TABLE OF CONTENTS

TABLE OF CONTENTS **1**

A WORD FROM THE DIRECTOR **2**

PRESENTING THE CRM **4**

PERSONNEL **5**

SCIENTIFIC PERSONNEL **6**

Members 6

Postdoctoral Fellows 8

Visitors 9

MANAGEMENT **11**

Bureau 11

Advisory Committee 11

Computer Facilities 12

SCIENTIFIC ACTIVITIES **13**

Theme Year 1998-1999 13

Chaire Aisenstadt 20

General Program 22

CRM Prizes 27

Member's Seminars & Special Events 31

CRM-ISM Colloquium 36

COMING EVENTS **37**

Theme Year 1999-2000 37

General Program 1999-2000 43

Theme Year 2000-2001 45

General Program 2000-2001 49

Theme Year 2001-2002 50

RESEARCH PROGRAMS **51**

COLLABORATIONS **65**

INDUSTRIAL PARTNERSHIPS **67**

PUBLICATIONS **70**

Recent Titles 70

Previous Titles 71

Research Reports 74

FINANCIAL REPORT **77**

A WORD FROM THE DIRECTOR

This report is my first as Director of the CRM, and it has given me the opportunity to reflect somewhat on the nature of the ship of which I have taken over the helm, as well as to contemplate its record and its achievements.

The main result of this contemplation is that it is a remarkably fit and efficient ship. This is due in large measure to the remarkable efforts expended by my predecessors, in particular my immediate predecessor, Luc Vinet. Thanks to his efforts, and to those of the vigourous and efficient team surrounding him, the CRM now has stable funding for its activities; these activities, such as theme programs, general programs, publications, have expanded considerably, and several large new initiatives in industrial mathematics such as the ncm_2, Bell-LUB, and MITACS are now in place. The CRM is an extraordinary vehicle for the promotion of mathematics in all its protean guises, and indeed it has been performing these many functions with great effectiveness.

Last year was no exception. Let me begin by mentioning the core of our scientific programme, the theme year, which last year focused on number theory and arithmetic geometry. The scientific programme committee, under the inspired leadership of Ram Murty, gave us a year which I think is a model for those to come, combining scientific activities and training in a remarkable way. The year began with a bang in Banff, with a Summer School on the Arithmetic and Geometry of Algebraic cycles, which was a resounding success attended by 110 participants. The year then continued in earnest in Montreal, with a relatively modest number of workshops being compelemented by a stunningly effective series of short courses on focused topics given by experts in the field. The attendance was considerable, in particular because the organisers had assembled for the duration of the year a collection of a dozen postdoctoral fellows and twenty graduate students in the area, complementing the substantial Montreal contingent with visiting students from all over the country. This does not include participants who attended only some of the activities; in all, over 300 attended the activities of the year. In assembling this contingent, the CRM was greatly assisted by the Centre Interuniversitaire de Calcul Algébrique (CICMA).

The general programme was quite full, with twelve conferences being funded. The publications programme, was also very active : our two joint series with the American Mathematical Society continued to flourish and the CRM series in Mathematical Physics published by Springer-Verlag saw its first three volumes produced and manuscripts were submitted for the initial volumes of the CRM subseries of the Springer Lecture Notes in Statistics. Finally we had the honour of publishing the complete works of the eminent number theorist Sarvadaman Chowla. Our computer system got a major and much needed boost, thanks to a grant from the Canadian Foundation for Innovation.

It is on the industrial front that major developments occured. The big news was the funding of MITACS (Mathematics of Information Technology and Complex Systems) by the Canadian Networks of Centres of Excellence program. The proposal comprises about 21 projects, of which 5 are centred in Montreal. They are divided into five sectors: biomedical, trading and finance, information technology, commercial and manufacturing. The MITACS initiative will bring about a major realignment of the discipline's dynamics in the country, and in particular its relationship with other fields.

Meanwhile, in Montreal, the Network for Computation and Mathematical Modelling (ncm_2) finalised its agreement with Bell Canada to create the Laboratoire Universitaire Bell (LUB). The agreement provides money for research projects as well as an endowment fund, and is worth a total of $12M. The LUB launched its first series of research projects, of which five are located at the CRM, covering areas such as cryptography, imaging, data mining and quality of service in networks. The infrastructure for the LUB will be financed by an envelope of funds from Bell, several computer companies, the Quebec government and the Canadian Foundation for Innovation: this will allow the construction of two laboratories.

All in all, then, a busy year. The current year, as well as the ones to follow, will also be busy and replete with major challenges. The first one, of course, is to run all these networks and laboratories: the grant is only the beginning, and they must then be made to thrive, and to develop. A second is to expand and improve the CRM's links with its various partners, in particular the neighbouring universities. There

are many mutual gains through these associations, I believe, in particular in incorporating a greater pool of researchers into the CRM's scientific base. This pool of researchers who view the CRM as one of their scientific homes has always been one of our strengths, and I think that the development and structuring of this base is a priority for the coming years.

This is intimately tied to what I think is the most important challenge for the CRM. The coming years will see great changes in the personnel at our universities, as many of the faculty hired thirty years ago during the years of great expansion in the university system come up for retirement. This presents us with the opportunity of shaping our mathematical community for the years to come. The CRM hopes to participate fully in this process, so as to make it strong and vibrant. The interaction with this community is the central focus of our mission, as we serve it, enrich it and are enriched by it. People, in the end, are our greatest resource.

Jacques Hurtubise, Director

PRESENTING THE CRM

The Centre de recherches mathématiques (CRM) was created in 1969 by the Université de Montréal through a special grant from the NRC. It became an NSERC national research centre in 1984. It is currently funded by NSERC (Natural Sciences and Engineering Research Council), by the Government of Québec through the FCAR (Fonds pour l'aide et le soutien à la recherche) and the Université de Montréal, and by private donations. The mission of the CRM is to do research in mathematics and closely related disciplines and to provide leadership in the development of the mathematical sciences in Canada.

The CRM accomplishes its mission in several ways. As part of its national mandate,

- it organizes a series of scientific events each year, around a given theme (distinguished lecture series, workshops, conferences, summer schools, visitor programs, etc.);
- it has a general program which helps to fund conferences and special events across the country;
- each year it invites, through the Chaire Aisenstadt, one or two prestigious mathematicians, to give advanced courses as part of its thematic program;
- it awards three prizes yearly: the CRM-Fields Prize recognizing major contributions to mathematics, the Aisenstadt Prize given for outstanding work done by a young Canadian mathematician, and the CAP-CRM Prize for exceptional achievement in theoretical and mathematical physics;
- it publishes some 150 technical reports and 6-8 books per year. Some of its collections are published jointly with the AMS and with Springer Verlag;
- it has an extensive postdoctoral fellowship programme, with 20 postdoctoral fellows in place last year, funded either solely by the CRM or in partnership with other organisations;
- it informs the community of its activities through its web site at

  www.CRM.UMontreal.CA

- it participates, with the other two Canadian centres, in groundbreaking national initiatives such as the MITACS (Mathematics of Information Technology and Complex Systems) proposal. Another example is found in the National Program Committee which provides funding for offsite research activities.

This national mandate is complemented by, and indeed supported by, a long-standing vocation of promoting research in the Montréal area. Indeed the CRM

- supports, through partnership agreements, a local group of researchers chosen mainly from departments of mathematics and statistics, but also from departments of computer science, physics, economics, engineering, etc.;
- sponsors joint activities with the ISM (Institut des Sciences Mathématiques) including the weekly CRM / ISM colloquium, graduate courses offered by distinguished visitors and a program of postdoctoral fellowships.
- works actively at developing contacts with industry. Its joint activities with liaison and research centres (CERCA, CIRANO and CRIM) and research centres doing applied research (CRT, GERAD and INRS Télécom) led to the creation of the Network for Computing and Mathematical Modelling (ncm_2). This network is funded by NSERC and about 20 partners such as financial institutions, hightech companies and ministries. More recently, a contract has been signed with Bell Canada to form BUL (Bell University Laboratory) which will focus on the development of multimedia products.

The CRM fulfils its national mission by involving the largest possible number of Canadian mathematicians in its scientific programs, both as participants and as organizers. It also supports many events taking place outside Montréal and the Prov-ince of Québec. It is recognized worldwide as one of the major institutes in the mathematical sciences.

The director of the CRM is supported by two managerial structures: the Bureau and the Advisory Committee. The Advisory Committee is a prestigious group of internationally renowned mathematicians, both Canadian and non-Canadian, who approve scientific programs and thematic years, choose recipients of the CRM-Fields and Aisenstadt prizes, and suggest new scientific ventures to explore. The president of the Canadian Mathematical Society is a member *ex officio.*

PERSONNEL

The Director's Office

Luc Vinet	***Director***
Martin Goldstein	***Deputy Director***
Yvan Saint-Aubin	***Deputy Director***
Jacques Hurtubise	***Deputy Director***
Diane Poulin	***Secretary***

Administration

Béatrice Kowaliczko	***Head of Administration***
Vincent Masciotra	***Financial and Administrative Officer***
Michèle Gilbert	***Secretary***
Muriel Pasqualetti	***Secretary***

Scientific Activities

Louis Pelletier	***Coordinator***
Josée Laferrière	***Assistant Coordinator***
Diane Brulé-De Filippis	***Secretary***

Publications

André Montpetit	***TeX Expert***
Louise Letendre	***Technician***

Computer Services

Daniel Ouimet	***UNIX Systems Manager***
David Rand	***Web Master and Macintosh expert***

MITACS/MaTISC
(Mathematics of Information Technology and Complex Systems)

Yoshua Bengio	***Deputy Director***
Marie Pineau	***Business Development Officer***

SCIENTIFIC PERSONNEL

Since its foundation in 1969, the CRM has supported a wide variety of research in mathematics by having various members attached to it, either as research staff, or through exchange agreements with neighbouring universities and industries, or as long-term visitors. These people perform their research at the CRM, and their presence has brought many benefits. In particular, the CRM's national program is greatly facilitated by having on hand a large reserve of willing organisers, who have even contributed financially to the organisation of activities. The largest partnership is with the Université de Montréal, which gives annually the equivalent of 6 full-time teaching positions in release time to the CRM. The CRM has release agreements with the other Montréal area universities, providing for the equivalent of two more full time positions. Facilities are also provided to researchers attached to junior colleges. In addition, each year, a certain number of visiting researchers spend the year at the CRM and are given visiting member status. There are also members whose presence is due to industrial agreements with Atlantic Nuclear Services and Lockheed Martin.

Members

Ali, Syed Twareque	Concordia Univ.
Angers, Jean-François	Dép. de math. et de stat., Univ. de Montréal
Arminjon, Paul	Dép. de math. et de stat., Univ. de Montréal
Beaulieu, Liliane	Collège Rosemont
Bélair, Jacques	Dép. de math. et de stat., Univ. de Montréal
Bélair, Luc	Dép. de mathématiques Univ.du Québec à Montréal
Bengio, Yoshua	Dép. d'info. et de recherche opérationnelle, Univ. de Montréal
Bergeron Nantel	York University
Boyer, Steven	Dép. de mathématiques Univ.du Québec à Montréal
Broer, Abraham	Dép. de math. et de stat., Univ. de Montréal
Clarke Francis	Univ. de Lyon
Darmon, Henri	McGill University
Delfour, Michel	Dép. de math. et de stat., Univ. de Montréal
Dssouli, Rachida	Dép. d'info. et de recherche opérationnelle, Univ. de Montréal
Durand, Stéphane	Collège Édouard-Montpetit
Fournier, Richard	Collège Dawson
Fleischer, Isidore	Univ. of Windsor
Gagnon, Langis	Lockheed Martin Canada
Gauthier, Paul	Dép. de math. et de stat., Univ. de Montréal
Goldstein, Martin	Dép. de math. et de stat., Univ. de Montréal
Goulard, Bernard	Groupe PhysNum; Dép. de physique, Univ. de Montréal
Granas, Andrzej	Dép. de math. et de stat., Univ. de Montréal
Greiter, Cornelius	Dép. de math. et de stat. Univ. Laval
Grundland Michel	Univ. du Québec à Trois-Rivières
Harnad, John	Concordia Univ.
Hurtubise, Jacques	McGill Univ.
Hussin, Véronique	Dép. de math. et de stat., Univ. de Montréal
Joffe, Anatole	Dép. de math. et de stat., Univ. de Montréal
Kamran, Niky	McGill Univ.
Kisilevsky, Hershy	Dép. de math. et de stat., Concordia Univ.
Lalonde, François	Univ. du Québec à Montréal
Langlands, Robert	Institute for Advanced Study, Princeton
Léger, Christian	Dép. de math. et de stat., Univ. de Montréal
Lessard, Sabin	Dép. de math. et de stat., Univ. de Montréal
LeTourneux, Jean	Dép. de physique, Univ. de Montréal
Lina, Jean-Marc	CRM Univ. de Montréal
McKay, John	Concordia University
Mathieu, Pierre	Dép. de physique Univ. Laval
Nekka, Fahima	Faculté de Pharmacie Univ. de Montréal
Patera, Jiri	Dép. de math. et de stat., Univ. de Montréal
Perron, François	Dép. de math. et de stat., Univ. de Montréal
Rahman, Qazi	Dép. de math. et de stat., Univ. de Montréal
Rogers, Colins	Univ. of New South Wales Australia
Rosenberg, Ivo	Dép. de math. et de stat., Univ. de Montréal
Rousseau, Christiane	Dép. de math. et de stat., Univ. de Montréal

Roy, Roch	Dép. de math. et de stat., Univ. de Montréal	Valin, Pierre	Lockheed Martin Canada
Sabidussi, Gert	Dép. de math. et de stat., Univ. de Montréal	van Vliet, Carolyne	Univ. of Florida
Saint-Aubin, Yvan	Dép. de math. et de stat., Univ. de Montréal	Vinet, Luc	Dép. de physique, Univ. de Montréal
Sankoff, David	Dép. de math. et de stat., Univ. de Montréal	Winternitz, Pavel	Dép. de math. et de stat., Univ. de Montréal
Schlomiuk, Dana	Dép. de math. et de stat., Univ. de Montréal	Yatracos, Yannis	Dép. de math. et de stat., Univ. de Montréal
Shahbazian, Elisa	Lockheed Martin Canada	Yui, Noriko	Dép. de math. et de stat., Queen's Univ.
Sharp, Robert	McGill Univ.	Zolésio, Jean-Paul	Institut non linéaire de Nice
Soumis, François	GERAD		
Stern, Ron	Concordia Univ.		

Postdoctoral Fellows

Each year the CRM receives several postdoctoral fellows. The source of their funding can be a national program like the NSERC postdoctoral program, the NATO international program administered by NSERC, the CRM (alone or with the ISM or the Fields Institute), or personal grants from the members. Since 1993-1994 we have added to this list the CRM industrial program which, in association with its ncm_2 partners, now offers postdoctoral fellowships, as the MITACS program began to do last year. We have also included below the joint CICMA/CRM fellows who participated in the thematic year's activities.

Aassila, Mohammed	Univ. Louis Pasteur et C.N.R.S.	Oppenheim, Henri	C.E.R.M.I.C.S. (ENPC)
Abdeljelil, Farhat	Université de Tunis, (MITACS)	Perron, Sylvain	École Polytechnique de Montréal, (MITACS)
Anderson, Parreira,	Ecole Polytechnique de Montréal, (MITACS)	Rajaei, Ali	Princeton Univ.
Bracken, Paul	Univ. of Waterloo	Rousseau, Guillaume	Univ. of Toronto, (MITACS)
Bryant, Dave	Univ. of Canterbury	Saint-Cyr, Amik	Univ. de Montréal
Caprioglio, Myriam	Systèmes Électroniques Lockheed Martin Canada	Saint-Jean, Philippe	Univ. de Montréal
Chen, Imin	McGill Univ.	Schaefer, Carsten	McGill Univ., (MITACS)
De Guise, Hubert	Univ. de Toronto	Schweizer, Andreas	Concordia Univ.
Derakhchan, Katayoun	Institut de cardiologie de Montréal (MITACS)	Sebbar, Abdellah	State University of New York at Stony Brook
Deteix, Jean	Univ. de Montréal	Shinagawa, Kaori	Institut de cardiologie de Montréal (MITACS)
Hadjar, Ahmed	École Polytechnique de Montréal, (MITACS)	Spiteri, Raymond	Univ. of British Columbia
Huan, Min Yi	McGill Univ., (MITACS)	Stojkovic, Goran	École Polytechnique de Montréal, (MITACS)
Jurco, Branislav	Palacky Univ.	Tateno, Katsumi	McGill Univ., (MITACS)
Kagabo, lssa	Polytechnique, (MITACS)	Tekogan, Hemazro	École Polytechnique de Montréal, (MITACS)
Lesage, Frédéric	Systèmes Électroniques Lockheed Martin Canada	Villeneuve, Daniel	École Polytechnique de Montréal, (MITACS)
Madrane, Aziz	Univ. de Montréal	Zabrocki, Mike	Univ. du Québec à Montréal
Muzy, Jean-François	Centre de Recherches Paul Pascal (CNRS)	Zaugg, Philippe	CNRS, LAPP
Nagai,Yoshihiko	McGill Univ., (MITACS)	Ziarati, Koorush	HEC, (MITACS)
Nagih, Anass	HEC		

Visitors

Each year the CRM receives a large number of visitors. Most of these are here to participate in scientific activities: in the year 1998-99, 340 participants registered for workshops run solely by the CRM. In addition, the CRM helped fund 12 other scientific events. The following list does not include any of these, but only those who visited for longer periods, ranging from over a week to several months.

Adhikari, Sukumar Das	Mehta Research Institute
Atakishiyev, Natig	IIMAS-UNAM (Mexico)
Bacry, Emmanuel	École Polytechnique, Paris
Banks, Bill	Univ. of Missouri
Benali, Habib	CHU, Pitié-Salpêtrière
Bertolini, Massimo	Univ. di Pavia
Chandrasekher, Madhav	Univ. of Illinois at Urbana-Champaign
Chen, Huaihui	Nanjing Normal Univ.
Cho, Yong-Min	APCTP
Choi, Seung-Il	Univ. of Michigan
Christopher, Colin	Bogazici Univ.
Coleman, Mark David	UMIST
Conte, Robert	CEA - Saclay
Dorodnitsyn, Vlad, D.	Russian Academy of Sciences (Moscow)
Dumortier, Freddy	Limburgs Universitair Centrum, Belgique
Elliott, George A.	Univ. of Toronto & Univ. of Copenhagen
Ferapontov, Evgeny	Technische Universität Berlin
Fernandez, David J.	CINVESTAV IPN
Françoise, Jean-Pierre	Univ. Paris VI
Fu, Lei	Nankai Univ.
Gardeyn, Francis	Universiteit Gent
Gazeau, Jean-Pierre	Univ. Paris VII
Giroud, Patrick	Univ. Joseph Fourier
Gomez, Nicolas	INRIA
Gomez-Mont, Xavier	Guanajuato, Mexico
Gordon, Brent	Univ. of Oklahoma
Goresky, Mark	Institute for Advanced Study
Granville, Andrew	Univ. of Goergia
Gross, Benedict	Harvard Univ.
Havlicek, Miloslav	Faculty of Nuclear Sc. and Physics Eng. (Czech Republic)
Henry, Jacques	INRIA-Rocquencourt
Iovita, Adrian	Univ. of Washington
Ito, Hiroyuki	Tôhoku Univ. & Harvard Univ.
Kaloshin, Vadim	Princeton Univ.
Kani, Ernst	Queen's Univ.
Korotkin, Dmitri	Max Planck Institut
Kudla, Stephen	Univ. of Maryland
Kunisawa, Takashi	Sciences Univ. of Tokyo
Lemire, Frank	Univ. of Windsor
Levi, Decio	Universita di Roma
Lewis, James D.	Univ. of Alberta
Lieman, David	Univ. of Missouri
MacPherson, Robert D.	Institute for Advanced Study
Mahaffy, Joseph	San Diego State Univ.
Mardesic, Pavao	Univ. de Bourgogne
Martina, Luigi	Univ. de Lecce
Masakova, Zuzana	Faculty of Nuclear Sc. and Physics Eng. (Czech Republic)
Mestre, Jean-François	Univ. Paris VII
Moody, Robert V.	Univ. of Alberta
Mourtada, Albelraouf	Univ. de Bourgogne
Murnaghan, Fiona	Univ. of Toronto
Murty, Kumar	Univ. of Toronto
Murty, Ram	Queen's Univ.
Musette, Micheline	Vrije Universiteit Brussel
Ng, Nathan	Univ. of British Columbia
Nikolaev, Igor	Institute of Mathematics, Moldavie
Odzijewicz, Anatol	Univ. of Warsaw
Ohyama, Yousuke	Osaka Univ.
Oort, Frans	Universiteit Utrecht
Ota, Kaori	Tsuda College
Patera, Jan	Czech Technical Univ.
Pelantova, Edita	Faculty of Nuclear Sc. and Physics Eng. (Czech Republic)
Phan, Quoc Khanh	Vietnam National University - HCM City
Picinbono, Bernard	École Supérieure d'Électricité et Université de Paris-Sud
Pogosyan, Georges	Joint Institute for Nuclear Research (Dubna)
Posta, Severin	Czech Technical Univ.
Raghunathan, Ravi	Caltech
Raghuram, Anantharam	Tata Institute
Rajan, Conjeeveram S.	Tata Institute of Fundamental Research
Ribenboim, Paulo	Queen's Univ.
Ribet, Kenneth A.	Harvard Univ.

Roche, Philippe	MIT et École Polytechnique (Palaiseau, France)	Terras, Audrey A.	Univ. of California, San Diego
		Thalmann Nadia	Univ. de Genève
Roussarie, Robert	Univ. de Bourgogne	Thomova, Zora	SUNY-Institute of Technology
Rowe, David	Univ. of Toronto		
Saidak, Filip	Queen's Univ.	Tuszynski, Jacek A.	Univ. of Alberta
Saito, Masahiko	Kobe Univ.	Verger-Gaugry, Jean-Louis	Université J. Fourier
Schwartz, Laurent	Membre de l'Académie des sciences, Paris	Vicher, Anne	Université Paris V
Sheftel, Misha B.	North-Western Correspondence Polytechnical Institute (St.Petersburg, Russia)	Vivolo, Olivier	Laboratoire Emile Picard, UPS
		Zakrzewski, Wojciech J.M.	Univ. of Durham
Skinner, Chris	Harvard Univ.	Zhang, Yuanli	Purdue Univ.
Sorba, Paul	LAPP	Zhedanov, Alexei	Donetsk University
Souriau, Jean-Marie	Univ. de Provence		
Steer, Brian	Oxford College		

MANAGEMENT

Bureau

The Bureau consists of members from the Université de Montréal (8 to 11 members) and from the outside (2 to 5 members). The rector of the Université and the dean of the Faculté des arts et des sciences are represented on the Bureau. Its role is to adopt the policies of the Centre, to recommend the nomination and the promotion of researchers and the appointment of regular members, to advise the director on the preparation of the budget and the Université on the choice of the director.

Bergeron, François	UQAM
Brassard, Gilles	Univ. de Montréal
Caillé, Alain	Vice-recteur à la recherche, Univ. de Montréal
Cléroux, Robert	Univ. de Montréal
Goldstein, Martin	Dir. adj., CRM, Univ. de Montréal
Habashi, Wagdi G.	Univ. Concordia
Hubert, Joseph	Vice-doyen à la rech., FAS, Univ. de Montréal
Hurtubise, Jacques	McGill Univ.
Hussin, Véronique	Univ. de Montréal
Jeffrey, Lisa	Univ. of Toronto
Lessard, Sabin	Univ. de Montréal
Ransford, Thomas J.	Univ. Laval
Rousseau, Christiane	Univ. de Montréal
Roux, Benoît	Univ. de Montréal
Saint-Aubin, Yvan	Dir. adj., CRM, Univ. de Montréal
Vaillancourt, Jean	Univ. de Sherbrooke
Vinet, Luc	Directeur, CRM, Univ. de Montréal

Advisory Committee

The Advisory Committee is constituted of distinguished researchers from Canada and abroad. Its members are either mathematicians or scientists with close ties to the mathematical sciences. The rector of the Université de Montréal or his representative and the director of the CRM also take part in the meetings. The Advisory Committee is informed periodically of the activities of the Centre, through the director, and transmits any advice that it deems relevant to the Bureau.

Bengio Yoshua	Univ. de Montréal
Goldstein Martin	Univ. de Montréal
Hambleton Ian	McMaster Univ.
Hurtubise Jacques	McGill Univ.
Kane Richard	Univ. of Western Ontario
Lalonde François	UQAM
Lawless Jerry	Univ. de Waterloo
Melrose Richard	MIT
Miller Willard	IMA
Murty Ram	Queen's Univ.
Odlyzko Andrew	AT&T Labs
Pianzola Arturo	Univ. of Alberta
Putnam Ian	Univ. of Victoria
Saint-Aubin, Yvan	Univ. de Montréal
Treves Francois	Rutgers Univ.
Ward Michael	Univ. of British Columbia

Computer Facilities

The CRM offers to its members and visitors a Unix environment based on a Sun Enterprise-450 equipped with four 400-MHz Ultra-Sparc processors and 2 Gb of memory as a main server, and a secondary server Sun Sparc-1000 with eight 40-MHz processors and 384 Mb of memory for lightweight tasks. This computing power is distributed through the offices and common rooms via more than 30 Sun workstations (from Sparc-4 to Ultra-10) and several X-terminals. The software libraries include compilers (SparcWorks environment for C, C++ and Fortran, GNU compilers, Java, etc.), symbolic manipulation programs (Mathematica, Maple, Macaulay), several text editors, web browsers, a web server, mail tools, and most utilities common to the mathematical world (SPLUS, etc.). Upgrades to TeX and its dialects are uploaded whenever they are released.

In 1999, the CRM installed its own private local area network (LAN) : four BayNetworks Baystack-450 switches, twisted-pair and optic fiber links supporting 10/100 Mb/s and Gigabit Ethernet. This private local network is linked to the network of the Université de Montréal that maintains the connections with RISQ (Réseau interordinateurs scientifique québécois) and CA*net (the Canadian internet transit service).

Since the end of 1998, it is now possible for our users and guests to access our local network with phone link through our new PPP server and its 4 modems.

The CRM also has a Silicon Graphics Challenge L with six R4400 processors at 100MHz and 128 Mb of memory, purchased through the NSERC grant of one of its research teams. Access to this server is limited to the members of that team or, upon request, to other members with numerical processing needs. The support staff works on Sun stations, X-terminals or on Macintoshes tied to the Sun server for all services, such as mail and backups.

In 1998, the CRM installed its servers in a new room specifically designed for computers, with indepedent controlled environment and UPS (Uninterruptible Power Supply).

**The main server (Enterprise-450), 22 Sun workstations Ultra-5 and Ultra-10 and the complete Local Area Network installed in 1999 were all paid by a grant from the Canadian Foundation for Innovation together with the Government of the Province of Quebec and a donation (20% of total value) from Sun Microsystems (for computers) and Anixter (for the network).*

SCIENTIFIC ACTIVITIES

The core of each year's scientific program at the CRM is its thematic program. The topic is chosen by the Advisory Committee for its scientific importance, its timeliness, and its impact on the Canadian scientific community. Preceding years' topics include: Probability and Stochastic Control (1992-93); Dynamical Systems (1993-94); Geometry and Topology (1994-95); Applied and Numerical Analysis (1995-96); Combinatorics and Group Theory (1996-97), Statistics (1997-98). A year's activities can combine a good number of workshops and conferences, one or two Aisenstadt chairs, a certain number of visiting scientists in residence, and some post-doctoral fellowships. Typically, there is some coordination with Montréal universities to offer appropriate graduate courses in order to help graduate students participate in the activities. The reports are presented in the language in which they were submitted.

Theme Year 1998-1999 : Number Theory and Arithmetic Geometry

Overview

Number theory is at the core of mathematics. It has been a rich source of research problems that have given rise to fundamental concepts in many parts of mathematics. The CRM has played an active role in promoting research in this area: the thematic year 91-92 was related to number theory and was organized by Ram Murty and earlier, during the spring of 1988, Robert Langlands and Dinakar Ramakrishnan held a workshop at the CRM on the zeta functions of Picard modular surfaces. Both the thematic year and the workshop were extremely successful, not only in terms of the number of participants and of their quality, but also of their legacy: four important publications came out of them (Elliptic Curves and Related Topics, CRM Proceedings and Lecture Notes, Vol. 4; Theta Functions, CRM Proceedings and Lecture Notes, Vol.1; Introduction to Abelian Varieties, Kumar Murty, CRM Monograph series, Vol. 3; The Zeta Functions of Picard Modular Surfaces, eds. R. P. Langlands, D. Ramakrishnan, Les Publications CRM) and several recent results can be traced back to them.

In 1994, Andrew Wiles resolved the 350 year old problem of Fermat's Last Theorem. This work has introduced a new universe of methods into the subject that needs to be understood, simplified and explained so that further problems may be solved.

It was the aim of the CRM thematic year 98-99 to address this need. The format of the year emphasized both research and teaching. Number theory is an extremely wide area and most universities cannot offer the many specialized courses necessary to provide young students with a sound basis. It was consequently thought that the following format would better serve the needs of the community: six seminar courses (given for the benefit of graduate students and postdoctoral fellows), ten mini-courses (presenting more specialized research topics), five research workshops and three conferences, including a summer school in Banff. The seminar courses and mini-courses were offered with the idea of preparing for and/or supplementing the research workshops. Students participating in the seminar courses received university credit toward their programs.

It is safe to say that perhaps the most successful aspect of the special year were the courses and mini-courses which drew a large audience of faculty, postdoctoral fellows, graduate students, and even undergraduates students. These courses creating an atmosphere of almost continuous and lively activity in number theory in Montreal.

8th CRM Summer School at Banff: *The Arithmetic and Geometry of Algebraic Cycles*

7-23 June, Banff (Alberta)

Org. : James D. Lewis (Univ. of Alberta), Noriko Yui (Queen's), Brent Gordon (Univ. of Oklahoma), Stefan Muller-Stach (Universitat Essen), Shuji Saito (Tokyo Institute of Technology).

The purpose of the Summer School was to bring together two mathematical schools under the same umbrella, namely those that study algebraic cycles from an arithmetic point of view, and those that approach the subject geometrically. This interaction was strikingly successful - both schools benefiting from the presence of the other. For a student learning the subject of algebraic cycles, the conference offered

the unique opportunity to view the depth of this subject in its entirety.

A full and in-depth account of the arithmetic and geometry of algebraic cycles was offered, ranging from introductory courses on the subject by the leading experts to discussions of the latest developments in the fields. Several points of view were considered, including arithmetic methods, transcendental methods, topological methods, and motives and K-theoretic methods.

There were a series of lectures given by V. Voevodsky, and one by H. Gillet aimed at discussing the topology of algebraic varieties from the point of view of motives. D. Zagier's lectures and also that of N. Yui were aimed at discussing the relation between algebraic cycles and L-series, as well as a discussion of polylogarithms and more generally regulator maps. S. Bloch and H. Esnault discussed their recent work of the application of Chern-Simons invariants to algebraic cycles via the study of algebraic vector bundles with algebraic connection.

A recurring theme in this conference was the notion of a higher regulator map, often referred to as the arithmetic Abel-Jacobi map by others interested in the arithmetic aspects of the subject. This is very important for studying cycles on arithmetic varieties, and number of results along these lines was discussed in the lectures of W. Raskind, C. Schoen, D. Ramakrishnan, J. Nekovar and J.-L. Colliot-Thélène.

Two of the more striking lecture series were those given by M. Green and S. Saito. Both lecturers discussed higher regulators, one approach being geometric and the other arithmetic. It was later discovered was that both approaches (arithmetic/geometric) to regulators were essentially the same when computed infinitesimally. Much of this was centered around the elusive Bloch-Beilinson filtration, for which U. Jannsen was able to provide us with a more precise conjectural description.

Some explicit example calculations of the images of real regulator maps were provided by J. Lewis and B. Gordon.

Four lectures were delivered by invited speakers everyday, followed by sessions of contributed talks. Many informal discussions and working sessions involving small groups were organized by individual participants.

The NATO ASI/CRM SUMMER SCHOOL provided a unique opportunity for two camps of mathematicians participating together at the same conference, and gaining so much by this interaction. There will be two publication series produced, published by Kluwer academic publishers :

- The CRM Summer School Proceedings on the Arithmetic and Geometry of Algebraic Cycles.
- The NATO ASI Proceedings on the Arithmetic and Geometry of Algebraic Cycles.

