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A Word from the Director

The year 2002-2003, the last of Jacques Hurtubise's mandate as CRM Director, has been a resounding success. On top of working vigorously at developing the central role of mathematics in science, for many years the CRM has enjoyed exploring related fields where mathematics can offer new ideas to develop these other sciences. The Thematic Year on Math in Computer Science is a perfect example whereby mathematicians and computer scientists worked jointly on important problems of computer science, a science whose influence is now felt everywhere. With a summer school, four large international conferences, 19 workshops, two Aisenstadt Chairs (László Lovász and Endre Szemerédi), and more than 1900 participants, this thematic year has had a major impact in computer science as well as in mathematics, and has contributed to raise the profile of the Canadian mathematical institutes among the computer science community. I wish to sincerely thank the organisers of this thematic year.

The model of a mathematical research centre with programs based on workshops, short programs, and concentration periods often makes other scientists envious. However, some people sometimes wonder about the impact of such activities. While not always immediate, nor highly visible, there is no doubt that these scientific meetings where researchers, including postdoctoral fellows, interact and work together during relatively long periods of time have significant impact. Moreover, they lead to important scientific advances that would be more difficult to produce without the presence of research centres such as the CRM, and at a rather modest price. All of that said, a director is particularly happy when the impact of such an infrastructure and the way it functions is praised by an independent testimony. This is exactly what happened when Jeffrey Bub, a mathematician and science philosopher from the Philosophy Department of the University of Maryland, credited the concentration period on "Quantum Foundations in the Light of Quantum Information and Cryptography" for generating the ideas leading to his research project in his paper *Why the Quantum?* Organised by Gilles Brassard and Christopher Fuchs, this concentration period attracted 27 of the leading researchers on the foundations of the quantum world and was a follow-up to a smaller preliminary workshop that was held at the CRM in May 2000. Since then, G. Brassard gave an invited address on the same subject in 2004 in the main international conference in the field (Quantum Information Processing Conference) where he reviewed some of the work that ensued, following the concentration period.

One of the main accomplishments of Jacques Hurtubise's mandate is the structuring of research at the CRM in eight research laboratories. Although most of them have been active for a few years, this vision will be initiated in 2003-2004 thanks to a grant as a *Regroupement stratégique du Fonds québécois de recherche sur la nature et les technologies* (FQRNT) which more than doubled its funding to the CRM. This increased support from the Québec government combined with new funding from McGill and Concordia universities as well as the Université du Québec à Montréal and Université Laval provides the laboratories with the tools necessary to better coordinate and plan their scientific activities, in particular through research seminars, short workshops, funding for postdoctoral fellows and visitors, etc. The CRM benefits tremendously from the involvement of its laboratories in scientific activities, including the planning of its thematic years. It is quite pleasant to witness the dynamism of our young colleagues who have joined us in the last few years. Their energy level is inspiring and a breath of fresh air for all of us.

The 2002-2003 program is certainly not restricted to the thematic year and the laboratories. The General Program has provided funding and organisational support to more than 10 scientific meetings ranging from the *Séminaires de mathématiques supérieures* to conferences honouring André Joyal and Robert Sharp as well as a workshop on the Langlands program. As part of the General Program, the CRM was host to the first workshop of the National Program on Complex Data Structures, a joint initiative of the three Canadian mathematical institutes and of the Canadian statistical community, which is funded by NSERC. The Interdisciplinary and Industrial Program has also been active with two joint activities with the Institute for Mathematics and its Applications (IMS) as well as a workshop on "Quantum Control: Mathematical and Numerical Challenges". This workshop, organised by a mathematician, an engineer and a chemist, is another good example of what a research centre in mathematics can accomplish to further the goals of science when further development is needed across several fields. Indeed, this workshop attracted researchers in applied mathematics,

theoretical chemistry, and physics. Moreover, the proceedings of the conference were published in our joint Series with the American Mathematical Society and will ensure that the research presented at that meeting will be much more widely available. This is particularly important for a new research field such as this one. This is a persuasive example of the added value that a research centre such as ours can provide by being able to plan, organise, and present a conference on an emerging field, and then publish the results for the benefit of all those who could not attend.

Productivity from the publication sector has been rather high this year with more than 15 new books published or to appear. We are particularly proud that the Fields medal winner Laurent Lafforgue has published a book on surgery of grassmannians in the CRM Monograph Series of the AMS, especially that the book is written in French!

As in previous years, the CRM has honoured many outstanding researchers from different fields and different stages in their career. John McKay and Edwin Perkins have been awarded the CRM-Fields Prize for exceptional achievement in mathematical sciences. Alexander Brudnyi received the André-Aisenstadt Prize, which recognizes talented young Canadian mathematicians. The CRM-CAP and CRM-SSC Prizes, for exceptional contributions to theoretical physics and statistics, have been awarded to Matthew Choptuik and Charmaine Dean. We are also continuing to develop a close relationship with the other Canadian mathematical institutes, Fields and PIMS, with AARMS to develop the mathematical sciences in the Atlantic provinces, with our network partners (ncm_2 and MITACS) as well as with the mathematical sciences societies (CMS, SSC, and CAIMS).

All of these accomplishments are of course not the work of a single individual. First, I want to thank Jacques Hurtubise for all he accomplished for the CRM in his four-year mandate as Director. His achievements were simply phenomenal. Anne Bourlioux, Steven Boyer, and Jean LeTourneux have all played a significant supporting role as Deputy Directors during the year 2002-2003. The organisation of scientific activities, the writing of grant applications, the planning of the laboratories, the management of the Centre, and the editing of our various collections all benefited greatly from their help. On behalf of Jacques Hurtubise, I thank them. Finally, I wish to underline the tireless work of the staff and thank them. It is always pleasant for a director to receive compliments from members, organisers, authors, users of the computing system, long- and short-term visitors for their overall satisfaction with the services they have received from our staff. These constantly renewed thanks for our personnel's work make us very proud. Indeed, the quality of our infrastructure and our staff are such that researchers are always ready to renew their CRM experience in the future.

The stage is set for year 2003-2004 to be at least as exciting as the year that just ended. The thematic year will be devoted to Geometric and Spectral Analysis. It is well known that analysis has traditionally stood at the centre of a wide spectrum of research activities in mathematics and that geometric and spectral analysis play a fundamental role in several themes of mathematics. The extensive scientific program will greatly benefit from the presence of a large number of long-term visitors and of postdoctoral fellows. Some activities will be organised jointly with the Fields Institute and AARMS. We are also working on new initiatives, notably a partnership with the University of Ottawa whereby they will organise scientific activities, support some teaching releases for CRM involvement and fund postdoctoral fellows. We are also establishing links with the Statistical and Applied Mathematics Science Institute (SAMSI), a new American mathematical institute, to develop joint activities starting in 2004-2005.

My job as Interim Director is greatly simplified by the constructive approach of all those involved in the activities of the CRM. I would like to underline the dedication of all organisers of scientific activities and of the members of the Advisory Committee and thank them. My task is also easier to accomplish thanks to the support that the CRM and myself are receiving from the administration of the Université de Montréal and from the Bureau de direction. Thanks to their vision and renewed financial support, I am convinced that they will find a first rate successor who will rise up to the great challenges that the CRM will face in the next few years.

Presenting the CRM

The Centre de recherches mathématiques (CRM) was created in 1969 by the Université de Montréal through a special grant from the National Research Council of Canada. 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 FQRNT (Fonds québécois de la recherche sur la nature et les technologies), by the Université de Montréal, as well as McGill, du Québec à Montréal, Concordia, Laval universities 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 carries on its mission and national mandate in several ways:

- it organizes a series of scientific events each year, around a given theme (distinguished lecture series, workshops, conferences, summer schools, visitor programs, etc.);
- its general program provides funding for conferences and special events at the CRM and across the country;
- each year it invites, through the Aisenstadt Chair, one or more distinguished mathematicians, to give advanced courses as part of its thematic program;
- it awards four prizes yearly: the CRM-Fields Prize recognizing major contributions to mathematics, the Aisenstadt Prize given for outstanding work done by a young Canadian mathematician, the CAP-CRM Prize for exceptional achievement in theoretical and mathematical physics, and the CRM-SSC Prize for exceptional contributions to statistics in early career;
- it publishes some 150 technical reports and about ten books per year. Some of its collections are published jointly with the AMS and with Springer Verlag;
- it has an extensive postdoctoral fellowship program, with 32 postdoctoral fellows in place last year, funded either solely by the CRM or in partnership with other organizations;
- it informs the community of its activities through its newsletter, *Bulletin du CRM*, and its web site at www.CRM.UMontreal.CA;
- it participates, with the other two Canadian centres, in groundbreaking national initiatives. One example is the MITACS project (Mathematics of Information Technology and Complex Systems). Another example is the National Program Committee, which provides funding for off-site research activities. Finally, the three institutes contribute financially to the development of the mathematical sciences in the Atlantic provinces through AARMS, and also participate in the National Program on Complex Data Structures jointly with the Canadian statistical community.

This national mandate is complemented by, and indeed supported by, a long-standing vocation of promoting research in the mathematical sciences in Québec. For instance,

- the CRM supports research through its eight research laboratories spanning most of the important areas of the mathematical sciences;
- it supports, through partnership agreements, a group of local researchers chosen mainly from departments of mathematics and statistics, but also computer science, physics, economics, engineering, etc.;
- it organizes series of regular seminars and lecture courses on different areas of the mathematical sciences;
- it 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;
- it 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-Télécommunications) led to the creation of the Network for Computing and Mathematical Modelling (ncm_2). NSERC and about twenty partners such as financial institutions, high-tech companies and government agencies fund this network.

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 Province of Québec. It is recognized worldwide as one of the major institutes in the mathematical sciences.

The director of the CRM is assisted by two managerial structures: the Bureau de direction and the Advisory Committee. The Advisory Committee is a group of internationally renowned mathematicians from Canada and abroad, who approve scientific programs and thematic years, choose recipients of the Aisenstadt Prize, participate in the selection of the CRM-Fields Prize, and suggest new scientific ventures to explore.

