconvex domains.

NICOLAS BURQ, Université Paris Sud-Orsay, France
[Monday December 9 / lundi le 9 décembre, 12:00 – Dalhousie]
Non-linear Schrödinger boundary value problems

The purpose of this talk is to present some recent results obtained in collaboration with P. Gérard and N. Tzvetkov (Université Paris Sud-Orsay). On the well posedness of non-linear Schródinger equations on domains (with Dirichlet boundary conditions):

$$i\partial_t u + \Delta u + F(u) = 0, \quad u|_{\partial\Omega} = 0,\ u|_{t=0} = u_0 \in H_0^s(\Omega).$$

I will present two type of results:

1) In the ball, we show that if the non linearity has a gauge invariance (typically $F(u) = |u|^p u$), the problem is not well posed, even for initial data in some Sobolev spaces above the scaling critical index.

2) If the domain is the exterior of a bounded obstacle satisfying a non-trapping condition, we show that the problem is locally well posed for any initial data in $H_0^1(\Omega)$ or $L^2(\Omega)$ (hence globally well posed in the case of defocusing non-linearities) for a large class of non linearities.

TANYA CHRISTIANSEN, University of Missouri, Columbia, Missouri 65211, USA
[Monday December 9 / lundi le 9 décembre, 11:30 – Dalhousie]
Pseudospectra in automorphic scattering

We study surfaces with (hyperbolic) cusp ends. The generator, B, of the Lax-Phillips semigroup has spectrum given in terms of the eigenvalues of the Laplacian and the poles of the scattering matrix. We show that away from the continuous spectrum of the Laplacian, the norm of the resolvent of $B + 1/2$ is comparable (in the non-physical plane) to the norm of the scattering matrix. In particular, for the modular surface this means that the norm of the resolvent of $B + 1/2$ is comparable to $|\zeta(2s)|^{-1}$ when $0 < \epsilon \leq \Re s \leq 1/2 - \epsilon$. This is joint work with M. Zworski.

JIM COLLIANDER, University of Toronto, Toronto, Ontario
[Sunday December 8 / dimanche le 8 décembre, 15:00 – Dalhousie]
Global existence and scattering for rough solutions of $3d$ NLS

This talk will describe a new result establishing global existence and scattering of solutions for the cubic defocusing nonlinear Schrodinger equation in three space dimensions. The main ingredient is a new Morawetz-type inequality which provides a global spacetime L^4 bound. This talk concerns joint work with Keel, Staffilani, Takaoka and Tao.

ANDREW COMECH, Department of Mathematics, University of North Carolina-Chapel Hill, Chapel Hill, North Carolina 27599, USA
[Sunday December 8 / dimanche le 8 décembre, 14:30 – Dalhousie]
Purely nonlinear instability of minimal energy standing waves

For a variety of nonlinearities, the nonlinear Schroedinger equation is known to possess localized quasistationary solutions ("standing waves"). We prove that in the generic situation the standing wave of minimal energy among all other standing waves is unstable. This case was falling out of the scope of the classical paper by Grillakis, Shatah, and Strauss on orbital stability of standing waves. An interesting feature of the problem is the absence of (exponential) instability in the linearized system; in this sense, the resulting instability is "purely nonlinear". Essentially, the instability is caused by higher algebraic degeneracy of zero eigenvalue in the spectrum of the linearized system. The result can be generalized to abstract Hamiltonian systems with $U(1)$ symmetry.

PETER GREINER, Department of Mathematics, University of Toronto, Toronto Ontario M5S 3G3
[Sunday December 8 / dimanche le 8 décembre, 12:00 – Dalhousie]
Subelliptic PDE's and subRiemannian geometry

Subelliptic PDE's induce the geometric ideas of subRiemannian geometry. Using these sub-Riemannian geometric invariants I shall construct some examples of fundamental solutions to subelliptic PDE's.

DMITRY JAKOBSON, Department of Mathematics, McGill University, Montreal, Quebec H3A 2K6
[Monday December 9 / lundi le 9 décembre, 16:00 – Dalhousie]
Critical points and L_p norms of eigenfunctions

We discuss several results on critical points and L_p norms of eigenfunctions of Laplacians on Riemannian manifolds.

VOJKAN JAKSIC, Department of Mathematics, McGill University, Montreal, Quebec H3A 2K6
[Monday December 9 / lundi le 9 décembre, 16:30 – Dalhousie]
Eigenvalues of Liouvilleans

Let L be a Koopman operator (classical Liouvillean) of an ergodic dynamical system. An old result of Halmos and von Neumann asserts that the eigenvalues of L are simple and form a subgroup of R. I will discuss a non-commutative analog of this result. This talk is based on a joint work with C.-A. Pillet.

CHRIS SOGGE, John's Hopkins University
[Monday December 9 / lundi le 9 décembre, 15:30 – Dalhousie]
Eigenfunction estimates and applications

I shall present a simple proof of sharp eigenfunction estimates for manifolds with boundary. Using these and the finite propagation speed for the wave equation one can prove some sharp estimates in harmonic analysis, such as the L^1 mapping properties of Riesz means. I shall also discuss some open problems.

CATHERINE SULEM, Department of Mathematics, University of Toronto, Toronto, Ontario M5S 3G3
[Sunday December 8 / dimanche le 8 décembre, 14:00 – Dalhousie]
On asymptotic stability of solitary waves for nonlinear Schrödinger equations

We suppose that it possesses stable solitary wave solutions and we investigate their asymptotic stability, that is the long-time behavior of solutions whose initial conditions are close to a stable solitary wave.

The method, initiated in [1], is based on the spectral decomposition of solutions on the eigenspaces associated to the discrete and continuous spectrum of the linearized operator near the solitary wave. Under some hypothesis on the structure of the spectrum, we prove that, asymptotically in time, the solution decomposes into a solitary wave and a dispersive part described by the free Schrödinger equation. We calculate explicitly the time behavior of the correction.

This is a joint work with V. Buslaev.

References

[1] V. Buslaev and G. Perleman, *Scattering for the nonlinear Schrödinger equation: states close to a soliton*. St. Petersburg Math. J. **4**(1993), 1111–1142.

GUENTER UHLMANN, Department of Mathematics, University of Washington, Seattle, Washington 98195-4350, USA
[Sunday December 8 / dimanche le 8 décembre, 10:30 – Dalhousie]
The boundary rigidity problem

We describe some recent progress on the inverse problem of determining a Riemannian metric on a compact Riemannian manifold with boundary from the lengths of geodesics joining boundary points. In particular we consider the analogy between this problem and the problem of determining a Riemannian metric from the Dirichlet-to-Neumann map associated to the Laplace-Beltrami operator.

ANDRAS VASY, Department of Mathematics, MIT, Cambridge, Massachusetts 02139, USA
[Monday December 9 / lundi le 9 décembre, 10:30 – Dalhousie]
Many-body scattering and symmetric spaces

I will talk about the use of methods from many-body scattering in the study of the Laplacian on higher rank symmetric spaces. I focus on the relationship of three-body scattering and $\mathrm{SL}(3,R)/\mathrm{SO}(3,R)$. I will describe the asymptotics of the Green's function at infinity (Taylor series at infinity), extending results of Anker, Guivarch, Ji and Taylor. I also describe the analytic continuation of the resolvent in the spectral parameter through the continuous spectrum. The new results presented are joint work with Rafe Mazzeo.

JARED WUNSCH, Northwestern University, Evanston, Illinois, USA
[Monday December 9 / lundi le 9 décembre, 11:00 – Dalhousie]
The sojourn relation and the Schrödinger equation

We discuss the construction of a parametrix for the time-dependent Schrödinger equation in non-trapping regions of a manifold X with asymptotically conic ends. The construction, in the framework of the "Legendrian distributions" of Melrose-Zworski (generalized by Hassell and Vasy) involves a phase function parametrizing a certain relation between points in the cosphere bundle of X and the (rescaled) cotangent bundle of the boundary of the compactification. We call this relation the 'sojourn time' owing to its similarity to the sojourn time in scattering theory introduced by Guillemin. As a consequence, we are able to prove some new results on propagation of singularities for the Schrödinger operator.