Main Lectures

- Spencer Bloch (University of Chicago) *Algebraic cycles and differential forms* (2).
- Jean-Louis Colliot-Thélène (Université de Paris-Sud), *Local-global principle for zero-cycles on conic bundles.*
- Hélène Esnault (Universität Essen), *A remark on Bolibruch's theorem.*
- Pawel Gajer (Johns Hopkins University), *Geometry of Deligne cohomology.*
- Henri Gillet (University of Illinois at Chicago), *Motives for arithmetic varieties.*
- B. Brent Gordon (University of Oklahoma), *Indecomposabe Bloch--Quillen cycles.*
- Mark Green (UCLA), *Algebraic cycles and Hodge theory (3).*
- Uwe Jannsen (Universität zu Köln), *Equivalence relations on algebraic cycles (2).*
- Manfred Kolster (McMaster University), *The Lichtenbaum conjectures revisited.*
- Andreas Langer (Universität Münster), *Zero-cycles on Hilbert-Blumenthal surfaces.*
- James D. Lewis (University of Alberta), *Remarks on indecomposable motives.*
- Stefan Müller-Stach (Universität Essen), *Algebraic cycle complexes.*
- Jacob P. Murre (University of Leiden), *On cycles on abelian varieties.*
- V. Kumar Murty (University of Toronto), *Hodge cycles on abelian varieties.*
- V. Kumar Murty (University of Toronto), *Hodge cycles on abelian varieties.*
- Jan Nekovar (University of Cambridge), *p-adic Abel-Jacobi maps and p--adic heights.*
- Dinakar Ramakrishnan (California Institute of Technology), *Zero cycles on surfaces (3).*
- Wayne Raskind (University of Southern California), *Higher Abel-Jacobi mappings and filtrations on Chow groups.*
- Masahiko Saito (Kobe University), *Prepotentials of Yukawa couplings of certain Calabi-Yau 3-folds and lattice Theta functions.*
- Shuji Saito (Tokyo Institute of Technology), *Filtrations on Chow groups and higher Abel-Jacobi maps (3).*
- Takeshi Saito (University of Tokyo), *Modular forms p-adic Hodge theory.*
- Chad Schoen (Duke University), *Cycle class maps for nullhomologous cycles on a variety over a finite field.*

- Anthony Scholl (University of Durham), *Algebraic cycles and modular forms.*
- Christopher Soulé (IHES), *Perfect forms and the Vandiver conjecture.*
- Vasudevan Srinivas (Tata Institute), *Zero cycles on singular varieties.*
- Bert van Geemen (Universita'di Pavia), *Cycles on abelian fourfolds.*
- Vladimir Voevodsky (Northwestern University), *Motivic cohomology (2).*
- Noriko Yui (Queen's University), *The L-series, periods, and special values of L-series of certain Calabi--Yau varieties.*
- Don Zagier (Max-Planck-Institut), *Polylogarithms, elliptic polylogarithms, periods and L—values (3).*
- Yuri Zarhin (Pennsylvania State University), *Semistable reduction of abelian varieties and inertia groups.*

Workshop on algebraic modular forms and modular forms mod p

2-8 October, 1998
Org. : H. Darmon (McGill)

La dernière décennie a connu l'émergence d'une "philosophie de Langlands modulo p" qui lie les représentations galoisiennes aux formes modulaires mod p. L'atelier sur les formes modulaires algébriques et les formes modulaires mod p qui s'est déroulé au CRM du 2 au 8 octobre 1998 s'est penché sur deux développements récents qui s'inscrivent dans ce cercle d'idées: la théorie des "formes modulaires algébriques" de Gross, et les progrès sur les conjectures de Serre qui découlent des travaux récents de Ribet, Taylor et Wiles. Trois séries de conférences ont été organisées autour de ce thème.

1. B. Gross (Harvard) a donné trois heures d'exposé sur les Formes modulaires algébriques, et trois de ses anciens étudiants (Lansky, Pollack, et Padowitz) ont donné des exposés d'une heure chacun sur des sujets connexes.
2. K. Ribet (UC Berkeley) a donné cinq heures de conférences sur le sujet des congruences entre formes modulaires, où il a expliqué la démonstration de son célèbre résultat sur la conjecture de Serre qui établit un lien entre le théorème de Fermat et la conjecture de Shimura-Taniyama.
3. S. Kudla (Maryland) a donné trois heures d'exposé sur la formule de Siegel-Weil. De plus, l'atelier a joui de la participation active d'un grand nombre de conférenciers invités: Kevin Buzzard (Cambridge), Wee Teck Gan (Princeton), Ali Rajaei (McGill, Concordia et CICMA), Kamal Khuri-Makdisi (McGill et CICMA), Gisbert Wustholz (ETH), Ernst Kani (Queen's), Shuzo Takahashi (Harvard), et Eyal Goren (Concordia, McGill et CICMA).

Il y avait environ 50 participants inscrits à l'atelier dont de nombreux étudiants venant de Montréal et de plusieurs universités canadiennes et américaines.

Workshop on analytic number theory

23-28, October 1998
Org. : R. Murty (Queen's)

The workshop brought together leading experts in analytic number theory with the purpose of exposing the latest methods and results in the field.

The most notable of the lectures was that of Iwaniec where he announced an improvement of estimates of Dirichlet L-functions on the critical line Re(s)=1/2. His work involves new methods applicable in a more general context and are significant because they improve work of Burgess of the 1950's. There were also excellent lectures by Gonek, Friedlander, K. Murty, R. Murty, A. Zaharescu, Y. Petridis, A. Akbary, S. Adhikari, F. Sica, K. Dilcher, C. Stewart, C. S. Rajan, R. Raghunathan, M. Nair, and J. Hoffstein.

The meeting also brought together students and scholars from across Canada and around the world and enabled them to discuss topics of current research. It also gave opportunity for many postdocs to expose their work which they normally are unable to do in general meetings.

CMS Winter Meeting : *Special Session in Number Theory*

13-15 December 1998, Queen's, Kingston, Ontario
Org. : R. Murty and N. Yui (Queen's)

A. Akbary (Concordia University), *On the distribution of the values of symmetric square L-functions in the half plane Re(s) > 3/2.*
Henri Darmon (McGill University), *Modularity of hypergeometric abelian varieties*.
Eyal Goren (CICMA Concordia and McGill University), *Stratifications of moduli spaces and modular forms*.
C. Greither (Université Laval), *On Bruner's conjecture.*
James Huard (Canisius College, Buffalo), *An arithmetic reciprocity relation of Liouville type and applications.*
Hershey Kisilevsky (Concordia University), Henri Darmon's *Coxeter-James prize.*
Manfred Kolster (McMaster University), *Higher relative class number formulas.*
Arne Ledet (Queen's University), *Some small 2-groups as Galois groups.*
C. Levesque (Université Laval), *Explicit solutions of a family of Thue diophantine equations.*
Kumar Murty (University of Toronto), *Zeros of Dedekind zeta functions in towers of fields.*

W. Georg Nowak (Universität für Bodenkultur, Austria), *Large convex domains sometimes contain more lattice points than we would expect.*
Yannis Petridis (McGill University), *Zeros of the Riemann zeta function and central values of L-series of holomorphic cusp forms.*
D. Roy (University of Ottawa), *Criteria of algebraic independence and approximation by hypersurfaces.*
Gary Walsh (University of Ottawa), *Old and new results on quartic diophantine equations.*
Hugh Williams (University of Manitoba), *Computer verification of the Ankeny-Artin-Chowla conjecture for all* $p < 5.10^{10}$.
Kenneth Williams (Carleton University), *Values of the Dedekind eta function at quadratic irrationalities.*

De plus trois conférences ont été données par Chantal David, Jacek W. Frabrykowski and G. Frei.

Workshop on representations of reductive p-adic groups

9-13 May 1999
Org. : F. Murnaghan (Univ. of Toronto)

There were 16 hour long lectures. Most of the topics of interest in current research in the representation theory of *p*-adic groups were discussed in at least one of the talks. Summaries of the lectures are given below, grouped according to topic under one of five areas.

The Bruhat-Tits building in harmonic analysis and representation theory

- Allen Moy (University of Michigan), *A new proof of the Howe conjecture on group distributions via the Bruhat-Tits building.*
- Stephen DeBacker (University of Chicago), *The utility of G-domains.*
- Jeff Adler (University of Akron) *Buildings, filtrations and wild ramification.*
- Jiu-Kang Yu (Princeton University), *Construction of tame supercuspidal representations*
- Clifton Cunningham (University of Massachusetts), *Kazhdan-Lusztig sets via orbital integrals and the Bruhat-Tits building.*

Parabolic induction

- Alan Roche (Purdue University), *Parabolic induction and the Bernstein center.*
- David Goldberg (Purdue University), *On the tempered spectrum of quasi-split unitary groups.*
- Chris Jantzen (Ohio State University), *Discrete series for classical groups.*
- Yuanli Zhang (CRM), *L-packets and irreducibilities.*

Depth zero representations

- Lawrence Morris (Clark University), *Hecke algebras and parabolic induction.*
- Mark Reeder (Boston College), *Euler Poincaré pairings and elliptic representations.*

The theta correspondence

- Gordan Savin (University of Utah), *Symplectic-orthogonal theta lifts of generic discrete series.*
- David Manderscheid (University of Iowa), *Quadratic base change for p-adic* SL_2 *as a theta correspondence.*
- Brooks Roberts (University of Idaho), *Zeta integrals for the symplectic group.*

Distinguished representations

- Aloysius Helminck (University of North Carolina), *On representations associated with p-adic reductive symmetric varieties.*
- Fiona Murnaghan (University of Toronto), *Distinguished tamely ramified supercuspidal representations of* GL_n.

Workshop on arithmetical algebraic geometry

14-18 May, 1999.
Org. : M. Goresky (IAS) and K. Murty (Univ. of Toronto)

The Workshop on Arithmetical and Algebraic Geometry was held from May 14 to May 18, as part of the theme year in Number Theory and Arithmetic Geometry. It was organized by Kumar Murty and Mark Goresky. Participants came from across Canada and the United States, and most lectures had an audience of 30 to 35 present.

Since the subject matter covered a wide range of topics, and since a number of graduate students were attending the workshop, speakers made a special effort to address their lectures to a wide audience and to attempt to deliver survey talks.

Concurrent with these sessions, Professor F. Oort (Utrecht) delivered the Aisenstadt Chair Lecture and a follow-up minicourse on his proof of a conjecture of Grothendieck, while Professor Goresky gave a 5-lecture series on the geometry of modular varieties.

Several participants of the workshop (including the organizers, R. MacPherson of the Institute for Advanced Study in Princeton, and A. Terras from UCSD) took advantage of the hospitality of the CRM and extended their visit for the full month of May, thereby overlapping with the preceding workshop (on reductive p-adic groups) and the following workshop (on Moonshine). Many individual discussions and informal meetings took place during this period.

Moonshine workshop

29 May to 4 June 1999
Org. : J. Mckay (Concordia)

A very successful workshop was held at CRM. There were 25 speakers and many local visitors. Particularly in evidence were the Japanese mathematicians.

The talks ranged over many topics which appear closely related to moonshine; there were talks on Hirzebruch's "Prize Question"- Does

there exist a compact closed 24-dimensional "Monster manifold" with the Monster action and certain characteristic number restrictions? This talk by Baker was nicely complemented by one by his student Brightwell, who has constructed a manifold for the Suzuki sporadic group.

John Conway talked on the early history of moonshine and the extent to which it has been explained.

Dolgachev gave a talk on connections with surfaces (Kummer, Hessian, and cubic), their algebraic geometry, and mysterious connections with the Leech lattice.

The mysteries of the Mirror map and its relation to moonshine functions were expounded by Doran.

Glauberman adumbrated what seems known of the relations between the affine E_8 Dynkin combinatorics and the Monster and some subgroups.

Griess described his new theoretical foundations of the Leech lattice and its combinatorics.

Harada sketched his proposal for a re-examination of the Sylow 2-subgroups of simple groups.

Kaneko described number theoretic results on modular forms and j-invariants.

Shigeyuki Kondo sketched his recent work on Mukai's classification of automorphisms of K3 surfaces and their connections with Niemeier lattices.

C.H. Lam constructed moonshine vertex operator algebras from a tensor product based on a coset decomposition of the Leech lattice.

Li talked on regular representations of vertex operator algebras.

Dong & Mason surveyed results in conformal field theory and modular invariance.

Hoehn gave a survey of his work on super VOAs and connections with the baby monster group.

McKay and Sebbar described connections between Hecke operators and the Schwarz derivative and how they can be used to characterize the j-function and replicable functions.

Miyamoto talked on both modular invariance of the trace on multivariate vertex operator algebras (VOAs) and on the automorphism group of holomorphic framed VOAs.

Norton discussed irrational moonshine.

Ohyama described how to convert defining Schwarz differential equations for Haupt modules into non-associative commutative algebras derived from dynamical systems.

Kyoji Saito discussed his work on eta products and the signs of the q-coefficients.

Simons gave an account of his work with Conway on presentations for bimonster and related groups.

Tuite discussed his recent results on genus two conformal field theory.

Verrill gave an account of her work on Picards-Fuchs equations and Beauville surfaces and the modular forms which arise.

Yui discussed several examples of mirror maps of lattice polarized K3 surfaces and the functions attached to them.

Wednesday was free for trips to Quebec City and elsewhere. A photo of the participants was taken with a digital camera and was up on the web for viewing in a few hours!

There was plenty of interaction among the participants and the workshop was considered a great success.

Proceedings will appear under the CRM series logo, published by the AMS.

6th Conference of the CNTA

20-24 June 1999, Winnipeg, Manitoba
Org . : J. Borwein (SFU), D. Boyd (UBC), C. David (Concordia), R.Murty (Queen's), C. Stewart (Univ. of Waterloo), H. Williams (Univ. of Manitoba).

The Canadian Number Theory Association (CNTA) was founded in 1987 at the International Number Theory Conference at Laval University. The purpose of the CNTA is to enhance and promote learning and research in Number Theory, particularly in Canada where we already have a great deal of strength in this area. To advance these goals the CNTA has now organized six major international conferences, which have succeeded in exposing many Canadian students, faculty and researchers to the latest ideas in number theory worldwide, and provided further opportunities for Canada's best and brighest to exhibit their talents and ideas to a global audience. The focus of CNTA was mainly on the following areas : combinatorial / computational number theory, analytic number theory, diophantine problems and arithmetic geometry. All of these areas have seen rapid development in recent years, both in Canada and internationally.

For CNTA 99 there were 8 plenary one-hour talks and 17 invited 40 minute talks. The plenary speakers were : H. Darmon (McGill), J. Friedlander (Toronto), E. Goren (McGill) A. Granville (Georgia), P. Sarnak (Princeton), W. Schmidt (Colorado), C. Skinner (Princeton), and T. Wooley (Michigan). These were chosen on the basis of the importance of their recent and past work and their undoubted stature as internationally recognized number theorists.

They presented knowlegeable survey lectures concerning recent progress in their respective fields. The 17 invited speakers were selected to represent the themes of the conference and did so very effectively. To mention just a few of these talks, A. Odlyzko gave a very nice survey of his recent work in computing the zeros of the Riemann zeta function, D. Bressoud gave a very nice account of the alternating sign matrix conjecture, A. Bremner gave a beautiful presentation of his work on magic squares and elliptic curves, C. Greither provided a lovely account of his work on generalizing the Redei-Reichardt theorem and M. Harper gave the first proof of a very important result: Z[sqrt(14)] is Euclidean. There were also 40 contributed talks organized in 8 sessions representing a particular theme of the conference. These talks were very strong, and in some cases, outstanding. In particular. The talk of K. Williams on bounding the size of the least solutions of diatonal quadratic equations come to mind, but there were many others. The talks were all very well attended. It should also be mentioned that it was at this meeting that the first Ribenboim medal was presented. This is a prize which was recently established by the CNTA to honour distinguished research in number theory ; it is awarded, in conjunction with a CNTA meeting, to a mathematician who is either Canadian or who has maintained close connections to Canadian mathematics. The winner this time was Andrew Granville, a former Ph. D. student of P. Ribenboim from 1984-87. He also presented the Ribenboim Lecture. This was an account of his joint work with Soundararajan on how large or small character sums can be, both conjecturally and unconditionally, and how their values are distributed in the complex plane.

Seminar Courses

Modular forms and the Birch and Swinnerton-Dyer conjecture

September 1998 to March 1999
Lecturer : Henri Darmon (McGill and CICMA)

The goal of this seminar was to survey the recent progress on the Birch and Swinnerton Dyer conjecture which follows from the work of Kolyvagin and Wiles. In particular we tried to present a complete proof of the following statement: Let **E** be an elliptic curve over **Q** whose **L** at **s=1**. Then the Mordell-Weil group **E(Q)** is finite.

Elliptic and Hilbert Modular forms

September 1998 to March 1999
Lecturer : Eyal Goren (CICMA, Concordia & McGill)

The purpose of the course was to introduce the participants to the theory of modular forms, in particular the theory of modular forms of several variables with respect to the modular group GL_2(R), where R is the ring of integers of a totally real field. Emphasis was put on characteristic p methods, with applications to congruences between special values of L functions.

The first semester concentrated on the fundamental theory of abelian varieties and algebraic tori, on line bundles and polarizations, and on the theory of moduli of abelian varieties over the complex numbers and over a general field. Methods for studying abelian varieties over a general field were introduced and demonstrated by many applications. Included were Serre-Tate coordinates and Honda-Tate theorem.

The second semester focused on congruences and the relation to geometry of Hilbert modular varieties in positive characteristic. Partial Hasse invariants and their applications to congruences and geometry. Serre and Katz work on p-adic modular forms and its extension to totally real fields were discussed.

The second semester of the course was fused with a mini-course on the theory of deformation of abelian varieties in positive characteristic (leading, in particular, to proof of the basic properties of the stratification by Goren and Oort).

Notes of the two courses and the minicourse will appear on the AMS-CRM lecture notes series.

The Chebotarev density theorem and some applications

October 1998
Lecturer : Kumar Murty (Univ. of Toronto)

The Chebotarev Density Theorem is a fundamental tool in number theory and arithmetic geometry. Effective versions of this theorem and some of its applications were discussed.

An Introduction to Sieve Methods

November 1998
Lecturer : Ram Murty (Queen's)

This short course surveyed sieve methods and some of its applications. After looking at the sieve of Eratosthenes, the sieve methods of Brun, Selberg and Linnik were discussed. Then applications of these methods to such questions as Artin's primitive root conjecture, squarefree

values of polynomials, and structure of the group of points mod p of a global elliptic curve were discussed. The course consisted of a total of six lectures.

Mini-courses

Several two-week mini-courses were offered.

Iwasawa Theory of Modular Forms
September 1998
Lecturer : Massimo Bertolini (Universita di Pavia)

Ordinary Representations and Modular Forms
October 1998
Lecturer : Chris Skinner (Institute for Advanced Study)

Rankin-Selberg L-functions
November 1998
Lecturer : C.S. Rajan (Tata Institute)

Modular Forms and Modular Curves
January 1999
Lecturer : Imin Chen (CICMA, Concordia & McGill)

Automorphic forms over function fields
January 21, 26, 28 and February 2, 1999
Lecturer : Andreas Schweizer (CICMA, Concordia & McGill)

Topics in p-adic Galois representations
February 1999
Lecturer : A. Iovita (CICMA, Concordia & McGill)

Hilbert modular varieties
February 18 and March 2, 1999
Lecturer : Eyal Goren (CICMA, Concordia & McGill)

The spectrum of multiplicative values

The distribution and extreme values of L-functions
March 1999
Lecturer : Andrew Granville (Georgia)

Polynomial constructions, Galois theory and elliptic curves
March 1999
Lecturer : Jean-François Mestre (Paris VII, Jussieu)

Representations of reductive p-adic groups
April 1999
Lecturer : Fiona Murnaghan (Toronto)

Chaire Aisenstadt

The Chaire Aisenstadt was endowed by Montréal philanthropist Dr. André Aisenstadt. Under its auspices, one or two distinguished mathematicians are invited each year for a period of at least one week, ideally one or two months. During their stay the lecturers present a series of courses on a specialized subject. They are also invited to prepare a monograph. At the request of Dr. Aisenstadt, the first of their lectures should be accessible to a wide audience. Previous holders of the Chaire Aisenstadt are: Marc Kac, Eduardo Zarantonello, Robert Hermann, Marcos Moshinsky, Sybren de Groot, Donald Knuth, Jacques-Louis Lions, R. Tyrell Rockafellar, Yuval Ne'eman, Gian-Carlo Rota, Laurent Schwartz, Gérard Debreu, Philip Holmes, Ronald Graham, Robert Langlands, Yuri Manin, Jerrold Marsden, Dan Voiculescu, James Arthur, Eugene B. Dynkin, David P. Ruelle, Robert Bryant, Blaine Lawson, Yves Meyer, Ioannis Karatzas, László Babai, Efim I. Zelmanov, Peter Hall and David Cox.

The CRM was honoured to have as Aisenstadt chairholder, during the 1998-99 Theme Year in Number Theory and Arithmetic Geometry, Frans Oort of the Utrecht Universiteit .

Professor Frans Oort
(Universiteit Utrecht)
May 4, 18, 20, 25, 27 and 28, 1999

Professor Frans Oort has spent the better part of his professional and private life in his native Holland. Immediately after obtaining his masters' degree from the Leiden University in 1958, he began his doctoral studies at the same institution under the direction of W. T. van Est and J. P. Murre. He continued these studies in Pisa (1959-60) under A. Andretti and in Paris (1960-61) under J.-P. Serre, returning to Leiden to receive his Ph. D. (cum laude) in 1961. The period in Paris proved to be a decisive one for his mathematical career. It was at this time that he assimilated the then developing language of schemes and modern algebraic geometry, and his interest in geometry over arbitrary fields crystallized. This is witnessed in one of his earliest works: Commutative group schemes (LNM 15).

The next sixteen years were spent at the University of Amsterdam, where he became a full professor in 1967. In 1977 he moved to Utrecht University, where he remains to this day. Professor Oort has traveled widely andvisited deparments and institutes all over the mathematical world, including his receiving the 1999 Aisenstadt Chair from the CRM in Montreal. From 1966 to 1982 he was managing editor of *Compositio Mathematica,* and is currently an editor of several others.

Frans Oort is an algebraic geometer. The bulk of his work pertains to the study of geometry over fields of positive characteristic and of moduli spaces. Continuing the work of Grothendieck, Mumford and Deligne, he was a pioneer in the study of abelian varieties, their moduli spaces, and ensuing questions on group schemes. Following fundamental work by Y. Manin, Frans Oort studied moduli of abelian varieties in positive characteristic, and he is largely responsible for most of the knowledge we have on the special features of these varieties, that play a fundamental role in arithmetic algebraic geometry and number theory.

In trying to put Professor Oort's numerous research papers and books in perspective, we would like to mention in particular his works on stratification of moduli spaces (some with collaborators) by Newton polygons and by structure of the first deRham cohomology; his characterizations and deep study of supersingular and superspecial abelian varieties; his works on p-divisible groups (Cayley-Hamilton and Catalogues); his study of special loci (hyperelliptic, Torelli, etc.) and lifting problems (CM, endomorphism, Jacobians), and his work on group schemes and deformation problems. His works are always characterized in their balance between general theory and concrete questions. An interplay that was instrumental in his contribution to making those objects and the special attributes they have, familiar and understood. Besides his direct contributions to mathematical knowledge, Professor Oort is well known for producing a line of leading mathematicians, and for his tremendous influence on the development of mathematics in The Netherlands.

In his Montreal Notes, Grothendieck included a letter to Barsotti in which he announces a conjecture. In this course I will present a proof for this conjecture. To every p-divisible group (also called a Barsotti-Tate group) in characterstic p one can attach

a discrete invariant, its Newton Polygon. Grothendieck showed that under specialization Newton Polygons "go up"; his conjecture says that, conversely, for a given p-divisible group, and a given "lower" Newton Polygon such a specialization should be possible.

My main interest comes from the study of moduli spaces of abelian varieties in positive characteristic. These spaces have an incredibly rich structure. Several properties can be studied by "going to the boundary" (a useful method in algebraic geometry), by which we mean in this case that the abelian variety does not degenerate at all, but that the p-structure becomes more special. The Grothendieck conjecture (in the polarized case) tells us exactly which strata should be in the boundery of a given stratum.

In proving this conjecture one encounters the problem that the variation of the Newton Polygon under a deformation is very difficult to follow (this is why it took us so long to give a proof for this reasonable conjecture). I shall explain this in several ways in my course. This causes that a direct approach to the problem does not seem to lead anywhere. My proof consists of several very different stages, each of them developing very interesting new techniques.

In my course I shall define, study and prove : Finite group schemes, p-divisible groups and deformation theory. Moduli of abelian varieties. A conjecture by Manin ("every symmetric Newton Polygon is algebraizable"). This conjecture by Grothendieck. Techniques involving "catalogues" (a new, useful notion). Study various strata in many different moduli spaces and catalogues. Determine the structure of Newton Polygon strata (dimension, irreducibility, etc.).

In my first course (May 14) I shall review definitions and results. In my second (May 18) I shall sketch ingredients used and the main lines of the proofs. The first two lectures give a complete survey of methods and results. I shall try to make these 6 lectures accessible for a wide audience (although, on some occasions I am using advanced methods).

In each of the last four courses (May 20-28) I shall concentrate on a particular, interesting aspect. Catalogues will be introduced and discussed. Some combinatorial problems have to be solved. A mixture of deep algebraic geometry and easy computations will be presented, eventually leading to a complete understanding of this complex of problems, giving a rather precise description of the spaces involved. A. Grothendieck, Groupes de Barsotti-Tate et cristaux de Dieudonné. Sém. Math. Sup., Univ. Montréal, (Presses Univ. Montréal, 1974.)

General Program

The CRM's general program funds a wide variety of scientific events, both on-site and around the country. The program is quite flexible, to allow for opportunities as they arise. Following the cancellation of the NSERC conference grant program, the CRM, along with the other Canadian mathematics institutes, is responsible for funding conferences across Canada.

Congress of the Statistical Society of Canada

31 May-3 June 1999, Univ. of Sherbrooke
Org. : L-P Rivest (Univ. Laval)

The CRM was the official sponsor of a session entitled "Special session of the Centre de recherche mathematiques: Analysis of Shape" featuring H. Le (University of Nottingham), I. Dryden (University of Leeds) and K. Worsley (McGill University).

Summer Meeting of the Canadian Mathematical Society: *Special session : Relativity & Geometry*

13 - 15, June 1998 Univ. of New Brunswick, Saint John
Org. : Jacques Hurtubise and Niky Kamran (McGill)

This special session consisted of 12 lectures.

Maung Min-Oo (McMaster University), *Mass, scalar curvature and K-area*.
Charles P. Boyer (University of New Mexico), *Contact geometry and Einstein manifolds*.
Roger Bielawski (Max Planck Institute, Germany), *T^n-invariant hyperkähler 4n-manifolds.*
Andrew Dancer (McMaster University), *Einstein metrics of cohomogeneity one.*
Paul Ehrlich (University of Florida), *Bochner's technique for compact Lorentzian manifolds (after A. Romero and M. Sanchez)*.
Marek Kossowski (University of South Carolina), *Characteristic classes for pseudo Riemannian manifolds with volume-resolvable metric singularities.*
Hans-Peter Künzle (University of Alberta), *SU(n)-Einstein-Yang-Mills fields in sphericaly symmetric and cosmological space-times.*
McKenzie Y. Wang (McMaster University), *The cohomogeneity one Einstein equations.*
Rob Milson (McGill University), *Realization of reflection quotients by singular metrics.*
Conrad Hewitt (St Jerome's University), *Three dimensional symmetry groups in cosmology*.

Two lectures were given by G. Weinstein and A. Coley as well.

Formal Power Series and Algebraic Combinatorics'98

15-19, June 1998.
Org. : N. Bergeron, Walter Whiteley (York) and Frank Sottile (Univ. of Toronto)

The Formal Power Series and Algebraic Combinatories Conference (FPSAC) was held in Toronto on the University of Toronto campus with talks at the Koffler Institute, and poster sessions and software demonstrations at the Fields Institute.

The conference had financial assistance from a number of sources including the centre de recherche mathematiques in Montreal, the Connaught fund of the University of Toronto, the Fields Institute, York University, and individual NSERC research grants. Logistical support for the conference was provided by the Fields Institute and it was organized by Nantel Bergeron and Walter Whitely of York University and Frank Sottile of the University of Toronto.

The Scientific program consisted of 9 hour long invited addresses by P. Diaconis (Stanford), P. Dehornoy (Paris), C. Godsil (Waterloo), J. Y. Thibon (Paris), B. Sturmfels (Berkeley), K. Ono (Penn. State), B. Derrida (Paris), G. Benkart (Wisconsin) and P. Cameron (England). There was also 27 contributed talks, 24 posters presented in 2 sessions, and 3 software demonstrations.

The invited speakers were from the USA, France, England, and Canada, and represented areas of mathematics, statistics, and physics related to the themes of the conference. The contributed talks, posters, and software demonstrations were refereed by the program committee, which also selected the invited speakers. The program committee was chaired by Ian Goulden of the University of Waterloo and included Bergeron and Sottile, as well as 20 others from Europe, North America, and Asia. There were 136 registered participants from many countries, including Canada, Russia, the USA, Japan, France, Switzerland, Hong Kong, England, Korea, Italy, Germany, Australia, Austria, Israel, Slovenia, Sweden, and Mexico. This included 44 graduate students.

Over all, the organizing committee feels the conference was a success. We had a strong scientific program, due in part to the extensive refereeing of contributions. The facilities of the

Fields Institute and the lecture room at the Koffler Institute facilitated the presentations. The financial assistance we received enabled us to invite distinguished speakers and help support a large number of young mathematicians.

ISMB '98: Sixth International *Conference on Intelligent systems for Microbiology*

28 June-1 July, 1998
Org. : Janice Glasgow, (Queen's)

The Sixth International Conference on Intelligent Systems for Molecular Biology (ISMB '98) was held in Montreal, Canada from June 28-July 1, 1998. As with the previous ISMB conferences, this meeting provided a general forum for disseminating the latest developments in bioinformatics. ISMB is a multidisciplinary conference that brings together scientists from computer science, molecular biology, mathematics and statistics. Its scope includes the development and application of advanced computational methods for biological problems. The relevant computational techniques included machine learning, pattern recognition, knowledge representation, databases, string algorithms, statistical analysis, genetic algorithms, information theory, hidden Markov models, logic programming, linguistic methods, constraint satisfaction, and data compression. Biological areas at the forefront of the conference were molecular structure, gene prediction, sequence alignment and analysis, molecular function, simulation environments, modeling protein repeats, docking, threading and and phylogenetics. The emphasis of the conference was on the validation of methods using real data sets, on practical applications in the biological sciences, and on the development and application of novel computational techniques. The level of interest in ISMB '98 was high. The call for papers produced a record number of 92 submissions. All papers were rigorously reviewed by members of a distinguished program committee, and the program was assembled based on their recommendations. This selection process was very competitive and resulted in 25 high-quality papers that appear in the proceedings, which were published by AAAI Press. The conference was truly international with authors of accepted papers representing 12 countries and 4 continents. There was also record breaking attendance at ISBM '98: 413 attendees registered including representatives from government and university (176), industrial participants (135), students (96) and exhibitors (6).

ISMB is well known for its poster session and its introductory tutorial program. There were 11 tutorials, with a total enrollment of 559 (note that some participants attended more than one tutorial). Tutorial topics included protein evolution, comparative genomics, molecular phylogenetics, machine learning and knowledge discovery. In total, there were 96 posters presented during an afternoon session on the second day of the conference. The conference was held concurrently with a workshop on Ontologies for Molecular Biology. This meeting focussed on several aspects of the schemata, controlled vocabularies and ontologies for bioinformatics.

In order to encourage and reward student participation in the conference, student awards were introduced. Malcolm Casale, from the University of California, Irvine, was presented with the Best Student Paper Presentation and Carolyn Allex, from the University of Wisconsin, won for the Best Student Poster Presentation. These awards were made possible by a donation from Glaxo Wellcome. The conference also facilitated student participation by making available travel awards that were made possible by the generous sponsorship of several industrial and government agencies.

Three keynote addresses were presented by eminent scientists: Robert Cedergren, from the University of Montreal, gave a talk on "Fishing for Function in RNA Form and Features"; Michael Waterman, from the University of Southern California, spoke on the topic of "Constructing Restriction Maps", and Shoshana Wodak, from the European Bioinformatics Institute, gave a presentation on "Database Derived Potentials for Prediction of Protein Structure and Stability".

For the first time, ISMB was under the official sponsorship of the International Society for Computational Biology (ISCB). The mission of this society is the advancement of the scientific understanding of living systems through computation; its emphasis is on the role of computing and informatics in advancing molecular biology. Information on ISCB can be found at its web site (http://www.iscb.org). The conference was also held in cooperation with the American Association for Artificial Intelligence (AAAI).

Along with the high quality program of the conference, attendees were able to enjoy social events that included a welcoming reception and a boat cruise on the St-Lawrence River. The conference was timed so that many of the participants could attend the world famous Montreal Jazz festival, which took place immediately following the meeting.