Personnel 2002-2003

The Director's Office	***Jacques Hurtubise***	Director
	Anne Bourlioux	Deputy Director, Scientific Program
	Steven Boyer	Deputy Director, Scientific Program
	Jean LeTourneux	Deputy Director, Publications
	Diane Poulin	Secretary
Administration	***Vincent Masciotra***	Head of Administration
	Michèle Gilbert	Administrative Assistant
	Muriel Pasqualetti	Administrative Assistant
	Josée Simard	Secretary
	Guillermo Martinez-Zalce	Administrative Technician
Scientific Activities	***Louis Pelletier***	Coordinator
	Josée Laferrière	Assistant Coordinator
	Luc St-Pierre	Coordinator (temporary)
Computer Services	***Daniel Ouimet***	Systems Administrator
	André Montpetit	Office systems manager (1/2 time)
	Jasmin Lapalme	programmer (technical aid, part time)
Publications	***André Montpetit***	TeX Expert (1/2 time)
	Louise Letendre	Technician
	Diane Brulé-De-Filippis	Secretary
Communications	***Suzette Paradis***	Communications Officer &Webmaster
MITACS	***Nicole Huron***	Administrative Assistant

Scientific Personnel

Since its foundation in 1969, the CRM has been involved in a wide variety of mathematics research as reflected by the spectrum of the research interests of its members, including the CRM's permanent research staff, members attached to the CRM through exchange agreements with neighboring universities and industry, and long-term visitors. The presence at the CRM of such an active group of researchers has brought many benefits to the centre. In particular, the CRM's national program is greatly facilitated by having on hand a large reserve of willing organizers, who have even contributed financially to the organization of activities. The largest partnership is with the Université de Montréal, which gives the equivalent of five full-time teaching positions in release time to the CRM. Release agreements with the other Montréal area universities provide for the equivalent of two more full-time positions. Facilities are also provided to researchers attached to junior colleges. Several members are attached to the CRM through industrial agreements such as those with Lockheed Martin Canada.

Members

Ali, Syed Twareque
Math. & stat.,
Concordia Univ.

Angers, Jean-François
Math. & stat.,
Univ. de Montréal

Apostolov, Vestislav
Math.,
UQAM

Arminjon, Paul
Math. & stat.,
Univ. de Montréal

Bandrauk, André
Chimie,
Univ. de Sherbrooke

Baribeau, Line
Math. & stat.,
Univ. Laval

Bartello, Peter
Math. & stat.,
McGill Univ.

Beaulieu, Liliane
Cégep du Vieux Montréal

Bédard, Robert
Math.,
UQAM

Bélair, Jacques
Math. & stat.,
Univ. de Montréal

Benali, Habib
INSERM, CHU Pitié-Salpêtrière,
Paris

Bengio, Yoshua
Info. & rech. op.,
Univ. de Montréal

Bergeron, Anne
Math.,
UQAM

Bergeron, François
Math.
UQAM

Bergeron, Nantel
Math. & stat.,
York Univ.

Bourlioux, Anne
Math. & stat.,
Univ. de Montréal

Boyer, Steven
Math.,
UQAM

Brassard, Gilles
Info. & rech. op.,
Univ. de Montréal

Broer, Abraham
Math. & stat.,
Univ. de Montréal

Brunet, Robert
Math. & stat.,
Univ. de Montréal

Bryant, David
Math. & stat.,
McGill Univ.

Clarke, Francis
Univ. de Lyon

Collin, Olivier
Math.,
UQAM

Crépeau, Claude
École d'info.,
McGill Univ.

Csürös, Miklos
Info. & rech. op.,
Univ. de Montréal

Cummins, Chris J.
Math. & stat.,
Concordia Univ.

Dafni, Galia
Math. & stat.,
Concordia Univ.

Darmon, Henri
Math. & stat.,
McGill Univ.

David, Chantal
Math. & stat.,
Concordia Univ.

Delfour, Michel
Math. & stat.,
Univ. de Montréal

Durand, Stéphane
Collège Édouard-Montpetit

Dssouli, Rachida
Informatique,
Concordia Univ.

El-Mabrouk, Nadia
Info. & rech. op.,
Univ. de Montréal

Fournier, Richard
Collège Dawson

Frigon, Marlène
Math. & stat.,
Univ. de Montréal

Gander, Martin
Math. & stat.,
McGill Univ.

Gauthier, Paul
Math. & stat.,
Univ. de Montréal

Goren, Eyal
Math. & stat.,
McGill Univ.

Goulard, Bernard
Physique,
Univ. de Montréal

Granville, Andrew
Math. & stat.,
Univ. de Montréal

Grundland, Michel
Math.,
UQTR

Hall, Richard L.
Math. & stat.,
Concordia Univ.

Hallett, Michael
Math. & stat.,
McGill Univ.

Harnad, John
Math. & stat.,
Concordia Univ.

Hurtubise, Jacques
Math. & stat.,
McGill Univ.

Hussin, Véronique
Math. & stat.,
Univ. de Montréal

Jakobson, Dmitry
Math. & stat.,
McGill Univ.

Jaksic, Vojkan
Math. & stat.,
McGill Univ.

Kamran, Niky
Math. & stat.,
McGill Univ.

Kharlampovich, Olga
Math. & stat.,
McGill Univ.

Kisilevsky, Hershy
Math. & stat.,
Concordia Univ.

Klemes, Ivo
Math. & stat.,
McGill Univ.

Koosis, Paul
Math. & stat.,
McGill Univ.

Korotkin, Dmitri
Math. & stat.,
Concordia Univ.

Labelle, Gilbert
Math.,
UQAM

Labelle, Jacques
Math.,
UQAM

Lalonde, François
Math. & stat.,
Univ. de Montréal

Langlands, Robert P.
Institute for Advanced
Study, Princeton

Léger, Christian
Math. & stat.,
Univ. de Montréal

Leroux, Pierre
Math.,
UQAM

Lesage, Frédéric
CRM,
Univ. de Montréal

Lessard, Sabin
Math. & stat.,
Univ. de Montréal

LeTourneux, Jean
Physique,
Univ. de Montréal

Lévesque, Claude
Math. & stat.,
Univ. Laval

Lina, Jean-Marc
CRM,
Univ. de Montréal

Major, François
Info. & rech. op.,
Univ. de Montréal

Makkai, Michael
Math. & stat.,
McGill Univ.

Mashreghi, Javad
Math. & stat.,
Univ. Laval

Maslowe, Sherwin A.
Math. & stat.,
McGill Univ.

Mathieu, Pierre
Physique,
Univ. Laval

McKay, John
Math. & stat.,
Concordia Univ.

Miasnikov, Alexei
Math. & stat.,
McGill Univ.

Nekka, Fahima
Pharmacie,
Univ. de Montréal

Nigam, Nilima
Math. & stat.,
McGill Univ.

Patera, Jiri
Math. & stat.,
Univ. de Montréal

Perron, François
Math. & stat.,
Univ. de Montréal

Petridis, Yiannis
CRM,
Univ. de Montréal

Polterovich, Iosif
Math. & stat.,
Univ. de Montréal

Ramakrishna, Ravi
Math. & stat.,
McGill Univ.

Ransford, Thomas
Math. & stat.,
Univ. Laval

Reutenauer, Christophe
Math.,
UQAM

Rosenberg, Ivo
Math. & stat.,
Univ. de Montréal

Rousseau, Christiane
Math. & stat.,
Univ. de Montréal

Roy, Roch
Math. & stat.,
Univ. de Montréal

Russell, Peter
Math. & stat.,
McGill Univ.

Sabidussi, Gert
Math. & stat.,
Univ. de Montréal

Saint-Aubin, Yvan
Math. & stat.,
Univ. de Montréal

Sankoff, David
Math. & stat.,
Univ. de Montréal

Schlomiuk, Dana
Math. & stat.,
Univ. de Montréal

Schmidt, Georg
Math. & stat.,
McGill Univ.

Shahbazian, Elisa
Lockheed Martin Canada

Stern, Ron
Math. & stat.,
Concordia Univ.

Thaine, Francisco
Math. & stat.,
Concordia Univ.

Toth, John
Math. & stat.,
McGill Univ.

Valin, Pierre
Lockheed Martin Canada

Van Vliet, Carolyne
Physique,
Univ. Miami

Vinet, Luc
Math. & Phys.,
McGill Univ.

Winternitz, Pavel
Math. & stat.,
Univ. de Montréal

Wise, Daniel
Math. & stat.,
McGill Univ.

Worsley, Keith
Math. & stat.,
McGill Univ.

Zolésio, Jean-Paul
INRIA, France

Postdoctoral Fellows

Each year the CRM plays host to a number of postdoctoral fellows. The sources for their funding include the NSERC postdoctoral program, the NATO international program administered by NSERC, the CRM (alone or with the ISM), and individual research grants from CRM members. The list below includes only postdoctoral fellows in residence at the CRM or funded or co-funded by the CRM, with their funding source given in brackets. Some of the fellows were in residence at the CRM for only part of the year – the affiliation is that where their doctoral degree was obtained.

Allen, Steve
Univ. de Sherbrooke
(rcm_2-Lockheed Martin)

Archinard, Natalia
ETH Zurich
(CRM-ISM)

Bertola, Marco
S.I.S.S.A.
(CRM-ISM)

Bourque, Guillaume
Univ. of Southern California
(FQRNT)

Buono, Luciano
Univ. of Warwick
(NSERC)

Casesnoves, Raquel
Univ. de Montréal
(CRM)

Chapoton, Frédéric
Paris VI
(LaCIM-CRM)

Dai, Jack Jie
Iowa State Univ.
(CRM-ISM)

Deteix, Jean
Univ. de Montréal
(CRM-GIREF)

Gomez-Ullate, David
Univ. Complutense de Madrid
(CRM-ISM)

Lafaye de Micheaux, Pierre
Univ. de Montréal
(CRM)

Langerman, Stefan
Rutgers Univ.
(CRM-McGill)

Maillot, Sylvain
Univ. Paul Sabatier
(CRM)

Matessi, Diego
Univ. of Warwick
(CRM-ISM)

Mei, Ming
Kanazawa Univ.
(CRM-McGill)

Mohammadalikhani, Ramin
Univ. de Toronto
(NSERC)

Nuzzo, Regina
Stanford Univ.
(CRM-ISM)

Pal, Ambrus
Colombia Univ.
(CRM-ISM)

Penskoi, Alexei
Univ. de Montréal
(CRM)

Prasad, Amritanshu
Univ. of Chicago
(CRM-CICMA)

Rasmussen, Jorgen
Univ. of Lethbridge
(CRM-ISM)

Saikia, Anupam
Trinity College,
Univ. of Cambridge
(CRM-ISM)

Schiffler, Ralf
UQAM (FQRNT)

Sikora, S. Adam
Univ. of Maryland
(CRM-ISM)

Tempesta, Piergiulio
Univ. degli studi di Lecce
(CRM-ISM)

Titcombe, Michèle Suzanne
Univ. of British Columbia
(CRM-ISM)

Tremblay, Sébastien
Univ. de Montréal
(CRM)

Urquiza, José Manuel
Univ. Pierre et Marie Curie
(CRM-ISM)

Vassilev, Dimiter
Purdue Univ.
(CRM-ISM)

Vénéreau, Stéphane
Institut Fourier
(CRM-McGill)

Vitse, Pascale
Univ. de Bordeaux I
(CRM-ISM)

Zhalij, Alexander
Institute of Mathematics of the National Academy of Sciences, Ukraine
(NATO-NSERC)

Zhao, Yulin
Peking Univ., Beijing
(CRM)

Next is a separate list for the postdoctoral fellows specifically involved with MITACS projects attached to the CRM. The affiliation listed indicates where the research is being done.