STEVE ZELDITCH, John's Hopkins University
[Sunday December 8 / dimanche le 8 décembre, 11:00 – Dalhousie]
Quantum ergodicity of boundary values of eigenfunctions

The purpose of my talk is to outline a proof of a new result obtained jointly with Andrew Hassell (ANU) that L^2-normalized boundary values (*i.e.* Cauchy data) $u_j^\flat$ of eigenfunctions

of the Laplacian on piecewise smooth convex domains Ω with corners and with ergodic billiards are quantum ergodic. In other words, that

$$\langle A_{h_j} u_j^\flat, u_j^\flat \rangle \to \int_{B^*\partial\Omega} \sigma_A \, d\mu_B \quad \text{in density one,}$$

for all semiclassical pseudodifferential operators on $\partial\Omega$. The relevant notion of boundary values u_j^b depends on the boundary condition B, as does the classical limit measure $d\mu_B$. Our methods cover Dirichlet, Neumann, Robin and more general boundary conditions. The proof is based on the analysis of boundary layer potentials and their boundary restrictions as quantizations of the billiard map.

Schedule for "Real-World" Problems in Search of Solutions
Horaire pour Problèmes mathématiques provenant du monde industriel

Monday December 9	lundi 9 décembre
10:30 - 11:00	André Longtin, RealPr, Sussex
11:00 - 11:30	Liang Chen, RealPr, Sussex
11:30 - 12:00	Michael Rudnicki, RealPr, Sussex
12:00 - 12:30	General Discussion, RealPr, Sussex
15:30 - 16:00	Mary Hefford, RealPr, Sussex
16:00 - 16:30	Rejean Munger, RealPr, Sussex
16:30 - 17:00	Eric Dubois, RealPr, Sussex
17:00 - 17:30	General Discussion, RealPr, Sussex

"Real-World" Problems in Search of Solutions
Problèmes mathématiques provenant du monde industriel
(Org: André Dabrowski)

LIANG CHEN, Department of Physics, University of Ottawa, Ottawa, Ontario K1N 6N5
[Monday December 9 / lundi le 9 décembre, 11:00 – Sussex]
Polarization mode dispersion and polarization dependent loss in single mode fiber communication systems

Single mode fibers in fiber optic communication networks in fact supports two degenerate polarization modes. This degeneracy, however, could be lifted by either environmental perturbations or by manufacturing imperfections during fabrication. As a result, light group velocity can become polarization dependent, this is the so-called polarization mode dispersion (PMD). Furthermore the light intensity attenuation can also become polarization dependent, this is the so-called polarization dependent loss (PDL). PMD will broaden an optical pulsewidth, while PDL will result in optical power fluctuation. PMD and PDL will thus induce extra bit-error for a high rate digital optic communications fiber network. Because fibers installed in the field are subjected to dynamic environments such as wind and temperature, the PMD and PDL interactions are therefore intrinsically statistical. We will review the challenges of calculating precisely what the impact of combined PMD and PDL on high speed communication systems.

ERIC DUBOIS, Faculty of Engineering, University of Ottawa, Ottawa, Ontario K1N 6N5
[Monday December 9 / lundi le 9 décembre, 16:30 – Sussex]
Representation of 3D environments based on images

Virtual reality systems are generally based on computer graphics models of scenes and objects. With a complete model, it is possible to navigate in a virtual environment by generating

the images as needed on a virtual camera. This is widely used in video games. However, if we want to remotely navigate in a real, existing physical environment, it is very costly and time-consuming, if not impossible, to generate an accurate graphics model of the entire environment. It is more realistic to accomplish this based on actual images taken of the environment. This field, called *image-based rendering*, is quite new and there remain many unsolved questions: Which images should be captured—how many and from what viewpoints? How should this potentially enormous dataset be represented and stored? How can arbitrary views be rendered quickly for real-time navigation, with high quality? How can the system be designed for remote navigation, say over the internet? These issues will be surveyed in this talk.

MARY HEFFORD, Centre for Biologics Research, Biologics and Genetic Therapies Directorate, Health Canada, Ottawa, Ontario K1A 0L2
[Monday December 9 / lundi le 9 décembre, 15:30 – Sussex]
Calculating protein-protein interactions in proteomes in both health and disease

Many, if not most, diseases alter the number, the kind or the properties of the proteins expressed in cells—the cellular proteome. Using a combination of database searching, predictive algorithms and the traditional tools of protein chemistry, scientists are beginning to systematically unravel the human proteome into discrete, functional components of interacting proteins. Through the identification of protein-protein interactions that are altered in diseased states we gain new insights into the mechanisms of pathology and new hopes for effective treatments.

ANDRÉ LONGTIN, Department of Physics, University of Ottawa, Ottawa, Ontario K1N 6N5
[Monday December 9 / lundi le 9 décembre, 10:30 – Sussex]
Stochastic dynamics of biological information

This talk focusses on new mathematical challenges that arise in the context of biological problems. The first concerns the motion of eyes during reading. We have recently proposed a model for such eye movements which assumes that information is gathered from words in parallel in the word stream. The model has an intrinsic memory that expands with time. This expanding memory of the incoming words, as well as the "forcing" of the "reading system" by sequences of words of differing difficulties and with serial correlations pose great mathematical challenges. Another context in which information is gathered from an environment occus in swarm intelligence problems. For example, ant colonies communicate with each other directly as well as through environment signals (such as the magnitude of food resources). In many colonies, there is non-hierarchical control in which ants perform different different tasks, and switch tasks as well. We will discuss the deterministic/stochastic dynamics of such task allocation in terms of birth-death processes, and discuss the challenges involved in incorporating the spatial domain in such problems.

REJEAN MUNGER, University of Ottawa Eye Institute, Ottawa Health Research Institute, Ottawa Hospital, Ottawa, Ontario
[Monday December 9 / lundi le 9 décembre, 16:00 – Sussex]
Modeling the optics of the human eye: An interesting mathematical enigma

Our visual perception of the world is the result of many factors, some physiological, some neural and some optical. The first step in this process is the formation of an image of the world in the back of the eye, the retina, where the photoreceptors, the light detectors, are located. As an optical instrument the eye is relatively simple in construction having only 2 refractive elements and one limiting aperture. Yet we have yet to build a model of the optics of a normal human eye that can be useful in clinical applications. We will discuss the mathematical issues that arise when (A) collecting data for deriving the model and (B) in solving for the optical system.

MICHAEL RUDNICKI, Department of Cellular and Molecular Medicine, University of Ottawa, Ottawa, Ontario K1N 6N5
[Monday December 9 / lundi le 9 décembre, 11:30 – Sussex]
The stem cell genomics project

The molecular mechanisms that regulate the formation, self-renewal, and differentiation of stem cells remain at best poorly understood. The full exploitation of the potential of stem cells will require a complete understanding of the genetic factors that specify stem cell identity, and that regulate the commitment towards specific differentiated cell lineages. Therefore, we propose to define the spectrum of genes that define the identity and regulate the plasticity of embryonic and adult stem cells. This is the overarching goal of the Stem Cell Genomics Project. We will work primarily with human and mouse embryonic, neural, muscle, and marrow stem cells, and utilize high-throughput genomic analyses towards achieving this objective. A variety of stem cells will be isolated using a range of methodologies from both embryos and from a variety of adult tissues. We will employ emerging technologies to conduct expression microarray analysis on as few as 1–10 cells. Cluster analysis of multiple stem cell isolates and their immediate downstream differentiated derivatives will identify genes that are enriched or specifically expressed within the stem cell compartment. This data will then be used as a baseline to investigate the changes in gene expression that occur early during stem cell commitment and differentiation. To facilitate gene discovery and to complement the microarray analysis, we will employ serial analysis of gene expression (SAGE). A proteomics approach will be employed to monitor protein expression profiles from both immature stem cells and differentiated cells. Full exploitation of the stem cell expression data will be facilitated by the mounting of a web site for the dissemination and analysis of data (StemBase). This approach will facilitate large-scale reiterative analysis to elucidate hierarchical molecular regulatory mechanisms during stem cell commitment as well as stratification of subtle differences in stem cell states or identities.