International Conference on Operator Theory and its Applications to Scientific and Industrial Problems

October 7 - 11, 1998, Winnipeg
Org. : P.N. Shivakumar (Univ. of Manitoba)

The scope of the conference topics was broad: it included theoretical aspects of linear and nonlinear operator theory and its applications to numerical analysis, biology, physics and engineering sciences. Scientific and industrial problems can often be formulated in terms of differential and integral equations. There were many talks on various aspects of the theory and applications of such equations. At the suggestion of the National Science Foundation (USA), sessions were held to discuss directions of research in the field as well as to formulate some open problems.

Among the participants were internationally known specialists: D. Alpay, Y. Alber, J. Ball, G. Elliott, F. Gesztesy, E. Khruslov, A. Ramm, P. Rejto, F. Rofe-Beketov, B. Silbermann, H. de Snoo, V. Strauss, V. Trenogin, N. Voitovich, N. Young, and many other prominent specialists and young researchers.

There were several mini-symposia organized by internationally known specialists: on biomathematics, on ill-posed problems, on mathematical problems in solid mechanics, on operator evolution equations, on non-standard inverse problems arising in electrodynamics. The participants of the conférence came from North and South America, Europe and Asia. Large groups came from the fSU (Russia, Ukraine, Armenia), Japan, Israel and Spain. There were also groups of participants from Germany, Great Britain, The Netherlands and Italy. There were several junior participants and Ph.D students among the participants and financial help was given to them.

Due to the financial crisis in Russia, it was necessary to buy air tickets for some of the Russian participants. The Conference was supported by the Fields Institute ($5,000), CRM ($5,000) and the National Science Foundation (US $15,000) .

There is an agreement with the Fields Institute that a volume with these papers will be published by the Fields Institute jointly with the American Mathematical Society. P.N. Shivakumar, A.G. Ramm and A. Strauss are the Editors for the Proceedings.

The IIMS (Institute of Industrial Mathematical Sciences) at the University of Manitoba organized the Conference, and its Director, Dr. P.N. Shivakumar, was the chair of the local organizing committee and the chairman of the conference. The participants expressed gratitude to the NSF, the Fields Institute, CRM and IMA and to the organizers of the conférence at the closing of the conférence on October 11, 1998. A follow up Conference on Inverse Problems was discussed and is expected to take place in 2000.

Atelier sur les méthodes algébriques et géométriques en théorie des champs de vecteurs

13-19 January 1999
Org. : C.Rousseau and D. Schlomiuk (UdeM)

Cet atelier a regroupé plusieurs chercheurs oeuvrant sur différentes méthodes algébriques et géométriques en théorie des champs de vecteurs et permis des échanges sur le sujet. Parmi les thèmes abordés les problèmes de finitude du nombre de cycles limites d'un champs de vecteurs ont reçu une attention particulière, tant au niveau des champs de vecteurs du plan (conférences de F. Dumortier, V.Kaloshin, A. Mourtada, R. Roussarie, C. Rousseau, D. Schlomiuk et H. Zhu) que des champs de vecteurs dans l'espace (conférences de L.-S. Guimond et V. Kaloshin). Le thème de l'étude des points singuliers en dimension supérieure a été couvert avec la conférence de P. Mardesic et le colloque de X. Gomez-Mont auquel ont assisté beaucoup d'étudiants. Le dernier thème majeur de cet atelier a été celui de l'intégrabilité avec les conférences de C. Christopher et J.-P. Françoise.

Les conférences les plus marquantes de l'atelier ont été la conférence d'A. Mourtada et les conférences de V. Kaloshin, ces conférences témoignant d'une percée de premier plan dans le sujet et les participants de l'atelier ont beaucoup discuté avec ces deux conférenciers des détails des résultats présentés. L'atelier a accueilli la soutenance de thèse de L.-S. Guimond, thèse effectuée en cotutelle entre l'université de Montréal et l'université de Bourgogne (Dijon). L'étudiant Zhu a pu profiter de l'expertise de F. Dumortier et R. Roussarie pour la poursuite de sa thèse. Enfin la présence de tous ces visiteurs a permis de nouvelles collaborations entre A. Mourtada et D.Schlomiuk d'une part et entre C. Christopher, P. Mardesic et C. Rousseau d'autre part.

VI/QCAV'99 Conference: *Vision Interface and Quality Control by Artificial Vision*

18-21 May 1999, Trois-Rivières
Org. : F. Nouboud (UQTR)

La 12ième édition de la conférence Vision Interface (VI) a eu lieu à Trois-Rivières, Québec, Canada, du 18 au 21 mai 1999 conjointement avec la 5ième édition de la conférence Quality Control by Artificial Vision (QCAV). VI/QCAV'99 a été un grand succès avec 220 participants provenant de plus de 23 pays et 150 présentations arbitrées par deux comités internationaux. En plus des sessions orales et d'affiches arbitrées, une session poster spéciale a été organisée pour les étudiants de deuxième et troisième cycles.

La participation du milieu industriel à ces deux conférences fût importante et s'est traduite par la tenue de deux ateliers spéciaux durant cet événement. Le premier atelier, Industry Researchers Link Up, était parrainné par CIPPRS (Canadian Image Processing and Pattern Recognition) et le NRC (National Research Council of Canada). Le second atelier, relié au projet international HUTOP (Human Sensory Factors for Total Production Life Cycle) a été organisé par une équipe de chercheurs universitaires et industriels du Japon.

Deux comptes-rendus arbitrés (VI et QCAV) ont été publiés ainsi qu'un disque compact. Les conférences VI/QCAV'99 se sont avérées être un succès grâce au support et la collaboration des nombreux partenaires impliqués dans ces conférences.

Colloque NOTERE' 98 (Nouvelles Technologies de la Répartition)

20-24 October, Univ. de Montréal
Org. : Rachida Dssouli (UdeM), Petre Dini (CRIM), Michel Kadoch (Université du Québec ETS)

C'est la deuxième édition du Colloque international sur les Nouvelles Technologies de la Répartition. La première édition a eu lieu à Pau (Novembre 97). Après l'ère de la programmation structurée, des modèles en couches et des réseaux de communication, l'informatique répartie est déjà bien rentrée dans une autre ère, celle des objets, des plates-formes, de la transparence et de la banalisation des réseaux de communication. Après un règne florissant et riche en production scientifique, normative et technologique, le modèle OSI et ses diverses variantes, ont déjà fait place à de nouveaux modèles, architectures et environnements, pour le développement d'applications réparties: DCE, ODP, CORBA, OLE, JAVA, WEB, etc.

- Les thèmes spécifiques à cette édition sont:
- Les aspects formels de la répartition
- Architectures et développements d'applications réparties dans des domaines spécifiques
- Aspects spécifiques de la gestion des applications réparties
- Ingénierie d'applications réparties:
- Applications distribuées dans les environnements mobiles.

27th Annual Canadian Conference on Operator Theory and Operator Algebras

20-24 May, 1999, Prince Edward Island
Org. : Gordon MacDonald

The 27th Canadian Operator Theory Symposium was held May 20-May 24, 1999 at the University of Prince Edward Island in Charlottetown, Prince Edward Island. Over 50 researchers were in attendance. The following papers were presented:

Blecher, David, Univ. of Houston
Noncommutative functional analysis and noncommutative spaces
Choi, Man-Duen, Univ. of Toronto
Re-encounters with numerical ranges
Davidson, Ken, Univ. of Waterloo
Isometric dilations of non-commuting n-tuples and representations of the Cuntz algebra
Dean, Andrew J., Univ. of Toronto
Stable relations and continuous fields
Drissi, Driss, Kuwait Univ.
On operators satisfying Kreis-Ritt resolvent condition
Elliot, George, Univ. of Toronto
On the possible role of algebraic K-theory in classification theory
Fialkow, Lawrence, SUNI-New Paltz
The quartic complex moment problem
Rulman, Igor, Univ. of Calgary
Ideals in non-selfadjoint algebras associated to semidynamical systems
Ge, Liming, Univ. of New Hampshire
Convex bodies, covering numbers and free entropy
Gong, Guihua,
Classification of simple inductive limit C-algebras*
Han, Deguang, McMaster Univ.
Adensity result for projective unitary representations
Hadwin, Don, Univ. or New Hampshire
Completely rank-nonincreasing linear maps
Handelman, David, Univ. or Ottawa
Matrices of positive polynomials
Haworth, Paul, Lancaster Univ.
Characterisation of separable operator algebras
Holbrook, John, Univ. of Guelph
Big problems with small matrices
Kribs, David, Univ. or Waterloo
Isometric dilations of non-commuting finite rank n-tuples
Kumjian, Alex, Univ. of Nevada
C-Algebras of higher rank graphs*
Larson, David, Texas A & M Univ.
Operator algebras and wavelets
Livshits, Leo, Colby College

On band algebras
Marcoux, Laurent, Univ. of Alberta
Lie structures in operator algebras
Mohebi, Hossein, Dalhousie Univ.
Best approximation in reflexive subspaces of L (X, Y)
Nikolaev, Igor, CRM, Univ. de Montréal
Glimm algebras over S^1
Power, Stephen, Lancaster Univ.
Approximately finitely acting operator algebras
Radjavi, Heydar, Dalhousie Univ.
On semigroups of non-negative operators (in other sense)
Rosenthal, Peter, Univ. of Toronto
Inequalities for spectral radII of products
Tang, Wai Shing, National Univ. of Singapore
Multiwavelets in Hilbert spaces
Toms, Andrew,
On perforated ordered K_0 groups of simple and commutative C-algebras*
Vasilevski, Nikolai, CINVESTAV del I.P.N.
Toeplitz operators on the unit disk with radial symbols
Yahaghi, Reza, Dalhousie Univ.
On simultaneous triangularization of commutants
Zorboska, Nina, Univ. of Manitoba
Essentially normal composition operators

CRM Prizes

CRM/Fields Prize

In 1994 the Centre de Recherches Mathematiques (CRM) and the Fields Institute announced the creation of a new prize to be awarded for exceptional contributions to the mathematical sciences. The recipient of the prize is chosen by the Comite consultatif of the CRM and the Scientific Advisory Committee of the Fields Institute according to the criterion of excellence in research. The prize consists of both a $5 000 award and a medal, and the winner is required to give a lecture at the CRM and the Fields Institute. The past recipients are: H.S.M. Coxeter, G.A. Elliot, J. Arthur, and R.V. Moody; this year's winner is Stephen A. Cook.

The CRM / Fields Prize for 1998 was awarded to Professor Stephen A. Cook of the University of Toronto. Professor Cook works primarily in the field of computational complexity which is the study of the inherent difficulties in computer calculation. He is probably most well known for a result which first appeared in his 1971 paper "The Complexity of Theorem Proving Procedures" and which is now known simply as "Cook's Theorem". This result established, by means of an elegant construction, the existence of the first NP-complete problem. It stimulated considerable further research, much of it by R.M. Karp. For their efforts Professors Cook and Karp were both awarded the Turing Prize.

Professor Cook has also made significant contributions to the fields of the structure of abstract complexity classes, models of parallel computation, and mathematical logic.

Stephen A. Cook received his doctorate from Harvard University in 1966. After a four year stay at the University of California at Berkeley, as assistant professor, he joined the faculty of the University of Toronto where he is currently Professor in the Department of Computer Science, Honorary Professor in the Department of Mathematics and "University Professor". To mention just a few of his numerous honours, he has held Steacy and Killam Fellowships, he is a member of the Royal Society of Canada and the National Academy of Sciences of the United States, as well as numerous other honorary societies both foreign and domestic. Professor Cook has given many invited addresses including a plenary lecture at the International Congress of Mathematicians in 1998.

The following is Professor Cook's resume of the CRM / Fields Prize Lecture which he gave at the CRM on November 19, 1999:

"We present an historical overview of computational complexity theory. The emphasis is on the importance, plausibility, and difficulty of the conjecture that P is not equal to NP, which Steve Smale listed as one of the top three mathematical problems for the next century."

André-Aisenstadt Prize

Created in 1991, the André-Aisenstadt Mathematics Prize is intended to recognize and reward talented young Canadian mathematicians. The Prize, which is given for research achievement in pure and applied mathematics, consists of a $3000 award. The recipient is chosen by the CRM Advisory Committee. At the time of nomination, candidates must be Canadian citizens or permanent residents of Canada, and no more than seven years from their Ph.D. The previous winners of the André-Aisenstadt Prize were: Niky Kamran(1991); Ian Putnam (1992); Michael Ward and Nigel Higson (1994); Adrian S. Lewis (1995); Henri Darmon and Lisa Jeffrey (1996) ; Boris Khesin (1997).

The CRM took great pleasure in awarding the 1998 Andre Aisenstadt Prize to Professor John Toth from McGill University.

Professor Toth is one of the leading young microlocal analysts in the world. His has done fundamental work on the asymptotic concentration of eigenfunctions of quantum completely intégrable Laplacians. This work has important implications for inverse spectral theory on Riemannian manifolds. He has also developed a deep and fascinating link between semiclassical analysis and a geometric "law of large numbers" for parametrized families of Riemannian metrics of positive Ricci curvature.

John Toth obtained his B.Sc in 1988 and his M.Sc in 1989, both from McMaster University.

He then moved on to MIT where he obtained his Ph.D. under the direction of Victor Guillemin in 1993. From 1993 to 1995, he was a Benjamin Peirce Instructor at Harvard. He joined McGill University as an Assistant Professor in the Fall of 1995.

Professor Toth presented a lecture at the CRM on October lst 1999, entitled, *Concentration phenomena in semiclassical analysis*. A summary of his talk follows :

Let (M,g) be a compact, C^∞ Riemannian manifold and Δ, the associated Laplace-Beltrami operator. One of the main objectives of semiclassical analysis is the study of the connection between the spectral asymptotics of Δ and the geometry of the geodesic flow on the cosphere bundle, S^*M. Over the past thirty years, there has been a great deal of work devoted to this question principally in terms of trace formulae for the reduced wave operator, $U(t)= exp(it\sqrt{\Delta})$ and the related Weyl asymptotics for the spectral counting function, $N(\lambda) = \#\{\lambda_j \in Spec(\Delta); \lambda_j \leq \lambda\}$ as $\lambda \to \infty$. However, comparatively little is known about the asymptotics of the corresponding eigenfunctions. In the first part of the talk, I discussed recent results on the asymptotic concentration of Laplace eigenfunctions in the case where Δ is quantum completely integrable. I then gave some implications for inverse spectral theory.

In the second part, I linked semiclassical analysis to a geometric ``Law of Large Numbers'' for families of Riemannian manifolds of increasing dimension and positive Ricci curvature. To do this, I showed how questions involving semiclassical concentration phenomena arise naturally when considering the dimensional limits of Gromov and Milman.

CRM-CAP Prize

The CRM-CAP Prize is given for outstanding contributions to theoretical and mathematical physics. Previous winners were Werner Israel of the University of Alberta (1995), William G. Unruh of the University of British Columbia (1996), Ian Affleck of the University of British Columbia (1997), and J. Richard Bond of CITA of the University of Toronto (1998).The 1999 CRM-CAP prize has been awarded to David J.Rowe.

The Canadian Association of Physicists (CAP) and the Centre de recherches mathématiques (CRM) are pleased to announce that the 1999 CAP-CRM Prize in Theoretical and Mathematical Physics will be awarded to David J. Rowe, Professor at the University of Toronto, for developing a microscopic foundation for the models and theories of nuclear collective states by the application of elegant techniques from group theory and mathematical analysis.

Together with his students and associates, Dr. David J. Rowe has been able to develop a detailed picture of important system, based on the underlying properties of the protons and neutrons that form the nucleus. In doing so, he also developed a number of new mathematical tools that have used to explain other classes of phenomena.

Rowe's research has introduced many techniques of modern mathematics into physics, a strategy that allowed him to make significant steps in the development of modern nuclear theory. Understanding the atomic nucleus has been considered an intractible problem, as it involves simultaneously describing the behaviour of hundreds of particles, all interacting strongly under the force that binds together the nucleus. Rowe's contributions have enabled us to view this system as literally a fluid, albeit one with unusual properties. The mathematical techniques he has introduced have found application in many other areas of physics, especially in those cases where the underlying patterns or symmetries of the system change. Rowe's impact on theoretical physics has therefore extended far beyond the original scope of his work on the structure of the atomic nucleus.

Prof. Rowe received B.A.s in 1959 from Cambridge University and Oxford University. In 1962, he obtained his M.A. from Oxford University as well as a D. Phil (Thesis: "Studies of Nuclear Structure using Medium Energy Protons"). After spending a year as a lecturer at a Royal Air Force Radio School, Dr. Rowe worked as a Ford Foundation Fellow at the Neils Bohr Institute followed by a three years with the Atomic Energy Research Establishment (Harwell). He was a Research Associate at the University of Rochester from 1966-68 and joined the faculty at the University of Toronto as an Associate Professor in 1968. He became full Professor in 1974. He was elected a Fellow of the Royal Society of Canada in 1986.

Dr. Rowe has received a number of honours, including an A. P. Sloan Fellowship (1972), the Rutherford Memorial Medal (1983) of the Royal Society of Canada, Fellowship in the Royal Society of Canada (1986) and an Isaac Walton Killam Senior Research Fellowship from 1990-92.

The annual CAP-CRM Prize in Theoretical and Mathematical Physics was first introduced in 1995. Dr. Rowe will receive the 1999 Prize during the CAP's awards banquet to be held at the University of New Brunswick on June 8th, 1999.

Statistical Society of Canada Prize

The CRM-SSC Prize in Statistics is a new joint prize awarded yearly by the Centre de recherches mathématiques (CRM) and the Statistical Society of Canada in recognition of outsanding contributions to the Statistical Sciences during the recipient's first 15 years after earning a doctorate. The CRM-SSC Prize in Statistics consists of a $3000 award and a medal. The recipient is chosen by a joint CRM/SSC advisory committee, consisting of three members named by the SSC and two, including a president, by the CRM.The Statistical Society of Canada and the CRM took great pleasure in awarding the 1999 Statistical Society of Canada Prize to Professor Christian Genest from Laval University.

Born in Chicoutimi (Quebec), Christian Genest received his mathematical education at the University of Quebec at Chicoutimi (B. Sp. Sc., 1977) and at the University of Montreal (M. Sc., 1978). He then specialized in statistics at the University of British Columbia, where he completed in 1983 a doctoral thesis for which he was selected as the winner of the Pierre Robillard Award of the Statistical Society of Canada (SSC). He held teaching and research positions at Carnegie-Mellon University, in Pittsburgh (1983-4), and at the University of Waterloo, in Ontario (1984-7), before joining the Department of Mathematics and Statistics at Laval University in June 1987, where he was promoted to professorship in 1993. Author or co-author of over forty research papers in fundamental and applied statistics, Professor Genest has developed expertise in opinion pooling methods, multicriteria decision making techniques, concepts and non parametric measures of dependence, as well as inference for multivariate stochastic models derived from copulas. Most of his work has been published in English or in French in peer-reviewed statistical journals, but he also co-authored publications in actuarial science, finance, management, mathematical psychology and other areas. A complete list of his writings may be found at www.mat.ulaval.ca/pages/genest.

In recognition of his contributions to research, Dr Genest received the 1999 Summa Award from Laval University's Faculty of Science and Engineering; he was also promoted to the rank of fellow of the American Statistical Association (1996) and the Institute of Mathematical Statistics (1997). Also recognized for the quality of his teaching and for his careful supervision of some fifteen graduate students he advised over the years, Dr Genest was awarded the SSC Plaque for Services to the profession in 1997. He served on many thesis committees and national orinternational selection committees (NSERC, FRSQ, COPSS Fisher Award, ISI Jan Tinbergen Award, etc.), in addition to being actively involved in the scientific and local organization of several international meetings, most notably the memorable 1996 meeting of French-speaking statisticians in Quebec City. Christian Genest is currently Editor in Chief of "The Canadian Journal of Statistics." In recent years, he has also been responsible for several quality insurance workshops in industry, in addition to being a regular consultant for the Quebec Institute of Statistics and Statistics Canada's Committee on Statistical Methodology.

Member's Seminars & Special Events

The members of the CRM are encouraged to organise seminars and other scientific activities during their stay at the CRM. These activities take the form of a course, a workshop, of a research seminar.

Seminar in statistics
Org. : Christian Léger (UdeM)

- **8 October 1998**
  Keith Worsley, Univ. McGill
  Detecting shape changes via non-isotropic random fields
- **15 October 1998**
  David Bellhouse, Univ. of Western Ontario
  Density Estimation from Complex Surveys
- **29 October 1998**
  Michael Newton, Univ.du Wisconsin à Madison
  Statistical methods for a cancer mutagenesis experiment
- **5 November 1998**
  Jean-François Angers, Univ. de Montréal
  Transformée de Fourier et l'estimation bayesienne d'un paramètre de position
- **12 November 1998**
  Celia Greenwood, Univ. McGill
  Affected sib pair models with covariates and constraints
- **19 November 1998**
  Renate Meyer, Univ. d'Auckland
  Bayesian Stock Assessment Using a Nonlinear State-Space Model
- **26 November 1998**
  James Ramsey, New York Univ.
  The role of time scale in the analysis of aggregated relationships using wavelets
- **3 December 1998**
  Don Fraser, Univ. de Toronto
  Some useful integrals for asymptotic densities: the mystery of hyperaccuracy in inference
- **14 January 1999**
  Christian Genest, Univ. Laval
  À propos de l'estimation de la fonction de dépendance d'une loi de valeurs extrêmes bivariée
- **28 January 1999**
  Angelo Canty, Univ. Concordia
  Hypothesis Testing for Convergence of the Gibbs Sampler
- **4 February 1999**
  Pierre L'Ecuyer, Univ.de Montréal
  Interaction des tests sériels avec la structure de certaines familles de générateurs pseudo-aléatoires
- **8 February 1999**
  Annie Morin, IRISA Univ. de Rennes 1
  Présentation de deux méthodes d'analyse des données textuelles pour la recherche documentaire
- **11 February 1999**
  Éric Renault, CREST-INSEE (Paris)
  Composantes principales non linéaires et inférence sur un opérateur d'espérance conditionnelle
- **18 February 1999**
  Christian Gouriéroux , CREST, Paris
  Kernel Based Nonlinear Canonical Analysis
- **10 March 1999**
  Mark Glickman, Boston Univ.
  Parameter Estimation in Large Dynamic Paired Comparison Experiments
- **18 March 1999**
  Michael Evans, Univ. de Toronto
  Concepts of Surprise Used to Derive Inferences

Seminar in statistics
Org.: Roch Roy (UdeM)

- **3 June 1999**
  Ian McLeod, Univ. of Western Ontario
  Misspecification in Hyperbolic Time Series

Seminar in nonlinear Analysis
Org.: Marlène Frigon (UdeM)

- **28 September 1998**
  Frédéric Picard, Univ.de Montréal
  Introduction aux espaces de Sobolev
- **5 October 1998**
  Frédéric Picard, Univ. de Montréal
  Introduction aux espaces de Sobolev, II
- **19 October 1998**
  Frédéric Picard, Univ.de Montréal
  Introduction aux espaces de Sobolev, II
- **26 October 1998**
  Isidore Fleischer, Fleischer Foundation
  Comment présenter le théorème de point fixe de Brouwer en analyse III
- **9 November 1998**
  Alexandre Girouard, Univ.de Montréal
  Points critiques multiples de fonctionnelles symétriques
- **16 novembre 1998**
  Alexandre Girouard, Univ. de Montréal
  Points critiques multiples de fonctionnelles symétriques II
- **23 November 1998**
  Alexandre Girouard, Univ. de Montréal
  Points critiques multiples de fonctionnelles symétriques III
- **30 November 1998**
  Nicolas Beauchemin, Univ. de Montréal
  Théorème du point de selle généralisé pour des fonctionnelles multivoques paires
- **14 December 1998**
  Nicolas Beauchemin, Univ. de Montréal

Théorème du point de selle généralisé pour des fonctionnelles multivoques paires II

- **18 January 1999**
  Nicolas Beauchemin, Univ. de Montréal
  Théorème du point de selle généralisé pour des fonctionnelles multivoques paires III
- **February 1, 1999**
  Marlène Frigon, Univ.de Montréal
  La notion d'enlacement en théorie des points critiques
- **8 February 1999**
  Ron Stern, Concordia Univ.
  Some current issues in feedback control
- **15 February 1999**
  Frédéric Picard, Univ.de Montréal
  Enlacement local
- **8 March 1999**
  Emmanuel Montoki, Univ. de Montréal
  Problème elliptique résonnant
- **15 March 1999**
  Emmanuel Montoki, Univ. de Montréal
  Problème elliptique résonnant II
- **29 March 1999**
  D. Anosov, Univ. of Moscow
  Some achievements in the theory of Dynamical Systems during the last 25 years

Seminar in Mathematical Physics

Org.: Pavel Winternitz (UdeM)

- **11 August 1998**
  I. Mindlin, Technical Univ.
  New Analytic Methods for Solutions of Nonlinear Problems of Vortex and Wave Dynamics in Heavy Liquids with Piecewise Constant Density
- **18 August 1998**
  D. Levi, Univ. of Roma III
  Solitons on a Free Electron Laser
- **25 August 1998**
  Luigi Martina, Univ.Lecce
  Bright Solitons and Black Holes
- **15 September 1998**
  Iadh Ayari, Univ.de Montréal
  Symétries conditionnelles pour les équations de Sawada-Kotera et Tzitzéica
- **22 September 1998**
  D. Richter, Univ. McGill
  Z-Gradations of Simple Lie Algebras and Infinitesimal Generators
- **28 September 1998**
  Jean-Marie Souriau, Univ. de Provence
  DE MOTU
- **29 September 1998**
  Jean-Marie Souriau, Univ. de Provence
  DE MOTU II
- **13 October 1998**
  John Harnad, Univ. Concordia et CRM
  Les équations de Picard-Fuchs, les fonctions modulaires et les systèmes intégrables
- **21 October 1998**
  Alexei V. Penskoï, DMS et CRM
  Les crochets de Poisson algébro-géométriques et le système de Volterra
- **3 November1998**
  Z. Masakova, Univ.Technique de Prague et CRM
  Autosimilarités des quasicristaux basés sur des nombres de Pisot quadratiques unitaires
- **5 November 1998**
  Bernard Champagne, CRM
  Méthodes de Coxeter pour la génération de Quasi-Réseaux
- **10 November 1998**
  C. Doran, Harvard Univ.
  Algebraic and Geometric Isomonodromic Deformations
- **17 November 1998**
  D.Korotkin, Max Planck Institute
  Isomonodromic Deformations and Theta Functions in Dimensionally Reduced Einstein Equations
- **23 November 1998**
  V. Dorodnitsyn, Keldysh Institute of Applied Mathematics, Moscow
  Lie point symmetries of second order ordinary difference equations and of a nonlinear discrete heat equation
- **24 November 1998**
  Myriam Caprioglio, CRM
  Reconnaissance de contours: Application en vidéokératographie
- **December 1,1998**
  Roman Grodzicky, CRM
  Un quasi-cristal vu comme un ensemble modèle
- **8 December 1998**
  George Pogosyan, Institut international de physique nucléaire, Dubna, Russie
  Coulomb Oscillator Duality on Spaces with Constant Curvature
- **16 December 1998**
  Anatol Odzijewicz, Univ.de Bialystok, Pologne
  Quantum Algebras and q-special functions related to coherent state map
- **7 January 1999**
  N.M. Atakishiyev, Instituto de Matematicas, Unam (Mexico)
  Fourier-Gauss Transforms of some q-special functions
- **12 January 1999**
  Zora Thomova, SUNY (Utica)
  Maximal Abelian subalgebras of the e(p,q) algebras and their application
- **19 January 1999**
- **Paul Bracken, CRM**
  The Weierstrass-Enneper System for Constant Mean Curvature Surfaces the Completely Integrable Sigma Model, and Certain Classes of Solutions
- **26 January 1999**
  Stéphane Lafortune, CRM
  Schlesinger Transformations for linearisable equations
- **9 February 1999**
  Philippe Roche, MIT (Cambridge) et École Polytechnique (Palaiseau, France)

Analyse harmonique sur le groupe quantique de Lorentz et polynômes d'Askey-Wilson

- **22 February 1999**
  Robert Conte, Saclay
  Correspondance birationnelle entre les deux fonctions entières de la transformation de Bäcklund: le cas de l'équation de Kaup-Kupershmidt
- **23 February 1999**
  Philippe Zaugg, CRM, CNRS et LAPP
  Le modèle de Schrodinger non-linéaire et algèbre de Yangien
- **2 March 1999**
  Jean-Pierre Gazeau, Univ.Paris VII
  États cohérents pour des systèmes à spectre discret et/ou continu
- **9 March 1999**
  Stephen Anco, Univ.Concordia
  Complete conservation laws and symmetries of Maxwell's equations
- **30 March 1999**
  Alexei V. Penskoi, CRM et DMS
  Les opérateurs aux différences finies algébro-géométriques
- **13 April 1999"**
  Paul Sorba, LAPTH, CNRS, Annecy (France)
  A (Quantum) Group Theoretical Model for the Genetic Code
- **20 April 1999**
  Pierre Mathieu, Univ. Laval
  Bases de fusion
- **27 April 1999**
  J.A. Tuszynski, Univ.of Alberta
  Model of Motor Protein Motion Along Microtubule Filaments
- **4 May 1999**
  Pavel Winternitz, CRM et DMS, Univ. de Montréal
  Classification des équations à différences finies selon leurs symétries de Lie
- **11 May 1999**
  Paul Sorba, LAPTH, CNRS et CRM
  Remarques sur les algèbres de symétrie déformées : propriétés et relations
- **13 May 1999**
  Stephen Anco, Concordia Univ.
  Classification of Symmetries and Conservation Laws of Maxwell's Equations
- **18 May 1999**
  Lubomir T. Dechevsky, DMS
  Integral Represenations of Local and Gobal Diffeomorphisms and Applications
- **20 May 1999**
  E.V. Ferapontov, Moscow, Landau Institute for Theor. Phys.
  Systems of conservation laws and projective theory of congruences
- **25 May 1999**
  A. Zhedanov, Donetsk Univ.et CRM
  Orthogonal polynomials satisfying higher order differential equations

Working Group on Frobenius Manifolds, Seiberg-Witten Theory and Integrable Systems

Org. : John Harnad (Concordia et CRM)

- **16 October 1998**
  Introduction to Frobenius Manifolds I
- **23 October 1999**
  Introduction to Frobenius Manifolds. II
- **30 October 1998**
  Frobenius Manifolds and Isomonodromic Deformations
- **6 November 1998**
  Frobenius Manifolds and Isomonodromic Deformations, II
- **13 November 1998**
  Frobenius Manifolds and Isomonodromic Deformations, III
  Frobenius Manifolds Seiberg-Witten Theory and Integrable Systems
- **20 November 1998**
  Hurwitz Spaces

Special Lectures

Org. : Ram Murty (Queen's)

- **25 November 1998**
  Dmitry Jackson, Caltech
  Limits of eigenfunctions
- **25 November 1998**
  Nathan Ng, Univ. of British-Columbia
  Zeros of L-functions on the critical line
- **25 November 1998**
  Mark David Coleman, UMIST
  Chens Theorem, Linniks Theorem
- **19, 21, 25 and 26 May 1999**
  Mark Goresky, IAS
  Chern classes of modular varieties
- **21, 25 and 26 May 1999**
  Mark Goresky, IAS
  Lefschetz fixed point for Hecke correspondances

Workshop in Industrial and Applied Mathematics

Org.: Michel Delfour (UdeM)

- **30 March 1999**
  Mohammed Aassila, CRM
  Nouvelle approche à la stabilisation forte des systèmes distribués
- **29 April 1999**
  Jacques Henry, INRIA Rocquencourt, France
  Factorisation d'opérateurs elliptiques du $2^{ème}$ ordre par programmation dynamique
- **29 April 1999**
  Patrick Giroud, IMAG, Grenoble, France
  Analyse asymptotique de coques inhomogènes en lasticité linéarisée anisotrope

Seminar of the PHYSNUM Group

Org.: Jean-Marc Lina (UdeM)

- **11 June 1998**
  Rita Noumeir, École de technologie supérieure
  Reconstruction de Surface en Tomographie
- **16 June 1998**
  Emmanuel Bacry , CMAP, École Polytechnique, Paris
  Récents développements en analyse du signal: de l'analyse en ondelettes au "matching pursuit
- **18 June 1998**
  Kalid Daoudi, MIT
  Construction de modèles autogressifs muti-échelles ayant des coéfficients en ondelettes comme variables d'état
- **October 1,1998**
  Bernard Picinbono, Laboratoire des Signaux et Systèmes, École Supérieure d'Électricité et Université de Paris-Sud
  Du réel au complexe en traitement du signal
- **8 October 1998**
  Jean-Charles Côté, U de M et Hôp. Notre-Dame (CHUM)
  Nouveau concept d'excitation RF en Imagerie de Résonance Magnétique Nucléaire
- **12 November 1998**
  Jean-Louis Merrien, INSA-Rennes (France)
  Interpolants d'Hermite par subdivison et rayons spectraux généralisés
- **17 February 1999**
  Kaleem Siddiqi, Univ. McGill
  Geometric flows for shape segmentation
- **11 May 1999**
  G. Oppenheim, Equipe de probabilité et Statistique d'Orsay et Univ. De Marne la Vallée
  Une façon simple de créer de la mémoire longue