Ben Amor, Hatem
École Polytechnique
de Montréal

Bub, Gil
McGill Univ.

Davidsen, Joern
Univ. of Toronto

Dumais, Paul
McGill Univ.

Hadjar, Ahmed
École Polytechnique
de Montréal

Mangin, Laurence
McGill Univ.

Lafaye de Micheaux, Pierre
Univ. de Montréal

Plank , Gernot
Univ. of Calgary

Wang, Shaojun
Univ. of Waterloo

Zou, Renqiang
Institut de cardiologie
de Montréal

Visitors

Each year the CRM hosts a large number of visitors. The majority come to the centre to participate in scientific activities: in the year 2002-2003, 1193 such participants registered for workshops run solely by the CRM. In addition, the CRM helped fund about twenty other scientific events. The following lists include, only visitors who were in residence for long periods, ranging from a week to several months.

Visitors who were in residence for at least four weeks:

Andrle, Miroslav
Czech Technical Univ.

Belhaj, Adil
Univ. Mohammed V

Daboul, Jamil
Ben Gurion Univ.

Eynard, Bertrand
CEA, SPhT

Fleischer, Isidore
Univ. de Montréal

Goldstein, Piotr
The Andrzej Soltan Institute for Nuclear Studies

Hernandez-Heredero, Rafael
Univ. Complutense de Madrid

Hong, Hee Sun Regina
Hong Kong Baptist Univ.

Hrivnak, Jiri
Czech Technical Univ., FNSPE

Kaczynski, Tomasz
Univ. de Sherbrooke

Karolyi, Gyula
Eotvos Univ.

Karrakchou, Jamila
École Mohammadia d'ingénieurs

Kashuba, Iryna
Univ. de Sao Paulo

Kececioglu, John
Univ. of Arizona

Kouritzin, Michael
Univ. of Alberta

Lee, Paul H.C.
National Central Univ., Taiwan

Levi, Decio
Univ. di Roma Tre

Mardoyan, Levon
Yerevan State Univ.

Mohar, Bojan
Univ. of Ljubljana

Monastyrsky, Michael
ITEP, Moscow

Moraru, Ruxandra
Univ. of Toronto

Novotny Petr
Czech Technical Univ., FNSPE

Patera Jan
Czech Technical Univ.

Pouryayevali, Mohamad Reza
Univ. of Isfahan

Reed, Bruce A.
McGill Univ.

Rodriguez, Miguel A.
Univ. Complutense de Madrid

Segura, Velez Anatoli
École normale supérieure Paris

Szemerédi, Endre
Rutgers Univ.

Vulpe, Nicolae
Academy of Sciences of Moldova

Zeron, Eduardo Santillan
Cinvestav-IPN (Institut Polytechnique National, Mexique)

Visitors who were in residence for less than four weeks:

Alon, Noga
Tel Aviv Univ.

Arnéodo, Alain
C.N.R.S., France

Artes, Joan C.
Univ. Autonoma
de Barcelona

Baake, Michael
Univ. of Greifswald

Bagby, Thomas
Indiana Univ.

Ballesteros, Angel
Univ. de Burgos

Barany, Imre
Hungarian Academy
of Sciences

Benali, Habib
CHU Pitié Salpêtrière

Cheftel, Mikhail B.
Feza Gursey Institute

Chen, Goong
Texas A&M Univ.

Christopher, Colin
Univ. of Plymouth

Chudnovsky, Maria
Princeton Univ.

Chvatal, Vasek
Rutgers Univ.

Cioaba, Sebastian
Queen's Univ.

Dawson, Donald
Carleton Univ.

de Guise, Hubert
Lakehead Univ.

Del Moral, Pierre
Centre Interuniversitaire
de Calcul de Toulouse

Devroye, Luc
McGill Univ.

Dey, Dipak K.
Univ. of Connecticut

Floreanini, Roberto
INFN, Trieste

Fonseca, Pedro
Rutgers Univ.

Frieze, Alan
Carnegie Mellon Univ.

Herranz, Francisco Jose
Univ. de Burgos

Jeffres, Thalia David
Instituto de Fisica
y Matematicas

Jurco, Branislav
Univ. of Munich

Lassonde, Marc
Univ. Antilles-Guyane

Lemire, Frank
Univ. of Windsor

Llibre, Jaume
Univ. Autonoma
de Barcelona

Lovász, Lászlo
Microsoft Research Lab.

Lugosi, Gabor
Pompeu Fabra Univ.

Matignon, Denis
Ecole Nationale Supérieure
des Télécommunications

Merrien, Jean-Louis
I.N.S.A. de Rennes

Mischaikow, Konstantin
Georgia Institute
of Technology

Mrozek, Marian
Uniw. Jagiellonski

Murty, Ram
Queen's Univ.

Pach, János
Courant Institute of
Mathematical Sciences

Paramonov, Petr
Steklov Institute, Moscow,
Russie

Raffinot, Mathieu
Univ. d'Evry

Ranada, Manuel F.
Univ. de Zaragoza

Rifford, Ludovic
Univ. Lyon I

Sokolov, Vladimir V.
Landau Institute for Theoretical
Physics

Sokolowski, Jan
Univ. Henri Poincaré Nancy I

Sudakov, Benjamin
Princeton Univ.

Thiriet, Marc
INRIA Rocquencourt

Thomova, Zora
SUNY-Institute of Technology

Tolar, Jiri
FNSPE, Czech Technical Univ.

Van Vliet, Carolyne
Univ. of Miami

Wolkowicz, Henry
Univ. of Waterloo

Wormald, Nicholas
Univ. of Waterloo

Zolésio, Jean-Paul
INRIA

Management

Bureau de direction

The Bureau consists of members from the Université de Montréal (eight to eleven members) and from the outside (two to five members). The rector of the Université de Montréal and the Dean of its Arts and Sciences faculty are represented on the Bureau. The Bureau adopts the policies of the Centre, recommends the nomination and the promotion of researchers and the appointment of regular members, advises the Director on the preparation of the budget and the Université de Montréal on the choice of the Director.

Bergeron, François
UQAM

Brassard, Gilles
Univ. de Montréal

Caillé, Alain
Vice-recteur à la rech.,
Univ. de Montréal

Hubert, Joseph
Doyen,
Faculté des arts
et des sciences,
Univ. de Montréal

Hurtubise, Jacques
Director CRM,
McGill Univ.

Hussin, Véronique
Univ. de Montréal

Kisilevsky, Hershy
Concordia Univ.

Léger, Christian
Univ. de Montréal

Rémillard, Bruno
UQTR

Rousseau, Christiane
Univ. de Montréal

Russell, Peter
McGill Univ.

Saint-Aubin, Yvan
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 and the Director of the CRM attend the meetings of the Advisory Committee. 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 de direction.

Caillé, Alain
Univ. de Montréal

Craig, Walter
McMaster Univ.

Glynn, Peter
Stanford Univ.

Haiman, Mark
Univ. of California,
Berkeley

Hambleton, Ian
McMaster Univ.

Hitchin, Nigel
Oxford Univ.

Hurtubise, Jacques
McGill Univ.

Lawless, Jerry
Univ. of Waterloo

Luskin, Mitchell
Univ. of Minnesota

Murty, Ram
Queen's Univ.

Odlyzko, Andrew
Univ. of Minnesota

Rousseau, Christiane
Univ. de Montréal

Zelditch, Steven
Johns Hopkins Univ.

Computer Facilities

The CRM offers 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 several workstations distributed through the offices and common rooms. These workstations consist mainly of 15 Linux computers (1.4 to 1.8 GHz with 2 Gb of memory each), 28 Sun workstations (from Sparc-4 to Ultra-10) and 12 X-terminals.

The software libraries include compilers (FORTE environment for C, C++ and Fortran, GNU compilers, Java, etc.), symbolic manipulation programs (Mathematica, Maple, Matlab, Macaulay), several text editors, web browsers, mail tools, and most utilities common to the mathematical world (fftw-Discrete Fourier Transform, dstool-tool for dynamical systems, FreeFem, SciGraphica, etc.). Upgrades to TeX and its dialects are uploaded whenever they are released. Unix software to interwork with PC and Mac world is also installed, such as SAMBA (PC file and printer server), OpenOffice (Office suite), and Netatalk (file server for Macintosh). The CRM web pages are hosted on a Web server (Apache under Unix) with secured tool SSL and a recognized 128-bit Thawte certificate that enables secured registration for participants to CRM activities.

For security, many programs for surveillance and access control are in place. Operating system updates are performed frequently. Also most of our computers are connected to an alarm system.

The CRM operates its own private local area network (LAN): five BayNetworks Baystack-450 switches, providing 120 ports on twisted-pair at 10/100 Mb/s and 4 optic fiber links supporting Gigabit Ethernet. This private local network is linked to the network of the Université de Montréal that maintains the connections with RISQ (Réseau d'informations scientifiques du Québec) and CA*net (the Canadian internet transit service). Members and guests can now connect their personal laptops (or computers) to the CRM private network directly, or if they are outside CRM offices they can connect through phone links to our PPP server and its 4 modems.

The support staff use Sun workstations or Macintoshes tied to the Sun server for services, such as mail and backups. An upgrade to MacOS X is planned during summer of 2003.

Since 2001, a new database called "Le Monstre" is being developped and used in many CRM tasks. Phase two was completed at the end of 2002 with further expansions planned to follow. Up to now, it is helping support staff to better manage the contacts, activities, offices, automatic web pages and registrations to conferences, printing and filling forms, web dynamic directory, etc. Also, the scientific CV and publications from members are included in the database, which will give the ability to display on the web some of this information later.