Schedule for Representation Theory of Real and p-adic Groups
Horaire pour Théorie des représentations des groupes réels et p-adiques

Sunday December 8	**dimanche 8 décembre**
10:30 - 11:00	Wentang Kuo, P-adic, Cartier
11:00 - 11:30	Alfred Noël, P-adic, Cartier
11:30 - 12:00	Paul Mezo, P-adic, Cartier
12:00 - 12:30	Eric Sommers, P-adic, Cartier
14:00 - 14:30	Stephen DeBacker, P-adic, Cartier
14:30 - 15:00	Ju-Lee Kim, P-adic, Cartier
15:00 - 15:30	Fiona Murnaghan, P-adic, Cartier
17:00 - 17:30	Monica Nevins, P-adic, Cartier
17:30 - 18:00	Fernando Szechtman, P-adic, Cartier

Monday December 9	**lundi 9 décembre**
15:30 - 16:00	Clifton Cunningham, P-adic, Cartier
16:00 - 16:30	Heather Betel, P-adic, Cartier
16:30 - 17:00	Jason Levy, P-adic, Cartier
17:00 - 17:30	Yuanli Zhang, P-adic, Cartier

Representation Theory of Real and p-adic Groups
Théorie des représentations des groupes réels et p-adiques
(Org: Jason Levy and/et Monica Nevins)

JULEE KIM, University of Illinois at Chicago, USA
[Sunday December 8 / dimanche le 8 décembre, 14:30 – Cartier]
Character expansions and refined K-types

Let k be a p-adic field. Let G be the group of k-rational points of a connected reductive group defined over k. Let π be an irreducible admissible representation of G of positive depth. We find a new character expansion of the character χ_π, which depends on K-types contained in π. We also determine a G-domain where this expression is valid. This is a joint work with Fiona Murnaghan.

CLIFTON CUNNINGHAM, University of Calgary, Calgary, Alberta
[Monday December 9 / lundi le 9 décembre, 15:30 – Cartier]
On some depth-zero orbital integrals

We show how l-adic sheaves on the rigid analytic Lie algebra for a p-adic group may be used to associate orbital integrals to generalised Green's functions on the reductive quotient of a parahoric.

STEPHEN DEBACKER, Science Center 325, Harvard University, Cambridge, Massachusetts 02138, USA
[Sunday December 8 / dimanche le 8 décembre, 14:00 – Cartier]
Some applications of Bruhat-Tits theory to harmonic analysis

Beginning with the fundamental work of Allen Moy and Gopal Prasad, the elegant structure theory of Bruhat and Tits has played an increasingly important role in both the representation theory and harmonic analysis of reductive p-adic groups. In this talk, we shall review some of the basic results in the latter category and discuss work that is currently in progress.

HEATHER BETEL, Toronto
[Monday December 9 / lundi le 9 décembre, 16:00 – Cartier]

WENTANG KUO, Queen's University, Kingston, Ontario
[Sunday December 8 / dimanche le 8 décembre, 10:30 – Cartier]
Principal nilpotent orbits and reducible principal series

Let G be a split reductive p-adic group. In this talk, we will establish an explicit link between principal nilpotent orbits of G and the irreducible constituents of principal series of G. A geometric characterization of certain irreducible constituents is also provided. In addition, we can express the relation in terms of L-group objects.

JASON LEVY, University of Ottawa, Ottawa, Ontario
[Monday December 9 / lundi le 9 décembre, 16:30 – Cartier]
Invariance and Arthur's truncation

We will derive an alternative derivation of the Kudla-Rallis regularized Siegel-Weil formula, using Arthur truncation. We show that a simple criterion determines when the truncated integrals are invariant, and relate it to the assumptions of Kudla-Rallis on the relative sizes of the dual groups.

PAUL MEZO, The Fields Institute, Toronto, Ontario M5T 3J1
[Sunday December 8 / dimanche le 8 décembre, 11:30 – Cartier]
The unitary dual for metaplectic coverings of general linear groups

Suppose F is a p-adic field containing the n-th roots of unity. A metaplectic covering of $\mathrm{GL}(r, F)$ is a non-trivial n-fold covering group of $\mathrm{GL}(n, F)$. We shall provide a classification of the irreducible unitary representations of these metaplectic coverings, and discuss an application to the automorphic representations of metaplectic coverings.

FIONA MURNAGHAN, University of Toronto, Toronto, Ontario
[Sunday December 8 / dimanche le 8 décembre, 15:00 – Cartier]
Distinguished supercuspidal representations

Let G be the F-rational points of a connected reductive F-group, where F is a p-adic field. Let H be the fixed points of an involution of G. A representation of G is said to be *H-distinguished* whenever there exists a nonzero H-invariant linear functional on the space of

the representation. We will discuss distinguishedness of tame supercuspidal representations of G in terms of the inducing data defined by J.-K. Yu.

MONICA NEVINS, University of Ottawa, Ottawa, Ontario K1N 6N5
[Sunday December 8 / dimanche le 8 décembre, 17:00 – Cartier]
Branching rules for principal series representations of p-adic SL(2)

The principal series representations of p-adic $\mathrm{SL}(2,k)$ are restricted to $\mathrm{SL}(2,\mathcal{O})$, where $\mathcal{O}$ denotes the integer ring in k. This subgroup represents one of the two conjugacy classes of maximal compact subgroups in $\mathrm{SL}(2,k)$. The decomposition of these restricted representations is described in terms of Shalika's classification by orbits of irreducible representations of $\mathrm{SL}(2,\mathcal{O})$.

ALFRED NOËL, The University of Massachusetts, Boston, Massachusetts 02125, USA
[Sunday December 8 / dimanche le 8 décembre, 11:00 – Cartier]
Maximal Tori of reductive centralizers of nilpotents in exceptional complex symmetric spaces

The maximal tori and normal triples that I shall describe in this talk arise naturally in the study of nilpotent orbits of Lie groups and play an important role in several problems such as: classification of nilpotent orbits of real Lie groups, description of admissible nilpotent orbits of real Lie groups, classification of spherical nilpotent orbits, determination of component groups of centralizers of nilpotents in symmetric spaces. I shall present a simple algorithm for computing such tori and discuss two of the above applications.

ERIC SOMMERS, University of Massachusetts-Amherst and IAS
[Sunday December 8 / dimanche le 8 décembre, 12:00 – Cartier]
Ideals in the nilradical of a Borel subalgebra

We study an equivalence relation on the set of ideals in the nilradical of a Borel subalgebra. This appears to be related to the Springer correspondence. It also has a connection with Kazhdan-Lusztig cells in the affine Weyl group and we will explain a theorem concerning this connection.

FERNANDO SZECHTMAN, University of Waterloo, Waterloo, Ontario N2L 3G1
[Sunday December 8 / dimanche le 8 décembre, 17:30 – Cartier]
Weil representations of symplectic and unitary groups over finite local rings

Let $\mathcal{O}$ be the ring of integers of a local field, with maximal ideal $\mathfrak{P}$. Write $\mathrm{Sp}_{2n}(R)$ for the symplectic group of rank $2n$ over the quotient ring $R = \mathrm{O}/\mathfrak{P}^l$. The Weil representation W of $\mathrm{Sp}_{2n}(R)$ is defined, its irreducible constituents are determined, their Clifford theory is elucidated, and their character fields and Schur indices are computed. A character formula for the restriction of W to the unitary group $\mathrm{U}_n(\bar{R})$, $\bar{R}$ a quadratic extension of R, is given.

YUANLI ZHANG, CRM, University of Montreal, Montreal, Quebec
[Monday December 9 / lundi le 9 décembre, 17:00 – Cartier]
R-groups and Aubert involutions

Let π be a generic discrete representation of a Levi subgroup of $\mathrm{SO}(2n+1)(F)$, where F is a p-adic field. Then the R-group of Arthur and the classical R-group of the Aubert involution of π are isomorphic. This is a join work with Ban.