Seminar on Probability Theory

Org. : Dana Schlomiuk (UdeM) and Martin Goldstein

- **12 November 1998**
  Ioan Cuculescu, Univ. de Bucarest
  Représentations des mesures de probabilité préservant la moyenne et leur application à la positivité des moments fonctionnels

Special Lectures

Org.: Paul Arminjon (UdeM)

- **17, 19 and 22 June 1998**
  Marie-Claude Viallon, Univ. de Saint-Etienne
  Principe de convergence d'une méthode de volumes finis pour la résolution d'une équation de conservation hyperbolique. Introduction aux mesures de Young.
  Applications à la convergence d'une généralistion des schémas aux différences de Lax-Friedrichs et Nessyahu-Tadmor à uneméthode de volumes finis d'ordre 2 sur des maillages non-structurés
  Application à la convergence de la méthode Arminjon-Viallon pour une équation de conservation hperbolique non linéaire

Workshop in Industrial and Applied Mathematics

Org. : Noriko Yui (Queen's)

- **27 November 1998**
  James Lewis, Univ. of Alberta
  Chow Groups, Hodge Theory and (higher) regulartors
- **27 November 1998**
  Brent Grodon, Univ.of Oklahoma
  Chow-Künneth decompositions for some degenerating families of abelian varieties
- **27 November 1998**
  Hiroyuti Ito (Tôhoku Univ.and Harvard Univ.)
  Extremal and elliptic modular surfaces
- **27 November 1998**
  Abdella Sebbar, CRM
  Discrete subgroups of SL (2,R) and Schwarzian differential equations
- **27 November 1998**
  Noriko Yui, Queen's Univ. and CRM
  The modularity conjecture for rigid Calabi-Yau threefolds over number fields

Workshop on Algebraic and Geometric Methods in the Theory of Vector Fields

Org. : C. Rousseau and D. Schlomiuk (UdeM)
13 - 19 January 1999

- **13 January 1999**
  J.-P. Françoise,Paris VI
  The classical Bautin method
  V. Kaloshin, Princeton
  An estimate for cyclicity of elementary polycycle I (Il'yashenko-Yakovenko theorem with an explicit estimate)
  C. Christopher, Plymouth, UK
  Liénard systems with linearisable centres
  V. Kaloshin (Princeton)
  An estimate for cyclicity of elementary polycycle II
- **14 January 1999**
  D. Schlomiuk, CRM
  Théorèmes de finitude pour les cycles limites et en géométrie diophantienne
  R. Roussarie, Dijon, France
  Unfolding hyperbolic polycycles
  X. Gomez-Mont, Guanajuato, Mexique
  Dissipative and Conservative Components in Transversely Conformal Foliations
  L.-S. Guimond,Univ. de Montréal, (soutenance de thèse)
  Cyclicité finie des boucles homoclines dans R^3 non dégénérées avec valeurs propres principales en résonance 1:1
- **15 January 1999**
  F. Dumortier, Diepenbeek, Belgique
  Hamiltonian bifurcations in Liénard equations of type (3,2)
  V. Kaloshin, Princeton

Bifurcation of spatial polycycles and the Newton Interpolation polynomials (multidimensional extension of Il'yashenko-Yakovenko theorem)
Mourtada, Dijon, France
Déploiement analytique de polycycles hyperboliques. Un cas localement noethérien
X. Gomez-Mont, Guanajuato, Mexique
Computing Topological Invariants with Linear Algebra

- **18 January 1999**
  J.P. Françoise, Paris VI
  « A global complex analytic version of Bautin's theorem »
  P. Mardesic, Dijon, France
  Indice des champs de vecteurs tangents aux variétés singulières
  C. Rousseau, CRM
  Finite cyclicity of graphics through a nilpotent point of saddle or elliptic type I
- **19 January 1999**
  J.P. Françoise, Paris VI
  The successive derivatives method and its comparison to the classical Bautin's approach. The Abel equation approach.
  H.-P. Zhu , Université de Montréal
  Finite cyclicity of graphics through a nilpotent point of saddle or elliptic type II

CRM-ISM Colloquium

The CRM, together with the Institut des Sciences Mathématiques (the Québec university graduate mathematics consortium), runs the Montréal mathematics colloquium, which, during the university year, organises survey talks by distinguished mathematicians on topics of current interest.

autumn 1998

- **24 September 1998**
  Jean-Marie Souriau, Univ. de Provence
  DE MOTU
- **2 October 1998**
  Herbert Hetchcote, Univ.of Iowa
  Periodicity and Stability in Epidemiological Models
- **23 October 1998**
  Ram Murty, Queen's Univ.
  Artin L-functions
- **30 October 1998**
  Paul Koosis, McGill University
  Relations between two results about entire functions of exponential type
- **6 November 1998**
  Brian Steer, Oxford Univ.
  Knots and some (uncalculable) invariants
- **13 November 1998**
  Mark Sapir, Vanderbilt Univ.
  Dehn functions on groups and computational complexity
- **20 November 1998**
  Yuri Berest, Univ. of California at Berkeley
  Differentially Isomorphic Curves
- **27 November 1998**
  Alexandru Buium, Univ. of Illinois
  Elementary adeles and differential modular forms
- **4 December 1998**
  Nancy Reid, Univ. of Toronto
  Approximate ancillarity and accurate p-values
- **11 December 1998**
  Idun Reiten, Norwegian Univ.of Science
  Finite dimensional algebras and commutative rings

winter 1998

- **15 January 1999**
  Xavier Gomez-Mont, CIMAT, Guananjuato (Mexique)
  Computation of topological numbers via linear algebra
- **29 January 1999**
  Keith Worsley, McGill Univ.
  Shape analysis and the geometry of random fields
- **5 February 1999**
  Alexander Zvonkine, Univ.de Bordeaux I
  Combinatoire des polynomes complexes
- **12 February 1999**
  Changfeng Gui, Univ. of British Columbia
  On a conjecture of de Giorgi and related problems
- **19 February 1999**
  Donald Dawson, The Fields Institute
  Local and global random structures in nonlinear stochastic partial differential equations
- **26 February 1999**
  Israel M. Sigal, Univ. of Toronto
  Some mathematical problems in quantum field theory
- **5 March 1999**
  Andrew Granville, Univ. of Georgia
  Locating zeros of Fekete polynomials
- **12 March 1999**
  Michel Delfour, Univ. de Montréal
  L'optimisation de forme via l'analyse fonctionnelle
- **19 March 1999**
  Jean-François Mestre, Univ.de Paris VII
  Capacités, courbes hyperelliptiques et moyennes arithmético-géométrique
- **26 March 1999**
  Fred Gehring, Univ.of Michigan
  Quasiconformal mappings and their role in mathematics
- **9 April 1999**
  A. Johan de Jong, M.I.T.
  The fundamental group of a curve over a finite field
- **16 April 1999**
  Sylvain Cappell, Courant Institute, NYU
  New geometrical comparisons of integration and lattice summation
- **23 April 1999**
  Karen Parshall, Univ.of Virginia
  The Mathematical Legacy of James Joseph Sylvester (1814-1897)

COMING EVENTS

Theme Year 1999-2000 : Mathematical Physics

Organizing Committee

Philippe Di Francesco (North Carolina)
Lisa Jeffrey (Univ. of Toronto)
André LeClair (Cornell)
Yvan Saint-Aubin (UdeM, CRM)
Luc Vinet (UdeM, CRM)

Overview

Many sectors of mathematics and physics have been tightly interwoven in the last decades. The interactions have triggered some important developments that turned out to be fruitful for both disciplines: to name only a few, conformal field theory, vertex operators and representation theory; string theory, duality, non-commutative geometry and mirror symmetry; classical and quantum integrable systems and quantum groups.

These links make a theme year in mathematical physics particularly appealing. Several other reasons make it compelling. Canada can boast of an impressive number of first-class mathematical physicists, a number which is even larger if one includes theoretical physicists whose research interests have been influenced by mathematical developments. Through its various events and minicourses, it will also provide excellent opportunities for (pure) mathematicians to learn how recent developments in some of their disciplines are being used in physical theories. The summer school, the longer workshops, and the winter concentration period are designed to welcome advanced graduate students and postdoctoral fellows in both mathematics and physics and give them a chance to interact among themselves and with the leaders of these disciplines. Two of the workshops draw not only from mathematics and physics but from yet a third discipline (finance and computer science, respectively). Finally the theme year will enhance links between the mathematics and theoretical physics communities in Canada.

9th CRM Summer School
Theoretical Physics at the End of the XXth Century

June 27 - July 10, 1999, Banff, Alberta,
Org. : Yvan Saint-Aubin (UdeM & CRM), Luc Vinet (McGill & CRM)

Invited Speakers : Ian Affleck (UBC), Gilles Brassard (Montréal), Eric D'Hoker (UCLA), Michael Duff (Texas A&M), Krzysztof Gawedzki (IHES), Brian R. Greene (Columbia), Allan Griffin (Toronto), Satoru Odake (Shinsu), José N. Onuchic (UCSD), Marc Potters (Science & Finance, Paris), Ben Simons (Cambridge), Frank Wilczek (Institute for Advanced Study)

The School will cover a large spectrum of active topics in theoretical physics such as conformal field theory and its applications, string theory and duality, mesoscopic systems, integrable models, disordered systems, cosmology, Bose-Einstein condensation as well as new fields of interest to physicists like quantum information processing and statistical physics in finance.

Aisenstadt Chair Lecture Series

Renormalization Group and Fermionic Functional Integrals
Joel Feldman (UBC)
August 22-25, 1999

Nonlinear (fluid dynamical) equations and d-Branes
Roman Jackiw (M.I.T)
March 2000

Supersymmetric Gauge Theories, Symplectic Forms, and Integrable Models
Duong H. Phong (Columbia)
May 2000

Fermi surfaces and infinite genus Riemann surfaces
Joel Feldman (UBC)
May 2000

Workshop on Theoretical Methods for Strongly Correlated Fermions

26-30 May 1999

Org. : André-Marie Tremblay (Univ. of Sherbrooke), Andrei Ruckenstein (Rutgers)

Invited Speakers : I. Affleck (UBC), N.E. Bickers (USC), C. Bourbonnais (Sherbrooke), A. Chubukov (Wisconsin, Madison), A. Deppeler (Rutgers), V. Dobrosavljevic (NHMFL, FSU), M.P. Fisher (UC Santa Barbara), R. Frésard (Institut de Physique), T. Giamarchi (Paris-Sud), S. Haddad (Sherbrooke), K. Hallberg (Nacional de Energia Atomica), M. Imada (Tokyo), B. Kyung (Sherbrooke), S. Kehrein (Harvard), G. Kotliar (Rutgers), A. Rosch (Rutgers), A. Ruckenstein (Rutgers), S. Sachdev (Yale), D. Sénéchal (Sherbrooke), N. Shah (Rutgers), R. Shankar (Yale), S.R. White (UC Irvine), P. Wölfle (Karlsruhe), Soucheng Zhang (Stanford)

The quest to understand the physics of high-temperature superconductors, organic conductors, heavy-fermion alloys and giant magneto resistance materials, has led to remarkable advances in the theory of strongly correlated electrons. Some of the recent theoretical achievements as well as open questions will be discussed in a number of tutorial lectures, contributed presentations and poster sessions.

Workshop on Bäcklund & Darboux Transformations : The Geometry of Soliton Theory

4-9 June 1999, Halifax, Nova Scotia

Org. : Mark J. Ablowitz (Colorado), Alan Coley (AARMS, Dalhousie), Athanassios S. Fokas (Imperial College), Decio Levi (Roma 3), Peter J. Olver (Minnesota), Colin Rogers (New South Wales), Pavel Winternitz (UdeM, CRM)

Invited Speakers : M.J. Ablowitz (Colorado), Y.A. Aminov (Kharkiv), I. Anderson (Utah State), N. Atakishiyev (UNAM, Mexico), Y. Berest (Berkeley), O. Bogoyavlenskij (Queen's), M. Boiti (Lecce), J. Cieslinski (Warsaw), P. Clarkson (Kent), A. Coley (AARMS, Dalhousie), R. Conte (CEA-Saclay), F. Estabrook (Caltech), M. Fels (Utah State), E. Ferapontov (Steklov Math. Inst., Moscow), D. Finley (New Mexico), A.S. Fokas (Imperial College), J. Gegenberg (New Brunswick), V.I. Gromak (Bielorussian State), A. Grünbaum (UC Berkeley), M. Grundland (CRM), M. Gurses (Bilkent), M. Havlicek (Faculty of Nuclear Science, Prague), J. Hietarinta (Turku), L. Hlavaty (Czech Technical Univ.), C. Hoenselaers (Loughborough), N. Joshi (Adelaide), N. Kamran (McGill), A. Kasman (MSRI), B. Konopelchenko (Lecce), M. Kruskal (Rutgers), V. Kuznetsov (Leeds), S. Lafortune (CRM), M. Legaré (Alberta), D. Levi (Roma 3), Wen-Xiu Ma (City Univ., Hong Kong), P. Mathieu (Laval), O. Mokhov (Steklov Math. Inst., Moscow), M. Musette (Brussel), G. Neugebauer (Friedrich-Schiller), J. Nimmo (Glasgow), P.J. Olver (Minnesota), M. Paranjape (Montréal), F. Pempinelli (Lecce), O. Ragnisco (Roma 3), S. Rauch (Linköping), E.G. Reyes (Utah State), C. Rogers (New South Wales), P. Santini (Roma 1), W. Schief (UNSW), R. Schmid (Emory), H. Steudel (Max-Planck Institute), A. Sym (Warsaw), K. Tenenblat (Brasilia), Z. Thomova (SUNY, Utica) A. Turbiner (UNAM, Mexico), P. Wiegmann (Chicago), P. Winternitz (CRM), W. Zakrzewski (Durham)

The objective of this workshop is to bring together active researchers in the general field of soliton science to present original results and reviews concerning the development and applications of Bäcklund and Darboux transformations.

Conference on General Relativity, Astrophysics and Cosmology

6-12 June 1999

This large conference will group two major workshops covering closely related subjects that are usually isolated.

Workshop on Black Holes II : Theory and Mathematical Aspects

6-9 June 1999, Val Morin, Québec

Co-sponsors : Canadian Institute for Advanced Research (CIAR) Canadian Institute for Theoretical Astrophysics (CITA)

Org. : Valeri Frolov (Univ. of Alberta), Werner Israel (Univ. of Victoria), Robert Myers (McGill), Don Page (Univ. of Alberta), Eric Poisson (Guelph)

Invited Speakers : A. Ashtekar (Pennsylvania State), S. Carlip (UC Davis), V. Frolov (Alberta), W. Israel (Victoria), T. Jacobson (Maryland), R. Kallosh (Stanford), G. Kunstatter (Winnipeg), J. Maldacena (Harvard), R. Mann (Waterloo), E. Martinec (Chicago), D. Page (Alberta), L. Susskind (Stanford), B. Unruh (UBC), B. Wald (Chicago)

This workshop will focus mostly on recent developments regarding the statistical mechanics of black-holes, and is meant to bring together relativists and string theorists who are interested in this exciting topic. It is the second installment in a series of similar workshops; the first one was held in Banff (Alberta) in June 1997.

8th Canadian Conference on General Relativity and Relativistic Astrophysics

10-12 June 1999,McGill University

Co-sponsor : Canadian Institute for Theoretical Astrophysics (CITA)

Org. : C.P. Burgess (McGill), J. Gegenberg (New Brunswick), D. Hobill (Univ. of Calgary), G. Kunstatter (Univ. of Winnipeg), R.G. McLenaghan (Univ. of Waterloo), R.C. Myers (McGill)

Invited Speakers : A. Ashtekar (Pennsylvania State), G. Fontaine (Montréal), T. Jacobson (Maryland),

Vicky Kaspi (MIT), L. Kofman (CITA, Toronto), S. Morsink (Wisconsin-Milwauke), D. Page (Alberta), P. Saulson (Syracuse), L. Susskind (Stanford), W. Unruh (UBC), J. Winicour (Pittsburgh

General Relativity and Relativistic Astrophysics are both fields which are seeing exciting new progress in several directions, e.g., black hole physics, gravitational wave detectors and new cosmological data. This conference will be the eighth in an ongoing series of biannual Canadian meetings, which bring together researchers working on various aspects of gravitational physics.

Frontiers of Mathematical Physics : *Summer Workshop on Particles, Fields and Strings '99*

2-20 August, 1999, Univ. of British Columbia, Vancouver

Co-sponsors : Pacific Institute for Mathematical Sciences (PIms) Asia Pacific Center for Theoretical Physics (APCTP)

Org. : Taejin Lee (Kangwon National University), Yuri Makeenko (ITEP, Moscow & NBI, Copenhagen), John Ng (TRIUMF), Soonkeon Nam (APCTP, Seoul), Chaiho Rim (APCTP, Seoul), Alexander Rutherford (PIms), Gordon Semenoff (UBC), K.S. Viswanathan (SFU), Ariel Zhitnitsky (UBC)

Invited Speakers : R. Dijkgraaf (Amsterdam), D. Gross (UC Santa Barbara), J. Harvey (Chicago), I. Klebanov (Princeton), J. Maldacena (Harvard), J. Polchinski (UC Santa Barbara), A. Polyakov (Princeton), H. Verlinde (Princeton)

The workshop is devoted to modern developments in mathematical physics, gauge and string theories. The subject of the workshop includes in particular : non-perturbative string and superstring theory; anti-de-Sitter space and conformal field theory; large-N QCD, confining strings; MQCD, duality; M(atrix) theory.

Workshop on Nonlinear Dynamics and Renormalization Group

22-27 August, 1999

Org. : Catherine Sulem (Univ. of Toronto), Michael Sigal (Univ. of Toronto)

Invited Speakers : S. Alama (McMaster), N. Alikakos (Tennessee & Athens), F. Bethuel (Orsay), O. Bogoyavlenski (Queen's), L. Bronsard (McMaster), P. Constantin (Chicago), P. Deift (Courant), J. Dimock (Buffalo), Weinan E. (Courant), J.P. Eckmann (Geneva), J. Feldman (UBC), G.M. Graf (Zurich), S. Gustafson (Toronto), T. Hurd (McMaster), V. Jaksic (Ottawa), R. Jerrard (Illinois), L. Kapitanski (Kansas), N. Kevlahan (McMaster), M. Kiessling (Rutgers), J. Lebowitz (Rutgers), M.-A. Lewis (Paris VI), C.-K. Lin (National Cheng-Kung University), F.H. Lin (Courant), R. McCann (Toronto), M. Merkli (Toronto), H. Nawa (Nagoya), D. Pelinowsky (Toronto), G. Perelman (École Polytechnique, Paris), G. Ponce (Santa-Barbara), J. Quastel (Toronto), Y. Saint-Aubin (Montréal, CRM), S. Serfaty (ENS), J. Shatah (Courant), A. Soffer (Rutgers), T. Spencer (IAS), B. Vasiljevic (Toronto)

The workshop is devoted to two relatively young and fast developing areas of mathematical physics-nonlinear dynamics and renormalization group, the former being understood as a qualitative theory of nonlinear evolution partial differential equations. Some of the questions addressed are: the dynamics of particle-like structures (e.g solitons and vortices) and interface boundaries, blow-up profiles, universal features of large-time behavior, and the application of renormalization group methods to the dynamical phenomena in nonequilibrium statistical mechanics and in particular to nonlinear PDEs. The workshop will have review talks summarizing recent advances, talks on current progress and discussions on promising directions.

Workshop on Aspects of Quantization

23-28 September, 1999

Org. : Lisa Jeffrey (Univ. of Toronto)

Invited Speakers : S.T. Ali (Concordia), S. Berceanu (NIPNE, Romania), M. Brion (Grenoble), C. Duval (Marseille), H. Fuehr (INRIA/LATP), M. Gotay (Hawaii), B. Hall (Notre-Dame), J. Hurtubise (McGill), Y.-H. Kiem (Yale), B. Kostant (M.I.T.), E. Lerman (UIUC, Illinois), E. Meinrenken (Toronto), P.-E. Paradan (Grenoble), R. Sjamaar (Cornell), J. Sniatycki (Calgary), A. Szenes (M.I.T.), C. Teleman (Texas, Austin), A. Uribe (Michigan), M. Vergne (Paris VII), C. Blas Villegas (UNAM), J. Weitsman (UC Santa Cruz), C. Woodward (Rutgers)

Quantization describes a mathematical procedure which associates a vector space (the "physical Hilbert space") to a symplectic manifold (the "classical phase space"). The workshop will focus on three aspects of quantization: geometric quantization, coherent state quantization and the behaviour of quantization under symplectic reduction (which was the subject of a celebrated conjecture of Guillemin and Sternberg, recently proved under very general hypotheses).

QIP 2000
Third Workshop on Quantum Information Processing
6-11 December, 1999
Org. : Gilles Brassard (UdeM), Richard Cleve (Univ. of Calgary)

Invited Speakers : Dorit Aharonov (Berkeley), Charles H. Bennett (IBM Yorktown), Thomas Beth (Karlsruhe), Eli Biham (Technion), Gilles Brassard (Montéal), Harry Buhrman (Amsterdam), Isaac Chuang (IBM Almaden), Richard Cleve (Calgary), Claude Crépeau (McGill), David DiVincenzo (IBM Yorktown), Artur Ekert (Oxford), Christopher Fuchs (Los Alamos), Daniel Gottesman (Microsoft), Lov Grover (Lucent), Richard Jozsa (Bristol), Raymond Laflamme (Los Alamos), Hoi-Kwong Lo (MagiQ Technologies), Dominic Mayers (NECI), Tal Mor (UCLA), Michele Mosca (Waterloo), Michael Nielsen (Caltech), John Preskill (Caltech), Vwani Roychowdhury (UCLA), Louis Salvail (Aarhus), Peter Shor (AT&T), Umesh Vazirani (Berkeley), John Watrous (Calgary) et Ronald de Wolf (Amsterdam).

Quantum information processing is a new and exciting field that studies the implication of quantum mechanics for information processing purposes. This includes quantum computing, quantum cryptography, quantum teleportation and other forms of quantum communication that hinge upon quantum entanglement. QIP 2000, which takes place just slightly before year 2000, is part of the 1999-2000 special year on Mathematical Physics, sponsored by the CRM. It is also the natural continuation of the workshops on Algorithms in Quantum Information Processing (AQIP '98 in Aarhus and AQIP '99 in Chicago). Like these workshops, QIP 2000 will put emphasis on the computer science aspects of the discipline, focusing on algorithms and information theory. The first day, 6 December, will be a day of tutorials aimed at nonspecialists who may have had no previous acquaintance with quantum mechanics. The technical sessions will start on Tuesday, 7 December, and continue through Saturday, 11 December. There will be ample time and facilities for informal interaction among participants.

Workshop on Strings, Duality and Geometry
March 22-25 2000
Org. : Eric D'Hoker (UCLA), Duong H. Phong (Columbia), Shing-Tung Yau (Harvard)

Invited Speakers : L. Chien-Hao (Harvard), F. Denef (Columbia), M. Faux (Columbia), D.S. Freed (Texas, Austin), D. Freedman (M.I.T.), J.-L. Gervais (ENS, Paris), B. Greene (Columbia), M. Gross (Cornell), R. Jackiw (M.I.T.), B. Julia (ENS, Paris), D. Kabat (I.A.S.), A. Klemm (I.A.S.), I. Krichever (Columbia), B. Lian (Brandeis), A. Libgober (Illinois, Chicago Circle), K. Liu (Stanford), S. Mathur (Ohio State), J. Morgan (Columbia), S. Naculich (Bowdoin), L. Rastelli (M.I.T.), C. Pioline (École Polytechnique, France), W. Ruan (Columbia), M. Porratti (New York), H. Schnitzer (Brandeis)

This one-week workshop, to be held during the month of March 2000, will concentrate on recent progress in non-perturbative aspects of both field and string theories.

Workshop on Mathematical Physicists in Finance and Industry
12-17 June, 2000
Org. : Luis Seco (Univ. of Toronto), Stathis Tompaidis (Texas)

Invited Speakers : C. Albanese (Morgan Stanley & Toronto), M. Avellaneda (Courant), J. Bona (Austin), J. Chadam (Pittsburgh), C. Fefferman (Princeton), R. Garcia (Montréal), I. Karatzas (Columbia), R. McCann (Toronto), G. Papanicolau (Stanford), S. Tompaidis (Austin)

Since the work of Nobel Laureates Merton, Scholes and Black, basic issues in Mathematical Finance show a remarkable analogy with others in Mathematical Physics. This workshop brings together mathematical physicists who are dealing with financial issues, in combination with experts in different areas of finance and economics.

Concentration Period
Quantum Integrability 2000
April 2 - June 11, 2000
Org. : Philippe Di Francesco (North Carolina), André LeClair (Cornell), Nicolai Reshetikhin (Berkeley), Hubert Saleur (USC)

The CRM will host a semester-long concentration period with several specialists in residence. The program is organized around two 4-week periods described below and a workshop.

Quantum Algebras and Integrability
April 2-30, 2000
Org. : André LeClair (Cornell), Nicolai Reshetikhin (Berkeley)

Invited Speakers : O. Babelon (Jussieu), V. Bazhanov (Canberra), D. Bernard (Saclay), E. Corrigan (Durham), E. D'Hoker (UCLA), P. Dorey (Durham), Vl. Drinfeld (*) (Kharkov), P. Etingof (*) (M.I.T.), V. Fateev (Montpellier), E. Frenkel (Berkeley), I. Frenkel (Yale), G. Felder (Zurich), J. Harnad (Concordia, CRM), A. Its (Indiana), N. Jing (North Carolina), S. Khoroshkin (ITEP, Moscow), V. Korepin (Stony Brook), S. Lukyanov (Rutgers), N. MacKay (Sheffield), P. Mathieu (Laval), B. McCoy (Stony

Brook), L. Mezincescu (Miami), T. Miwa (Kyoto), G. Mussardo (Trieste), A. Nakayashiki (Kyushu), R. Nepomechie (Miami), S. Pakuliak (Dubna), N. Reshetikhin (Berkeley), F. Smirnov (Jussieu), Y. Saint-Aubin (Montréal, CRM), L. Takhtajan (*) (Stony Brook), V. Tarasov (*) (St. Petersburg), C. Tracy (UC Davis), A. Varchenko (North Carolina), L. Vinet (Montréal, CRM), R. Weston (Durham), H. Widom (UC Davis), A. Zamolodchikov (*) (Rutgers)
(*) To be confirmed

Topics : Quantum affine algebras in lattice models and quantum field theory; vertex operators and form-factors; deformed Kniznick-Zamolodchikov equations and other finite-difference equations; elliptic algebras; deformed Virasoro algebras; exact results for correlation functions; finite temperature; boundary field theory; integrable perturbations of conformal field theories; quantum affine algebras and exact S-matrices.

Workshop on Isomonodromic Deformations and Applications in Physics
May 1-6, 2000
Org.: John Harnad (Concordia, CRM), Alexander Its (IUPUI, Indianapolis)

Invited Speakers : P. Bleher (IUPUI, Indianapolis), A. Bolibruch (Steklov Institute, Moscow), P. Deift (Courant Institute), B. Dubrovin (*) (SISSA, Trieste), H. Flaschka (*) (Arizona), T. Fokas (Imperial College), H. Hitchin (*) (Oxford), A. Its (IUPUI, Indianapolis), M. Jimbo (*) (Kyoto), N.A. Kapaev (Steklov Institute, St. Petersburg), A. Kitaev (Steklov Institute, St. Petersburg), V. Korepin (ITP, SUNY, Stony Brook), D. Korotkin (Max-Planck Institute, Potsdam), A. Orlov (Oceanology Institute, Moscow), J. Palmer (Arizona), N.A. Slavnov (Steklov Institute, Moscow), C. Tracy (UC Davis), P. Van Moerbeke (Université Catholique de Louvain), H. Widom (UC Santa Cruz), X. Zhou (Duke)
(*) To be confirmed

The study of isomonodromic deformation equations is currently in very active development, motivated by the central role of such equations in a number of areas of quantum and statistical physics. The main domains to which this approach is applicable are: computation of correlation functions in quantum integrable systems and lattice models of statistical physics; the spectral theory of random matrices, with applications to quantum gravity; topological field theory, with applications to solution of the DVVW equations through the theory of Frobenius manifolds; Scaling reductions of classical integrable systems.

Integrable Models in Condensed Matter and Non-Equilibrium Physics
May 14 - June 11, 2000
Org. : Philippe Di Francesco (North Carolina), André LeClair (Cornell), Hubert Saleur (USC)

Invited Speakers : I. Affleck (UBC), J. Cardy (Oxford), J.-S. Caux (Oxford), J. Chalker (Oxford), C. Chamon (Boston), F. David (Saclay), M. den Nijs (Washington), B. Derrida (École Normale), P. DiFrancesco (North Carolina), V. Dotsenko (Jussieu), P. Fendley (Virginia), M. Fisher (ITP, UC Santa Barbara), E. Fradkin (Illinois), V. Gurarie (ITP, UC Santa Barbara), D. Haldane (*) (Princeton), R. Konik (UC Santa Barbara), M. Lassig (Max-Planck Institute, Teltrow), F. Lesage (Montréal, CRM), A. Ludwig (UC Santa Barbara), S. Maslov (Brookhaven), C. Mudry (Harvard), B. Nienhuis (UVA), M. Oshikawa (Tokyo Inst. Of Technology), V. Pasquier (Saclay), N. Read (Yale), V. Rittenberg (Bonn), V. Rupasov (Toronto), H. Saleur (USC), D. Sénéchal (Sherbrooke), G. Sierra (IMFF, Madrid), M. Stone (Illinois), A.-M. Tremblay (Sherbrooke), A. Tsvelik (Oxford), X.G. Wen (MIT), P. Wiegmann (Chicago), A. Zee (ITP, UC Santa Barbara), M. Zirnbauer (Koeln)
(*)To be confirmed

Topics: Disordered systems; random matrices; impurity problems; quantum Hall systems; integrability in stochastics processes; cellular automata; biological evolution models; scaling in far from equilibrium systems; turbulence; self-organized criticality.

Mini-courses

Several mini-courses are planned during the year to prepare graduate students for the workshops and the concentration period.

Orthogonal polynomials and Random Matrices: A Riemann-Hilbert approach
Fall 1999
Lecturer : John Toth (McGill)

Informal seminar covering (parts of) Percy Deift's book "Orthogonal polynomials and Random Matrices: A Riemann-Hilbert approach", which is available directly from the Courant Institute website (www.courant.edu).

L'intégrabilité des systèmes discrets, entropie algébrique, lien avec les équations de Yang-Baxter et l'intégrabilité quantique
November 2, 3 and 11, 1999
Lecturer : Claude Viallet (Université Pierre et Marie Curie et CNRS)

Mathematical foundations of second quantization
January - February 2000
Lecturer : Jan Derezinski (Warsaw)

Various mathematical structures that are used in quantum mechanics and quantum field theory will be described. (Tentative) list of topics:

1. Canonical commutation relations.
   a) Schrodinger representation;
   b) Weyl quantization;
   c) Fock spaces, Wick quantization;
   d) Metaplectic group;
   e) Coherent states;
   f) Inequivalent representations;
   g) Quasi-free states.
2. Canonical anticommutation relations.
3. Simple models of quantum field theory.
4. Elements of axiomatic quantum field theory.

Selected Topics in Mathematical Physics: Random Matrices
Winter 2000
Lecturer : John Harnad (Concordia, CRM)

This course is intended as an introduction to the spectral theory of random matrices. The subject is a remarkable one, with important applications and connections to a variety of areas of current research; in mathematical physics (statistical theory of nuclear spectra, topological field theory, quantum gravity, integrable systems), as well as in number theory (distributions of zeros of zeta functions). The topics to be covered are: the Gaussian ensembles and circular ensembles (Orthogonal, Symplectic, Unitary); ensembles related to the classical orthogonal polynomials; joint probability densities for eigenvalues; level densities, partition and correlation functions; level spacing distribution functions; scaling limits in the "bulk" and "edge" of the spectrum; Fredholm determinant representations, univer-sality; differential equations for correlation functions; Hamiltonian structure and asymptotics.