For printing, the CRM has two HP-8000DN workgroup printer (1200-dpi double-sided), a jet-ink network printer Epson-900N for color-printing, and some small printers for support staff.

The CRM has its servers installed in a room specifically designed for computers, with independent controlled environment and UPS (Uninterruptible Power Supply).

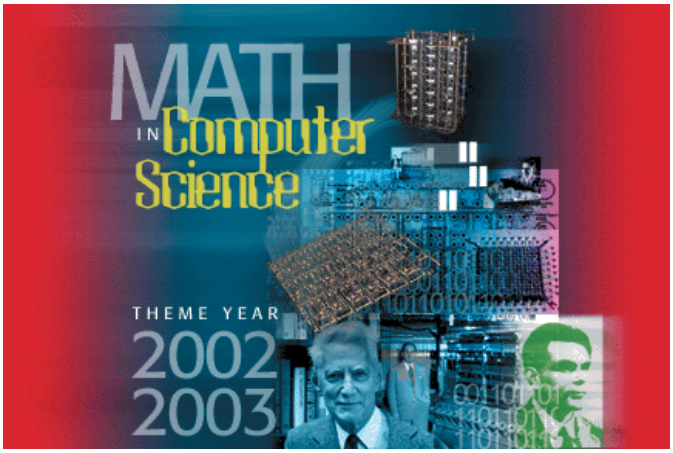
In 2002, a new room with 5 X-terminals and 3 Mac computers was installed for conference participants. They can use Telnet, FTP and SSH while they are at the CRM.

Scientific Activities

The core of each year's scientific program at the CRM is its thematic program. The Advisory Committee chooses the topic for its scientific importance, its timeliness, and its impact on the Canadian scientific community. The preceding year's topic was Groups and Geometry. A thematic year's activities can combine a good number of workshops and conferences, one or two Aisenstadt Chairs, a number of visiting scientists in residence, and some postdoctoral 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 2002-2003: Math in Computer Science

The field of computation, formally born only last century but with roots that stretch back to Euclid, is now a mathematical discipline in its own right, with solid theoretical foundations on which its spectacular development is based. The CRM special year in the mathematics of computer science proposed to explore in depth a significant spectrum of the many sub-areas that are core foundational material for modern coputer science, that exhibit significant and new mathematical content, and that have indeed influenced the development of mathematics.



Organizing Committee: David Avis (McGill), Yoshua Bengio (Montréal), Gilles Brassard (Montréal), Luc Devroye (McGill), Pierre L'Écuyer, (Montréal), Pierre McKenzie (Montréal), Prakash Panangaden (McGill), Bruce Reed (McGill), Denis Thérien (McGill).

Mathematically, the areas with the earliest influence on computer science were logic and discrete mathematics. Since then, the theoretical foundations of computer science have blossomed, and ideas from the area (like effectiveness, complexity and tractability) have grown to occupy an ever more important role in mathematics. More recently, a recurrent theme in many of the domains examined are probabilistic methods; these have permeated the whole of computer science, and so particular emphasis will be placed on the utilisation of these techniques, both in theoretical areas and in more applied ones such as simulation and machine learning.

Summer School on Quantum Information Processing

July 16-20, 2002

Org.: Gilles Brassard (Montréal)

Speakers: A. Ambainis, C. H. Bennett, G. Brassard, H. Buhrman, R. Cleve, C. Crépeau, D. Gottesman, N. Gisin, P. Hoyer, R. Laflamme, A. Tapp, J. Watrous.

Classical information theory is firmly rooted in the classical physics of Newton and Einstein. But the world is quantum mechanical. This has prevented us from tapping the full potential of physical reality for information processing purposes. For instance, quantum mechanics allows for unbreakable cryptographic codes and such a high level of parallelism in computation that a classical computer the size of the universe would be left behind. The goal of this school was to make the field of quantum information processing accessible to a general audience of mathematicians and computer scientists who have little or no familiarity with quantum mechanics.

Aisenstadt Chair Lecture Series

The holders of the Aisenstadt chair for the year were László Lovász (Microsoft Research Lab.) and Endre Szemerédi (Rutgers University).

CONCENTRATION PERIODS

Complexity theory, analysis of algorithms

May-June, 2002

Org.: Pierre McKenzie (Montréal), Denis Thérien (McGill)

En mai 2002, le CRM fut l'hôte de deux des conférences les plus importantes de l'informatique théorique, le *Symposium on Theory of Computing* de l'ACM et la *Conference on Computational Complexity* de l'IEEE.
En plus, il y a eu plusieurs ateliers d'une semaine sur des sujets au coeur de l'informatique théorique. Chaque atelier a réuni un nombre de chercheurs de premier plan qui ont donné des cours de survol ainsi que des conférences sur la recherche de pointe.

Lecture series on branching programs

May 13-17, 2002, McGill Univ.

Speaker: Ingo Wegener (Dortmund)

Number participants: 14

Randomness in Branching program

May 27-31, 2002, McGill Univ.

Speakers: P. Beame (Washington), A. Gal (Texas at Austin), T.S. Jayram (IBM Almaden), P. Pudlak (Czech Academy of Sciences), R. Raz (Weizmann Institute), A. Razborov (Institute for Advanced Studies), E.Vee (Washington), X. Sun (Rutgers).

Number of participants: 18

Les techniques probabilistes ont un rôle important en informatique qui provient d'algorithmes donnant une solution efficace à des problèmes pour lesquels aucune solution déterministe n'est connue, ou par l'intermédiaire de l'étude probabiliste de la complexité. Cette semaine était vouée à ce thème, en commençant par les liens entre les techniques probabilistes et les programmes de branchement.

Verification and model-checking

June 3-7, 2002, McGill Univ.

Speakers: P. Bouyer (ENS Cachan), S. Demri (ENS Cachan), A. Petit (ENS Cachan).

Number of participants: 12

Depuis dix ans, le travail théorique dans le domaine de la vérification a porté fruit. Cet atelier a couvert les aspects les plus importants de ce développement, en particulier, ceux liés au model-checking.

Quantum Foundations in the Light of Quantum Information and Cryptography

October 14 to November 2, 2002

Org.: Gilles Brassard (Montréal), Christopher A. Fuchs (Bell Labs, Lucent Technologies)

Speakers: M. Appleby (Queen Mary, Univ. of London), Howard Barnum (Los Alamos National Laboratory), C. H. Bennett (IBM Thomas J. Watson Research Ctr), G. Brassard (Montréal), H. Briegel (München), J. Bub (Maryland), A. C. Quintero (Seville, Avda Reina Mercedes), C. M. Caves (New Mexico), C. Crépeau (McGill), J. M. Fernandez (École Polytechnique de Montréal), R. Floreanini (Sezione di Trieste), C. Fuchs (Bell Labs, Lucent Technologies), E. Galvão (Oxford), N. Gisin (Genève), L. Hardy (Perimeter Institute), P. Hayden (California Institute of Technology), F. Markopoulou (Perimeter Institute), D. Mayers (California Institute of Technology), N. D. Mermin (Cornell), D. Poulin (Waterloo), R. Schack (Royal Holloway, Univ. of London), B. Schumacher (Kenyon College), J. Smolin (IBM Thomas J. Watson Research Ctr), R. Spekkens (Perimeter Institute), C. Timpson (Oxford), S. Wolf (Montréal), W. Wootters (Williams College).

Number of participants: 27

The late Rolf Landauer once claimed that "information is physical". The purpose of this Workshop was to take the opposite stand and explore the implications of our firm belief that "physics is informational"! At the moment, quantum information theory is replete with beautiful theorems on what is and is not possible according to quantum mechanics. For example, quantum key distribution is possible but quantum bit commitment is not. But the axioms of quantum mechanics are strange and ad hoc, reflecting at best the history that led to discovering this new world order. It is time to pause and reflect on what is really fundamental and what are merely consequences. Our long-term goal is to restructure the foundations of quantum mechanics in the light of quantum information. Our dream is to make the axioms of quantum mechanics as simple and natural as those of relativity.

A first intimate CRM three-day meeting was held in Montréal in May 2000, to which less than a dozen people were invited. This paved the way for this second much less intimate CRM meeting, which brought together 27 of the world's foremost quantum foundation thinkers for a period of three weeks. The format of this meeting was meant to foster as much interaction as possible between the participants, with a very loose schedule of two talks on each day and consequently lots of time for talking to each other.

The paper "Quantum Mechanics as Quantum Information (and only a little more)" (http://arxiv.org/abs/quant-ph/0205039, May 2002) by Christopher Fuchs served as basis of discussion throughout this period of concentration. It describes most of the emerging theory. A more complete paper by Brassard and Fuchs is under way, for inclusion in the

forthcoming issue of Foundations of Physics that will honour the 70th birthday of Asher Peres (Technion, Israel).

The fruits of the meeting have been many in terms of papers, talks and research, not only for the organizers, but for many who attended the Workshops. An eloquent testimony is found in Jeffrey Bub's "Why the Quantum" (http://arxiv.org/abs/quant-ph/0402149, February 2004), in which he wrote: "The project [of using quantum information as foundation for quantum mechanics] was first suggested to me by remarks by Gilles Brassard at the meeting 'Quantum Foundations in the Light of Quantum Information and Cryptography' held in Montreal". Several additional papers on this topic have been posted on the quant-ph archive in the past year or two, some from those who attended the Workshop, some by others who have been introduced to our work. A complete list would take too much space to compile here.

Among the results of this CRM Workshop, Gilles Brassard had the opportunity to give an invited presentation at the 7th Quantum Information Processing Conference (2004), which is the main Annual International Conference on computer science aspects of quantum information. The title of the talk was adequately enough "Quantum Foundations in the Light of Quantum Information". The slides can be viewed in Adobe PDF at URL http://www.iro.umontreal.ca/~brassard/QFLQI/QIP2004.pdf .

In conclusion, this was a most fruitful Workshop. But it's only the beginning of the story for which it contributed so much to the introduction. We must look with confidence at the daunting road still ahead of us.

Combinatorics, probability and algorithms

May 5-23, 2003

Org.: David Avis (McGill), Luc Devroye (McGill), Bruce A. Reed (McGill).

Number of participants: 105

This meeting was based around six mini-courses of five hours on exciting current directions in these areas, and especially at their intersection. These mini-courses were directed at doctoral students and postdocs.