Schedule for Symplectic Geometry
Horaire pour Géométrie symplectique

Sunday December 8	**dimanche 8 décembre**
10:30 - 11:00	Henrique Bursztyn, SymGeo, Wellington
11:00 - 11:30	Misha Kogan, SymGeo, Wellington
11:30 - 12:00	Eugene Lerman, SymGeo, Wellington
12:00 - 12:30	David Metzler, SymGeo, Wellington
14:00 - 14:30	Jonathan Weitsman, SymGeo, Wellington
14:30 - 15:00	Yael Karshon, SymGeo, Wellington
15:00 - 15:30	Rebecca Goldin, SymGeo, Wellington
17:00 - 18:00	François Lalonde, SymGeo, Wellington

Monday December 9	**lundi 9 décembre**
10:30 - 11:00	Askold Khovanskii, SymGeo, Wellington
11:00 - 11:30	Ely Kerman, SymGeo, Wellington
11:30 - 12:00	Tara Holm, SymGeo, Wellington
12:00 - 12:30	Jedrzej Sniatycki, SymGeo, Wellington
15:30 - 16:00	Catalin Zara, SymGeo, Wellington
16:00 - 16:30	Ramin Mohammadalikhani, SymGeo, Wellington
16:30 - 17:00	Ping Xu, SymGeo, Wellington
17:00 - 17:30	Liviu Mare, SymGeo, Wellington

Tuesday December 10	**mardi 10 décembre**
10:30 - 11:00	Siye Wu, SymGeo, Wellington
11:00 - 11:30	Jacques Hurtubise, SymGeo, Wellington
11:30 - 12:00	Megumi Harada, SymGeo, Wellington
12:00 - 12:30	Anton Alekseev, SymGeo, Wellington

Symplectic Geometry / Géométrie symplectique
(Org: Lisa Jeffrey and/et Eckard Meinrenken)

ANTON ALEKSEEV, Section of Mathematics, University of Geneva, Geneva, Switzerland
[Tuesday December 10 / mardi le 10 décembre, 12:00 – Wellington]
Poisson Geometry and the Kashiwara-Vergne conjecture

I'll explain a Poisson-geometric proof of the Kashiwara-Vergne conjecture for quadratic Lie algebras, based on the equivariant Moser trick. This talk is based on a joint work with E. Meinrenken, preprint math.RT/0209346.

HENRIQUE BURSZTYN, University of Toronto, Toronto, Ontario
[Sunday December 8 / dimanche le 8 décembre, 10:30 – Wellington]
Notions of equivalence for Poisson manifolds

I will discuss the relationship between two notions of equivalence in Poisson geometry: one is gauge equivalence, that appears as the Poisson counterpart of Morita equivalence of star-product algebras via Kontsevich's formality correspondence; the other is Xu's Morita equivalence for integrable Poisson manifolds, that is a refinement of Weinstein's notion of dual pairs. As an application, I will show how to construct complete invariants of gauge and Morita equivalence for topologically stable Poisson structures on compact oriented surfaces.

REBECCA GOLDIN, George Mason University, Fairfax, Virginia 22039, USA
[Sunday December 8 / dimanche le 8 décembre, 15:00 – Wellington]
Counting chambers of the moment polytope

Let M be a compact symplectic manifold with a Hamiltonian T action and moment map Φ. For H a subtorus of T, denote by M^H the fixed point set of the H action on T. The images of $\Phi(M)$ and $\Phi(M^H)$ for all one-dimensional subtori of T form a polytope carved into chambers. It is not at all trivial to count the number of these chambers. I will present an invariant which distinguishes the chambers in the case of $\mathrm{SU}(n)$ coadjoint orbits. The general story is still unknown. This is joint work with T. Holm.

MEGUMI HARADA, University of California-Berkeley, California, USA
[Tuesday December 10 / mardi le 10 décembre, 11:30 – Wellington]
The symplectic geometry of the Gel'fand-Cetlin basis for representations of the symplectic group

The Gel'fand-Cetlin canonical basis for a finite-dimensional representation V_λ of $U(n,\mathbb{C})$ can be constructed by successive decompositions of the representation by a chain of subgroups

$$U(1,\mathbb{C}) \subset U(2,\mathbb{C}) \subset \cdots U(n-1,\mathbb{C}) \subset U(n,\mathbb{C}).$$

A key point in the analysis is that the decomposition of an irreducible representation of $U(k,\mathbb{C})$ under the subgroup $U(k-1,\mathbb{C})$ is multiplicity-free. Guillemin and Sternberg constructed in the 1980s the Gel'fand-Cetlin integrable system on the coadjoint orbits $\mathcal{O}_\lambda$ of $U(n,\mathbb{C})$, which is the symplectic geometric version, via geometric quantization, of the Gel'fand-Cetlin canonical basis for V_λ.

For $G = U(n,\mathbb{H})$, the compact symplectic group (also described as the *quaternionic* unitary group), however, the decompositions are not multiplicity-free. However, in recent years, Molev et al. have found a Gel'fand-Cetlin type basis for representations of the symplectic group, using essentially new ideas, including the Yangian $Y(2)$, an infinite-dimensional quantum group, and a subalgebra called the twisted Yangian $Y^-(2)$. In this talk I will explain the symplectic and Poisson geometry underlying the canonical basis for finite-dimensional irreducible representations of $U(n,\mathbb{H})$. In particular, I will construct an integrable system on the symplectic reductions of the coadjoint orbits of $U(n,\mathbb{H})$ by $U(n-1,\mathbb{H})$ and explain its correspondence with Molev *et al.*'s work.

TARA HOLM, University of California, Berkeley, California 94720, USA
[Monday December 9 / lundi le 9 décembre, 11:30 – Wellington]
Symplectic quotients and real loci

Let M be a compact, connected symplectic manifold with a Hamiltonian action of a compact n-dimensional torus T^n. Suppose that M is equipped with an anti-symplectic involution σ compatible with the T-action. The real locus of M is the fixed point set M^σ of σ. Duistermaat introduced real loci, and extended several theorems of symplectic geometry to real loci. We extend another classical result to real loci: the Kirwan surjectivity theorem. In addition, we compute the kernel of the real Kirwan map. We will mention several salient examples. This is joint work with Rebecca Goldin (George Mason University).

JACQUES HURTUBISE, Centre de Recherches Mathématiques
[Tuesday December 10 / mardi le 10 décembre, 11:00 – Wellington]
Dynamical r-matrices and bundles on elliptic curves

At the level of loop algebras, there is an equivalence between the integrable systems defined using r-matrices and the Hitchin systems for rigid holomorphic bundles over a Riemann surface. The latter generalise to cases when the bundle is not rigid. On the level of loop groups, however, there does not seem to be a suitable generalisation. An exception is provided by the dynamical r-matrices of Felder, Etingof, Varchenko *et al.*, which turn out to correspond to G-bundles over an elliptic curve. We develop the geometry of this moduli space, which allows a fairly exhaustive elucidation of the Poisson geometry of the dynamical r-matrix. (joint with E. Markman)

YAEL KARSHON, University of Toronto and The Hebrew University of Jerusalem
[Sunday December 8 / dimanche le 8 décembre, 14:30 – Wellington]
Blow-ups of $\mathbb{CP}^2$ without torus actions

Compact symplectic 4-manifolds which admit Hamiltonian torus actions must be blowups of $\mathbb{CP}^2$ or of $S^2 \times S^2$. We show that the converse is false: we prove, using holomorphic machinery, that certain blow-ups of $\mathbb{CP}^2$ do not admit torus actions or even circle actions. This is joint work with Liat Kessler.

ELY KERMAN, SUNY-Stony Brook, Stony Brook, New York, USA
[Monday December 9 / lundi le 9 décembre, 11:00 – Wellington]
Symplectic homology and periodic orbits near symplectic extrema

In this talk I will describe joint work with Kai Cieliebak and Viktor Ginzburg in which we use methods from symplectic topology to strengthen previous existence results for periodic orbits of Hamiltonian flows. More precisely, we show that for sufficiently small neighborhoods of compact symplectic submanifolds the symplectic homology of Floer and Hofer is nontrivial. This implies the existence of periodic orbits on a dense set of level sets near symplectic extrema.

ASKOLD KHOVANSKII, Toronto
[Monday December 9 / lundi le 9 décembre, 10:30 – Wellington]
Newton polyhedra and Parshin's symbols

According to the famous theorem of A. Weil the product of so-called Weil's symbols $\{f, g\}$ over all the points of an algebraic curve Γ is equal to 1. Here f, g are non-zero meromorhpic functions on Γ. It turns out that one can obtain a very simple proof of this theorem just

by looking at the Newton polygon of the equation of the image of the curve Γ under the meromorphic map $f, g\colon \Gamma \to (\mathbb{C}^*)^2$. Parshin generalized Weil's theorem to the multidimensional case and defined so-called Parshin's symbols of $(n+1)$ meromorphic functions on a n-dimensional variety. Pashin's construction is pure algebraic. I will present a new topological explanation of the Parshin theory and a multidimensional generalization of the classical Vieta's formula for the product of all the roots of a polynomial.