Random Schrödinger operators
Winter 2000
Lecturer : Vojkan Jaksic (Univ. of Ottawa)

Isomonodromic deformations and twistor geometry
March 27-30, 2000
Lecturer : Yousuke Ohyama (Osaka)

General Program 1999-2000

CMS Summer Meeting
Special Session in Harmonic Analysis
May 29- June 1, 1999, St. Jean, Newfoundland
Org. : K. Hare (Univ. of Waterloo) and A. Broce (UdeM)

Speakers: J. Benedetto, M. Christ, C. Finet, B.Forrest, J.-P. Gabardo, E. Granirer, H. Henig, z. Hu, R. Kerman, T. Korner, T. Lau D. Oberlin, J.-O. Ronning, G. Sinnamon, S. Wainger

Congress of the Statistical Society of Canada *: Special session on directional statistics*
6-9 June 1999, Regina, Saskatchewan,
Org. : Louis-Paul Rivest, (Univ. Laval)

Un chercheur établi dans le domaine de la statistique directionnelle Nick Fisher de CSIRO en Australie de même que deux chercheurs canadiens Peter Kim de l'Université Guelph et Duncan Murdoch de Western seront les invités de cette séance spéciale.

13th Annual International Symposium on High Performance Computing Systems and Applications (HPCS'99)
13-16 June 1999, Kingston
Org. : A. Pollard (Queen's)

This symposium will cover all aspects of high performance computing, theoretical as well as practical. The applications covered in the program include: scientific and industrial computing, application to finance and economics, geographic-information processing, computing with the Web, performance evaluation, seismic-signal processing and visualization. Besides systems, we will discuss the technology of compilers, architecture, user systems, and parallel computing.

9th LDS Forum
21-25 June 1999, Montreal
Org.: Rachida Dssouli (UdeM), Gregor von Bochmann (Univ. of Ottawa), Yair Lahav (SDL Forum Society, ECI Telecom LDT) et Nortel Networks

Le Forum LDS se tient tout les deux ans, celui-ci sera la 9ième occurrence de cette série. Le langage normalisé LDS qui permet la spécification et la description des systèmes communicants a évolué sur une vingtaine d'années à travers des versions successives du standard émanant de l'organisation de normalisation ITU-T. LDS est connu sous le nom "norme Z.100". La première version est apparue en 1980; elle contenait déjà une représentation graphique en plus de représentation textuelle. La dernière version est appelée SDL 2000. La particularité du forum est que les participants proviennent pour les 2/3 de l'industrie et pour 1/3 des universités.
Les thèmes du forum sont:

1. Les applications du langage LDS
2. La dérivation systématique de LDS et génération de code
3. Les extensions au langage
4. La convergence avec UML
5. Test, performance et simulation fondés sur LDS

International Conference and Workshop on Valuation Theory
28 July – 4 August 1999, Saskatoon
Org. : F.V, Kuhlmann (Univ. of Saskatchewan), Salma Kuhlmann and Murray Marshall

This conference is dedicated to Paul Ribenboim to honor his numerous contributions to the subject. The subject has experienced a rebirth in recent years and has been applied to Galois theory, asymptotic analysis, model theory, and C*-algebras. The topics to be discussed are: applications in algebraic geometry, in real algebraic geometry and quadratic forms, non-commutative valuation theory, valuations and Galois theory, rigid analysis, o-minimality and Hardy fields, the theory of models of valuated fields, and ultra-metric spaces.

Winter Meeting of the Canadian Mathematical Society
11-13 December 1999, Univ. de Montreal
Org. : Michel Delfour (UdeM)
Org. local : Véronique Hussin (UdeM)

There will be a special session on algebraic and geometric methods in differential equations: Celestial mechanics in the 20th century of work on Hilbert's 16th problem.

The ncm_2 (Network for Computing and Mathematical Modeling) in conjonction with the LACIM (laboratoire de combinatoire et d'informatique mathématique) and the CRM will be sponsering two symposiums.

Atelier CRM-MITACS Data Mining and Machine Learning : Selecting and Combining Models with Machine Learning Algorithms

12-14 April 2000

Org. :Yoshua Bengio, Département d'Informatique et Recherche Opérationnelle, (UdeM)

Invited Speakers : P. Bartlett (Australia National Univ.), L. Breiman (Berkeley Univ.), T. Dietterich (Oregon State Univ.), Y. Freund (AT&T), R. Neal (Univ. of Toronto), M. Perrone (IBM), R. Schapire (AT&T), G. Wahba (Univ. of Wisconsin at Madison).

It has been recognized in the last few years by many corporations that they possess an almost untapped source of information to improve themselves: the large amount of computerized data that they are collecting on their processes and their customers. Machine learning algorithms are becoming very important technological tools in many applications such as data mining, in which one wants to extract useful information from large databases, and they are particularly important when the probability distribution of that data is not known ahead of them. Machine learning algorithms and their analysis focus on the problem of generalization: it is not enough to extract some information from the data (e.g. to characterize the relation between some variables), we want this information to generalize well to new data, so that it becomes really useful information.

In this regard, an old question is that of «model selection», that is the choice of a class of functions, or the ways to impose a preference over functions which make the learning problem well-posed. For this, it would be very useful to estimate the expected generalization performance that would be obtained with a particular preference of function class. One could then pick the function class that is expected to yield the lowest error, or combine functions from the functions classes with the lowest expected error. For this purpose, many approaches have been proposed in the past, both in the statistics and the machine learning community.

In the area of machine learning algorithms, there has recently been a lot of interest in new ways to evaluate generalization error, to optimize it, and to combine or select models, e.g, the Structural Risk Minimization approach along with Support Vector Machines, various Boosting algorithms and the Bagging algorithm (which combine several models). These new approaches suggest that better generalization performance can be obtained using certain rather general procedures.

Méthodes d'inférence statistique

28 April, 2000

Org. : Christian Genest (Univ. Laval)

Tous les avis recueillis incitent à croire que les résultats exposés dans l'article de Feifang et John D.Kalbfleisch qui sera publié dans la Revue canadienne de statistique contribuent de façon importante au développement des méthodes d'inférence statistique fondées sur le réé-chantillonnage et le calcul numérique intensif.

Comme le Canada compte plusieurs spécialistes des techniques d'auto-amorçage, ce travail se prêterait bien, je crois, à un débat scientifique dont les comptes rendus pourraient être publiés en même temps que l'article lui-même, vraisemblablement dans le numéro de septembre 2000 de la revue.

Ce genre de débat public, très prisé au Royaume-Uni où il est pratiqué depuis plus d'un siècle par la Société royale de statistique, constituerait une première au Canada.

La liste des commentateurs pressentis s'établit comme suit :

- du Canada : Christian Léger (UdeM), Nancy M. Reid (Univ. of Toronto), James V. Zidek (Univ. of British Columbia);
- des États-Unis : Thomas J. DiCiccio (Cornell Univ.), Robert J. Tibshirani (Stanford Univ.);
- d'Europe ou d'Asie : Anthony C. Davison (Ecole polytechnique fédérale de Lausanne), Peter J. Hall (Australian National Univ.), Stephen M.-S. Lee (Univ. of Hong Kong).

Theme Year 2000-2001 : Mathematical Methods in Biology and Medicine

Organizing Committee

Jacques Bélair (UdeM)
Leon Glass (McGill)
Brian Golding (McMaster)
Leah Keshet (UBC)
David Sankoff (UdeM)
Keith Worsley (McGill)

Overview

The year 2000-2001 at the CRM will be devoted to the rapidly developing field of mathematical methods in biology and medicine. The application of mathematics contributes to the understanding of natural processes both through mathematical models and their analysis, and through the development and application of mathematical methods of inference. The year emphasizes both aspects, with workshops covering various applications of nonlinear dynamics in biology and medicine, as well as genomics, and medical imaging.

10th Summer School : *Nonlinear Dynamics in Biology and Medicine*

May 22 - June 3, 2000
Org. : Jacques Bélair (UdeM)

Instructors : M. Courtemanche (Montréal), E. Doedel (Concordia), L. Glass (McGill), M. Guevara (McGill), A. Longtin (Ottawa), M. C. Mackey (McGill), J. Milton (Chicago), A. Vinet (Montréal), J. Bélair (Montréal)

Offered jointly with the "Centre for Nonlinear Dynamics in Physiology and Medicine", this is an intensive introduction to the applications of nonlinear dynamics to biology and medicine, with computer exercices and an introduction to numerical techniques.

Aisenstadt Chair Lecture Series

Vortices in Motionless Media
Arthur T. Winfree (Arizona)
September 2000

Mathematics for Reading and Understanding Genetic Sequences
Michael S. Waterman (USC)
March 2001

International Annual Meetings *Combinatorial Pattern Matching (CPM 2000)*

June 21-23, 2000
Org. : Raffaele Giancarlo (Univ. of Palermo), David Sankoff (UdeM)

Invited speakers : A. Broder (Altavista), F. Pereira (AT&T Labs), I. Witten (Waikato, New Zealand)

This meeting has a major computational biology component and includes fields which share a common focus on the formulation, algorithmic recognition, analysis, communication and storage of patterns in diverse kinds of data.

5th Annual International Conference on Computational Molecular Biology (RECOMB 01)

April 21-24, 2001
Org. : David Sankoff (UdeM)

The premier annual meeting in computational molecular biology, featuring a highly competitive selection of the best research papers from cutting edge projects for presentation, its subject is computational and mathematical in nature.

Workshops *Workshop on Novel Approaches in RNA Informatics (NARI)*

May 18-19, 2000
Org. : François Major (UdeM)

Invited speakers : C. Duarte (Columbia), A. Ellington (*) (Texas), R. Hughey (*) (UCSC), V. Mohan (Isis), E. Rivas (Washington), B. Shapiro (NCI), C. Wilson (UCSC)
(*) to be confirmed

The goal of this symposium is to explore the current state of the art in RNA informatics and to look towards the future of the field. The NARI symposium will provide a general forum for disseminating the latest developments, and will bring together scientists from biochemistry, molecular biology, computer science, mathematics and statistics who will present an overview of novel approaches.

Workshop on Bioinformatics

May, 2000

Org. : Nadia El-Mabrouk (UdeM)

Invited speakers : G. Butler (Concordia), G. Drouin (Ottawa), D. Forsdyke (Queen's), A. Kusalik (Saskatoon), M. Li (Waterloo), P. Rouzé (Ghent)

A workshop on diverse problem areas in bioinformatics, in the context of the annual meeting of the Association canadienne-française pour l'avancement des sciences.

There will also be several colloquium style lectures.
Invited participants: A. Gabrielov (*) (Purdue University), G.G. van der Hoeven (*) (CNRS, Université de Paris-Sud (Orsay)), N. Kamran (*) (McGill University), A. Khovansky (*) (University of Toronto), M. Lodav-Richaud (*) (Université d'Angers), D. Marker (University of Illinois at Urbana-Champlain), F. Menous (*) (Université de Paris-Sud (Orsay)), Abderaouf Mourtada (Université de Bourgogne), R. Moussu (*) (Université de Bourgogne) A. Pillay (University of Illinois at Urbana-Champlain), Ch. Rousseau (Université de Montréal), D. Schlomiuk (Université de Montréal), M. Singer, (University of North Carolina), P. Speisegger (*) (Fields Institute), J.C Tougeron (*) (Université de Rennes), B.Vallet (*) (Université de Paris-Sud (Orsay)).
(*)to be confirmed

Workshop on Molecular, Metabolic, and Gene Control Networks

September 9-13, 2000

Org. : Michael C. Mackey (McGill)

Invited speakers : J. Collins (Boston), G. Church (Harvard), I. Epstein (Brandeis), J. Ferrell (*) (Stanford), L. Glass (McGill), A. Goldbeter (Brussels), H. Herzel (Berlin), K. Kohn (NIH), R. Larter (Purdue), S. Leibler (*) (Princeton), J. Mahaffy (San Diego State), J. Reinitz (Mt. Sinaï), J. Ross (Stanford), M. Roussel (Lethbridge), M. Santillan (Mexico City), M. Savageau (Michigan), S. Scott (Leeds), K. Showalter (West Virginia), P. Smolen (*) (Houston), R. Somogyi (Incyte), J. Tyson (Virginia), D. Wolf (Lawrence Livermore)
(*) to be confirmed

Modeling in this field has recently considered topics including regulation of progression through the cell cycle as mediated by check points, control in the lactose and tryptophan operons, and the integrated behaviour of large coupled molecular / metabolic / gene networks. This workshop brings together both experimentalists and modelers to examine the current state of the field and the exciting future prospects.

Workshop on Gene Order Dynamics, Comparative Mapping and Multigene Families (DCAF)

September 22-25, 2000

Org. : David Sankoff (UdeM), Joseph H. Nadeau (Case Western Reserve University)

Invited speakers : S. Anderson (Uppsala), V. Barriel (Paris) & C. Gallut (Paris), B. Bed'Hom (Paris), M. Blanchette (Seattle), J. Boore (Michigan), P. Bork (Heidelberg), D. Bryant (Montréal), G. Burger (Montréal), A. Caprara (Bologna) & G. Lancia (Padua), O. Cohen (Grenoble), K. Devos (UK), E. Eichler (Case Western Reserve), N. El-Mabrouk (Montréal), V. Ferretti (Montréal), A. Hughes, R. Irving (Glasgow), H.-P. Klenk (Gottingen), B. Koop (Victoria), D. Liben-Nowell (Cornell), L.A. Lyons (NIH), S.R. McCouch (Cornell), A. McLysaght (Dublin), S.M. McPeek (Chicago), J. Meidanis (Sao Paolo), A. Paterson (Georgia), J. Postlethwait (Oregon), D. Schoen (McGill), R. Shamir & I. Pe'er (Tel Aviv), M. Turmel (Laval), B. Trask (Seattle), D. Waddington (UK), J. Womack (Texas A&M)

This meeting will bring together scholars in the biological and mathematical sciences working on genome rearrangement, mapping and the evolution of gene families in human, animal, plant, other eukaryote, prokaryote, organellar and viral genomes.

Workshop on Nonlinear Dynamics and Biomathematics

October 3-6, 2000

Org. : Pierre Auger (Lyons), Jacques Bélair (UdeM), Jacques Demongeot (Grenoble), Christiane Rousseau (UdeM),

Invited speakers : O. Arino (Pau), P. Auger (Lyons), H. Benali (CHU Pitié Salpêtrière), A. Bourdou (INSERM), R. Bravo de la Parra (Alacala), F. Clarke (Lyons), J.-L. Coatrieux, J. Demongeot (Grenoble), A. Goldbeter (UL Bruxelles), R. Roussarie (Dijon), R. Thomas (UL Bruxelles), P. Tracqui (Grenoble), J. Bélair (Montréal), L. **Gagnon** (CRIM), L. Glass (McGill), B. Goulard (Montréal), J.-M. Lina (Montréal), S. Lessard (Montréal), A. Vinet (Hôpital du Sacré-Coeur), N. Raissi (Maroc), D. Salahub (Institut Steacie), G. Wolkowicz (McMaster)

The state of the art in the application of techniques from nonlinear dynamics to diverse fields of biology (biochemistry, physiology, resources management, medical imaging) will be covered. This workshop is part of the Entretiens du Centre Jacques-Cartier.

Workshop on Memory, Delays and Multistability

October 12-15, 2000
Org. : André Longtin (Univ. of Ottawa)

Invited speakers : P. Bressloff (Loughborough), S.A. Campbell (Waterloo), C. Canavier (Nouvelles Orléans), G. Carpenter (Boston), A. Destexhe (Laval), M. Ding (Florida Atlantic), W. Gerster (Lausanne), L. Glass (McGill), J. Guckehneimer (Cornell), A. Herz (Humboldt-Bremen), F. Hoppenstaedt (Arizona State), W. Mass (Tech. U. Graz), J. Milton (Chicago), K. Pakdaman (INSERM), X.-J. Wang (Brandeis)

This workshop will focus on important current issues in the modeling of neural activity in recurrent circuitry, such as recurrent activity thought to lie at the core of sensory information processing. The emphasis will be on the mathematical issues which arise in the modeling of such activity in real biological systems.

Workshop on Mapping and Control of Complex Arrhythmia

October 29 - November 1, 2000
Org. : Leon Glass (McGill)

Invited speakers : M. Allessie (*) (Holland), D. Christini (New York), J. Collins (Boston), W. Ditto (*) (Georgia), A. Garfinkel (Los Angeles), P. Guerra (*) (Montréal), R. Ideker (Alabama), J. Jalife (*) (Syracuse), A. Karma (Boston), V. Krinsky (Nice), J. Leon (*) (Montréal), M. Lesh (San Francisco), R. Mehra (*) (Minneapolis), D. Nahon (*) (Montréal), S. Nattel (*) (Montréal), A. Panfilov (Holland), Y. Rudy (Cleveland), N. Trayanova (New Orleans), A. Vinet (Montréal), A. Winfree (*) (Arizona), F. Witkowski (*) (Calgary)
(*) to be confirmed

This workshop will bring together mathematicians, experimentalists, physicians, and industrial representatives to present papers and discuss approaches to map and control complex arrhythmias. There would be a strong focus on novel interdisciplinary approaches to control atrial fibrillation.

Workshop on Fractal and Modeling in Structural and Dynamical Analysis

November 11-14, 2000
Org. : Jacques Bélair, Fahima Nekka (UdeM)

Invited speakers : Q. Cheng (York), A. Einstein (Mt. Sinaï), B.H. Kaye (Laurentian), S. Lubkin (North Carolina), H.E. Stanley (Boston), C. Tricot (Clermont-Ferrand), E. Vrscay (Waterloo), G. West (Los Alamos)

Classical problems in material sciences (surface characterization, description of branching networks) have been given new impetus by the introduction of fractal concepts. This workshop will cover the latest theoretical developments, their contributions in the biomedical field and future directions of investigations.

Workshop on Mathematical Methods in Brain Mapping

December 10-11, 2000
Org. : Keith Worsley (McGill)

Invited speakers : J. Ashburner (UCL), J. Aston (London), H. Benali (CHU Pitié Salpêtrière), E. Brown (Harvard), A. Dale (Harvard), K. Friston (UCL), G. Glover (Stanford), L. K. Hansen (Tech. U. Denmark) , N. V. Hartvig (Aarhus), M. Hurdal (Florida Atlantic), S. Kiebel (FSU jena), J.-F. Mangin (Service Hospitalier Frédéric Joliot, Orsay), J. Raz (U. Penn.), J. Riera (Cuban Neuroscience Center), J. Taylor (McGill), P. Thompson (UCLA)

Brain mapping is a rapidly growing research field that tries to understand human brain function and anatomy using 3D images from MRI, fMRI, PET, EEG and MEG using geometry, topology, statistics and random fields. This workshop is intended to bring together mathematicians and statisticians interested in brain mapping, and medical researchers interested in mathematical and statistical methods for the analysis of brain mapping data.

Workshop on Fractals and Wavelets in Medical Imaging

March, 2001
Org. : Jean-Marc Lina (UdeM)

Workshop on Population Genetics at the Molecular Level

March 8-11, 2001
Org. : Brian Golding (McMaster)

Invited speakers : J. Huelsenbeck (Rochester), A. Rzhetsky (Columbia), N. Goldman (*) (Cambridge), J. Thorne (NCSU), Z. Yang (U.C.London), L. Excoffier (Geneva), S. Kumar (Arizona State), B. Rannala (Stony Book), S. Muse (NCSU), M. Gouy (Lyons)

The genes and alleles of classical genetics are abstract notions. Now that these are increasingly understood in terms of particular sequences of DNA and protein, the mathematical foundations of the field must be revisited and expanded, which is the object of this workshop.

Workshop on Mathematical Formalisms for RNA Structure

April 25-26, 2001

Org. : François Major (UdeM)

Invited speakers : R. Altman (Stanford), J. Brown (NCSU), D. Case (Scripps), D. Gautheret (CNRS-Marseille), R. Gutell (Texas), S. Harvey (Alabama), D. Haussler (*), E. Westhof (CNRS-Strasbourg), M. Zuker (*) (St. Louis)
(*) to be confirmed

This symposium will explore the current state of the art in computational RNA structure, and provide a look towards the future of the field

Courses and Seminars

Combinatorial Pattern Matching
June 19-20, 2000
Org. : David Sankoff (UdeM)

Invited speakers : D. Bryant (UdeM), N. El-Mabrouk (UdeM), I. Witten (Waikato, New Zealand) and others

Preceding CPM2000, this is a two-day tutorial on sequence analysis and other topics in computational biology and pattern matching.

Developing the Tools: A Canadian Bioinformatics Workshop
June 26-July 1, 2000
Org. : Christopher Hogue (Toronto), François Major (UdeM)

One of a series of training workshops piloted by the Canadian Genetic Diseases Network and the Biotechnology Human Resources Council.

Biochemical and Chemical Kinetics
September 7-8, 2000
Org. : Michael C. Mackey (McGill)

Invited speakers : K. Shoewalter (West Virginia), S. Scott (Leeds)

Preceding the workshop on Molecular, Metabolic, and Gene Control Networks, this course will introduce the basic concepts and techniques for the modeling of biochemical processes.

Techniques in Brain Mapping
December 5-8, 2000
Org. : Keith Worsley (McGill), Bernard Goulard (UdeM)

Invited speakers : R. Adler (TECHNION), H. Benali (CHU Pitié Salpêtrière), N. Lange (Harvard), P. Valdes (Cuban Neuroscience Center)

In preparation for the workshop on brain mapping, four series of introductory lectures will be given, covering the geometry of random field, methods in functional magnetic resonance imaging and methods for EEG analysis.

Fractals and Wavelets in Medical Imaging
March, 2001
Org. : Jean-Marc Lina (UdeM), Fahima Nekka (UdeM)

Invited speakers : J. Levy-Vehel (INRIA, Rocquencourt), M. Unser (Swiss Federal Institute of Technology, Lausanne)

Preceding the workshop, this tutorial will introduce the subject to nonspecialists.

Showcase for Competing Technologies for Phylogenetics (SCOPH)
April 18-20, 2001
Org.: David Bryant and David Sankoff (UdeM)

Invited speakers : D. Bryant (Montréal), A. Dress (Bielefeld), J. Felsenstein (Seattle), O. Gascuel (Montpellier), T. Hagedorn (College of New Jersey), K. Nixon (Cornell), M. Steel (Canterbury), D. Swofford (Cornell), T. Warnow

This seminar is addressed to researchers, teachers and students interested in current developments in phylogenetic analysis. The speakers will each address one or two major areas and there will be ample time for comparison, debate and discussion. Some of the themes will be: efficient methods for very large phylogenies, model-based versus model-free approaches, tree inference with and without ancestor reconstruction, generalizations of trees. Software packages will be available on-line and there will be facilities for demonstrations and hands-on experimentation.

Visitors

Support is available for short and long-term visits. Preference will be given to Junior investigators.

Those wishing to participate in the above activities are invited to write to:

Louis Pelletier
Centre de recherches mathématiques (CRM)
E-mail: **ACTIVITES@CRM.UMontreal.A**
World Wide Web:
http://www.CRM.UMontreal.CA/biomath

General Program 2000-2001

Asymptotic series, differential algebra and finiteness problems in non-linear dynamical systems

June 18 - July 7, 2000
Org. : Dana Schlomiuk, (UdeM), Luc Bélair, (UQAM).

While the relationship between asymptotic analysis and differential algebra has a long history in linear differential equations, the merger of tools and the opening of a wider scope of investigation in both the areas of nonlinear dynamics and differential algebraic geometry is more recent. In particular, model theoretical methods have recently come to the fore in the area. These new developments provide ample motivation for organizing a mini-programme in this area of research.

The aim is to get specialists together from these different fields and have them talk. Plenty of time will be reserved for discussion, and the whole event will last three weeks, starting with a week of mini-courses, and followed by an extended two week workshop-working session.

1. There will be four mini-courses for graduate students and potential researchers:
- on asymptotic analysis, by A. Bolibruch (Steklov);
- on differential algebra with applications to finiteness problems and differential algebraic geometry, by A. Buium (University of Mexico);
- on o-minimality and logarithmic-exponential series, by L. Van den Dries (University of Urbana-Champaign);
- on finiteness theorems in dynamical systems, by V.Y. Kaloshin (Princeton).

2. A workshop built-around four themes :
- Algebras of quasi-analytic germs, Weierstrass type preparation theorems and finiteness results with applications to global problems on analytic vector fields
- Finiteness theorems in non-linear dynamical systems
- Ecalle's theory and applications
- Model theory-finiteness theorems in o-minimality

National Programme Committee : *Funding Recommendations*

The National Programme Committee composed of the three canadian mathematical institutes met in Montreal on November 10, 1999. The following events were approved for funding :

- Pauline van den Driessche, UVic
  Western Canada Linear Algebra Meeting
  May 2000.
  University of Manitoba
- Luc Vinet, McGill
  Special Functions 2000
  May-June 2000
  Arizona State University
- Duncan Murdoch, UWO
  Statistical Society of Canada
  June 2000
  Ottawa, Ontario.
- Wieslaw Krawcewicz, Alberta,
  Topological and Variational Methods in Nonlinear Analysis
  June 2000
  Warsaw
- Lynn Batten, Manitoba
  First Prairie Industrial Problem Solving Workshop
  August 2000
  Brandon, Manitoba
- George Elliott, Fields
  Canadian Annual Symposium on Operator Algebras
  May 2001
- Arturo Pianzola, Alberta
  Conference in Honour of Robert Moody
  August 2001
  Banff, Alberta

Theme Year 2001-2002 : Groups and geometry

Org. : Steven Boyer (UQAM), Abram Broer (UdeM), Jim Carrell (UBC), William Casselman (UBC), Niky Kamran (McGill), Boris Khesin (Univ. of Toronto), Dani Wise (McGill).

The year 2001-2002 will be devoted to various aspects of the relationship between groups and geometry. It will consist of two segments. The first (summer-fall 2001) will concentrate on selected interactions between groups, topology and differential geometry. Topics to be covered include transformation groups in geometry and topology, geometric group theory, hyperbolic geometry, and infinite-dimensional Lie groups. The second segment (winter-spring 2002) will focus on the links between algebraic geometry, group theory and representation theory. Topics to be explored include geometric representation theory and algebraic or unitary representations, algebraic transformation groups, invariant theory, quantum groups, and affine algebraic geometry.

There will be a significant component of theprogram devoted to graduate training, with each workshop preceded by a mini-course. Furthermore, given the rather heavy technical requirements of some of the topics, graduate courses will be offered through the ISM covering perverse sheaves and intersection homology, D-modules, and geometry and representation theory.

A series of workshops, listed below with their organizers, is planned.

- transformation groups (I. Hambleton)
- groups and 3-manifolds (S. Boyer, D. Wise).
- infinite dimensional Lie groups (N. Kamran, B. Khesin).
- algebraic transformation groups (A. Broer, F. Knop, J. Carrell).
- representation theory of real reductive Lie groups, algebraic and geometric methods (W. Casselman).
- classical invariant theory (E. Campbell, D. Welhau).
- quantum groups (P. Etinghof).
- group actions and affine algebraic geometry (D. Daigle, P. Russell).

RESEARCH PROGRAMS

Research reports appear in their original language.

Square-integrable group representations, wavelets and Wigner transforms

Twareque Ali

My research during the last couple of years was centered around the theory of square-integrable group representations and the relationship of square-integrability with the Plancherel transform. It has been demonstrated that the Plancherel transform for Type I groups is the unifying link between square-integrability, the wavelet transform and the generalized Wigner function. This connection has far-reaching consequences, in the sense that it can be used to generate large classes of Wigner functions for Type I groups. From the point of view of physical applications, Wigner functions are quasi-probability distributions on classical phase spaces (coadjoint orbits of the groups in question), corresponding to quantum mechanical states, and hence they can be used to study the physical states of atomic and quantum-optical systems. They can also be interpreted as characteristic signatures of signals in image analyses. In this way, the use of the Plancherel transform in connection with square-integrability unifies the theories of signal analysis, wavelet transforms and quantum tomography. On the computational side, a large number of generalized Wigner distributions have been computed for a special class of group semidirect products admitting open free orbits under the coadjoint action. These distributions have been used extensively in atomic and quantum optical calculations.

Modélisation avec des densités à queues aplaties

Jean-François Angers

En théorie de la décision bayésienne, en plus de spécifier un modèle statistique pour les observations, nous devons spécifier un second modèle pour les paramètres décrivant celui des observations. Lorsqu'un des deux modèles est inadéquat, notre échantillon peut alors contenir des valeurs extrêmes. Le comportement des règles de décisions en présence de ces observations extrêmes dépend surtout de l'aplatissement des queues de la densité des paramètres et de celui de la densité des observations. Il est donc important d'être capable de bien caractériser les queues d'une densité. Le cas où nous avons une seule observation et nous voulons estimer un paramètre de position a déjà été étudié. Ce cas ne correspond pas vraiment à la réalité et il doit être généralisé au cas où nous avons plusieurs observations. Il serait aussi intéressant de voir comment cette façon de caractériser les queues d'une densité peut s'appliquer au paramètre d'échelle. Si nous réussissons à généraliser au paramètre d'échelle, il sera intéressant de s'attaquer au modèle de position-échelle et par la suite au modèle multivarié.

Numerical methods in fluid dynamics and electrodynamics

Paul Arminjon

P. Arminjon works in the domain of Computational Fluid Dynamics (CFD). With A. Dervieux, he constructs and analyzes high resolution non-oscillatory, positivity preserving finite volume/finite element methods for hyperbolic systems, with applications to compressible flows.

With M.C. Viallon, he has constructed a two-dimensional, second-order accurate, nonoscillatory finite volume method for staggered unstructured triangular grids inspired by the Lax-Friedrichs and Nessyahu-Tadmor one-dimensional difference schemes : they also proved the convergence of the method for a linear hyperbolic equation.

With D. Stanescu, he extended these schemes to a finite volume method for Cartesian grids, and with A. Madrane he developed and applied the triangular method to many typical flow problems ; comparison with other methods (discontinuous finite elements, etc.) showed the high resolution and sharp shock capture capacities of the method, which also requires shorter computing times. With A. Madrane, he has constructed a mixed finite volume/finite element method for the Navier-Stokes equations, where the convective terms are treated with the Arminjon-Viallon finite volume method and the viscous terms with a finite element method. With A. St-Cyr and A. Madrane, they have also extended the method to the three-dimensional case. Results are excellent both for cartesian grids and for unstructured tetrahedric grids. For cartesian grids they have proved positivity and a maximum principle.

History of Bourbaki and 20th Century Mathematics

Liliane Beaulieu

This manifold study reconstitutes the history of the Bourbaki group of mathematicians, from its inception in the 1930s until the late 1960s. Through a meticulous examination of the technical and the biographical evidence, it illustrates Bourbaki's work method by documenting the frequent shifts between individual and team work and the interplay of sometimes conflicting mathematical ideas, especially in the areas of set theory, algebra, and integration theory. As it probes the group's intellectual and social milieu, the analysis shows how the Bourbaki group came into being and eventually left its imprint on both the field of mathematics and French intellectual life in general. The study draws on a large body of unpublished material; sources include minutes of Bourbaki meetings, drafts written for the group's internal discussions, correspondence between members, as well as interviews with former members or witnesses of Bourbaki's deeds.

Equations non linéaires retardées

Jacques Bélair

La dynamique non linéaire fournit une interprétation de changements complexes du rythme physiologique comme bifurcations lorsque les valeurs des paramètres de contrôle sont modifiées. La théorie mène à des prédictions pour les comportements possibles dans un environnement expérimental et permet une explication unifiée des divers régimes. Le travail de Bélair est concentré sur les feedback non linéaires à retard en contrôle et dans les systèmes d'oscillations hormonales et neuromusculaires, en insistant sur le rôle du délai, des boucles multiples de feedback et des délais variables dans la génération de comportements périodiques (oscillatoires) ou irréguliers.

En collaboration avec J. Mahaffy et M. Mackey, on a développé un modèle d'érythropoiesis qui inclut un mécanisme de destruction à taux constant. Ce travail est étendu pour représenter la thrombopoièse, et inclure les découvertes récentes sur la thrombopoeitine.

Un projet de collaboration avec des chercheurs en pharmacologie, a mené à une co-supervision d'étudiant, afin de construire des modèles qui incorporent des régimes transients pour la représentation de mécanismes d'absorption.

Modélisation en imagerie neurofonctionnelle

Habib Benali

Le traitement du signal Imagerie par Résonance Magnétique fonctionnelle (IRMf) intégrant ses caractéristiques spatiales et temporelles et la reconstruction précise des signaux de l'activité neuronale locale dans le cortex en MagnétoEncéphaloGraphie (MEG) et en ÉletroEncéphaloGraphie (EEG), suscitent de nombreux travaux de recherche où d'importantes difficultés de modélisation se posent.

Notre projet vise, d'une part, au développement et à la validation de modèles spatio-temporels pour l'étude statistique des données de l'IRM fonctionnelle cérébrale et, d'autre part, à la caractérisation de populations de neurones sous-jacentes à la localisation de ce signal par l'étude des relations fonctionnelles avec le signal MEG et EEG. La reconstruction tomographique en MEG/EEG sera basée, d'une part, sur le calcul de distances entropiques et informationnelles et, d'autre part, sur l'emploi des approches hiérarchiques de traitement des données.