The mini-courses were given by:
I. Barany (Hungarian Academy of Sciences), V. Chvatal (Rutgers), A. Frieze (Carnegie-Mellon), L. Lovasz (Microsoft), G. Lugosi (Pompeu Fabra), & J. Pach (City College New York).

Three of these speakers had given invited talks in the area they surveyed at the ICM. Another has given a plenary lecture there. Another has received the Fulkerson prize.

Further lectures were given by the following researchers:
M,. Chudnovsky (Princeton), N. Alon (Tel Aviv), R. Murty (Queen's), A. Soshnikov (California, Davis), E. Szemeredi (Rutgers).

These speakers were of the same calibre. For example, Alon (who also held an Aisenstadt chair, as did Szemeredi) gave a plenary lecture at the 2002 ICM and has won the Wolf prize.

The mood was deliberately kept informal and the talks to about 15 hours a week so as to encourage interaction between participants.

The success of this approach can be measured by the fact that there were 105 participants from four continents, including participants from all over Canada (Halifax to Vancouver).

INTERNATIONAL ANNUAL MEETINGS

ACM Symposium on Theory of Computing (STOC)

May 19-21, 2002

Org.: Pierre Mckenzie (Montréal), Denis Therien (McGill).

Program Commitee: Pankaj Agarwal (Duke), Allan Borodin (Toronto), Sam Buss (California), Shafi Goldwasser (MIT), Rao Kosaraju (Johns Hopkins), Richard Ladner (Washington), Gary Miller (Carnegie Mellon), Michael Mitzenmacher (Harvard), Satish Rao (California), John H. Reif (Duke), Micha Sharir (Tel Aviv), Paul Spirakis (Computer Technology Institute), Mikkel Thorup (Copenhagen), Leslie Valiant (Harvard).

Number of participants: 301

Le colloque annuel *Symposium on Theory of Computing* de *l'Association for Computing Machinery* en était à sa 34ième année en 2002. Tenu le plus souvent aux Etats-Unis, STOC'02 a eu lieu à Montréal en mai 2002 et son organisation locale fut orchestrée par le CRM, qui lançait ainsi les activités de son année thématique 2002-03 sur les aspects mathématiques de l'informatique. Le colloque fut un succès sur tous les fronts, attirant des participants provenant des quatre coins du monde.

Un comité international de 15 experts, présidé par John Reif de l'Université Duke, avait confectionné le programme du colloque sur la base de l'acceptation de 91 des 287 contributions soumises.
Les fonctions scientifiques du colloque se sont déroulées à l'Hôtel Wyndham, sur 3 jours, en deux séances parallèles comportant des présentations d'une vingtaine de minutes chacune. Le prix Knuth, reconnaissant deux fois tous les trois ans la contribution remarquable d'un individu au dé-

veloppement des fondements théoriques de l'informatique, fut attribué au Dr. Christos Papadimitriou de l'Université de la Californie à Berkeley. Ce dernier prononçait un exposé plénier au titre accrocheur, mémorable et pertinent : «The Joy of Theory »!

IEEE Conference on Computational Complexity

May 21-24, 2002

Org.: Pierre Mckenzie (Montréal), Denis Therien (McGill).

Speakers: A. Condon (UBC), C. Crépeau (McGill), N. Galesi (Toronto), R. Shaltiel (Weismann Institute), C. Umans (Microsoft Research), P. Winkler (Bell Laboratories).

Number of participants: 142

Le CRM prenait également la responsabilité de l'organisation locale en mai 2002 de la 17ième *Annual Conference on Computational Complexity* de l'*Institute of Electrical and Electronics Engineers*. Cette conférence plus spécialisée, d'une durée de 4 jours dont la première journée fut conjointe au colloque STOC'02, attira un nombre record de 142 participants, dont 60 étudiants. Depuis sa création en 1986, la conférence CCC n'avait pas dépassé le niveau de 110 participants.
Le comité du programme de CCC était formé de 9 experts provenant de la Hollande, de la France, des Etats-Unis et du Canada, et présidé par le Dr. Anne Condon de l'Université de la Colombie Britannique. Ce comité avait sélectionné 33 articles parmi les 74 articles soumis pour former le contenu scientifique du colloque. À l'exception des exposés de la première journée conjointe avec STOC'02, l'événement scientifique a eu lieu au pavillon Aisenstadt. Deux chercheurs de renom furent invités à prononcer une conférence dans le cadre du colloque, soient le Dr. Lance Fortnow de l'Institut de recherche NEC ('*The History of Complexity*') et le Dr. Peter Winkler de Lucent Technologies ('*Rapid Mixing*'). C'était la première fois que STOC et CCC se tenaient en tandem et l'expérience fut un grand succès. Un grand merci au personnel du CRM, et en particulier à Louis Pelletier!

Mathematical Foundations of Programming Semantics XIX (MFPS)

March 19-22, 2003

Org.: Prakash Panangaden

Speakers: V. Danos (Paris, VII), M. Fiore (Cambridge), J. Lawson (Louisiana State), N. Lynch (Massachusetts Institute of Technology), J. Millen (Stanford Research Institute), M. Mislove (Tulane), G. Plotkin (Univ. of Edinburgh).

Supported by: the United States Navy, Office of Naval Research.

The MFPS conferences are devoted to those areas of mathematics, logic and computer science which are related to the semantics of programming languages. The series particularly has stressed providing a forum where both mathematicians and computer scientists can meet and exchange ideas about problems of common interest.

The nineteenth Mathematical Foundations Of Programming Semantics conference was well attended (approximately 50 participants) and attracted a number of graduate students from the surrounding areas. The talks covered a variety of topics from logic, semantics and pure mathematics.

There were, in addition, 4 special sessions:
- Special Session on Security organized by Catherine Meadows (NRL)
- Special Session on Hybrid Systems organized by Prakash Panangaden
- Special Session on Probabilistic Systems organized by Prakash Panangaden
- Special Session on Domain Theory organized by Achim Jung.

Speakers were invited for these sessions and their presence greatly enhanced the conference. The domain theory session was in part a celebration of the 60th birthday of Prof. Lawson whose fundamental contributions to the theory of continuous lattices was recognized. The reception featured a birthday party for Prof. Lawson.

Overall the conference was a great success. A number of new connections were made between researchers in different areas. The role of probability theory was seen to be very significant. New areas like hybrid systems received a tremendous fillip. The synergy between mathematics and theoretical computer science continued both classical connections (domain theory) and forged new links (probability theory, analysis).

18th IEEE Symposium on Logic in Computer Science

June 22-25, 2003, Ottawa

Org.: Amy P. Felty (Ottawa), Philip Scott (Ottawa)

The CRM supported five workshops affiliated to the LICS conference. These workshops ranged from full blown meetings, with a call for papers and a program committee to review and select papers for presentation, to informal workshops where people from different disciplines could meet and exchange ideas. The workshops were part of one of the most successful IEEE Symposia on Logic in Computer Science held in North America in recent years and attracted several new, young researchers to the area of logic and computer science. In many cases there were many more attending then actually registered. For example the workshop on causality had at least 30 people in the room at any given time.

Probability in Artificial Intelligence

June 21, 2003, Ottawa
Org.: Doina Precup (McGill)
Speakers: Norm Ferms (McGill), Bob Givan (Purdue), Marta Kwiatkowska (Birmingham), Ron Parr (Duke), Pascal Poupart (Toronto), K. Subramani (West Virginia).
Number of participants: 16

This workshop brought together researchers in AI working with logic and probability with mainstream LICS participants. In the LICS conferences in recent years there has been a lot of activity around the area of verification and model checking in particular. There have also been a number of recent papers specifically focusing on probability. In AI, especially in machine learning, there has been much interest in probabilistic methods. Marta Kwiatkowska was also a keynote speaker at the main LICS conference.

Typical Case Complexity and Phase Transitions

June 21, 2003, Ottawa
Org.: Lefteris Kirousis (Carleton), Evangelos Kranakis (Patras).
Invited Speakers: Albert Atserias (Politcnica de Catalunya), Paul Beame (Seattle), John Franco (Cincinnati) Andreas Goerdt (Chemmitz).
Number of participants: 17

Typical case complexity refers to algorithmic complexity that holds with high probability for a class of random instances of a problem. Usually, the class of instances considered is parameterized by a "control parameter." It has been observed that for many computationally interesting problems, their typical case complexity undergoes an abrupt change (phase transition) about a critical value of the control parameter. At the same critical region, other phenomena of combinatorial interest are often observed. There were five contributed papers in addition to the invited talks. A special issue of the journal "Discrete Applied Mathemetics" will be dedicated to the workshop.

Logic and Computational Linguistics

June 26, 2003, Ottawa
Org.: Leonid Libkin (Toronto), Gerald Penn (Toronto).
Invited Speakers: Mark Steedman (Edinburgh), Frank Pfenning (Carnegie-Mellon).
Number of participants: 14

The purpose of this workshop was for people in logic and computational linguistics to discuss the "state of the art" in our respective fields. Our intent was to breathe a bit more vitality into the logical and mathematical approaches used in formal linguistics, and to introduce logicians and computer scientists to problems in the empirical domain of natural language that might serve as the impetus for important theoretical work. This was an informal meeting, with nine talks in total.

Causality in Computer Science and Physics

June 26, 2003, Ottawa
Org.: Prakash Panangaden (McGill)
Speakers: Samson Abramsky (Oxford), Bob Coecke (Oxford), Fortini Markopoulou (Perimeter Institute), Rafael Sorkin (Syracuse), Sumati Surya (Alberta), Glynn Winskel (Cambridge).
Number of participants: 35

This workshop brought together researchers in physics – especially those in general relativity and quantum gravity – with computer scientists working on causal structures. In both fields there has been a remarkable convergence of ideas. In physics Minkowski emphasized the importance of a geometrical view of space time structure in 1908 and subsequent developments in general relativity have emphasized the importance of focusing on the causal structure. Recently Sorkin and his collaborators have made causal structure the central theme in their development of a quantum theory of gravity. In particular they have investigated posets as embodying the mathematics of causal structure in space time. In computer science Petri emphasized the importance of causality in concurrent systems in the 60s. In 1977 Lamport wrote a famous paper on time, clocks and synchronization in distributed systems which made explicit the connections with relativity. Shortly thereafter Winskel wrote a thesis called "Event Structures" which emphasized the mathematical view of causality as described by posets enriched with other structure. The two main invited speakers (Sorkin, Winskel) are leaders in these two strands of research.