MISHA KOGAN, Northeastern University, Boston, Massachusetts 02115, USA
[Sunday December 8 / dimanche le 8 décembre, 11:00 – Wellington]
Degenerating Schubert varieties to unions of toric varieties associated to rc*-graphs*

We construct a flat degeneration of the flag manifold to the toric variety Y associated to the Gel´fand-Cetlin polytope. Every Schubert variety X_w degenerates to a reduced union of toric subvarieties of Y, generalizing results of Gonciulea and Lakshmibai. The faces of the Gel´fand-Cetlin polytope corresponding to the components of the degeneration of X_w are given by rc-graphs. We also explain how this degeneration is related to a construction of cycles representing equivariant Schubert classes in the flag manifold. This construction uses Gel´fand-Cetlin action coordinates and the cycles are glued from pieces indexes by rc-graphs. This is joint work with Ezra Miller.

FRANÇOIS LALONDE, Québec-Montréal
[Sunday December 8 / dimanche le 8 décembre, 17:00 – Wellington]
Critical values for the moduli space of symplectic balls in a rational 4*-manifold*

(joint work with Martin Pinsonnault)

We compute the rational homotopy type of the space of symplectic embeddings of the standard ball $B^4(c) \subset \mathbf{R}^4$ into 4-dimensional rational symplectic manifolds of the form $M_\lambda = \left(S^2 \times S^2, (1+\lambda)\omega_0 \oplus \omega_0\right)$ where ω_0 is the area form on the sphere with total area 1 and λ belongs to the interval $[0,1]$. We show that, when λ is zero, this space retracts to the space of symplectic frames, for any value of c. However, for any given $\lambda > 0$, the rational homotopy type of that space changes as c crosses the critical parameter $c_{\text{crit}} = \lambda$, which is the difference of areas between the two S^2 factors. We prove moreover that the full homotopy type of that space change only at that value, *i.e.* the restriction map between these spaces is a homotopy equivalence as long as these values of c remain either below or above that critical value. The same methods apply as well to other rational 4-manifolds like CP^2 or the topologically non-trivial S^2-fibration over S^2.

EUGENE LERMAN, University of Illinois-Urbana-Champaign, USA
[Sunday December 8 / dimanche le 8 décembre, 11:30 – Wellington]
Contact fiber bundles

This is work in progress. We discuss the definition and construction of contact fiber bundles. Applications include the contact versions of minimal coupling and of the cross-section theorem. In turn these are used to classify contact 5-manifolds with SU(2) invariant contact structures and to construct new examples of K-contact manifolds.

LIVIU MARE, University of Toronto, Toronto, Ontario M5S 3G3
[Monday December 9 / lundi le 9 décembre, 17:00 – Wellington]
Quantum cohomology of flag manifolds and Toda lattices

The main goal of the talk will be to present recent results of mine analogous to a theorem of B. Kim which describes the quantum cohomology ring of the generalized flag manifold G/B in terms of the integrals of motion of a certain completely integrable Hamiltonian system of Toda lattice type.

DAVID METZLER, Florida
[Sunday December 8 / dimanche le 8 décembre, 12:00 – Wellington]
Presentation of noneffective orbifolds

It is well-known that an orbifold M, all of whose stabilizer group actions is effective (an "effective" or "reduced" orbifold) can be presented as $M = P/K$, where P is a smooth manifold and K is a compact Lie group. For noneffective orbifolds, the corresponding result is unknown. We use the language of groupoids to understand the extra structure arising from the ineffective parts of the stabilizer groups, and show that a presentation exists in two cases. We will also discuss the difficulties with showing presentability in the general case. This work is joint with Andre Henriques.

RAMIN MOHAMMADALIKHANI, McGill University, CRM
[Monday December 9 / lundi le 9 décembre, 16:00 – Wellington]
Cohomology ring of symplectic reductions by circle actions

In this talk I will show how the Tolman-Weitsman theorem enables us to compute the cohomology ring of symplectic quotients at the zero level set of the moment map when a circle acts on the symplectic manifold. This is done when the original manifold is a product of two-dimentional spheres or more generally when it is a product of manifolds such that the cohomology ring of each of them is generated by a degree two class.

JEDRZEJ SNIATYCKI, University of Calgary, Calgary, Alberta T2N 1N4
[Monday December 9 / lundi le 9 décembre, 12:00 – Wellington]
Singular reduction of Poisson spaces

We consider a proper action of the symmetry group G of a Poisson manifold P. The orbit space $S = P/G$ is a differential space locally diffeomorphic to a subset of the Cartesian space. The ring of smooth functions on S is a Poisson algebra isomorphic to the algebra of smooth G-invariant functions on P.

We describe the structure of S directly in terms of derivations of the Poisson algebra of S. Orbits of the family of derivations that generate local one-parameter groups of local diffeomorphisms of S give rise to a stratification of S by Poisson manifolds. Orbits of the family of inner derivations define a singular symplectic foliation of S.

We extend our analysis of singular reduction of symmetries to subcartesian Poisson spaces.

JONATHAN WEITSMAN, Department of Mathematics University of California Santa Cruz, CA 95064
[Sunday December 8 / dimanche le 8 décembre, 14:00 – Wellington]
Euler-MacLaurin formulas for simple polytopes

We give an Euler MacLaurin formula with remainder for the sum of the values of a smooth function over the lattice points in a simple integral polytope. (joint work with Yael Karshon

and Shlomo Sternberg)

SIYE WU, Department of Mathematics, University of Colorado, Boulder Colorado 80309-0396, USA
[Tuesday December 10 / mardi le 10 décembre, 10:30 – Wellington]
Lattice polarization and projective flatness

Standard geometric quantization procedure requires choosing a real or complex polarization and the quantum physics is independent of the choice if there exists a projectively flat connection on the vector bundle of Hilbert spaces over the space of polarizations. In this talk, I will discuss a family of quantizations determined by lattices in a symplectic vector space and study the problem of projective flatness.

PING XU, Pennsylvania State, USA
[Monday December 9 / lundi le 9 décembre, 16:30 – Wellington]
Equivariant gerbes over compact simple Lie groups

We will discuss S^1-gerbes over a Lie groupoid (or more precisely, a stack), and describe their Dixmier-Douady class in terms of connection-like data. As an example, we present, for a compact simple Lie group G, an infite dimensional modle of S^1-gerbe whose Dixmier-Douady class corresponds to the canonical generator of the equvariant cohomology $H^3_G(G)$.
(joint work with Kai Behrend and Bin Zhang.)

CATALIN ZARA, Yale
[Monday December 9 / lundi le 9 décembre, 15:30 – Wellington]

Schedule for Theory and Applications of Point Processes
Horaire pour Théorie et applications des processus ponctuels

Tuesday December 10	mardi 10 décembre
10:30 - 11:00	Richard Serfozo, PntPro, Sussex
11:00 - 11:30	Francois Baccelli, PntPro, Sussex
11:30 - 12:00	Raluca Balan, PntPro, Sussex
12:00 - 12:30	Reg Kulperger, PntPro, Sussex
15:30 - 16:00	Jiashan Tang, PntPro, Sussex
16:00 - 16:30	Gail Ivanoff, PntPro, Sussex
16:30 - 17:00	David McDonald, PntPro, Sussex

Theory and Applications of Point Processes / Théorie et applications des processus ponctuels

(Org: Gail Ivanoff and/et David McDonald)

FRANCOIS BACCELLI, École Normale Supérieure
[Tuesday December 10 / mardi le 10 décembre, 11:00 – Sussex]
Stochastic geometry and modelling of coverage and capacity in CDMA networks

Joint work with B. Blaszczyszyn and F. Tournois (INRIA & Ecole Normale Supérieure)

The aim of the survey is to show that stochastic geometry provides an efficient computational framework allowing one to predict characteristics of large CDMA networks such as coverage or soft-handoff level or capacity. The general idea consists in representing the location of antennas and/or mobile stations as realizations of stochastic point processes in the plane within a simple parametric class, which takes into account the irregularities of antenna/mobile patterns in a statistical way. This approach leads to new formulas and simulation schemes allowing one to compute/estimate of the spatial averages of these local characteristics in function of the model parameters (density of antennas or mobiles, law of emission power, fading law *etc.*) and to perform various parametric optimizations.