Les protocoles expérimentaux sont conçus pour étudier la dynamique spatio-temporelle des réseaux d'activations sur le plan du traitement spatio-temporel des informations, via la mise en correspondance des différentes images fonctionnelles et des images anatomiques. Sur un plan clinique plus général, on étudiera les phénomènes de redistribution compensatrice des aires fonctionnelles dus à des lésions cérébrales et à la chirurgie, via la comparaison des informations recalées pré et post-opératoires.

Algorithmes d'apprentissage

Yoshua Bengio

Les algorithmes d'apprentissage automatique permettent à l'ordinateur d'apprendre à partir d'exemples. Ce champ de recherche est à l'intersection de l'intelligence artificielle, l'inférence statistique, et l'optimisation numérique. Les algorithmes d'apprentissage sont particulièrement utiles dans les situations où nous n'avons pas assez de connaissances sur un problème pour directement énoncer une solution sous la forme d'un programme, mais où nous avons des exemples illustrant la tâche à effectuer. Le problème de l'apprentissage peut s'exprimer comme le choix d'une fonction parmi un ensemble de fonctions selon l'espérance d'un critère (la qualité de la solution choisie par l'ordinateur pour un exemple particulier). Cependant, comme la véritable distribution des exemples est inconnue, cette espérance ne peut

pas être calculée, seulement estimée par sa valeur empirique sur les données observées. La véritable difficulté de l'apprentissage est donc de généraliser, ou de pouvoir transférer l'information existante dans les exemples disponibles à de nouveaux exemples. Les recherches de Yoshua Bengio se concentrent sur certains types d'algorithmes d'apprentissage (en particulier les réseaux de neurones artificiels et les modèles de Markov cachés) et leurs applications (en reconnaissance de formes, reconnaissance de la parole, vision par ordinateur, analyse de processus industriels, et la prédiction et prise de décision à partir de séries chronologiques financières).

Décomposition de représentations

François Bergeron

Mes recherches concernent divers aspects de l'interaction entre la combinatoire et l'algèbre, plus particulièrement autour d'un problème central de la théorie de la représentation consistant à décomposer une représentation donnée en ses composantes irréductibles. On dit que le nombre d'occurrences d'une représentation irréductible au sein d'une représentation est sa multiplicité. Il appert que le calcul de ces multiplicités est fondamental dans plusieurs domaines de la physique et des mathématiques. Ainsi, pour la physique, cette multiplicité peut correspondre aux niveaux atomiques, pour l'algèbre, elle représente une dimension, et pour la combinatoire, elle répond à un problème d'énumération. Un résultat classique de Frobenius rend accessibles ces calculs (autrement difficiles) dans le contexte de la théorie des fonctions symétriques, au prix du développement de formules donnant l'expression de certains polynômes en termes d'une base fixée. Les fonctions de Schur et les fonctions de Hall-Littlewood ont classiquement joué ce rôle de bases fondamentales, mais, au cours des dernières années, de nouvelles bases ont été introduites pour répondre à de nouvelles problématiques. Ces variantes ont été synthétisées par Macdonald pour donner naissance à une nouvelle famille de fonctions symétriques à deux paramètres contenant toutes les bases précédentes.

En utilisant des techniques de la théorie des représentations, de la combinatoire algébrique et des calculs dans l'algèbre des fonctions symétriques, je cherche à trouver et démontrer des identités et des propriétés de ces polynômes de Macdonald. Ce sujet est particulièrement intéressant en ce qu'il fait interagir combinatoire, théorie de la représentation, analyse harmonique, théorie des fonctions spéciales et géométrie algébrique: et chaque progrès donne lieu à de multiples questions et applications dans tous ces domaines.

Studies in low-dimensional topology

Steven Boyer

His research efforts over the last few years focused on the topology of low-dimensional manifolds, particularly knot theory, and the geometric representation theory of 3-manifold groups. His primary interest in the first of these research areas is to study exceptional phenomena which arise from the geometric operation of Dehn surgery on knots. Together with his collaborator Xingru Zhang (SUNY at Buffalo) they were able to prove definitive results in several cases they studied. The methods they employed involved an interplay between the topology of 3-dimensional manifolds and the representation theory of their fundamental groups. In particular they made important theoretical advances in this latter area which led to our applications in surgery theory.

The fields of algebraic transformation groups and invariant theory

Abraham Broer

At the moment he is primarily interested in the algebraic varieties that are related to the representation theory of semisimple Lie groups. The relations between representation theory and algebraic geometry are deep and very interesting.

Some typical examples of such algebraic varieties are varieties of nilpotents in a semisimple Lie algebra, decomposition varieties, and the cotangent bundle of a flag variety. For the study of these varieties one needs algebraic geometry, algebraic topology and invariant theory.

In recent years he studied in particular the structure of decomposition varieties of semisimple Lie algebras, with applications to hyperplane arrangements associated with reflections groups.

Control and nonsmooth analysis

Francis Clarke

A recent paper [IEEE Transactions on Automatic Control 42 (1997) 1394-1407] written in collaboration with Yu. S. Ledyaev, E. Sontag and A. Subbotin solves a well-known and long-standing question in control theory: we give a constructive proof of the fact that any asymptotically controllable system admits a *retour d'état* which stabilises it. In general, it is

necessary that this *retour d'état* be discontinuous. One can then prove its robustness by some new and apparently very promising techniques, and establish interesting relationships with the regularity of eventual Liapunov functions.

Courbes elliptiques et formes modulaires

Henri Darmon

Mes recherches des dernières années ont visé tout d'abord à démontrer certaines variantes p-adiques de la célèbre conjecture de Birch et Swinnerton-Dyer, projet qui a été mené à bien dans une série d'articles conjoints avec Massimo Bertolini. Plus récemment, mes travaux avec Bertolini m'ont amené à découvrir une généralisation tout à fait inattendue de la théorie classique de la multiplication complexe; cette généralisation, si elle pouvait être placée sur des bases mathématiques solides, aurait des conséquences importantes pour la théorie des nombres. C'est désormais le développement de cette théorie qui me préoccupe principalement.

Description of some current research areas

Michel Delfour

Modeling, computation, control and design of thin structures:

The use of distance functions and the tangential differential calculus have led to a completely intrinsic theory of thin structures. Applications are numerous: static design, noise reduction in airplanes and pipes, stabilization of high-speed rotating machines, shape optimization of vibrating gyroscopes now used in cars, planes and missiles. The new tools and models tend to demystify the classical theory of shells and provide more intuitive constructions of models of composite shells including piezzoelectric sensors and actuators. This has also helped in understanding certain aspects of the numerical locking which arise from missing terms in Naghdi's model for instance. The work on asymptotic models has also been helpful in identifying three-dimensional approximations which converge to the asymptotic model. The potential of these methods is considerable in practice, and for the optimal design, since it becomes possible to simultaneously deal with the approximation of a thin structure by a thin shell and the approximation of the shell in a single step (Yang, Fortin) from a set of points specifying the midsurface of the shell.

Radio frequency assignments and design of cellular systems

This area of research is becoming more and more important as the volume of voice and data communications increases and as the industry develops and offers new products. The objective is to maximize the use of a finite spectrum of channels in the increasingly saturated environment of large Canadian urban areas while maintaining sufficient flexibility for changing conditions. These optimization and design problems can involve thousands of frequencies which have to satisfy intra and inter cellular non-interference conditions. This can require enormous volumes of intensive computations.

Description de projets

Rachida Dssouli

Nos projets de recherche s'inscrivent dans le cadre de l'ingénierie des logiciels de télécommunication. On s'intéresse tout particulièrement à la modélisation des systèmes complexes réactifs et temps réel. La majorité de nos travaux utilisent des techniques formelles telles que la théorie de contrôle, la théorie des automates, la théorie des graphes et algorithmes de minimisation. Nos projets sont:

- Les environnements de création de service : deux projets sont en cours, l'un Bell (LUB) sur les applications multimédia, et l'autre avec France Telecom.
- La génération de séquences de test fondées sur les modèles. Projets en cours :
  - Les tests fondés sur les automates étendus par les données incluant les machines communicantes (Nortel).
  - Les tests fondés sur les automates d'entrée sortie temporisés. Deux modèles de temps sont pris en considération, le temps dense et le temps discret (CRSNG).
- La spécification gestion et négociation des aspects du temps et de performance dans les applications multimédia (projet rcm_2).

Fractional generalization of the KdV equation

Stéphane Durand

Using supersymmetry it is possible to generalize in a non-trivial way the Korteweg-de-Vries equation (KdV) to an integrable system of two coupled differential equations (Mathieu). Knowing that the supersymmetry can itself be extended (parasupersymmetry and fractional supersymmetry [Durand, Vinet]), it is natural to look for generalizations to integrable systems of several coupled differential equations. The formalism of fractional superspace introduced

by Durand allows such a generalization in a natural way. This result is reached using the fractional extension of supersymmetry, the Hamiltonian structure of the fractional pseudo-classical mechanics and the fractional generalization of a superextension of Virasoro algebra (and / or its *q*-deformations).

Méthodes algorithmiques pour l'analyse des séquences génomiques

Nadia El-Mabrouk

Mes projets de recherche s'orientent sur deux aspects différents liés à l'analyse des génomes.

Le premier aspect se rattache à la phylogénie. L'une des méthodes utilisées pour reconstituer le scénario d'évolution d'une espèce consiste à étudier les régularités à l'intérieur de son génome, et en particulier à considérer l'ensemble des gènes dupliqués. La duplication du génome entier est l'un des mécanismes qui entraîne l'apparition de gènes dupliqués. A la suite d'un tel phénomène, le génome subit une suite de mutations qui modifie grandement l'ordre et l'orientation des gènes. Le problème consiste alors à retrouver le génome initial et les mutations survenues. Une façon d'aborder ce problème est de considérer le nombre minimum d'opérations de réarrangement nécessaire pour transformer un génome en un génome dupliqué (méthode de parcimonie). Ce projet contient de nombreux aspects différents, et donne lieu à diverses études algorithmiques et combinatoires intéressantes.

Le deuxième aspect de ma recherche concerne la prédiction de motifs biologiques structurés, et en particulier de motifs d'ARN. Les motifs sont définis par un certain nombre de contraintes liées aux structures primaires et secondaires. Dans la plupart des cas, les motifs sont connus par leur fonction plutôt que par leur structure. Le but est alors de développer une méthode de recherche qui soit suffisamment souple pour permettre de découvrir des structures encore inconnues, et, de ce fait, d'améliorer la connaissance que l'on a du motif et d'affiner les contraintes. L'idée générale est d'élaborer des méthodes efficaces pour la recherche d'éléments structuraux ayant des caractéristiques bien déterminées, et d'intégrer les différents sous-programmes dans un programme global permettant de les utiliser dans un ordre choisi. La recherche de sous-motifs de la structure primaire fait appel à des méthodes de *pattern-matching*. La recherche de sous-motifs de la structure secondaire se base sur des considérations variées liées à des contraintes d'énergie, de structure (hélice, pseudo-nœud, épingle à cheveux, etc.), et de bases conservées.

Change of variables in multiple integrals

Isidore Fleischer

Change of variables in multiple integrals is very useful both for evaluation of integrals and for theoretical purposes. The basic theorem is usually stated by requiring continuous differentiability and injectivity of the transformation. Recent work has succeeded in lightening these hypotheses e.g. by removing continuity from the derivative. This study aims to push this cleaning up further.

Critical point theory for multivalued functionals

Marlène Frigon

Here are three main aspects of Marlène Frigon's researches:

Critical point theory and set-valued analysis (with differential inclusions) are two very active domains of mathematics which have, up to now, almost no intersection. Marlène Frigon started to link those two domains in developing a critical point theory for multivalued functionals. One can expect that this theory will lead to many applications in differential inclusions and control theory.

In collaboration with D. O'Regan of the National University of Ireland at Galway, Marlène Frigon studies differential equations with impulses, i.e. differential equations such that solutions must satisfy some impulses at fixed or variable moments. Their work is a part of an important project on differential equations with impulses sponsored by INTAS (an international association for the promotion of co-operation with scientists from the new independent states of the former Soviet Union), of which Prof. Rogovchenko of Ukrainian National Academy of Sciences is the supervisor. Another part of Marlène Frigon's research concerns existence and uniqueness results of fixed points for contractive or nonexpensive, single or set-valued maps.

Image segmentation and characterization using level set-based curve and surface evolution, boundary detection and Lie groups

Langis Gagnon

The objective of the current project is the development of algorithms based on snakes to detect contours in images. Methods to refine the analysis further and extract morphological information, in both two dimensions and three

dimensions, in an automatic way are also within the scope of this project.

Analyse

Paul Gauthier

Les nombres complexes peuvent être identifiés aux points du plan. Une fonction complexe $w=f(z)$ est donc une fonction qui envoie les points du plan des z sur des points du plan des w. Le problème principal des fonctions complexes est d'estimer la grandeur des disques contenus dans l'image de f (constante de Bloch). Le meilleur estimé à ce jour est celui de Gauthier et Chen. Encouragés par ce succès avec les transformations du plan, Gauthier et ses collaborateurs et étudiants ont amorcé une étude semblable pour les transformations de l'espace. Ils continuent aussi leurs recherches en approximation.

Statistical methods and imagery

Bernard Goulard

Bernard Goulard, in collaboration with J.M. Lina and P. Turcotte, extends to remote sensing some statistical methods worked out for remote monitoring and classification of nuclear reactor regimes. In the course of this work, focusing on scalar quantities (pressure, temperature…), the properties of some of the functions worked with (" wavelets " in particular) have been explored as one goes from one to two dimensions. We intend to adapt statistical methods to include extraction and anomaly detection in imagery, with an eye toward applications in several fields (environmental surveillance,…). Since last year, in collaboration with two research units of CHU Pitié-Salpêtrière of Paris (Dr. H. Benali), B. Goulard, J.M. Lina and C. Amblard have applied the statistical methods they recently developed to functional cerebral imaging (Magnetoencephalography and functional Magnetic Resonance).

Symétries et solutions des systèmes non-linéaires

Michel Grundland

Au cours des dernières années, les recherches de Michel Grundland portent sur les méthodes de réduction par symétries (MRS) ainsi que sur la méthode des invariants de Riemann (MRI) et leurs applications aux équations de la théorie des champs non-linéaires, à la physique de la matière condensée ainsi qu'à la dynamique des fluides. Le développement de ces méthodes nous fournit de nouveaux outils pour aborder les phénomènes non-linéaires en physique, spécialement ceux décrits par des systèmes multidimensionnels d'équations aux dérivées partielles (EDP) et qui n'ont pu être résolus par d'autres méthodes (par exemple la diffusion inverse). Le programme de recherche est constitué des 4 projets suivants:
Symétries conditionnelles pour les systèmes d'EDP non-linéaires.
Une comparaison entre les différentes méthodes de groupe de Lie servant à solutionner les EDP.
Solutions invariantes et partiellement invariantes des équations de la dynamique des fluides.
Les ondes de Riemann multiples pour les systèmes quasilinéaires d'EDP et les relations avec la méthode de réduction par symétries.

Systèmes intégrables, Déformations isomonodromiques et fonctions

John Harnad

Au cours de l'année passée, un projet collaboratif était complété en collaboration avec J. McKay, portant sur des solutions à une classe de systèmes différentiels généralisant le système de Halphen, avec les solutions générales données en termes de certaines fonctions modulaires uniformisant des surfaces de Riemann de genre zéro.
Un autre projet, complété durant un séjour au MSRI à Berkeley, concerne des déterminants de certains opérateurs intégraux de Fredholm qui figurent comme fonctions de distributions spectrales des matrices aléatoires. On a démontré que ces déterminants étaient des "fonctions tau" des systèmes dynamiques qui déterminent des déformations isomono-dromiques de certaines classes d'opérateurs différentiels linéaires aux coefficients rationnels.
Dans un troisième projet, on a démontré le rapport entre l'approche "bihamiltonienne" aux systèmes intégrables, la séparation de variables et l'approche développée auparavant, fondée sur les "coordonnées de Darboux spectrales" et les matrices-R rotationnelles. Ce dernier travail a amené de nouveaux contacts et échanges fructueux avec le groupe de l'Université de Milan (F. Magri, P. Casati) et ses réseaux (G. Falqui, de Trieste, M. Pedroni de Genoa).

Geometry and Physics

Jacques Hurtubise

During the year 1997-98, Jacques Hurtubise worked on several different topics. The first concerns stability theorems for moduli spaces of holomorphic curves in complex manifolds, and a long article on this topic was finished at the beginning of the period, and submitted. In

another area, a joint project with E. Markman on algebraically integrable Hamiltonian systems of Prym varieties was brought to fruition. Also, with a student (M. Kjiri), Dr. Hurtubise generalised a previous construction of separating coordinates for generalised Hitchin systems, which produces such coordinates, among others, for the elliptic and trigonometric matrix systems. Finally, a joint project with Lisa Jeffrey on the links between moduli spaces of bundles over Riemann surfaces and toric varieties has been pushed through, giving rise to a new class of objects on a Reimann surface, that of framed parabolic bundles.

Supersymmetry

Véronique Hussin

During the last twenty years, the theory of Lie groups and algebras has been extended in many directions. One of them deals with the supersymmetric theories and the notions of Lie supergroups and superalgebras. Since it is concerned with a unified description of fermionic and bosonic objects, one has to work with commuting and anticommuting variables. The problem of resolving nonlinear differential equations with such variables has been studied by V. Hussin, in collaboration with A. Ayari and P. Winternitz. New supersolitonic solutions have been obtained by generalizing the method of reduction by symmetries for such equations.

Another aspect of the research of V. Hussin deals with the construction of minimal uncertainty states in terms of the so-called “coherent” or “squeezed” states for supersymmetric systems in quantum mechanics. We make use of new relations between the eigenstates of annihilation operators associated with the harmonic and anharmonic oscillators and the Jaynes-Cummings model important in quantum optics.

Probabilités pures et appliquées

Anatole Joffe

Les processus de branchement décrivent l'évolution d'une population d'objets (individus, plantes, particules) qui se reproduisent suivant un mécanisme aléatoire. Lorsque ces objets se déplacent, le modèle est "la promenade aléatoire avec branchement"; ce modèle décrit des choses aussi différentes que le comportement d'un réacteur nucléaire (une population de neutrons se reproduisant par les chocs des neutrons sur les atomes) ou la description de la forme d'une forêt (une population de graines dispersées par le vent et les oiseaux).

Joffe s'intéresse depuis longtemps aux propriétés asymptotiques de ces processus sous des hypothèses minimales.

Formule exacte de l'espérance du rapport de la somme des carrés par le carré de la somme. Il s'agit d'études très techniques dont l'origine se trouve dans le problème précédent mais qui présente un intérêt *per se*. En collaboration avec A. Fuchs, J.L. Teugels, A. Joffe a obtenu des résultats définitifs sur le comportement asymptotique de ce rapport.

"L'ergodicité forte" dans le domaine des mathématiques pures ne peut être décrite dans un langage simple. A. Joffe et I. Fleischer ont obtenu des résultats dans ce domaine.

L'impact du développement des mathématiques pures est complètement imprévisible... mais presque toujours inéluctable (*it is a tale told by an idiot, full of sound and fury, signifying nothing* - Macbeth.)

Géométrie des équations aux dérivées partielles/ Groupes de Lie de dimension infinie/ Équations d’onde en relativité générale

Niky Kamran

Le programme de recherches de Niky Kamran comporte trois axes principaux. D’une part, il vise à étudier les rapports géométriques qui existent entre les diverses propriétés d’intégrabilité géométrique et l’existence de lois de conservation pour les équations aux dérivées partielles en dimensions $m \geq 3$. D’autre part, il porte sur l’étude des structures de groupe de Lie de dimension infinie qui sont adaptées à la théorie des pseudogroupes de Lie analytiques de type infini. Enfin, il a pour but d’étudier le comportement global des solutions d’équations d’onde telles que l’équation de Dirac dans les variétés pseudo-riemanniennes correspondant aux solutions exactes de type trou noir des équations d’Einstein, un des objectifs étant de démontrer la non-existence de fermions en configuration stable au voisinage d’un trou noir en rotation.

Amélioration de l’estimation harmonique

Paul Koosis

Jusqu’à récemment l’estimation harmonique (c.a.d. l’emploi de la formule généralisée de Jensen), a été l’un des procédés les plus puissants pour trouver des bornes pour une fonction analytique dont le comportement précis est inconnu. Il est très important en analyse de pouvoir établir ces bornes, car elles nous permettent d’augmenter notre connaissance de la fonction en question. Mais l’estimation

harmonique n'est pas un outil universel et ne s'applique pas dans certaines situations; il serait donc intéressant de trouver une méthode qui va plus loin.
On peut parfois obtenir les bornes qu'on cherche pourvu que les *intégrales* figurant dans l'estimation harmonique puissent être remplacées par des *sommes* de forme semblable, prises sur un ensemble discret de points, et on a vu dernièrement que ce remplacement *est* parfois possible. Pour cela la *plus petite majorante surharmonique* est employée. Le but de ce projet est de comprendre le rôle, encore mystérieux, joué par cet objet dans ce genre de question; on espère pouvoir de cette façon parvenir à une méthode générale.

Topologie symplectique et systèmes hamiltoniens

François Lalonde

Les travaux de recherche publiés dans les articles se rapportent à trois domaines différents des mathématiques :
La théorie de la complexité des algorithmes, en particulier la NP-complétude de problèmes algébriques qui apparaissent naturellement en informatique théorique;
La topologie différentielle classique, notamment la démonstration de la conjecture de J.H.C.Whitehead sur les homologies des simplexes plongés sans singularités et l'établissement des fondements de l'homologie sectionnelle de W. Shih;
La topologie symplectique et les systèmes hamiltoniens. Les articles les plus récents se rapportent à ce sujet, qui a fait l'objet d'un intense développement depuis une quinzaine d'années.
La topologie (ou géométrie) symplectique est l'étude mathématique des espaces courbes, de dimension paire arbitraire, munis d'une *forme symplectique*, analogue anti-symétrique d'une métrique riemannienne, qui donne à ces espaces la structure qu'il faut pour donner un sens aux lois de la physique aussi bien qu'aux procédés de quantification (passage du classique au quantique). Ce sujet est le versant mathématique de ce que les physiciens appellent la théorie des super-cordes. Son développement a attiré l'attention des physiciens (Witten, Vafa, Aspinwall, Greene, …) aussi bien que celle des mathématiciens, dont les méthodes ont suivi une évolution rapide depuis vingt ans.

The Ising model in domains with boundary

Robert Langlands, Marc-André Lewis et Yvan Saint-Aubin

In order to describe the critical behavior of the two-dimensional Ising model, this group of researchers has introduced a field similar to that of the free boson and whose jump lines delimit the constant spin clusters. The statistical distribution of this field has been studied by Monte-Carlo simulations. It satisfies the two hypotheses of universality and conformal invariance. Crossings on clusters of positive spins have also been investigated and certain of their properties are similar to those of crossings in percolation models.

Méthodes de rééchantillonnage et sélection de paramètres de lissage

Christian Léger

Les travaux de recherche de Christian Léger portent sur l'utilisation des méthodes de rééchantillonnage en statistique. Ces méthodes utilisent la puissance de l'ordinateur afin d'obtenir une approximation de la distribution d'un estimateur en vue de construire, par exemple, un intervalle de confiance pour un paramètre inconnu. Pour valider ces méthodes, on utilise la théorie asymptotique de même que des simulations. Parmi les problèmes particuliers étudiés par Christian Léger ces dernières années, il y a le choix d'un paramètre de lissage pour des estimateurs non paramétriques où les méthodes de rééchantillonnage comme le bootstrap et la validation croisée sont souvent utilisées. Un travail récent a démontré que la vitesse de convergence de l'estimateur avait un rôle important à jouer dans le succès de ces méthodes de sélection du paramètre de lissage. Plus particulièrement, ce travail a permis d'expliquer pourquoi la validation croisée fonctionne pour le choix d'un paramètre de lissage lorsque le problème est « difficile », alors qu'elle ne fonctionne pas lorsqu'il est « facile ».

Analysis of population genetic models

Sabin Lessard

Sabin Lessard's research interests include a wide variety of population genetic models and the concomitant evolutionary dynamics. His ultimate goals are: a) to explain the maintenance of variability in biological populations, b) to develop mathematical and statistical techniques to analyse population genetic structures, c) to deduce general evolutionary principles, and d) to study populations with complex interactions between individuals.

q-fonctions spéciales

Jean LeTourneux

La plupart des fonctions spéciales de la physique mathématique possèdent des *q*-analogues, c'est-à-dire des déformations faisant intervenir un paramètre *q*. De même que les algèbres de Lie fournissent un cadre unificateur pour l'étude des fonctions spéciales, les *q*-déformations de ces algèbres en fournissent un pour celle des *q*-fonctions spéciales. En collaboration avec Luc Vinet (CRM) et Roberto Floreanini (Trieste), Jean LeTourneux étudie systématiquement l'interprétation algèbrique des *q*-polynômes spéciaux contenus dans la hierarchie des polynômes d'Askey-Wilson.

Ondelettes, statistique et processus complexes

Jean-Marc Lina

En collaboration avec le groupe de recherche PhysNum qu'il codirige avec B. Goulard, Jean-Marc Lina consacre principalement ses activités scientifiques au traitement du signal. Les différents sujets étudiés ont comme dénominateurs communs l'analyse statistique, les techniques d'inférence et, depuis six ans, la théorie des ondelettes, qui a donné lieu à une recherche active dans le contexte des bases en ondelettes de Daubechies complexes. Les propriétés de ces fonctions ont conduit à des travaux plus appliqués, comme l'estimation de signaux dans le domaine de l'industrie nucléaire et, plus récemment, l'imagerie. Ainsi, la modélisation statistique de la représentation multi-échelle complexe des images (par un modèle de Markov caché) et la mise au point d'un algorithme d'optimisation pour des observations complexes ont débouché au cours de la dernière année sur des algorithmes d'estimation robustes et sur une technique originale de classification de textures. La statistique des signaux complexes est également à la base d'une étude d'estimation de phase pour l'imagerie d'interférométrie radar en collaboration avec l'industrie. Dans le contexte de l'imagerie cérébrale fonctionnelle, J.M. Lina collabore actuellement avec deux unités de recherche à Paris (INSERM et CHU-Pitié-Salpêtrière) pour appliquer des techniques statistiques à la détection des sources fonctionnelles à partir de données magnéto-électro-encéphalographiques. Parmi les principaux aspects de ce problème, on citera la prise en compte des informations *a priori* de l'imagerie de résonance magnétique fonctionnelle ainsi que la modélisation multi-échelle de la surface corticale.

Invariance conforme et intégrabilité

Pierre Mathieu

La théorie des champs conformes est une théorie quantique des champs en deux dimensions (2D) ayant une invariance sous tout le groupe conforme, qui, en deux dimensions, est infini. Grâce à la profonde analogie structurelle entre la théorie quantique des champs et la physique statistique, elle permet d'obtenir la solution exacte et la classification des phénomènes critiques en deux dimensions. En plus de son importance en physique statistique, la théorie des champs conformes est fondamentale en théorie des cordes, qui reste le seul cadre théorique viable pour l'unification de la gravité aux interactions de jauge qui décrivent les autres forces fondamentales. Les percées remarquables réalisées récemment en théorie des cordes, en particulier la conjecture reliant les espaces anti-de Sitter aux théories avec invariance conforme, ont donné une nouvelle dimension à cette interrelation. Finalement, par sa riche structure mathématique, la théorie des champs conformes en deux dimensions est un des domaines les plus fertiles de la physique mathématique moderne.

Etant invariantes sous des transformations d'échelle, les théories conformes constituent une classe restreinte de théories de champs quantiques en deux dimensions, soit les théories sans masse. Néanmoins elles peuvent devenir le point de départ d'une nouvelle approche à l'étude des théories massives en deux dimensions où ces dernières sont obtenues par des perturbations appropriées de théories conformes. Ceci permet d'appliquer la puissante technologie conforme à la description de systèmes au voisinage du point critique. Un fait remarquable est que certaines perturbations donnent des théories massives complètement intégrables, i.e. pour lesquelles il existe un nombre infini d'intégrales qui commutent. Le projet concerne l'étude des divers aspects de la relation entre les théories conformes et les systèmes intégrables quantiques.

Moonshine and its Haupt modules and ADE

John McKay

We investigate the consequences of the relation between the Monster sporadic finite group, and the Haupt modules which describe its representations. This research was started in 1979 by the author and is known as Monstrous Moonshine. Designated by John Thompson (Fields medalist) as a 'problem for the next

century' it has recently been explained by Richard Borchards for which he was awarded a Fields medal in 1998 at Berlin. By using recurrence relations for the Fourier coefficients of the Haupt modules, and the devices of symmetrization and desymmetrization, we believe we have a complete list. A consequence of this is the description of many hundreds of integrable systems attached to the Haupt modules, generalizing the work of Halphen in 1881 on the reduction of self-dual Yang-Mills.
The ADE problem, now called the McKay correspondence, involves the remarkable fact that the fundamental groups of type E_8, E_7, E_6 are related to the Monster, Baby, and F_{24} as Schur multipliers.

Lie Theory, Quasicrystals, and Image Processing

Jiri Patera

Following is a list of the research interests being pursued by Jiri Patera.
Application of Lie theory. Exploitation of our most recent results, namely the classification of the gradings of classical simple Lie algebras over the real number field. Most important among the applications is the grading preserving deformations of the algebras.
Study of properties and applications of the cut and project point sets ("quasicrystals"). Completion of a small monograph where the properties of the 1-dimensional sets are brought together, proven, explained.
Specific applications of image processing and data fusion motivated mainly by our collaboration with Lockheed Martin, Canada.
Most intensive efforts will be invested in the application of "quasicrystals" in cryptography, and in the exploration of the many possibilities, evaluation of demonstration models, and the security questions.

Inférence statistique, simulations MCMC

François Perron

Les intérêts de recherche de F. Perron sont liés à la statistique et portent plus particulièrement sur les sujets suivants : théorie de la décision, analyse multidimensionnelle, statistique bayésienne et simulations par MCMC (chaînes de Markov avec Monte-Carlo). Les problèmes liés à la théorie de la décision visent à améliorer les estimateurs existants. L'approche privilégiée consiste à produire de meilleurs estimateurs minimax, l'estimateur minimax étant celui qui performe le mieux dans le pire des cas. Un estimateur est meilleur qu'un autre s'il fait toujours au moins aussi bien que l'autre en faisant parfois mieux. Dans l'article « *On a Conjecture of Krishnamoorthy and Gupta* » on démolit la conjecture qui prétend qu'un certain algorithme améliore plusieurs estimateurs minimax. Dans un autre contexte, celui de l'estimation d'une moyenne pour une distribution de loi normale en plusieurs dimensions, on sait que lorsque la dimension excède deux, on peut améliorer l'estimateur donné par la moyenne échantillonnale. Dans l'article « *Improving on the MLE of a Bounded Normal Mean* » on montre que le même phénomène se produit en dimension 1 et 2 lorsque la moyenne est tronquée. De façon générale, on favorise l'approche bayésienne. On y parvient plus facilement avec l'aide de l'ordinateur en effectuant d'intenses calculs numériques. Ceci nous amène à raffiner les méthodes de simulations existantes. Dans l'article « *Beyond Accept-Reject Sampling* » on perfectionne la méthode d'acceptation-rejet. Un projet en cours est de la rendre encore plus sophistiquée en y incorporant des chaînes de Markov.

Clones et relations

Ivo Rosenberg

Universal algebra. The main topic is the study of clones on a finite universe A which are composition closed sets of operations on A, a basic problem for finite algebras. Ideals, congruence kernels and discriminator algebras were also studied. Algebraic duality, an extension of Stone's duality for boolean algebras, allows topological representations of algebras. It was shown that dualizability is invariant under nilpotent shifts.
The very complex problem of local completeness and of locally maximal clones on infinite universes was reduced to a few more manageable cases. The completeness problem for uniformly delayed circuits over a finite at-least-four-letter alphabet was advanced. The simplicity of the lattice of clones and the description of all Mal'tsev clones on a finite at-least-three-element universe was studied.
Hyperalgebras. A hyperalgebra on A is an algebraic structure with values in the set P of nonvoid subsets of A. I. Rosenberg studied them as C-isotone algebras on P which allowed a universal algebra approach to hyperalgebras and lead to interesting problems on C-isotone clones on P. In particular, hypergroups on A can be studied as C-isotone monoids on P.

Étude qualitative et bifurcations dans les équations différentielles ordinaires

Christiane Rousseau

C. Rousseau poursuit son grand programme de recherche amorcé en 1991 avec F. Dumortier (Diepenbeek, Belgique) et R. Roussarie (Dijon) sur l'existence d'une borne uniforme pour le nombre de cycles limites d'un champ de vecteurs quadratiques dans le plan (dans le cadre du 16e problème de Hilbert). Pour compléter ce programme il faut montrer la cyclicité finie de 121 graphiques. Un progrès très significatif a été accompli avec la thèse H. Zhu (décembre 1999) qui montre la cyclicité finie de graphiques génériques ayant un point nilpotent de type elliptique ou selle. Des applications de ces théorèmes montrent la cyclicité d'environ 35 graphiques parmi les 121 du programme ci-dessus.