The workshop generated much excitement as it brought together ideas from such disparate fields and created a lot of new excitement among computer scientists. During the course of the day many who had not planned to come started dropping in as news of the workshop spread. Ultimately there were 35 in the room when the workshop ended.

Fifth International Workshop on Implicit Computational Complexity

June 26-27, 2003, Ottawa
Org.: Jim Royer (Syracuse)
Invited Speakers: Albert Atserias (Univ. Politecnica de Catalunya), Erich Graedel (Aachen Univ. of Technology), Annie Liu (State Univ. of New York at Stony Brook), Harry Mairson (Brandeis).
Number of participants: 30

The synergy between Logic and Computational Complexity has gained importance and vigor in recent years, cutting across areas such as Proof Theory, Finite Model Theory, Computation Theory, Applicative Programming, Database Theory, and Philosophical Logic. Several machine independent approaches to computational complexity have been developed that are based on notions borrowed primarily from

mathematical logic. Examples include descriptive complexity (finite model theory), bounded arithmetic, set-existence principles, intrinsic theories, linear logics, and algebras of functions. Collectively these approaches might be termed Implicit Computational Complexity. Practically, implicit computational complexity provides a framework for a principled incorporation of computational complexity into areas such as formal methods in software development, the study of programming languages, and database theory. The mission of the workshop was to further the development of implicit computational complexity and its applications.

Topics of interest included:

- automatic complexity analysis of programs
- complexity analysis for functional languages
- complexity in database theory
- complexity in formal methods
- foundations of implicit computational complexity
- higher-type computational complexity
- logical and machine-independent characterizations of complexity classes
- logics closely related to complexity classes
- software that applies ICC ideas
- type systems for controlling complexity.

Erich Graedel was an invited speaker at the main LICS conference. In addition to the 4 invited talks, the programme committee selected 5 submitted talks for presentation at the workshop.

WORKSHOPS

Random Number Generation and Highly Uniform Point Sets

June 17-28, 2002

Org.: P. L'Écuyer (Montréal)

Speakers: P. P. Boyle (Waterloo), G. Chaitin (IBM), C. Crépeau (McGill), L.-Y. Deng (Memphis), M. J. Evans (Toronto), H. Faure (Institut de Mathématiques de Luminy), M. Fushimi (Nanzan), J. E. Gentle (George Mason), M. Goresky (Institute for Advanced Study), S. Heinrich (Kaiserslautern), A. Keller (Kaiserlautern), A. Klapper (Kentucky), C. Lemieux (Calgary), G. Leobacher (Linz), J. Leydold (Vienna Univ. of Economics), M. Mascagni (Florida State), M. Matsumoto (Hiroshima), S. Ninomiya (Tokyo Institute of Technology), T. Nishimura (Yamagata), A. B. Owen (Stanford), W. Ch. Schmid (Salzburg), I. H. Sloan (New South Wales), H. Wozniakowski (Columbia).

Number of participants: 48

This workshop brought together several world-leading experts on the theoretical and practical aspects of random number generation by computer and the design of highly uniform point sets for quasi-Monte Carlo integration. The workshop was spread over a period of two weeks, to allow enough time for serious discussions and collaborative work. It attracted 48 participants from different backgrounds, including mathematicians, physicists, computer scientists, and statisticians.

The general theme was the development of practical random number generation software for various classes of applications, such as simulation, statistics, numerical analysis, computer games, lotteries, cryptology, etc. Those applications often have different requirements, which in a sense makes things more interesting. The participants were concerned with mathematical tools for selecting and testing specific generators, the theoretical and statistical analysis of families of generators, software implementation techniques, and all related work that could be useful for the construction or analysis of practical generators. Uniform and non-uniform random number generation were both covered. In simulation, highly-uniform (or low-discrepancy) point sets can often advantageously replace the traditional random numbers. Their construction and analysis are based on very similar ideas and tools than for random number generators. A significant part of the talks and exchanges at the workshop were aimed at strenghtening and exploiting this connection.

A special issue of the ACM Transactions on Modeling and Computer Simulation has been devoted to a small selection of the best papers that came out of this workshop. This special issue just appeared: vol. 13, no. 4, October 2003; see http://www.acm.org/pubs/tomacs/.

Mathematical Models and Techniques for Analysing Systems

September 30 to October 4, 2002

Org.: Prakash Panangaden (McGill)

Speakers: R. Alur (Pennsylvania), C. Baier (Universitaet Bonn), P. Caines (McGill), L. de Alfaro (California), A. Finkel (CNRS), R. Jagadeesan (DePaul Univ.), M. Kwiatkowska (Univ. Birmingham), S. la Torre (Università degli Studi di Salerno), F. Laviolette (Laval), D. Precup (McGill), R. Segala (Università di Verona), M. Siegel (ETH), F. van Breugel (York), J. Rutten (CWI Amsterdam).

Number of participants: 34

The analysis of systems has both diversified and deepened tremendously in the last few years. In terms of diversification, systems of interest now include stochastic systems such as telecommunication systems, real-time systems and hybrid systems (i.e. systems where the state space is partly discrete and partly continuous). Examples of such systems are flight management systems for aircraft, process control systems, telecommunication systems and battle management systems. In all these types of systems one has to deal with continuous time evolution and usually with probabilistic aspects as well. Perhaps the most successful mathematical technique for dealing with these problems - now almost 20 years old - is model checking. This is now being extended to probabilistic systems and the theory has advanced to the point where tools have been designed and built. In terms of the general mathematical theory co-inductive techniques, like bisimulation, have proved their value repeatedly.

The meeting was very successful with significant interactions between participants and many possible collaborations.
For example various approaches to weak probabilistic bisimulation were analyzed in some detail and in several discussions differences in the approaches of Baier, of Segala, of Desharnais, Gupta, Jagadeesan and Panangaden and of Philippou-Lee-Sokolsky were hammered out. This sort of interaction was possible because of the intimate nature of the group and the focus of the topics.

Another example of a very fruitful interaction that occurred at the workshop was between Marta Kwaitkowska and Doina Precup at McGill. The one from probabilistic verification and the other from machine learning discovered many common themes and ideas in their respective fields. This has already led to collaborations and a joint paper between Precup (machine learning) and Panangaden (verification).
The main lectures were very well received and the entire group benefited from having the overview lectures of Marta Kwiatkowska. These lecture were suitable for the several graduate students in attendance and we were very pleased that they were thus provided with an entry point into the latest research in this area. The lectures of Rutten were also very interesting and provided a new ideas for most of the audience.

Finite Model Theory

March 2-9 2003, Bellairs Research Insitute of McGill Univ.

Org.: Denis Thérien (McGill)

Speaker: P. Kolaitis (U.C. Santa Cruz).

Number of participants: 16

Cet atelier ciblait la capacité d'expression de logiques ainsi que la relation profonde entre la logique et la théorie de la complexité.

La rencontre fut une occasion de réunir quelques-uns des chercheurs les plus actifs sur la question importante de la satisfaisabilité avec contraintes. Dans la foulée de cette réunion, plusieurs visites entre les participants continuent d'avoir lieu et quelques articles scientifiques sont en chantier.

Semigroups and Automata

March 9-16, 2003 McGill Univ.

Org.: Denis Thérien (McGill)

Invited Speakers: J. Almeida (Porto), S. Margolis (Bar Ilan), J.-E. Pin (Paris Denis Diderot and CNRS), H. Straubing (Boston College), P. Weil (Bordeaux).

Number of participants: 12

Cet atelier portait sur les développements récents de la théorie des automates et des semi groupes, en particulier ceux qui se rapportent à des questions de longue date telles que la décidabilité du dot-depth et la décidabilité de la complexité de Rhodes.

Domain Theoretic Methods for Probabilistic Processes

April 21-25, 2003, Bellairs Research Insitute of McGill Univ.

Org.: J. Desharnais (Laval), F. Laviolette (Laval), P. Panangaden (McGill).

Recently domain theoretic methods have been successfully used to establish important properties of probabilistic processes. Specifically, it was shown that a logical characterization of simulation could be given by analyzing the structure of a recursively defined domain of probabilistic processes. Furthermore a theory of approximation of such processes could be given in terms of domains.

The purpose of this workshop was to bring together workers in the area of verification of probabilistic processes with experts in domain theory.

The participants included V. Danos, M. Escardo, A. Jung, K.

Keimel, M. Mislove, D. Moshier, G. D. Plotkin, B. Redmond, F. van Breugel, B. Worrell

Scientifically the workshop was a huge success. Proofs of theorems were gone into detail and ideas were thrashed out and developed. Dr. Escardo gave a remarkable series of lectures on computability and topology in the context of domain theory. These were extremely novel ideas. Prof. Plotkin described work in progress towards an algebraic theory of powerdomains.

The synergy was so great that several new scientific relationships were forged. A group consisting of Danos, Desharnais, Escardo, Laviolette and Panangaden began a new research programme. The interaction between Worrell and Jung allowed Jung and Moshier to prove an analogue of Dynkin's l-p theorem in domain theory.

Prof. Mislove as editor of the *Electronic Notes in Theoretical Computer Science* decided that the meeting, though informal, was too valuable to be lost and has devoted a forthcoming special issue of ENTCS to papers from the Bellairs Workshop.

Workshop on Advances in Machine Learning

June 8-11, 2003

Org.: Yoshua Bengio (Montréal), Balazs Kegl (Montréal), Doina Precup (McGill).

Invited Speakers: Satinder Singh (Michigan), Sridhar Mahadevan (Massachusetts), Michael Littman (Rutgers), Peter Bartlett (California at Berkeley), Vladimir Koltchinskii (New Mexico), Imre Risi Kondor (Columbia), Yann Le Cun (NEC Research), Paolo Frasconi (Firenze), Dale Schuurmans (Waterloo), Sam Roweis (Toronto), Geoff Hinton, (Toronto).

Number of participants: 116

Probabilities are at the core of recent advances in the theory and practice of machine learning algorithms. The workshop focused on three broad areas where these advances are crucial: statistical learning theory, learning algorithms, and reinforcement learning. The workshop was a great success with 116 participants and 23 talks bringing together experts from each of these three important domains. We succeeded in attracting some of the best people of the field, who presented fresh results on cutting edge research in, among others, reinforcement learning, learning theory, and manifold learning. The timing of the workshop, three days after the submission deadline of NIPS, the most important conference in the field, turned out perfectly. Everbody had their ideas freshly developed. The relative heterogenity of the topics and the people created an atmosphere that provoked the participants to temporarily leave their narrow field of research, and to look at the broader picture of machine learning.