RALUCA BALAN, Universite de Sherbrooke, Sherbrooke, Quebec J1K 2R1
[Tuesday December 10 / mardi le 10 décembre, 11:30 – Sussex]
Markov point processes in Bayesian nonparametric statistics

At the origin of this work, there is a Bayes property of a classical Markov chain. We consider a class of random probability measures which satisfy a Markov type property. This class includes the Dirichlet process, the empirical process and a point process with Polya type finite dimensional distributions. Our main result proves that this class is "closed" in the Bayesian sense *i.e.*, if the prior distribution of the sample is Markov (in the specified sense), then its posterior distribution will also be Markov. In particular, a neutral to the right prior distribution leads to a neutral to the right posterior distribution.

GAIL IVANOFF, University of Ottawa, Ottawa, Ontario K1N 6N5
[Tuesday December 10 / mardi le 10 décembre, 16:00 – Sussex]
Random clouds and censoring in survival analysis

The theory of optional stopping is extended to general adapted random sets called "clouds". In particular, a stopping theorem is proven for martingales indexed by a class of sets. The theory may be applied to survival analysis of spatial data censored by clouds. An analogue to the classical Nelson-Aalen estimator of the integrated hazard is defined, and its asymptotic behaviour is studied.

REG KULPERGER, University of Western Ontario
[Tuesday December 10 / mardi le 10 décembre, 12:00 – Sussex]
Point Processes and Applications

This talk will discuss point processes in $\mathbb{R}^d$, $d = 1, 2$. We will consider some applications to bio-systems. Some questions of statistical inference will also be considered. In order to implement some of the inference methods one needs to consider approximations to the sampling distributions of certain statistics. These approximations are typically limit theorems, but currently parametric and non parametric bootstrap methods are of increasing interest.

DAVID MCDONALD, Department of Mathematics and Statistics, University of Ottawa, Ontario K1N 6M5
[Tuesday December 10 / mardi le 10 décembre, 16:30 – Sussex]
Do birds of a feather flock together?

One might wonder if the location of nests of red-wing blackbirds in the Mer Bleue conservation area may be modelled as a Poisson process. However it couldn't be a homogeneous Poisson process since some areas are less desirable than others for nesting (part of the nesting area is open water). The obvious alternative is that nest sites tend to clump together perhaps for protection or alternatively these aggressive birds tend to construct nests as far as possible from other nests.

RICHARD SERFOZO, Georgia Institute of Technology
[Tuesday December 10 / mardi le 10 décembre, 10:30 – Sussex]
Reversible Markov processes on general spaces: spatial birth-death and queueing

This study describes the stationary distributions of spatial birth-death and queueing processes that represent systems in which discrete units (customers, particles) move about in an Euclidean or partially ordered space where they are processed. These are reversible Markov jump process with uncountable state spaces (sets of "finite" counting measures). Reversible Markov processes on countable state spaces, introduced by Kolmogorov, have the exceptional property that their stationary distributions have a canonical form: a simple ratio of products of transition rates. We present an analogue of this result for uncountable state spaces. This involves representing two-way communication by certain Radon-Nikodym derivatives for measures on product spaces. Included is a Kolmogorov criterion that establishes the reversibility in the same spirit as one studies $[\psi]$-irreducible Markov jump processes (Meyn and Tweedie (1993). Stationary Markov Chains and Stochastic Stability). Related references for "infinite" birth-death processes are: N. Lopes Garcia, (1995). *Birth and death processes as projections of higher-dimensional Poisson processes.* Adv. in Appl. Probab., E. Glotzl,

(1981). *Time reversible and Gibbsian point processes. I. Markovian spatial birth and death processes on a general phase space.* Math. Nachr.

JIASHAN TANG, Carleton University
[Tuesday December 10 / mardi le 10 décembre, 15:30 – Sussex]
Balancing queues by mean field interaction

Consider a queueing network with N nodes in which queue lengths are balanced through mean-field interaction. When N is large, we study the performance of such a network in terms of limiting results as N goes to infinity.

(joint work with Don Dawson and Yiqiang Q. Zhao)

Schedule for Contributed Papers
Horaire pour Communications libres

Monday December 9	**lundi 9 décembre**
10:30 - 10:45	Murray Bremner, Ctrb, Alta Vista
10:30 - 10:45	Driss Drissi, Ctrb, Cartier
10:50 - 11:05	Martin Argerami, Ctrb, Cartier
11:10 - 11:25	Kunquan Lan, Ctrb, Cartier
11:10 - 11:25	Claude Levesque, Ctrb, Alta Vista
11:30 - 11:45	Ravil Moukhometov, Ctrb, Cartier
11:30 - 11:45	Amritanshu Prasad, Ctrb, Alta Vista
11:50 - 12:05	Vahid Dabbaghian, Ctrb, Alta Vista
11:50 - 12:05	Ronald Sklar, Ctrb, Cartier
12:10 - 12:25	Jonathan Sondow, Ctrb, Alta Vista

Tuesday December 10	**mardi 10 décembre**
10:30 - 10:45	Hans Heinig, Ctrb, Alta Vista
10:50 - 11:05	Vladlen Timorin, Ctrb, Alta Vista
11:10 - 11:25	Valentina Kiritchenko, Ctrb, Alta Vista
11:50 - 12:05	Trevor Jones, Ctrb, Alta Vista

Contributed Papers / Communications libres
(Org: Walter Burgess and/et Abdellah Sebbar)

MARTIN ARGERAMI, Department of Mathematics and Statistics, University of Regina, Regina, Saskatchewan S4S 0A2
[Monday December 9 / lundi le 9 décembre, 10:50 – Cartier]
The Schur-Horn Theorem in II_1 factors

The Schur-Horn theorem expresses a relation, in real n-space, of two apparently unrelated notions: majorization and convexity. In finite dimensional von Neumann algebras, it can be expressed in terms of maximal abelian subalgebras (masas) of factors:

Let M be a finite dimensional factor, $A \subset M$ a masa in M, and let P be the unique conditional expectation from M to A. Then, for every $a \in A$,

$$P\big(\mathcal{U}_M(a)\big) = \mathrm{co}\{vav^* : v \in \mathcal{N}(A)\},$$

where $\mathcal{U}_M$ is the unitary group of M and $\mathcal{N}(A)$ is the normalizer of A.

The author believes (and has evidence, although not a proof) that the Schur-Horn property characterizes masas of finite dimensional factors (that is, if a subalgebra of a finite dimensional factor satisfies the Schur-Horn relation, then it is a masa).

II_1 factors are a natural setting to try the Schur-Horn property, because there always exist a normal conditional expectation onto any masa, and also because the main notion used in the

finite dimensional proof is majorization, which can be reasonably extended to the setting of II_1 factor, thanks to the existence of the trace. One cannot expect masas in II_1 factors to be characterized by the Schur-Horn property (it fails clearly for singular masas) but it may, for instance, characterize regular masas.

In our attempts to prove this theorem, we have had to work with the notion of majorization in II_1 factors, and several interesting characterizations appear for unitary orbits of states and automorphisms.

MURRAY BREMNER, Department of Mathematics, University of Saskatchewan, Saskatoon, Saskatchewan S7N 5E6
[Monday December 9 / lundi le 9 décembre, 10:30 – Alta Vista]
Quantization of Lie and Jordan triple systems

This talk will show how the decomposition of the group ring of the symmetric group into a direct sum of full matrix subrings can be used to give a complete classification of n-ary operations. Roughly speaking, row equivalence of matrices corresponds to quasi-equivalence of operations. In particular, the Lie and Jordan products represent the two non-trivial quasi-equivalence classes of binary operations. For ternary operations, there are infinitely many quasi-equivalence classes, which divide into eight classes, and four infinite families of classes each with a single parameter. The Lie triple product is contained in one of the infinite classes, and the other operations in the class can be regarded as quantizations of that product. Similar remarks apply to the Jordan triple product. For special values of the parameter, the operation satisfies an identity of degree 5. This identifies some new ternary operations which define varieties of triple systems, similar to Lie and Jordan triple systems, which seem to be an interesting direction for further research.