D'autre part un grand projet de recherche a été initié sur l'organisation respective des champs de vecteurs normalisables, intégrables et linéarisables dans l'espace des champs quadratiques (ou polynomiaux) du plan complexe au voisinage d'un point de selle. Dans ce projet C. Rousseau collabore avec C. Christopher (Plymouth, UK), P. Mardesic et R. Roussarie (Dijon).

Modélisation des séries chronologiques

Roch Roy

Roch Roy s'intéresse à la modélisation des séries chronologiques. Bien qu'étant un domaine classique de la statistique, l'analyse et la modélisation des séries chronologiques demeurent un domaine de recherche d'actualité à cause du grand potentiel d'application dans plusieurs disciplines scientifiques. Ses recherches récentes ont porté principalement sur les projets suivants:

développement de tests d'indépendance de deux séries chronologiques stationnaires ou non-stationnaires et application en économie et en finance.

étude des propriétés d'une classe de modèles de type régression linéaire généralisé afin de décrire des séries chronologiques à valeurs entières et application en épidémiologie.

développement d'un algorithme pour l'estimation à vraisemblance maximale exacte des modèles ARMA multivariés sous la forme échelon ou à racines unitaires.

modélisation des séries chronologiques ARMA faibles et application en finance.

Graphes eulériens et automorphismes de graphes

Gert Sabidussi

Graphes eulériens : Études des graphes 4-réguliers. Inspiré par l'importance de ces graphes pour la théorie des noeuds et par le fait que peu est connu sur leurs propriétés combinatoires, nous avons fait une étude approfondie de deux paramètres combinatoires importants, le nombre chromatique et le nombre de stabilité, pour plusieurs classes de graphes 4-réguliers. Pour les deux paramètres il y a des valeurs "naturelles", et notre recherche porte sur l'existence d'algorithmes efficaces pour décider si un graphe 4-régulier donné (avec ou sans contraintes additionnelles) atteint les valeurs naturelles. Le résultat principal de l'étude est que pour les deux paramètres le problème s'avère NP-complet.

Automorphisme: Pseudo-similarité / similarité. Ici on étudie des questions découlant de la théorie de reconstruction de graphes. Si en supprimant deux arêtes d'un graphe (une à la fois) on obtient deux graphes isomorphes (pseudo-similarité), les deux arêtes sont-elles dans la même orbite sous l'action du groupe d'automorphismes du graphe (similarité)? En général la réponse est négative, mais elle est affirmative si le nombre d'orbites du graphe est petit. Jusqu'à quel nombre d'orbites les deux types de similarité coïncident-ils? Ce qui est important dans ce genre de questions, n'est pas nécessairement une réponse finale mais les méthodes utilisées pour reconnaître la similarité de deux arêtes (ou d'autres éléments) d'un graphe. Plusieurs méthodes puissantes de ce type ont été développées au cours de notre étude.

Biomathématique et sociolinguistique

David Sankoff

David Sankoff's research involves the formulation of mathematical models and the development of analytical methods in the sciences and humanities. This includes the design of algorithms for problems in computational biology, applied probability for phylogenetic analysis of evolution, and statistical methodology for studying grammatical variation and change in speech communities. Recent work has focused on the evolution of genomes as the result of chromosomal rearrangement processes and on formal models for bilingual syntax.

Études locales et globales de champs de vecteurs analytiques

Dana Schlomiuk

Les travaux de Dana Schlomiuk portent sur des problèmes locaux (problème de centre) ainsi que sur la géométrie globale de certaines familles de

champs de vecteurs polynomiaux ou analytiques dans le plan. Ces travaux visent en particulier à donner une base conceptuelle nouvelle pour les champs de vecteurs polynomiaux dans le plan, permettant d'en dégager des traits caractéristiques de la dynamique doublement globale (on s'intéresse aux champs dans toute l'étendue du plan et cela pour des familles dépendant de paramètres) afin d'unifier des résultats épars de la littérature et d'en obtenir des nouveaux. Un trait caractéristique de ces travaux est l'usage des méthodes multidisciplinaires : analytiques, algébriques, géométriques (plus particulièrement algébro-géométriques). Un autre volet du projet en cours porte sur la partie finitude du 16e problème de Hilbert concernant les cycles limites.

Data Fusion

Elisa Shahbazian

Elisa Shahbazian's main area of expertise is Data Fusion architectures, and how the data fusion capabilities should be integrated within large systems.

Since 1994, she has been responsible for conception, prioritization, and coordination of all R&D activities at Lockheed Martin Canada. These activities involve development of intelligent decision support technologies for C^4I applications (Data Fusion – levels 1, 2, 3 & 4, Resource Management, Imaging, etc.) and the engineering infrastructure for the establishments of these technologies on board the Naval and Airborne platforms of Canada, and diversification of these capabilities into commercial applications such as Intelligent Transportation and Remote Sensing.

Nonsmooth analysis: theory and applications

Ronald Stern

Dr. R.J. Stern's general area of interest is nonsmooth analysis and control theory. A general goal in control problems is to design a feedback law, which achieves some desired behaviour. Examples include problems of stabilizing a dynamical system, steering a trajectory to a target set in minimal time, or minimizing a cost functional subject to some dynamic constraints. Even in some very simple models of such problems, however, there is generally no classical (e.g. continuous or smooth) feedback synthesis. The root cause of this is the fact that in optimal control, the value function is generally nonsmooth, while in problems of stabilization, one only has a generalized (nonsmooth) Lyapunov function available. Dr. Stern's present research interests involve applying the methods of nonsmooth analysis to such feedback design problems, in order to obtain solutions in a generalized framework.

Description de projets

Carolyne van Vliet

Nous nous occupons de plusieurs projets, tous financés par des contrats avec l'Air Force Américaine (AF-OSR).

Le bruit électrique dans les dispositifs submicrons de l'arsenure de gallium, qui contiennent un puits quantique, porteur d'un gaz d'électrons bidimensionnel. Dans certains cas, on trouve des spectres Lorentziens causés par des fluctuations de génération-recombinaison. J'ai récemment donné une théorie complète pour échantillons avec de multiples niveaux de piège. Cette théorie, asymptotiquement en accord avec des théories antérieures, sera soumise à *Physical Review B* dans un proche avenir. En d'autres cas, le bruit de génération-recombinaison est absent. Cependant, on trouve des Lorentziens avec grandeur proportionnelle au courant. Alors, nous supposons que ce bruit est un "bruit de grenaille", modulé par centres d'émission aléatoire. J'ai expliqué ces données, en utilisant et modifiant une théorie développée par moi-même et des collègues en 1981, basée sur une distribution de Poisson avec moyen aléatoire (compound Poisson distribution). Les résultats ont paru dans le *Journal of Applied Physics* du 15 décembre 1999.

La théorie de transport quantique. Avec mon étudiant au doctorat Andres Barrios, je continue les études de transports quantiques dans les gaz d'électrons de dimension réduite, voir mon article dans le volume "Advances in Mathematics CRM'S 25 year" (CRM Proceedings : and Lecture Notes, vol. 11, 1997). On cherche à éviter l'approximation perturbative pour les termes d'écoulement, tant dans l'équation Master que dans l'équation de Boltzmann quantique. Loin de l'équilibre, il faut éviter le "lemme de Kubo". Pour certains cas on a déjà réussi. Quand la théorie sera complète, les applications pour les systèmes électroniques et photoniques seront nombreuses, avec des retombées d'importance pour la technologie frontière.

Physique quantique et combinatoire

Luc Vinet

Les objectifs principaux des projets de recherche de Luc Vinet sont: de développer les outils

théoriques nécessaires à la résolution des modèles importants de la physique des systèmes quantiques à plusieurs corps; d'étendre la théorie des fonctions symétriques.
Luc Vinet et son étudiant au doctorat, Luc Lapointe, ont franchi une étape majeure vers la résolution algébrique du modèle de Calogero-Sutherland et, ce faisant, ont démontré des conjectures de longue date portant sur des polynômes symétriques parmi les plus importants de la combinatoire algébrique. Avec Roberto Floreanini (Trieste) et Jean LeTourneux, Luc Vinet a poursuivi son étude systématique de l'interprétation des *q*-fonctions spéciales en termes des groupes quantiques. Il a également entrepris l'étude des symétries des équations aux différences.

Group Theoretical Methods in Physics and Nonlinear Phenomena in Physics

Pavel Winternitz

Field of research: Mathematical physics, symmetries and nonlinear phenomena.
Applications of Lie groups to the study of difference equations.
Exact solutions of nonlinear differential equations, especially those coming from nonlinear optics.
Lie algebra contractions and the separation of variables.
Classification of Lie algebras and their subalgebras.

The geometry of random images in medicine and astrophysics

Keith Worsley

The Euler characteristic of the excursion set of a random field is a tool that has been used over the last decade to analyse positron emission tomography (PET) images, functional magnetic resonance images (fMRI), galaxy density maps and the cosmic microwave background, thought to originate from the creation of the universe. These images are modelled as a Gaussian random field, and the excursion set is the set of points where the field exceeds some fixed threshold value. The Euler characteristic, which counts the number of connected components of the excursion set minus the number of "holes", is the basis of a proposed estimator of the number of "signals" in the image. I have extended the theory developed by Adler (1981), The Geometry of Random Fields, to: a) include a boundary correction for the expected Euler characteristic, which leads to a highly accurate *P* -value for the field maximum; b) c^2, *t* and *F* fields; c) searching over smoothing kernel width as well as location, so we can estimate the extent of the signal (joint work with David Siegmund); d) knots in the excursion set.

Projection pursuit exploration

Yannis G. Yatracos

A statistic that appears naturally in simple regression and in a decomposition of the sample variance is used to define a projection pursuit index which indicates data clustering, groups of remote cases in the factor space in multiple regression and different data structures. The index is successfully applied in several examples. A version of the statistic can also be suited to group treatment means.

Description de projets

Jean-Paul Zolézio

Modélisation et contrôle des coques élastiques en géométrie intrinsèque.
Contrôle en écoulements visqueux et en fluide non newtonien.
Équations de coques précontraintes.
Équations différentielles de domaine.
Solution variationnelle pour les équations incompressibles d'Euler.
La dérivation par rapport au domaine permet d'étudier les variations infinitésimales de la solution d'une équation, par rapport aux variations du domaine. La dérivation des équations elliptiques et paraboliques est connue depuis les années 75, la preuve se base sur le théorème des fonctions implicites. Toutefois, cette méthode ne fonctionne pas pour les équations hyperboliques et le problème restait ouvert.
Le premier volet de mes recherches consiste en la démonstration de la dérivabilité par rapport au domaine dans l'équation des ondes pour des seconds membres réguliers. On caractérise la dérivée comme solution d'un problème caractéristique au moyen de la dérivée normale de la solution. On établit une condition nécessaire d'optimalité d'un domaine en utilisant la dérivée de forme. Le cas Neumann est également étudié.
Les travaux de L. Lasiecka, J-L. Lions et R. Triggiani sur l'équation des ondes (1986) donnent une régularité de la dérivée normale, qui ne résulte pas de la régularité de la solution. Cette régularité cachée permet à l'équation caractéristique de « survivre » lorsqu'on baisse la régularité du second membre. On montre que la solution de ce problème est la dérivée par rapport au domaine, également dans le cas où le second membre est peu régulier.

Dans un second volet, je m'intéresse à la vibration d'une coque précontrainte. Une coque est contrainte par un grand déplacement et petite déformation. On calcule au moyen d'un logiciel calcul formel-calcul numérique les positions d'équilibre statique des coques de type Adèle et logiciel S3CS. On étudie ensuite la vibration de la coque autour de cette position d'équilibre stable. La modélisation est effectuée au moyen de la fonction distance orientée.
L'équation obtenue est de type hyperbolique, on souhaite dériver les solutions par rapport au domaine. Pour ce faire, nous utilisons les méthodes développées pour la dérivabilité par rapport au domaine dans l'équation des ondes. Le problème réside dans l'absence de résultat de régularité et l'absence de régularité cachée. On démontre un résultat analogue à la dérivabilité cachée de l'équation des ondes par des méthodes de type extracteur, la régularité intérieure étant obtenue par la théorie des semi-groupes.
Parmi les développements futurs, on envisage le modèle exact $p(d,\infty)$ pour les coques précontraintes. On envisage également de généraliser les résultats de dérivabilité par rapport au domaine à une plus grande classe d'équations hyperboliques en extrayant les hypothèses minimales.

COLLABORATIONS

Within its general mandate of promoting mathematical research, the CRM maintains a wide network of collaborations. Some of these are national in scope, others more regional; others are international.

A National Institute

The CRM is strongly committed to its national mission. NSERC had imposed a constraint of spending a significant proportion of its grant outside Quebec; the norm was fixed at 25%. The CRM has always spent a more substantial fraction of its funds outside its home area than the other national institutes, and has always met this norm quite easily. This has not only been a question of political will; it has come about quite naturally, in achieving the aim of better scientific performance. The CRM takes measures to ensure that the largest possible number of scientists across Canada benefit from its activities and become involved in their planning. For instance, it appoints to its Advisory Committee eminent Canadian scientists from various parts of the country; it is present at all important forums where the future directions of the Canadian mathematical sciences are discussed; it urges its organisers to make efforts to ensure the participation of the Canadian specialists in their activities; it organises and supports scientific events across the country; and it collaborates with Canadian institutes, societies and associations. A new initiative this past year has been to set aside and advertise a specific budget for the participation of Canadian graduate students in our programmes. The CRM is the only national institute which operates in the two official languages of Canada and it is highly visible on the international scene. In keeping with its national role, it coordinates its activities with the Fields Institute, PIms, CMS, CAMS, SSC, CAP, AARMS, CCARMS, and collaborates with technology transfer centres as well as with other institutes abroad.

The Fields Institute (FI) and the Pacific Institute for the Mathematical Sciences (PIms)

The importance of coordinating the scientific activities of the CRM and the Fields Institute (FI) was stressed when the FI was created at the beginning of the 1990's. Since the beginning, communication between the two centres has been excellent. Thus, the directors have always been in regular contact; also, several members of the CRM have served on the FI's Scientific Advisory Panel (SAP), and conversely. The picture was completed recently by the addition of PIms, which brings together mathematical scientists from the five main western universities. The CRM has a long tradition of collaboration with these institutions and with many of the scientists that are involved in the management of PIms, providing substantial support to their activities; this collaboration has been maintained by the allocation of a $50,000 start-up fund to PIms, to help in the interim period before the arrival of their own NSERC funding.

The most striking example of the collaboration between the three institutes is the MITACS network, of which more below; we report now on other examples of this collaboration. The CRM-FI prize awarded in recognition of outstanding accomplishments in the mathematical sciences in Canada was created in 1994. This year's winner is R. V. Moody of the University of Alberta. The administrative responsibility in this matter alternates each year between the CRM and the FI. Nominations for the 1999 prize are currently being received. Scientific collaboration continues between the FI and the CRM. This year, they co-sponsored a large conference on combinatorics and power series,as well as two conferences on operator theory. The program for 1999 includes a summer workshop on “particles, fields and strings.” One new initiative is a joint thematic period in symplectic geometry and topology, during the spring of 2001.

The allocation to PIms of course also funded a large number of scientific activities, a list of which can be found in the PIms annual report. Several pan-Canadian initiatives were launched in the course of the last few years, jointly piloted by the three institutes: one can mention, apart from MITACS, the initiative to create a national program to fund off-site activities at the institutes, and a re-launching of the Canada-China mathematics initiative. This has resulted in a Canada-China Mathematics congress at the end of August 1999, which will be reported on at length in next year’s report.

Canadian Associations and Professional Societies

There are now two regional university associations for the promotion of mathematics in Canada: the Atlantic Association for Research in the Mathematical Sciences (AARMS) and the Central Canada Association for Research in the Mathematical Sciences (CCARMS). The CRM is already involved with these organisations and looks forward to developing closer ties. This past year, the CRM sponsored a CCARMS conference. The CRM is also much involved with a number of professional societies related to the mathematical sciences: the Canadian Mathematical Society (CMS), the Canadian Applied Mathematics Society (CAMS), the Statistical Society of Canada (SSC) and the Canadian Association of Physicists (CAP). Over the years and particularly recently, the CRM has funded many meetings that were held under their ægis. An important segment of the Canadian mathematical community gathers at the winter and summer meetings of the CMS. This year the CRM subsidised a special session in Operator Theory and one in Relativity and Geometry at the 1998 Saint John Summer Meeting as well as a special session in Number Theory at the Kingston winter meeting. Also, the president of the CMS is an ex-officio member of the CRM Advisory Committee and is thus able to make the case directly for activities that the CMS would wish the CRM to support. The CRM and the Canadian Association of Physicists (CAP) jointly sponsor the CAP-CRM Prize recognising outstanding work in theoretical and mathematical physics. This collaboration will undoubtedly be reinforced by the 1999-2000 thematic year in mathematical physics. Each year CAMS holds a general meeting. This year, it takes place at Laval University, in parallel with the Finite Element Days. The CRM is supporting this conference. The 1997-1998 theme year in statistics gave the CRM the opportunity to collaborate with the Statistical Society of Canada (SSC) In addition to supporting the SSC annual congress in 1998, the CRM has sponsored a CRM-SSC prize to recognise important work by a young Canadian statistician.

International Collaboration

The Université de Montréal is part of the 3x3 Canada-China Consortium with UBC, Toronto and McGill in Canada; Beijing, Nankai and Tsing Hua Universities in China. The CRM is one of the principal partners in the mathematics component of the project, and is in some sense a precursor, having signed an agreement with the Institute of Mathematical Sciences at Nankai University. The CRM is continuing its collaboration with the American Mathematical Society, in particular with its two series of publications with the AMS, the CRM Monograph series and the CRM Proceedings and Lecture Notes. The CRM has also signed exchange protocols with Osaka University and with Seoul's Asia-Pacific Center for Theoretical Physics. Further agreements are expected in the framework of the Canada-China initiative.

A Solid Regional Base

All this activity rests on a solid base of cooperation with universities in the region, in particular the Montreal universities, and most particularly the Université de Montréal, whose support for the CRM has been unceasing. The Université de Montréal releases each year six of its faculty members to work at the CRM, and the support of these faculty members is an essential asset for the CRM's scientific activities. There is in addition a regular program of teaching release with the other Montréal universities, bringing the equivalent of another two positions to the CRM each year. On an *ad-hoc* basis linked to the theme program, the CRM has also been arranging release of research personnel from Laval and Queen's; it is hoped that these arrangements can be formalised and put on a more permanent footing, as well as being extended to other universities in the region. The partnerships of the CRM with the other research institutes in the Montreal area have been very profitable. More will be said about these in the next section.

The Institut des Sciences Mathématiques

One important vehicle for collaboration with the Quebec universities is the Institut des Sciences Mathématiques. This institute, which encompasses most of Quebec's universities, is principally concerned with coordinating graduate training. The links with research are obvious, and indeed, the CRM and the ISM have a long standing partnership, in particular in offering postdoctoral fellowships, in organising the CRM-ISM colloquium, and in organising special courses for the CRM's thematic programmes.

INDUSTRIAL PARTNERSHIPS

CRM'S industrial program has experienced remarkable growth in the past year. Several major initiatives were completed and others were launched.

MITACS

The network entitled "Mathematics of Information Technology and Complex Systems" (MITACS) is a network of centres of excellence in mathematics financed by the Canadian government and supported by the three Canadian mathematical institutes (CRM, Fields, PIms). The initial instalment of the financing is $14, 000,000 for four year. The MITACS project was one of three accepted from among 77 proposals.

The MITACS network currently has 21 research projects divided among five themes: Biomedical, Commercial/Industrial, Information Technology, Trading and Finance, an Manufactuting. The project teams, which often have components in several universities, are made up university professors, research associates, postdoctoral research fellows, and scientists working in industry.

The project teams, which often contain components from several universities, consist of university professors, research associates, postdoctoral fellows, master's and Ph.D. students, and scientists working in industry. At the moment 188 university professors are research membres or the MITACS network. This networking is essential for the activities of MITACS: networking among researchers associated with a project, networking among projects related to the same theme, and networking with industry, The research and technology transfer of the MITACS network are supported by an administrative centre whose head office is located at the host institution, the University of Toronto, with branches in the three institutes.

The MITACS projects managed by the CRM cover 4 of the 5 research themes: Biomedical (Project Head: Leon Glass), Commercial/Industrial (Project Heads: François Soumis and Brigitte Jaumard), Finance (Project Head: Jean-Marie Dufour), and Information Technology (Project Head: Yoshua Bengio).

In the biomedical field, the MITACS projects have an orientation toward either statistics (human population, epidemics) or modeling (physiological and cellular systems, neural networks). The latter directed by Leon Glass (McGill University) is a project to model cardiac arryhtmia. Its goal in to control these arrythmia which is of great interest to companies working in this field.

In the Commercial/Industrial field the various projects all seek to improve operations research algorithms which, using tools of modeling and optimization, permit the management of, for example, resources, schedules, inventories, client demand, or planning. The team of Brigitte Jaumard (Polytechnique) is working on combinatorial problems in the field of wireless communication problems in the field of wireless communication (cellular telephones) such as planning the usage of frequency bands. This project also touches on the problem of artificial intelligence: decision making in the presence of uncertainty. The project directed by François Soumis (Polytechniqe) concentrates on the extension to larger problems of an already successful mathematical programming tool (GENCOL), based on the generation fo columns.

In the field of quantitative finance, the majority of projects are concentred on the modeling of risk, and on prediction and decision systems. All of these projects are of interest to banks and other financial institutions who must face the ever-increasing sophistication of their international competitors. The project of Jean-Marie Dufour (Université de Montréal) applies progress in research in econometrics (in particular continuous time models, models of derivatives) and statistics to high-dimensional parametric and non-parametric models.

This problem of inference for high-dimensionnal data is central for the last of CRM'S five projects, that of Yoshua Bengio (Université de Montréal), wich falls in the framework of the Information Technology theme. The MITACS projects of this theme are varied: symbolic calculation, modeling components of communication networks, prediction and follow-up of aircraft and other military targets. Bengio's project is concentrated on automatic learning algorithms and computational statistics applied to the extraction of useful information from large data bases.

It is important to note that most of the MITACS centres in Québec, in fact, have a majority of their researchers in the rest of

Canada, and that these projects are linked to other projects in the MITACS network. The management of the network is organized around the three research centres, each of which directs a certain number of projects. In addition each centre has a university-industry liaison agent who is responsable for developing industrial contacts for existing projects, as well as new projects for the network.

Network for Computing and Mathematical Modeling (ncm_2)

The CRM is one of the five Montreal-based centres which together have created the Network for Computing and Mathematical Modeling, ncm_2 (in French: Réseau de calcul et de modélisation mathématique, rcm_2), a unique collaboration which allows the network to respond to the needs of industry in a large number of fields related to a common theme of computing and mathematical modeling. In March 1997, the ncm_2 received a 5-year NSERC grant with an average of $600K per year.

The other centres of the network at the time of creation were the Centre for Research on Computation and its Applications (CERCA), the Center for Interuniversity Research and Analysis on Organizations (CIRANO), the Centre for Research on Transportation (CRT), and the Group for Research in Decision Analysis (GERAD).

The year 1998-1999 has been rather active for the ncm_2. The major undertaking was the setting-up of the Bell University Laboratory (BUL). For the ncm_2 proper, this has required an important modification. Since the network was not a legal entity, and as a preliminary requirement for the BUL agreement with Bell, the ncm_2 was incorporated with letters patent received on September 16, 1998. The first meeting of the Board of Directors was held on March 9, 1999.

In addition, two new members joined the network: the Centre de Recherche Informatique de Montréal (CRIM) and the Institut National de la Recherche Scientifique-Télécommunications (INRS-Télécommunications). These two newcomers make a significant contribution to reinforce the presence of the ncm_2, precisely in areas of interest to the BUL.

The ncm_2 has also played a leadership role in the creation of the Réseau Québécois de Calcul de Haute Performance (RQCHP). This infrastructure was the object of a grant application submitted on February 4, 1999 to the Canada Foundation for Innovation, for a total of approximately $16M including federal, provincial and private contributions. This request was successful, and new computer equipment is now being installed.

The scientific projects of the network are progressing well and the ncm_2 has submitted a first progress report to NSERC in January 1999 with the results of work carried out within the three major themes of the network: (1) risk management, (2) information processing, imaging and parallel computing, and (3) transport and telecommunications. Overall, the projects have involved the participation of about 50 researchers in the network centres, and about 90 postdoctoral fellows and graduate students. The total value (cash and in-kind) of industry contributions in 1998-1999 was $1174K.

Finally, the ncm_2 has pursued its networking activities, encouraging integration. In particular, it has organized during the year two events for its series of Distinguished Lectures: On April 20, 1999, the network was host to Dr. Habib Benali, Institut national de la santé et de la recherche médicale (Paris), who spoke on "L'imagerie neurofonctionnelle: méthodes et applications". Dr. Benali has undertaken joint research work with the Physnum group at CRM, and he is now an associate member of CRM. On May 6, 1999, Dr. Darrell Duffie, from the Graduate School of Business, Stanford University, spoke on "Default Timing and Valuation", a topic in mathematical finance.

Establishment of the Bell University Laboratory

The CRM was actively involved in the establishment of the Bell University Laboratory. As early as 1998, Luc Vinet, director of the CRM and president of the ncm_2, began to negotiate with Bell Canada's executive office to develop university/industry partnerships capable of answering the needs of partners in the areas of training, research, and economic development. An agreement between Bell Canada and the ncm_2 for the set-up and management of the Bell University Laboratory was signed on December 16, 1998.

The Bell University Laboratory aims at creating innovations in the field of multimedia research and applications (mainly interactive applications aimed at the general public, electronic commerce applications and new generations of evolved networks) as well as at promoting the training of a highly qualified, international calibre workforce in these areas.

The guiding principles of the Bell University Laboratory are: a deep integration with the university environment; a balance between exploratory research, applied research and

applications development; and a multidisciplinary approach.

These objectives and guiding principles are made possible thanks to a $12M over 3 years investment which will be used to finance research projects, to create an endowment fund in order to recruit elite researchers, and to establish an infrastructure.

In May of 1998, the ncm_2 had requested an infrastructure grant of close to $4 million from the Canadian Foundation for Innovation (CFI) in order to set-up a Multimedia Applications Research Institute (MARI) to which a planned, Bell sponsored research laboratory could have been added. The CFI approved the project, which finished 5th among 54 requests, in January of 1999.

A Management Committee comprising 3 Bell representatives (including the President of this Committee), the directors of the member-centres of the ncm_2, and the Laboratory's Administrative Director manages the Bell University Laboratory. An Executive Board comprising a Bell representative, the Laboratory's General Director and the Laboratory's Administrative Director reports to the Management Committee and ensures the smooth functioning of the Laboratory on a regular basis. Myriam Bouroche was hired in May of 1999 as the Bell University Laboratory's Administrative Director and Secretary-Treasurer, replacing Beatrice Kowaliczko.

Upon the departure of Luc Vinet, who had been the General Director of the Laboratory since its creation, Michel Gendreau, Director of the CRT, was appointed to that position.

The Bell University Laboratory is funded by Bell Canada. Governmental agencies such as the Canadian Foundation for Innovation, the Quebec Ministry of Education, the Natural Sciences and Engineering Research Council (NSERC), the Consortium for Software Engineering Research (CSER) as well as equipment suppliers also financially contribute to the Laboratory's success.

Fifteen research projects had been accepted by the Bell University Laboratory as of June 30th, 1999. Of these, 5 are affiliated with the CRM. They are Yoshua Bengio's "Datamining", Rachida Dssouli's "Service Creation Environment : A Quality Driven Service Engineering Methodology", Bernard Goulard's "M3Int: Multi-Media Mathematical Imaging on the Net", and Jiri Patera's "Development of the Aperiodic Encryption Method" and "Evaluation and Demonstration of a New Family of Cryptographic Systems".

PUBLICATIONS

The CRM publishes monographs, lecture notes, proceedings, software, videos and research reports (for the latter see below). It has several collections. The in-house collection Les Publications CRM offers many titles in both English and French. The CRM also has publishing agreements with the American Mathematical Society (AMS), Springer-Verlag and International Press. Two collections, edited by CRM, have been published and distributed by the AMS for the past eight years. They are the CRM Monograph Series and the CRM Proceedings and Lecture Notes. Springer-Verlag publishes the CRM Series in Mathematical Physics and the CRM Subseries of the Springer Lecture Notes in Statistics. These series were newly created. During the year 1998-1999, the first three volumes of the series in Physics appeared and the first volume of the Lecture Notes in Statistics was delivered to the publisher. Of particular note was the publication by the CRM of three volumes containing the complete works of the renowned number theorist Sarvadaman Chowla. The following list of "Recent Titles" contains books that have appeared during the year 1998-1999 or that will be published soon.

Recent Titles

AMS *: CRM Monograph Series*

- James D. Lewis, *A Survey of the Hodge Conjecture*, 2e Edition (with an annexe by B. Brent Gordon), vol. 10, 1999.
- Spencer J. Bloch, *Higher Regulators, Algebraic K-Theory, and Zeta Functions of Elliptic Curves*, vol. 11, (to appear).
- Masayoshi Miyanishi, *Open Algebraic Surfaces*, vol. 12, (to appear).

AMS : *CRM Proceedings & Lecture Notes*

- Serge Dubuc et Gilles Deslauriers (eds.), *Spline Functions and the Theory of Wavelets*, vol. 18, 1999
- Rajiv Gupta et Kenneth S. Williams (eds.), *Number Theory*, vol. 19, 1999
- Katie Coughlin (ed.), *Semi-Analytic Methods for the Navier-Stokes equations*, vol. 20, 1999
- Michel Fortin (ed.), *Plates and Shells*, vol. 21, 1999
- Jan Felipe van Diejen et Luc Vinet (eds.), *Algebraic Methods and q-Special Functions*, vol. 22, 1999
- Pierre Hansen et Odile Marcotte (eds.), *Graph Colouring and Applications*, vol. 23, (to appear).
- B. Brent Gordon, James D. Lewis, Stefan Müller-Stach, Shuji Saito et Noriko Yui (eds.), *The Arithmetic and Geometry of Algebraic Cycles*, vol. 24, (to appear).
- Decio Levi et Orlando Ragnisco (eds.), *SIDE III - Symmetry and Integrability of Difference Equations*, vol. 25, (to appear).
- Michael Barr and Robert V. Moody (eds.), *Directions in Mathematical Quasicrystals*, (to appear).
- John Harnad, Pavel Winternitz (eds.), *Integrable Systems : from Classical to Quantum*, (to appear).
- Alan Coley, Decio Levi, Robert Milson, Colin Rogers and Pavel Winternitz (eds.), *Bäcklund and Darboux Transformations: the Geometry of Soliton Theory*, (to appear).
- Israel M. Sigal et Catherine Sulem, *Nonlinear Dynamics and Renormalization Group*, (to appear).

Springer-Verlag : *CRM Series in Mathematical Physics*

- Robert Conte (eds.), *The Painlevé Property: One Century Later*, 1999
- Richard MacKenzie, Manu B. Paranjape and Wojciech J. M. Zakrzewski (eds.), *Soliton: Properties, Dynamics, Interactions, Applications*, 1999
- Jan Felipe van Diejen and Luc Vinet (eds.), *Calogero-Moser-Sutherland Models*, (to appear).
- Yvan Saint-Aubin and Luc Vinet (eds.), *Algebraic Methods in Physics - A Symposium for the 60th Birthday of Jíri Patera and Pavel Winternitz*, (to appear).
- Yvan Saint-Aubin and Luc Vinet (eds.), *Theoretical Physics at the End of the XXth Century*. Proceedings of the CRM Summer School, June 27-July 10, 1999, Banff, Alberta, Canada, (to appear).

Les Publications CRM

- Michael Barr and Charles Wells, *Category Theory for Computing Science*, 1999
- James G. Huard and Kenneth S. Williams (ed.), *The Collected Papers of Sarvadaman Chowla, I, II, III*, (to appear).