Thematic years

The Centre de Recherches Mathématiques has organised thematic years every year since 1993. Before that from 1987 to 1993 special semesters and concentration periods were combined as thematic years.

Years	Themes
2005-2006	**Number Theory and Analysis**
2004-2005	**The Mathematics of Stochastic and Multiscale Modeling**
2003-2004	**Geometry and Spectral Analysis**
2002-2003	**Math in Computer Science**
2001-2002	**Groups and Geometry**
2000-2001	**Mathematical Methods in Biology and Medicine**
1999-2000	**Mathematical Physics**
1998-1999	**Number Theory and Arithmetic Geometry**
1997-1998	**Statistics**
1996-1997	**Combinatorics and Group Theory**
1995-1996	**Applied and Numerical Analysis**
1994-1995	**Geometry and Topology**
1993-1994	**Dynamical Systems and Applications**
1992	**Probability and Stochastic Control** (special semester)
1991-1992	**Automorphic Forms in Number Theory**
1991	**Operator Algebras** (special semester)
1990	**Nonlinear PDE's and Applications** (focal period)
1988	**Shimura Varieties** (special semester)
1987	**Quantum Field Theory** (special semester)
1987-1988	**Fractals: Theory and application**
1987	**Structural Rigidity** (special semester)

Aisenstadt Chair

The Aisenstadt Chair was endowed by Montréal philanthropist Dr. André Aisenstadt. Under its auspices, one or more 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 lectures on a specialized subject. They are also invited to prepare a monograph (see the Publications section in this report for a list of these publications). At the request of Dr. Aisenstadt, the first of their lectures should be accessible to a wide audience. Previous holders of the Aisenstadt Chair 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, David Cox, Frans Oort, Joel S. Feldman, Roman Jackiw, Duong H. Phong, Michael S. Waterman, Arthur T. Winfree, Edward Frenkel, Laurent Lafforgue and George Lusztig.
The CRM was honoured to have as Aisenstadt chairholders, during the 2002-2003 theme year Math in Computer Science, Professors *László Lovász* of Microsoft Research Laboratory and *Endre Szemerédi* of Rutgers University.

Professor *László Lovász*
Microsoft Research Laboratory

During the concentration period on Combinatorics, probability and algorithms, Professor László Lovász gave on May 13-15, 2003, a series of four lectures on the theme Sampling, Mixing, and Markov Chains. Here is his summary of these talks:

Sampling can be viewed as a general algorithmic problem, analogous to searching, maximization, or counting. One general method for sampling is the use of rapidly mixing Markov chains. In this series of talks, we give an introduction to this theory and survey the most common techniques for proving mixing time bounds: eigenvalues, isoperimetric inequalities, coupling, stopping rules. One motivating example is volume computation: since the first polynomial-time algorithm by Dyer, Frieze and Kannan, this problem has motivated a good part of the work in the area, and also in convex geometry.

Born in Hungary, Professor Lovász obtained his Ph.D. in mathematics from the Eötvös Loránd University in 1971. He is a member of the Hungarian Academy of Sciences and of three other academies. He was Professor of the A. József University of Szeged, the L. Eötvös University in Budapest, and Yale University. He is currently Senior Researcher at Microsoft Research. His awards include the Brouwer Medal (1993) and the Wolf Prize (1999). His field of research is discrete mathematics, in particular its applications in the theory of algorithms and the theory of computing.

Professor *Endre Szemerédi*
Rutgers University

During the same period, on May 20-22, 2003 Professor Endre Szemerédi gave three lectures, which he summarized as follows:

On the Regularity Method
The study of random objects has led to the fundamental notion of quasi-random objects, which exhibit the regular structure one finds in large scale random systems. Central tools in dealing with quasi-randomness are the various regularity and counting lemmas for graphs and hypergraphs. We are going to follow the development of these lemmas and present many important applications of them in number theory, graph and hypergraph theory, and theoretical computer science.

An Elementary Method in Combinatorial Number Theory
We are going to discuss a simple method, combinatorial by nature but using exponential sums. As applications of this method, we are going to present the proof of two conjectures. The first one (the conjecture of Erdos, Roth, Sarkozy and V. Sos) states that if you color the first N integers with colors 1, 2, ..., k, then one color class must contain two elements, i and j, such that $i+j=x^2$, for some integer x. The second conjecture (of Erdos and Silvermann) states that if for a set S there are no two elements i, j in S such that $i+j=y^2$ then the density of S is less than or equal to 11/32.

Long Arithmetic Progression in Sumsets, and the Number of Sum-Free Sets

We prove that if A is a subset of the first N integers of size at least $10N^{0.5}$ then the collection of subset sums of A contains an arithmetic progression of length N. Applying this theorem, we confirm a long standing conjecture of Erdos and Folkman on complete sequences and we will give a sharp bound on the number of sum-free sets.

Professor Szemerédi obtained a Ph.D. in mathematics from Moscow University in 1970 under the supervision of I. M. Gelfand. After occupying visiting positions at Stanford University, McGill University, the University of South Carolina and the University of Chicago, he was appointed in 1986 State of New Jersey Professor of Computing Science, Rutgers University. He is a member of the Hungarian Academy of Sciences. He has received several awards, the Grünwald Prize in 1967 and 1968, the Rényi Prize in 1973 and the Polya Prize of the Hungarian Academy of Sciences in 1979. He was Fairchild Scholar at Caltech in 1987. In more than 160 papers, Professor Szemerédi has made important contributions to the fields of theoretical computer science, combinatorics and combinatorial number theory. His most famous result is his Regularity Lemma, which has hundreds of applications spanning all three fields.

General Program 2002-2003

The CRM's general program funds a wide variety of scientific events, both on-site, elsewhere in Canada and around the world. Whether it be for specialized workshops for a small number of researchers, large meetings for hundreds of participants or activities for high school or undergraduate students, the general program promotes research in the mathematical sciences at all levels. The program is quite flexible, allowing projects to be considered as they arise. ***The reports are presented in the language in which they were submitted.***

Séminaire de mathématiques supérieures : Normal forms, bifurcations, and finiteness problems in differential equations

July 8 - 19, 2002

Org.: Christiane Rousseau (Montréal), Yulij Ilyashenko (Cornell Univ., Independant Univ., Moscow State Univ.), Sabin Lessard (Montréal), Robert Roussarie (Bourgogne), Gert Sabidussi (Montréal), Sergei Yakovenko (Weizmann Inst. of Science).

Speakers: A. Bolibrukh (Steklov Mathematical Inst.), F. Dumortier (Limburgs), J. Écalle (Paris-Sud XI), J.P. Françoise (Paris VI), A. Gabrielov (Purdue), V. Gelfreich (Warwick), A. Glutsyuk (École Normale Supérieure), J. Guckenheimer (Cornell), Y. Ilyashenko (Cornell), V. Kaloshin (Massachusetts Inst. of Tech.), R. Roussarie (Bourgogne), C. Rousseau (Montréal), D. Schlomiuk (Montréal), S. Yakovenko (Weizmann Inst. of Sci.).

Number of participants : 72

The 41st session of the Séminaire de mathématiques supérieures covered a wide spectrum of modern aspects of qualitative and quantitative theory of differential equations with a link to Hilbert's 16th problem for polynomial vector fields. Bifurcations were the common recurrent theme in all subjects discussed during this Advanced Study Institute. The 14 lecturers can be grouped into 5 large groups:

- Complex differential equations and Abelian integrals,
- Resummation, Stokes phenomena, problems of analytic classification and their geometric meaning,
- Non-singular perturbed systems,
- Systems having complicated behavior,
- Algebro-geometric methods in polynomial vector fields.

In addition to the 14 speakers, 58 participants from 19 different countries attended the session. Besides the support of the CRM, the SMS benefited from support by NATO (through its Advanced Study Institutes Program). C. Rousseau (Montréal) and Y. Ilyashenko (Cornell) were the scientific organizers of the session.

The proceedings have been published by Kluwer Academic Publishers in the NATO Science Series II, Vol.137.

Workshop on Symmetry in Physics in Memory of Robert T. Sharp

September 12 - 14, 2002

Org.: Pavel Winternitz (CRM, Montréal), John Harnad (CRM, Concordia), C.S. Harry Lam (McGill), Jiri Patera (CRM, Montréal).

Speakers: Stephen Anco (Brock), Chris Burgess (McGill), Chris J. Cummins (Concordia), Hubert de Guise (Lakehead), Marc de Montigny (Alberta), Terry Gannon (Alberta), Jean-Pierre Gazeau (Paris VII Denis Diderot), John Harnad (CRM, Concordia), Miloslav Havlicek (Technical Univ., Prague), Ronald King (Southampton), Peter Kramer (Tuebingen), C.S. Harry Lam (McGill), Frank Lemire (Windsor), John McKay (Concordia), Pierre Mathieu (Laval), Marcos Moshinsky (Instituto de Fisica, Mexico), Zorka Papadopolos (Tübingen), Jiri Patera (CRM, Montréal), Miguel A. Rodriguez (Complutense), David J. Rowe (Toronto), Gordon Shaw (California), Luc Vinet (McGill), Phil Wallace, Mark Walton (Lethbridge), Pavel Winternitz (CRM, Montréal).

Number of participants: 70

Topics covered at the workshop include:

- Finite and infinite dimensional Lie algebras
- Symmetries in nuclear and particle physics
- Generating function techniques
- Quasi-crystals
- Subgroup classifications and applications
- Symmetries of differential and difference equations
- Classical and quantum integrable systems
- Special function theory
- Lie algebra contractions
- Other related topics

The talks covered virtually all areas of the application of group theory in physics, the field to which our colleague and friend, the late Robert T. Sharp, contributed so much. The participants and speakers included many of Bob's collaborators from all over the world, and his ex-students and colleagues from McGill and the Université de Montréal.

The event was made special by the participation of Phil Wallace, Bob Sharp's Ph.D. advisor, and Bob's four children. The high quality and thematic unity of the contributions guarantee that the Conference Proceedings will have the character of a monograph on group theory in physics.

Workshop on Superintegrability in Classical and Quantum Systems

September 16 - 21 , 2002

Org.: P. Winternitz, (Montréal), J. Harnad (Montréal), P. Tempesta (Montréal), W. Miller, Jr (Minneapolis), G. Pogosyan (Yerevan & Cuernavaca & Dubna), M. A. Rodriguez (Madrid).