VAHID DABBAGHIAN, School of Mathematics and Statistics, Carleton University, Ottawa, Ontario K1S 5B6
[Monday December 9 / lundi le 9 décembre, 11:50 – Alta Vista]
An efficient algorithm to construct representations of finite groups

Let G be a finite group. It is easy to compute the character of G corresponding to a given complex representation, but much more difficult to compute a representation affording a given character. In part this is due to the fact that a class of equivalent representations contains no natural canonical representation.

Although there is a large literature devoted to computing representations, and methods are known for particular classes of groups, no general method has been proposed which is practical for any but very small groups. For example, the function "IrreducibleRepresentationsDixon" which is supplied in the latest version 4.3 of the computer algebra system GAP, is very slow in computing representations for even moderately sized groups and fails to compute a representation in many cases.

We shall describe an algorithm to compute an irreducible matrix representation R which affords a given character χ of a given group G. The algorithm uses properties of the structure of G which can be computed efficiently by a program such as GAP, theoretical results from representation theory, theorems from group theory (including the classification of finite simple groups), and linear algebra. The algorithm has been implemented in GAP and appears to work well for a general group G when the character supplied has degree up to about 30.

DRISS DRISSI, Department of Mathematics, Kuwait University, Kuwait
[Monday December 9 / lundi le 9 décembre, 10:30 – Cartier]
How to control the orbits of operators?

Let A be a bounded linear operator in a complex Banach space X, with spectrum in the unit disc. Ritt's theorem gives bounds for $\|A^n\|$ based on the behaviour of $|1-z|\,\|(zI-A)^{-1}\|$ near the unit circle. Using new methods, we improve previous results of Ritt's and others and obtain a generalization to higher powers of $(1-z)$. We also give a quantitative result of Tauberian's theorem for operators. We will discuss different relationships between Ritt's condition, strict sublinear growth and Katznelson-Tzafriri' theorem (Open problems).

HANS HEINIG, McMaster University, Hamilton, Ontario L8S 4K1
[Tuesday December 10 / mardi le 10 décembre, 10:30 – Alta Vista]
Exponential inequalities with weights

Characterizations of weight pairs are obtained for which a class of weighted exponential—logarithmic integral inequalities are satisfied. Special cases yield weight characterizations for the geometric mean operator as well as operators of Riemann-Liouville and Laplace type.

TREVOR JONES, University of New Brunswick
[Tuesday December 10 / mardi le 10 décembre, 11:50 – Alta Vista]
Computing some nonstandard Betti numbers

In previous work, we established an abstract generalized Gauss-Bonnet theorem for surfaces. We discuss the computation of our nonstandard Betti numbers in the theorem, at least for the special case of Riemann surfaces of constant curvature. By the uniformization theorem we may as well consider hyperbolic space modulo a discrete subgroup of isometries and we discuss the case of hyperbolic space in detail.

VALENTINA KIRITCHENKO, University of Toronto, Toronto, Ontario M5S 3G3
[Tuesday December 10 / mardi le 10 décembre, 11:10 – Alta Vista]
A Gauss-Bonnet theorem for constructible sheaves on reductive groups

We prove an analog of the Gauss-Bonnet formula for constructible sheaves on reductive groups. This formula holds for all constructible sheaves equivariant under the adjoint action and expresses the Euler characteristic of a sheaf in terms of its characteristic cycle. As a corollary from this formula we get that if a perverse sheaf on a reductive group is equivariant under the adjoint action, then its Euler characteristic is nonnegative.

KUNQUAN LAN, Ryerson University
[Monday December 9 / lundi le 9 décembre, 11:10 – Cartier]
Multiple positive solutions of higher order boundary value problems

We consider the existence of one or several nonzero positive solutions for a higher order nonlinear ordinary differential equation with n-sets of separated boundary conditions. The boundary value problems can be changed into a Hammerstein integral equation with a suitable kernel. We shall show that the kernel has upper and lower bounds. This enables us not only to exhibit a new property of positive solutions for the boundary value problems but also to derive new results on these boundary value problems from the well-known results

on the existence of one or several positive solutions of Hammerstein integral equations with singularities obtained by the author recently. This avoids utilizing the theory of fixed point index for compact maps defined on cones directly.

CLAUDE LEVESQUE, Département de mathématiques et de statistique, Université Laval, Québec G1K 7P4
[Monday December 9 / lundi le 9 décembre, 11:10 – Alta Vista]
A fundamental system of units for some fields of degree 9

We exhibit a fundamental system of units for some families of composita of two pure cubic number fields of the form $Q(\omega, \theta)$ where ω^3 and θ^3 are certain positive integers.

RAVIL MOUKHOMETOV, Ottawa
[Monday December 9 / lundi le 9 décembre, 11:30 – Cartier]
On problem of the reconstruction of metric on the Riemannian manifold

On a compact Riemannian manifold M with a boundary D we consider the problem of the reconstruction of the Riemannian metric g if are known the lengths of geodesics with endpoints on the boundary D of M. First results, namely an uniqueness and stability for this non-linear problem in a general formulation, have been got by the auther in 1977. In present time the auther obtains some results when geodesics are reflected from the part L of the boundary D of M and also for the linearized problem that is the integral geometry problem. The auther also gets in connection of this problem some formula: the symplectic volume and from here the Riemannian volume of M is expressed only by the lengths of geodesics with endpoints on the boundary D without L. In this formula the metric g is unknown and the manifold M is not known as the part L of the boundary D is unknown. The considered problems refer to the Riemannian geometry, also to the symplectic geometry (in proofs is used 1-contact form, see: C. Godbillon, *Geometrie Differentielle et Mecanique Analytique*). The near similar problems are also used in geophysics (structure of Earth) and the obtained results may stimulate the investigations of the new problems.

AMRITANSHU PRASAD, CRM, CP 6128, Succursale centre-ville, Montreal, Quebec H3C 3J7
[Monday December 9 / lundi le 9 décembre, 11:30 – Alta Vista]
Almost unramified automorphic representations for slpit groups over $F_q(t)$

Let G be a split reductive group over a finite field $\mathbf{F}_q$. Let $F = \mathbf{F}_q(t)$ and $\mathbf{A}$ be the adeles of F. We describe the local constituents at each valuation of F of all the irreducible representations of $G(\mathbf{A})$ that occur discretely in $L^2\big(G(F)\setminus G(\mathbf{A})\big)$ and have non-zero vectors invariant under the compact open subgroup K of $G(\mathbf{A})$ which is a product Iwahori subgroups at two valuations of F and maximal compact subgroups at all the other valuations.

This is done by showing, firstly, that the space generated by the representations mentioned above is spanned by residues of Eisenstein series associated to an unramified automorphic characters of a maximal split torus of G. This imposes consistency conditions on the local constituents at different valuations of a fixed automorphic representation. An earlier result of the speaker describes the local constituents of the aforementioned representations at the two places where the local factor of K is Iwahori. This, together with the consistency conditions uniquely determines the local constituents at all places of the automorphic representation.

RONALD SKLAR, St. John's University, Jamaica, New York 11439, USA
[Monday December 9 / lundi le 9 décembre, 11:50 – Cartier]
Mathematical techniques for circumventing query-set-size control in a statistical database

This talk will discuss the method of attacking a statistical database by the use of a tracker. Different types of trackers will discussed, and it will be shown that one of the commonly used techniques, namely query-set-size control, for protecting a statistical database can easily be subverted by the use of a tracker. The simple mathematics employed makes this interesting and timely topic one that can be successfully incorporated into a mathematics liberal arts course for non-majors.

JONATHAN SONDOW, 209 West 97th St., New York, New York 10025, USA
[Monday December 9 / lundi le 9 décembre, 12:10 – Alta Vista]
Irrationality measures, irrationality bases, and Euler's constant

We define a weak irrationality measure, the irrationality base, and give a condition implying an upper bound for the irrationality base of Euler's constant, γ. We present numerical evidence for the condition.