Previous Titles

AMS : *CRM Proceedings & Lecture Notes*

- Michel Delfour (eds.), *Boundaries, Interfaces and Transitions* (Banff, 1995), CRM Proc. Lecture Notes, vol.13, Amer. Math. Soc., Providence, RI, 1998.
- Alain Vincent (eds.), *Numerical Methods in Fluid Mechanics* (Montréal, 1995), CRM Proc. Lecture Notes, vol.16, Amer. Math. Soc., Providence, RI, 1998.
- John Harnad and Alex Kasman (eds.), *The Bispectral Problem* (Montréal, 1997), CRM Proc. Lecture Notes, vol.14, Amer. Math. Soc., Providence, RI, 1998.
- François Lalonde (eds.), *Geometry, Topology and Dynamics*, (Montréal, 1995), CRM Proc. Lecture Notes, vol. 15, Amer. Math. Soc., Providence, RI, 1998.
- Olga Karlampovich (eds.), *Summer School in Group Theory* (Banff, 1996), CRM Proc. Lecture Notes, vol.17, Amer. Math. Soc., Providence, RI, 1998.
- Luc Vinet (ed.), *Advances in Mathematical Sciences: CRM's 25 Years* (Montréal, 1994), CRM Proc. Lecture Notes, vol. 11, Amer. Math. Soc., Providence, RI, 1997.
- Peter G. Greiner, Victor Ivrii, Luis A. Seco and Catherine Sulem (eds.), *Partial Differential Equations and their Applications* (Toronto, 1995), CRM Proc. Lecture Notes, vol. 12, Amer. Math. Soc., Providence, RI, 1997.
- Donald E. Knuth, *Stable Marriage and its Relation to Other Combinatorial Problems. An Introduction to the Mathematical Analysis of Algorithms*, CRM Proc. Lecture Notes, vol. 10, Amer. Math. Soc., Providence, RI, 1996.
- Joel S. Feldman, Richard Froese, and Lon M. Rosen (eds.), *Mathematical Quantum Theory II : Schrödinger Operator* (Vancouver, 1993), CRM Proc. Lecture Notes, vol. 8, Amer. Math. Soc., Providence, RI, 1995.
- Decio Levi, Luc Vinet, and Pavel Winternitz (eds.), *Symmetries and Integrability of Difference Equations* (Estérel, 1994), CRM Proc. Lecture Notes, vol. 9, Amer. Math. Soc., Providence, RI, 1995.
- Hershy Kisilevsky and M. Ram Murty (eds.), *Elliptic Curves and Related Topics* (Sainte-Adèle, 1992), CRM Proc. Lecture Notes, vol. 4, Amer. Math. Soc., Providence, RI, 1994.
- Guido Mislin (ed.), *The Hilton Symposium 1993 : Topics in Topology and Group Theory* (Montréal, 1993), CRM Proc. Lecture Notes, vol. 6, Amer. Math. Soc., Providence, RI, 1994.
- Joel S. Feldman, Richard Froese, and Lon M. Rosen (eds.), *Mathematical Quantum Theory I: Many-Body Theory and Group Theory* (Vancouver, 1993), CRM Proc. Lecture Notes, vol. 7, Amer. Math. Soc., Providence, RI, 1994.
- Donald A. Dawson (ed.), *Measure-valued Processes, Stochastic Partial Differential Equations and Interacting Systems* (Montréal, 1992), CRM Proc. Lecture Notes, vol. 5, Amer. Math. Soc., Providence, RI, 1994.
- M. Ram Murty (ed.), *Theta Functions. From the Classical to the Modern*, CRM Proc. Lecture Notes, vol. 1, Amer. Math. Soc., Providence, RI, 1993.
- Philip D. Loewen, *Optimal Control via Nonsmooth Analysis*, CRM Proc. Lecture Notes, vol. 2, Amer. Math. Soc., Providence, RI, 1993.
- Andrei L. Smirnov and Rémi Vaillancourt (eds.), *Asymptotic Methods in Mechanics*, CRM Proc. Lecture Notes, vol. 3, Amer. Math. Soc., Providence, RI, 1993.

AMS : *CRM Monograph Series*

- Yves Meyer, *Wavelets, Vibrations and Scaling*, CRM Monograph Series, vol. 9, Amer. Math. Soc., Providence, RI, 1997.
- John Milton, *Dynamics of Small Neural Populations*, CRM Monogr. Ser., vol. 7, Amer. Math. Soc., Providence, RI, 1996.
- Ioannis Karatzas, *Lectures on Mathematics of Finance*, CRM Monogr. Ser., vol. 8, Amer. Math. Soc., Providence, RI, 1996.
- David Ruelle, *Dynamical Zeta Functions for Piecewise Monotone Maps of the Interval*, CRM Monogr. Ser., vol. 4, Amer. Math. Soc., Providence, RI, 1994.
- Andrew M. Bruckner, *Differentiation of Real Functions*, CRM Monogr. Ser., vol. 5, Amer. Math. Soc., Providence, RI, 1994.
- Eugene B. Dynkin, *An Introduction to Branching Measure-Valued Processes*, CRM Monogr. Ser., vol. 6, Amer. Math. Soc., Providence, RI, 1994.
- Maximilian Ya. Antimirov, Andrei A. Kolyshkin, and Rémi Vaillancourt, *Applied Integral Transforms*, CRM Monogr. Ser., vol. 2, Amer. Math. Soc., Providence, RI, 1993.
- V. Kumar Murty, *Introduction to Abelian* Varieties, CRM Monogr. Ser., vol. 3, Amer. Math. Soc., Providence, RI, 1993.

- Dan V. Voiculescu, Kenneth J. Dykema, and Alexandru Nica, *Free Random Variables*, CRM Monogr. Ser., vol. 1, Amer. Math. Soc., Providence, RI, 1992.

Springer-Verlag : *CRM Series in Mathematical Physics*

- Luc Vinet and Gordon Semenoff (eds.), *Particles and Fields* (Banff, 1994), CRM Series in Mathematical Physics, Springer, New York, 1998.

Les Publications CRM

- Maximilian Ya. Antimirov, Andrei A. Kolyshkin and Rémi Vaillancourt, *Mathematical Models for Eddy Current Testing*, Les Publications CRM, Montréal, 1998.
- Xavier Fernique, *Fonctions aléatoires gaussiennes, vecteurs aléatoires gaussiens*, Les Publications CRM, Montréal, 1997.
- Faqir Khanna and Luc Vinet (eds.), *Field Theory, Integrable Systems and Symmetries*, Les Publications CRM, Montréal, 1997.
- Paul Koosis, *Leçons sur le théorème de Beurling at Malliavin*, Les Publications CRM, Montréal, 1996.
- David W. Rand, *Concorder Version Three: Concordance Software for the Macintosh*, Les Publications CRM, Montréal, 1996 (guide de l'utilisateur et logiciel).
- Decio Levi, Curtis R. Menyuk, and Pavel Winternitz, *Self-Similarity in Stimulated Raman Scattering* (Montréal, 1993), Les Publications CRM, Montréal, 1994.
- Jacques Gauvin, *Theory of Nonconvex Programming*, Les Publications CRM, Montréal, 1994.
- Rémi Vaillancourt, *Compléments de mathématiques pour ingénieurs*, Les Publications CRM, Montréal, 1993.
- Robert P. Langlands and Dinakar Ramakrishnan (eds.), *The Zeta Functions of Picard Modular Surfaces* (Montréal, 1988), Les Publications CRM, Montréal, 1992.
- Florin N. Diacu, *Singularities of the N-Body Problem*, Les Publications CRM, Montréal, 1992.
- Jacques Gauvin, *Théorie de la programmation mathématique non convexe*, Les Publications CRM, Montréal, 1992.
- Pierre Ferland, Claude Tricot, and Axel van de Walle, *Analyse fractale: Application Windows ™ 3.x d'initiation aux ensembles fractals*, Les Publications CRM, Montréal, 1992 (guide de l'utilisateur et logiciel).
- Stéphane Baldo, *Introduction à la topologie des ensembles fractals*, Les Publications CRM, Montréal, 1991.
- Robert Bédard, *Groupes linéaires algébriques*, Les Publications CRM, Montréal, 1991.
- Rudolf Beran and Gilles R. Ducharme, *Asymptotic Theory for Bootstrap Methods in Statistics*, Les Publications CRM, Montréal, 1991.
- James D. Lewis, *A Survey of the Hodge Conjecture*, Les Publications CRM, Montréal, 1991.
- David W. Rand and Tatiana Patera, *Concorder: Concordance Software for the Macintosh*, Les Publications CRM, Montréal, 1991 (guide de l'utilisateur et logiciel).
- David W. Rand and Tatiana Patera, *Le Concordeur: un logiciel de concordances pour le Macintosh*, Les Publications CRM, Montréal, 1991 (guide de l'utilisateur et logiciel).
- Véronique Hussin (ed.), *Lie Theory, Differential Equations and Representation Theory* (Montréal, 1989), Les Publications CRM, Montréal, 1990.
- John Harnad and Jerrold E. Marsden (eds.), Hamiltonian *Systems, Transformation Groups and Spectral Transform Methods* (Montréal, 1989), Les Publications CRM, Montréal, 1990.
- M. Ram Murty (ed.) *Automorphic Forms and Analytic Number Theory* (Montréal, 1989), Les Publications CRM, Montréal, 1990.
- Wendy G. McKay, Jiří Patera and David W. Rand, *Tables of Representations of Simple Lie Algebras. I. Exceptional Simple Lie Algebras*, Les Publications CRM, Montréal, 1990.
- Anthony W. Knapp, *Representations of Real Reduc-tive Groups*, Les Publications CRM, Montréal, 1990.
- Wendy G. McKay, Jiří Patera and David W. Rand, *SimpLie User's Manual—Macintosh Software for Representations of Simple Lie Algebras*, Les Publications CRM, Montréal, 1990 (guide de l'utilisateur et logiciel).
- Francis H. Clarke, *Optimization and Nonsmooth Analysis*, Les Publications CRM, Montréal, 1989.
- Hedy Attouch, Jean-Pierre Aubin, Francis Clarke and Ivar Ekeland (eds.), *Analyse non linéaire* (Perpignan, 1987), Les Publications CRM, Montréal and Gauthiers-Villars, Paris, 1989.
- Samuel Zaidman, *Une introduction à la théorie des équations aux dérivées partielles*, Les Publications CRM, Montréal, 1989.
- Lucien Le Cam, *Notes on Asymptotic Methods in Statistical Decision Theory*, Les Publications CRM, Montréal, 1974.

AMS/International Press

- Duong H. Phong, Luc Vinet and Shing-Tung Yau (eds.), *Mirror Manifolds and Geometry*,

AMS/IP Studies in Advanced Mathematics, Amer. Math. Soc., Providence, RI, Internat. Press, Cambridge, MA, and CRM, Montréal, 1998 (vol.10).

Collection de la Chaire Aisenstadt

- Yuri I. Manin, *Quantum Groups and Noncommutative Geometry*, Les Publications CRM, 1988.
- Laurent Schwartz, *Semimartingales and Their Stochastic Calculus on Manifolds*, Presses de l'Université de Montréal, 1984.
- Yuval Ne'eman, *Symétries, jauges et variétés de groupe*, Presses de l'Université de Montréal, 1979.
- R. Tyrrell Rockafellar, *La théorie des sous-gradients et ses applications à l'optimisation, fonctions convexes et non convexes*, Presses de l'Université de Montréal, 1979.
- Jacques-Louis Lions, *Sur quelques questions d'analyse, de mécanique et de contrôle optimal*, Presses de l'Université de Montréal, 1976.
- Donald E. Knuth, *Mariage stables et leurs relations avec d'autres problèmes combinatoires,* Presses de l'Université de Montréal, 1976.
- Robert Hermann, *Physical Aspects of Lie Group Theory*, Presses de l'Université de Montréal, 1974.
- Mark Kac, *Quelques problèmes mathématiques en physique statistique*, Presses de l'Université de Montréal, 1974.
- Sybreen de Groot, *La transformation de Weyl et la fonction de Wigner: une forme alternative de la mécanique quantique*, Presses de l'Université de Montréal, 1974.

Divers

- Pierre Ferland, Claude Tricot, and Axel van de Walle, *Fractal analysis user's guide. Introduction to fractal sets using Windows ™ 3.x*., Amer. Math. Soc., Providence, RI and Centre de recherches mathématiques, Montréal, 1994.

Research Reports

[CRM-2547] Emil Horozov and Alex Kasman, *Darboux transformations of bispectral quantum integrable systems*, June 1998.

[CRM-2548] Robert Konik, Frédéric Lesage, Andreas W. W. Ludwig and Hubert Saleur, *Two-leg ladders and carbon nanotubes: Exact properties at finite*, 1998.

[CRM-2549] Lubomir T. Dechevsky and Serge Dubuc, *Multidimensional dyadic iterative interpolation and Fourier multipliers on Lebesgue spaces*, June 1998.

[CRM-2550] Stéphane Durand, *EPR-type behaviors modeled by wormhole-based time travel*, July 1998.

[CRM-2551] Igor Loutsenko and Vyacheslav Spiridonov, *Spectral self-similarity, one-dimensional Ising chains, and random matrices*, July 1998.

[CRM-2552] M. Ali Ayari, M. Iadh Ayari and Véronique Hussin, *Computation of Lie supersymmetries for the supersymmetric two bosons equations*, July 1998.

[CRM-2553] Marlène Frigon, *On a new notion of linking and application to elliptic problems at resonance*, July 1998.

[CRM-2554] David J. Fernández C., Véronique Hussin and B. Mielnik, *A simple generation of exactly solvable anharmonic oscillators*, July 1998.

[CRM-2555] Richard Fournier, *Extensions of the geometric-arithmetic means inequality to a disc of the complex plane*, July 1998.

[CRM-2556] M. Ali Ayari, Véronique Hussin and Pavel Winternitz, *Group invariant solutions for the N=2 super Korteweg-de Vries equation*, July 1998.

[CRM-2557] Stéphane Lafortune, Basile Grammaticos and Afred Ramani, *Constructing integrable third order systems: the Gambier approach*, July 1998.

[CRM-2559] Michèle Grenier and Christian Léger, *Bootstrapping regression models with BLUS residuals*, August 1998.

[CRM-2560] Denis Choquet, Pierre L'Écuyer and Christian Léger, *Bootstrap confidence intervals for ratios of expectations*, August 1998.

[CRM-2561] Christian Léger and Brenda MacGibbon, *On the bootstrap in cube root asymptotics*, August 1998.

[CRM-2564] Jean-Marc Lina, Paul Turcotte and Bernard Goulard, *Complex dyadic multiresolution analyses*, August 1998.

[CRM-2565] Zuzana Maskov, Jíri Patera and Edita Pelantov, *Quadratic irrationalities and geometric properties of one-dimensional quasicrystals*, September 1998.

[CRM-2567] D. Gomez Ullate, Stéphane Lafortune and Pavel Winternitz, *Symmetries of discrete dynamical systems involving two species*, September 1998.

[CRM-2568] Rafael Hernandez Heredero, Decio Levi and Pavel Winternitz, *Symmetries of the discrete Burgers equation*, September 1998.

[CRM-2569] Pavel Winternitz, *Lie groups and difference equations*, September 1998.

[CRM-2570] Lubomir Dechevsky, Brenda MacGibbon and James Ramsay, *On smooth bijections between subsets of* $\boldsymbol{R}^n$, September 1998.

[CRM-2571] Miloslav Havlicek, M. Posta and Pavel Winternitz, *Nonlinear superposition formulas based on imprimitive group action*, October 1998.

[CRM-2572] Yanick Dupuis and Dana Schlomiuk, *Géométrie des champs de vecteurs hamiltoniens à point de selle*, October 1998.

[CRM-2573] Robert Roussarie and Dana Schlomiuk, *On the geometric structure of the class of planar quadratic differential systems*, October 1998.

[CRM-2574] Pavel Winternitz, *Lie groups and difference equations*, October 1998.

[CRM-2575] Paul Arminjon and Aziz Madrane, *A staggered Lax-Friedrichs-type mixed finite volume/finite element method for the simulation of viscous compressible flows on unstructured triangular grids*, October 1998.

[CRM-2577] Paul Bracken, *Classical Yang-Mills coupled to a scalar triplet invariant under subgroups of the conformal group*, October 1998.

[CRM-2578] Frédéric Lesage and Hubert Saleur, *Strong coupling resistivity in the Kondo model*, October 1998.

[CRM-2579] David Bryant, *The complexity of the breakpoint median problem*, November 1998.

[CRM-2580] David Bryant, *Rapid evaluation of least squares and minimum evolution criteria on phylogenetic trees*, November 1998.

[CRM-2581] Frédéric Lesage and Hubert Saleur, *Perturbation of infra-red fixed points and duality in quantum impurity problems*, November 1998.

[CRM-2582] Alexei Zhedanov, *A method of constructing Krall's polynomials*, December 1998.

[CRM-2583] Luc Vinet and Alexei Zhedanov, *Generalized little q-Jacobi polynomials as eigensolutions of higher-order q-differential operators*, December 1998.

[CRM-2584] Paul Bracken and A. Michel Grundland, *On certain classes of solutions of the Weierstrass-Enneper systems inducing constant mean curvature surfaces*, December 1998.

[CRM-2585] François Gingras, Yoshua Bengio and Claude Nadeau, *Generalized little q-Jacobi polynomials as eigensolutions of higher-order q-differential operators*, January 1999.

[CRM-2586] M. K. Atakishiyeva and Natig M. Atakishiyev, *Fourier-Gauss transforms of bilinear generating functions for the continuous q-Hermite polynomials*, January 1999.

[CRM-2587] A. A. Izmest'sev, G. S. Pogosyan, Aleksey N. Sissakian and Pavel Winternitz, *Lie algebra contractions for overlap functions*, January 1999.

[CRM-2588] Francis H. Clarke, Yuri S. Ledyaev, L. Rifford and Ronald J. Stern, *Feedback stabilization and Lyapunov functions*, January 1999.

[CRM-2589] D. Gomez-Ullate, Stéphane Lafortune and Pavel Winternitz, *Symmetry classification of systems of differential-difference equations*, January 1999.

[CRM-2590] Basile Grammaticos, Alfred Ramani and Stéphane Lafortune, *The Gambier mapping, revisited*, January 1999.

[CRM-2591] Basile Grammaticos, Alfred Ramani, K. M. Tamizhmani and Stéphane Lafortune, *Again, linearisable mappings*, January 1999.

[CRM-2592] Paul Bracken, *Classical Yang-Mills equations invariant under subgroups of the conformal group without coupling to matter*, January 1999.

[CRM-2593] Basile Grammaticos, Alfred Ramani and Stéphane Lafortune, *Schlesinger transformations for linearisable equations*, January 1999.

[CRM-2594] M. Iadh Ayari, *Lien entre les variétés singulières des Équations aux dérivées partielles et les pseudopotentiels représentant les algèbres de Lie de dimension finie*, January 1999.

[CRM-2595] Alexeï V. Penskoï, *Lagrangian time-discretization of the Korteweg-de Vries equation*, January 1999.

[CRM-2596] John Harnad, Picard-Fuchs equations, *Hauptmoduls and integrable systems*, December 1998.

[CRM-2597] John Harnad and John McKay, *Modular invariants and generalized Halphen system*, December 1998.

[CRM-2598] Joseph M. Mahaffy, Samuel W. Polk and Roland K. W. Roeder, *An age-structured model for erythropoiesis following a phlebotomy*, February 1999.

[CRM-2599] David J. Fernández C. and Véronique Hussin, *Higher order SUSY, linearized non-linear Heisenberg algebras and coherent states*, February 1999.

[CRM-2600] Igor Nikolaev and Evgeny Zhuzhoma, *Flows on 2-dimensional manifolds: an overview*, February 1999.

[CRM-2601] Louis-Sébastien Guimond and Christiane Rousseau, *Finite cyclicity of finite codimension nondegenerate homoclinic loops with real eigenvalues in* $\mathbf{R}^3$, March 1999.

[CRM-2602] Lubomir T. Dechevsky and James O. Ramsay, *Penalized wavelet estimation with Besov regularity constraints*, April 1999.

[CRM-2603] A. Odzijewicz and A. Michel Grundland, *The superposition principle for the Lie type first order PDEs*, April 1999.

[CRM-2604] Robert P. Langlands, Marc-André Lewis and Yvan Saint-Aubin, *Universality and conformal invariance for the Ising model in domains with boundary*, April 1999.

[CRM-2605] Francis H. Clarke, S. N. Nobakhtian and Ronald J. Stern, *Universal near-optimal feedbacks*, April 1999.

[CRM-2606] Alexander Turbiner and Pavel Winternitz, *Solutions of nonlinear differential and difference equations with superposition formulas*, April 1999.

[CRM-2607] V. Dorodnitsyn and Pavel Winternitz, *Lie point symmetry preserving discretizations for variable coefficient Korteweg-de Vries equations*, April 1999.

[CRM-2608] M. Mintchev, E. Ragoucy, Paul Sorba and Philippe Zaugg, *Yangian symmetry in the nonlinear Schrödinger hierarchy*, May 1999.

[CRM-2609] Joseph M. Mahaffy, *Age-structured modeling of hematopoiesis*, May 1999.

[CRM-2610] Richard Fournier, *Inequalities involving weighted means in a disc of the complex plane*, May 1999.

[CRM-2611] Richard Fournier, *On boundary zeros of solutions of a class of functional equations*, May 1999.

[CRM-2612] E. V. Ferapontov, *Transformations of quasilinear systems originating from the projective theory of congruences*, May 1999.

[CRM-2613] John Harnad, *On the bilinear equations for Fredholm determinants appearing in random matrices*, May 1999.

[CRM-2614] E. V. Ferapontov and A. Michel Grundland, *On the bilinear equations for Fredholm determinants appearing in random matrices*, May 1999.

[CRM-2619] Richard Fournier and Stephan Ruscheweyh, *On extreme points of a class of functions related to a convolution conjecture*, May 1999.

[CRM-2657] Nantel Bergeron and F. Sottile, *A Pieri-type formula for isotropic flag manifolds*, 1998.

[CRM-2658] Niky Kamran, R. Milson and P. J. Olver, *Invariant modules and the reduction of non-linear partial equations to dynamical systems*, 1999.

[CRM-2659] F. Finster, Niky Kamran, J. Smoller and S.-T. Yau, *Non-existence of time periodic solutions of the Dirac equations in axisymmetric black hole geometries*, 1999.

[CRM-2660] F. Lalonde, D. McDuff and L. Polterovich, *Hamiltonian fibrations*, 1999.

[CRM-2661] D. Gatien and F. Lalonde, *Holomorphic cylinders with Lagrangian boundaries and periodic orbits of Hamiltonians systems*, 1999.

[CRM-2662] Tao Yi and Sabin Lessard, *Fundamental theorem of natural selection and frequency-dependent selection: Analysis of the diploid matrix game model*, March 1999.

[CRM-2663] J. Courteau and Sabin Lessard, *Optimal sex ratios in structured populations*, May 1999.

[CRM-2664] John McKay, *The semi-affine Coxeter-Dynkin diagram and* $G < SU_2$, 1999.

[CRM-2665] François Perron, *Beyond accept-reject sampling*, 1999.

[CRM-2666] M. Deza and Ivo G. Rosenberg, *n semimetrics*, 1999.

[CRM-2667] Langis Gagnon, A. Jouan, Elisa Shahbazian and Pierre Valin, *Fusion of imagery attributes with non-imaging sensor reports by truncated Dempster-Shafer evidential Reasoning*, July 1998.

[CRM-2668] J. R. Duquet, Elisa Shahbazian and Pierre Valin, *A blackboard architecture for incremental implementation of data fusion applications*, July 1998.

[CRM-2669] J. R. Duquet, M. Macieszczak, Elisa Shahbazian and Pierre Valin, *A generic expert system infrastructure for fusion and imaging decision aids*, October 1998.

FINANCIAL REPORT

The CRM's fiscal year begins June 1 and ends May 31. The financial statement presents, on a cash-flow basis, the major expenses and income of the CRM during 1998-1999, as well as its financial position at the beginning and the end of the period. The overall results have been broken down into seven principal columns representing the following sources of financing: the National Science and Engineering Research Council (NSERC Centre and NSERC- ncm_2), the Fonds pour la formation de chercheurs et l'aide à la recherche du Québec (FCAR Centre), the National Centres of Excellence program (NCE-MITACS), the Canadian Foundation for Innovation (CFI) with matching funds from the Government of Québec, the Université de Montréal (CEDAR), and other sources.

MAJOR SOURCES OF REVENUS FOR 1998-1999

NSERC-Centre	$880,000
NSERC-ncm_2 ($648,894 – $479,891)	$169,003
FCAR-Centre	$203,750
NCE-MITACS	$95,000
CFI-QC	$278,020
Université de Montréal*	$722,000
Other sources	$360,461

In addition, the Université de Montréal furnishes space and some services.

Revenues

During 1998-1999, the CRM received income (presented at the bottom of the Statement) from the following sources. NSERC-Centre: an operating grant of $880,000 to pursue its national mandate. NSERC- ncm_2: the second instalment of $648,894 of a five-year grant of $3.2 for the nc$m_2$. The financing of the ncm_2 funds activities in four other research centres in addition to the CRM: CERCA (Centre de recherche en calcul appliqué), CIRANO (Centre universitaire de recherche en analyse des organisations), CRT (Centre de recherche sur les transports), and GERAD (Groupe d'études et de recherche en analyse des décisions). The management of the ncm_2 is largely decentralized and $479,891 of the $648,894 instalment is allotted to these four centres; of the remaining $169,003, $86,003 constitutes the CRM's portion and $83,000 is reserved for centralized activities managed by the CRM in the name of the ncm_2. FCAR-Centre: the third annual instalment of $203,750 of a three-year operating grant from its Research Centres Program. NCE-MITACS: A first instalment of $95,000 from a first-year grant of $170,000 for fiscal 1999-2000 reserved for the network activities managed by the CRM within the Mathematics of Information Technology and Complex Systems Network of Centres of Excellence. CFI-QC: $278,020 in matching grants from the Canadian Foundation for Innovation and the Government of Québec for the purchase of computer network equipment. In addition, Sun Microsystems and Anixter Canada Inc. donated extra equipment valued at more than $68,500. The Université de Montréal: a substantial grant of $722,000 has been received from the Comité d'étude et d'administration de la recherche (CEDAR) of the Vice-rectorat à la recherche of the Université de Montréal (a decrease of 5% on the $760,000 received in 1996-1997). Other important sources of income include the Canadian Institute for Advanced Research (CIAR), the McConnell Foundation and Dr. André Aisenstadt who is the CRM's major benefactor; finally the CRM earns revenues from books in the CRM series published by the American Mathematical Society (AMS), from Springer-Verlag, and from its own in-house publication program, as well as from registration fees charged for attending scientific activities. We also consider as revenues the sums turned over to us by our university partners and by the Institut des sciences mathématiques (ISM) for joint postdoctoral fellowships; these sums are managed by the CRM. The contribution of industrial partners of the CRM's ncm_2 projects is similarly accounted for; those sums paid directly to CRM researchers are not.

Expenses

The expenses of the CRM are presented under three major categories: Scientific Activities, Publications and Administration. Major items under Scientific Activities include: (1) scientific personnel: the remuneration of professors at the Université de Montréal who undertake research as full-time members of the CRM; expenses associated with the detachment of Montreal-area professors so they can work at the CRM; as well as remuneration of postdoctoral researchers and summer students; (2) scientific programs: the thematic program in number theory and arithmetic geometry, the Banff summer school of 1998 related to the theme year and the advanced payment on the 1999 summer school; the general scientific program, constituted mainly of contributions of the CRM to off-site scientific activities, the colloquia and seminar series organized jointly

with the Montreal-based ISM, expenses associated with the four prizes for excellence in the mathematical sciences (the André-Aisenstadt Prize, the Canadian Association of Physicists (CAP)-CRM Prize in Theoretical and Mathematical Physics, the CRM-Fields Institute Prize, and the CRM-Statistical Society of Canada (SSC) Prize in Statistics), the conference and workshop programs of the ncm_2, and finally expenses related to invited researchers; (3) the personnel involved directly in the management of scientific programs; and (4) the research-support personnel involved directly in the delivery of computer services for the UNIX system and support to researchers for manuscripts. The rubric Publications includes remuneration to personnel assigned to the publications program as well as expenses directly related to this program. Finally, the administrative part of the financial statement includes: the remuneration of the director's office personnel, payments for administration and services to researchers and for administrative computing systems, expenses related to meetings of the Advisory Committee and other committees of the CRM, current operating expenses, and expenses related to computer equipment.

Mandate

The national mandate of the CRM is reflected in the NSERC column of the statement labelled as Canada outside Québec. Under this heading are singled out those NSERC-Centre funded expenditures of the CRM that occur in Canada but outside of Québec. Such expenses include the Summer School in Banff, numerous off-site scientific events sponsored by the CRM (often in collaboration with the Fields Institute or the Pacific Institute for the Mathematical Sciences), and the expenses related to non-Québec Canadians visiting the CRM in order to participate in its scientific programs. The ratio of such Canadian expenses to the overall NSERC-Centre funded expenses is 49% for the scientific programs only (51% last year), and 32% (39% last year) for the total expenses funded by NSERC. This ratio of 32% is more than the threshold of 25% suggested by the CRM-Fields Institute Coordinating Committee in its last report.

Financial Statement

The statement for the year thus indicates a surplus of $235,933 for operations, contributing to an accumulated surplus of $576,894. Two accounts in particular are responsible for the greater part of the financial year's surplus: the first corresponds to the MITACS project which started only in April 1999 and has therefore not a great amount of incurred expenses; the second corresponds to ncm_2, for which the NSERC contribution was abnormally high this year. Finally, a more prudent management of the grants was adopted for the year, since the CRM's NSERC grant was up for renewal. In general, the accumulated surplus corresponds to deferred revenues for activities that will take place in financial years following their accounting as revenue.

Financial Statement

	NSERC-Centre								
	Total	***Canada outside Québec***	**NSERC-ncm₂**	**FCAR-Centre**	**NCE-MITACS**	**CFI-QC**	**UdeM CEDAR**	**Other Sources**	**Overall Total**
Scientific Activities									
Scientific Personnel									
Salaries	10,000	*10,000*	25,083				521,992	26,360	583,435
Partnerships	27,845			1,157					29,002
Release Time							37,711		37,711
Postdoctoral Researchers:									
• CRM	44,917		4,426					27,041	76,383
• CRM / ISM	30,668							45,000	75,668
• CERCA / CRM	10,806							12,833	23,639
Students and Others	25,650	*16,650*	7,500					9,000	42,150
Subtotal: Scientific Personnel	149,886	*26,650*	37,008	1,157			559,703	120,233	867,987
Scientific Programs									
Statistics	23,033	*843*					- 8,950	5,671	19,754
Number Theory & Arithmetic Geometry	81,010	*24,205*						7,710	88,720
Transfert to PIms	50,000	*50,000*							50,000
Mathematical Physics	19,237	*600*						3,493	22,730
Summer School	44,905	*44,905*							44,905
General Scientific Program	86,218	*45,437*						7,611	93,829
Colloquia and Seminar Series	12,153	*2,242*	19,770					14,420	46,343
Prizes	5,449	*3,177*						10,018	15,467
Guest Researchers and Other Expenses	70,239	*19,887*	- 46					13,767	83,959
Subtotal: Scientific Programs	392,244	*191,297*	19,723				- 8,950	62,690	465,707
Canada-outside-Québec Ratio:		49%							
Personnel - Scientific Programs	116,665	*50,750*							116,665
Personnel - Direct Research Support	69,583			28,906					98,489
Total: Scientific Activities	728,377	*268,697*	56,732	30,062			550,753	182,924	1,548,848
Canada-outside-Québec Ratio:		37%							
Publications									
Personnel				73,864					73,864
Direct Publication Expenses	6,980							10,452	17,432
Total: Publications	6,980			73,864				10,452	91,297
Administration									
Personnel									
Executive	43,217	*3,788*	18,817				63,433	4,467	129,934
Aministration and Research	38,006		26,731	76,788	6,031		56,207	3,446	207,209
Programmer Analysts								57,434	57,434
Subtotal: Personnel	81,223	*3,788*	45,548	76,788	6,031		119,640	65,347	394,577
Advisory Committee	7,354	*3,207*						181	7,534
Operating Expenses	53,075	*2,398*	3,146		422		5,648	42,528	104,819
Computer Equipment	2,373			13,987	5,113	278,235	7,653	17,865	325,226
Total: Administration	144,024	*9,394*	48,694	90,775	11,566	278,235	132,942	125,921	832,156
Total: Expenses	**879,382**	*278,091*	**105,425**	**194,701**	**11,566**	**278,235**	**683,695**	**319,296**	**2,472,301**
Canada-outside-Québec Ratio:		32%							
Revenues									
Operating Grants	880,000			203,750			722,000	142,645	1,948,395
Research Network, Equipment & Other Grants			648,894		95,000	278,020			1,021,914
Contributions from Universities & Partners			- 479,891					122,364	- 357,527
Industrial Contributions								35,000	35,000
Sales and Registrations								60,452	60,452
Total: Revenues	**880,000**		**169,003**	**203,750**	**95,000**	**278,020**	**722,000**	**360,461**	**2,708,234**
Surplus (Deficit)	**618**		**63,578**	**9,049**	**83,434**	**- 215**	**38,305**	**41,165**	**235,933**
Cash at the beginning of the period	**154,164**		**- 17,483**	**7,501**	**0**	**0**	**1,206**	**195,573**	**340,961**
Cash at the end of the period	**154,782**		**46,094**	**16,550**	**83,434**	**- 215**	**39,512**	**236,737**	**576,894**