The irrationality exponent $\mu(\alpha)$ of an irrational number α is defined using the irrationality measure $1/q^{\mu}$. Using instead the irrationality measure $1/\beta^{q}$, we define the irrationality base $\beta(\alpha)$. More precisely, if there exists a positive real number β with the property that for any $\varepsilon > 0$ there is a positive integer $q(\varepsilon)$ such that $|\alpha - p/q| > (\beta+\varepsilon)^{-q}$ for all integers p, q, with $q \geq q(\varepsilon)$, then we denote by $\beta(\alpha)$ the least such β, and we call $\beta(\alpha)$ the *irrationality base* of α. Note that $\beta(\alpha) \geq 1$, and that $\beta(\alpha) = 1$ if α is not a Liouville number. We construct examples α_ρ with $\beta(\alpha_\rho) = \rho$, for any prescribed $\rho \in [1, \infty)$.

Next, we define a Beukers-type double integral I_n and a natural number S_n, with $\log S_n$ a $\mathbf{Z}$-linear form in $\log(n+1), \ldots, \log(2n)$, and we show that if $d_n = \mathrm{LCM}(1, \ldots, n)$ then $\mathrm{frac}\,(\log S_n) = d_{2n} I_n$, for $n \geq n_0$, if and only if $\gamma \in \mathbf{Q}$. A corollary is that γ is irrational if $\lim_{n\to\infty}(1/n)\log\|\log S_n\| \neq (e/4)^2$, where $\|x\|$ denotes the distance from x to the nearest integer. Computations by P. Sebah for $1 \leq n \leq 2500$ suggest that in fact the limit is zero. We prove that *if this limit equals zero, then γ has irrationality base $\beta(\gamma) \leq 2e = 5.436\ldots$, that is, for any $\varepsilon > 0$ there exists $q(\varepsilon) > 0$ such that $|\gamma - p/q| > (2e+\varepsilon)^{-q}$ for all integers p, q, with $q \geq q(\varepsilon)$.*

Having given an upper bound for $\beta(\gamma)$ assuming there does *not* exist a subsequence $\|\log S_{n_k}\|$ tending to zero exponentially, we then give an upper bound for the irrationality exponent $\mu(\gamma)$ if such a subsequence *does* exist, provided both that its convergence rate is different from that of $d_{2n_k} I_{n_k}$, and that the sequence n_k is asymptotically linear.

VLADLEN TIMORIN, University of Toronto, Tornoto, Ontario M5S 3G3
[Tuesday December 10 / mardi le 10 décembre, 10:50 – Alta Vista]
Circles and Clifford algebras

We study smooth maps from an open subset of $\mathbf{R}^m$ to an open subset of $\mathbf{R}^n$ that take germs of straight lines to germs of circles. "Degenerate circles", *i.e.* lines or points, are counted as circles. We give a construction of such maps based on representations of Clifford algebras. It provides a complete purely geometric description of Clifford algebras representations in terms of circles.

NIPISSING UNIVERSITY

Faculty of Arts and Science

Mathematics

The **Department of Computer Science & Mathematics**, Nipissing University, invites applications for a three-year limited term appointment in **Mathematics** at the rank of assistant professor, beginning July 1 2003, subject to final budgetary approval. The successful candidate will possess a completed (or nearly completed) PhD in Mathematics, as well as superior communication skills and a strong commitment to excellence in both teaching and research. While preference will be given to applicants who specialize in Geometric Topology/Continuum Theory with a strong interest in Dynamical Systems, highly qualified candidates in other areas will also be considered. Mathematics is a growing program at Nipissing University. It is presently offered as a 3-year (single or combined) and honours (combined) major, with approval for the single honours major expected by spring, 2003. The successful candidate will thus have a unique opportunity to participate in the initial implementation of this program, including the supervision of upper year honours students in senior research projects which may coincide with the candidates own scholarly interests.

Salary levels are very competitive, and Nipissing offers an attractive benefits program. The university is located in a beautiful natural setting on an escarpment overlooking Lake Nipissing in North Bay. The city, which is located 3.5 hours from Toronto, has a population of 60,000 and is a major center of cultural activity in Northeastern Ontario. For more information on Nipissing University, visit www.nipissingu.ca.

While all qualified candidates are encouraged to apply, Canadians and Permanent Residents will be given priority. Nipissing University is an equal opportunity employer and in particular welcomes applications from women and aboriginal peoples. Consideration of applications will begin January 31, 2003 and continue until the position is filled.

A letter of application plus a research agenda, statement of teaching philosophy, curriculum vitae, three letters of recommendation (with at least one commenting on research potential and at least one commenting on teaching potential) and teaching evaluation summaries (if available) should be sent to:

Dr. Andrew P. Dean, Dean of Arts & Science
Nipissing University
100 College Drive
North Bay, Ont. P1B 8L7
e-mail andrewd@nipissingu.ca
Fax: (705) 474-3072

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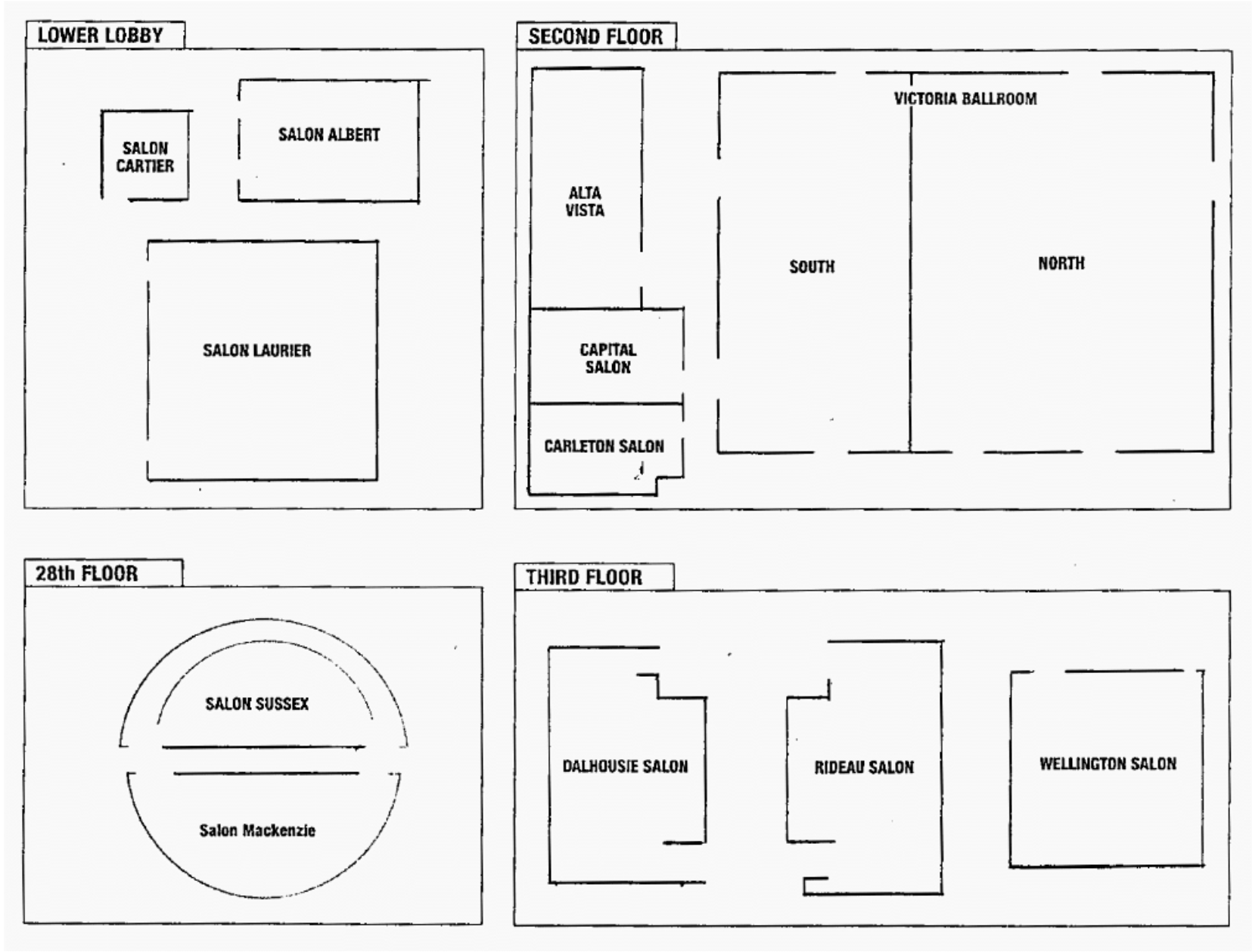
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