Speakers: A. Ballesteros (Burgos), F. Calogero (Roma, La Sapienza), T. Curtright (Miami), J. Daboul (Ben Gurion), E. Ferapontov (Loughborough), J.-P. Françoise (Paris VI), C. Gonera (Lodz), G. Goujvina (Moscow State Univ.), S. Gravel (Montréal), F. Jose Herranz (Burgos), N. Kamran (McGill), D. Korotkin (Concordia), L. Mardoyan (Yerevan State), P. Mathieu (Laval), W. Miller (Minnesota), A. Nikitin (Inst. of Math. of Nat. Acad. Sci. of Ukraine), Y. Nutku (Feza Gürsey Institute), A. V. Penskoi (Montréal), G. Pogosyan (Bogoliubov Laboratory of Theoretical Physics), M. F. Ranada (Zaragoza), T. Robart (Howard), M. A. Rodriguez (Complutense), M. B. Sheftel (Feza Gursey Institute), R. Smirnov (Paderborn), K. Takasaki (Kyoto) P. Tempesta (Montréal), J. Toth (McGill), A. Turbiner (UNAM, Mexico), Y. Uwano (Kyoto), P. Winternitz (Montréal), T. Wolf (Brock), M. Yakimov (Cornell), O. Yermolaeva (Concordia), A. Zhalij (Montréal), M. Znojil (Nucl. Phys. Institute).

Number of participants: 49

A superintegrable system is one that has more integrals of motion than degrees of freedom. A maximally superintegrable system has 2n-1 integrals of motion, n of them in involution. In classical mechanics such systems have stable periodic orbits (all finite orbits are periodic). In quantum mechanics all known superintegrable systems have been shown to be exactly solvable. Their energy spectrum is degenerate and can be calculated algebraically. The spectra of superintegrable systems may also have other interesting properties such as saturation of eigenfunction norm bounds.

The main feature of this workshop was that it was devoted to a well-defined and specific topic, that of superintegrable finite dimensional classical and quantum systems. This subject, on the other hand, was treated from many different points of view. A new feature, and a new concept, that of partial superintegrability, was introduced. The relation between superintegrability and such concepts as exact solvability, Nambu brackets, PT- quantum mechanics, Lax pairs, and bispectrality were elucidated. Several talks were devoted to new types of superintegrable systems. In some cases these would involve quantum algebras, or superalgebras, rather then the usual Lie algebras and groups.
In others, the new feature was the presence of magnetic fields and hence of vector potentials, in addition to scalar ones. Several talks were devoted to systems with higher order integrals of motions, for which quantum and classical superintegrable potentials do not coincide, and in which superintegrability is no longer related to the separation of variables in the Schrodinger, or Hamilton-Jacobi equation. Perturbations of integrable and superintegrable systems were considered. The mathematical tools used to study superintegrability, that were discussed at the workshop, include topology, differential and algebraic geometry, as well as many aspects of group theory and algebra. The participants were about equally divided between mathematicians and physicists.

Journée de probabilité

November 22, 2002

Org.: B. Rémillard (HEC Montréal), D. Dawson (Carleton)

Speakers: P. del Moral (Paul Sabatier, Toulouse), G. Ivanoff (Ottawa), D. Dufresne (Montréal), M. Kouritzin (Alberta).

Number of participants: 20

Les conférences de Pierre del Moral et Gail Ivanoff ont suscité plusieurs questions et commentaires positifs.

Il y avait des représentants de toutes les universités à Montréal (Univ. de Montréal, HEC, McGill, Concordia, UQAM). La plupart des participants, sauf les conférenciers, se connaissaient, ce qui a donné une ambiance très intéressante.

The Langlands' program and its applications

January 2-5, 2003

Org. : Ravi Ramakrishna (McGill & Cornell), Henri Darmon (McGill), Eyal Goren (McGill).

Number of participants: 33

The general theme of the workshop was the Langlands Program and its applications. Specific areas we were aiming to focus on were algebraic aspects, aspects of arithmetic varieties, and analytic aspects such as automorphicity and analytic continuation of L-functions.

This was the second workshop held at Far-Hills Inn n the Laurentians. Like the previous one ("Hilbert modular varieties and forms", January 3-6, 2002) it was very successful in drawing excellent speakers as well as graduate students and postdoctoral fellows. The presence of R. Langlands and other leading mathematicians had a very positive influence on the workshop and its program.

As in the previous workshop, a conscious effort was made to blend together beginners and experts, to allow much time for discussion and interaction and to sketch emerging research directions in the field. All these objectives were achieved.

The speakers and program appears below:
A. Kable, "On a conjecture of Jacquet".
C. Khare, "De Jong's conjecture on mod l representations of $\pi_1(X)$".
J. Lansky, "K-types and base change for U(3)".
R. Murty, "On a conjecture of Birch and Swinnerton-Dyer".

A. Pal, “On the modularity of universal deformation rings in positive characteristic”.
R. Langlands, “La formule de traces et la théorie analytique des nombres”.
C. Skinner, “Arithmetic and Eisenstein series”.
T. Haines, “On the local zeta function for some simple Shimura varieties at primes of mild bad reduction”.
F. Diamond, “Serre’s conjecture and local Langlands mod p”.
A. Prasad, “On the residual discrete spectrum for split groups over $F_q(t)$”.

Colloque en l’honneur d’André Joyal à l’occasion de son 60e anniversaire

April 11-13, 2003, UQAM

Org.: S. Boyer (UQAM), J. Hurtubise (McGill), F. Lalonde (Montréal), P. Leroux (UQAM), C. Reutenauer (UQAM).

Speakers: T. Bisson (Canisius College), P. Cartier (IHÉS), E. Getzler (Northwestern), P. Johnstone (Cambridge), C. Kassel (CNRS-Louis Pasteur), W. Lawvere (Buffalo), I. Moerdijk (Utrecht), R. Street (Macquarie), M. Tierney (Rutgers), D. Zeilberger (Rutgers).

Supported by: CIRGET, CRM, LaCIM

Number of participants: 83

Le but du colloque était de rendre hommage à André Joyal, à l’occasion de son 60e anniversaire. Plusieurs conférenciers ont illustré son apport inestimable, quoique souvent apocryphe, à la théorie des catégories (Lawvere, Bisson, Getzler, Johnstone, Moerdjik). La conférence de Cartier, un habitué de Montréal, comme le suggère son nom, portant sur l’algèbre différentielle, a été fort appréciée du public, ainsi que celle de Kassel, sur les catégories tensorielles tressées, notion introduite par Joyal et Street. Celui-ci, un collaborateur de Joyal, a exposé leurs travaux communs, de même que Bisson et Tierney. La conférence de Zeilberger ajoutait une note littéraire et comique, mais aussi très pertinente sur le plan mathématique.

Ce colloque n’a pas été surchargé d’exposés, ce qui a facilité les échanges informels. Les participants sont venus du Canada, des États-Unis, de la France, du Royaume-Uni, d’Australie...

Le banquet du samedi soir, dans le Vieux-Montréal, a rassemblé environ 110 personnes, et les discours plus ou moins improvisés ont une fois de plus porté sur le rayonnemment des travaux d’André Joyal. Ce colloque a été réussi sur tous les plans.

Contact Topology in Montreal

April 26-27 2003, UQAM

Org: Olivier Collin (UQAM)

Supported by: CIRGET

Speakers: John Etnyre (Penn), David Gay (Arizona), Vincent Colin (Nantes), Gordana Matic (Georgia), Yakov Eliashberg (Stanford), Ko Honda (USC), Will Kazez (Georgia).

The workshop focused on the recent advances in the fast growing area of Contact Topology. For this purpose, CIRGET tried to bring together the leading experts in the world. The main emphasis of the workshop was on contact 3-manifolds and their relationship to the topology of 4-manifolds, knot theory and symplectic 4-manifolds. Beyond the talks themselves, another aim of the workshop was to have informal discussion sessions during the day and the evening. This worked out very well. It was noted that apart for local participants and invited speakers, other mathematicians came to the conference simply as participants.

Workshop on the Analysis of Complex Surveys

April 30 to May 2, 2003

Org.: David Bellhouse (Western Ontario)

Speakers: D. Binder (Statistics Canada), S. Bondy (Toronto), F. Brisebois (Statistics Canada), A. Cyr (Statistics Canada), S. Laroche (Statistics Canada), J. Lawless (Waterloo), I. Lu (Carleton), Z. Patak (Statistics Canada), J. Rao (Carleton), C. Skinner (Southampton), M. Thompson (Waterloo), D. Wiggins (City Univ.).

Number of participants : 50

This workshop was the inaugural activity of the national Program on Complex Data Structures, a research program jointly coordinated by the three mathematical institutes and the statistical community. It was held in conjunction with a MITACS project, also on the analysis of complex surveys. The workshop themes were: (1) variance estimation for complex without replacement sampling designs; (2) modeling of correlated duration data from longitudinal surveys; (3) multi-level modeling of survey data; and (4) item response theory for surveys. On the first day of the workshop researchers from Statistics Canada made presentations of four complex surveys run by Statistics Canada. The focus of these presentations was on data analytic problems arising from the complexity of these surveys. On the second and third days researchers, both statisticians and subject matter specialists, made presentations that spoke directly to the workshop theme areas.

AMS Spring Eastern Section Meeting 2002

May 3 - 5, 2002, Univ. de Montréal

Plenary Speakers: Nicholas M Ercolani (Arizona), Lars Hesselholt (MIT), Niky Kamran (McGill), Rafael da la Llave (Texas at Austin).

Number of participants: 192

The four invited addresses were:

- Nicholas M Ercolani (Arizona), "A Riemann-Hilbert Approach for the Asymptotics of Matrix Integrals and Map Enumeration";
- Lars Hesselholt (MIT), "Algebraic K-Theory and Traces";
- Niky Kamran (McGill), "Wave Equations in Kerr Geometry";
- Rafael da la Llave (Texas at Austin), "Geometric Mechanisms for Diffusion in Mechanical Systems".

There were also nine special sessions, and a session for contributed papers. These sessions themselves ran over up to five parts, with as many as ten parallel sessions running at one time. Over the three days of the meeting, 192 papers were presented.
The special sessions and their organisers were:

- "Asymptotics for Random Matrix Models and Their Applications", Nicholas M. Ercolani (Arizona), Kenneth T.-R. McLaughlin (Arizona);
- "Combinatorial Hopf Algebras", Marcelo Aguiar (Texas A&M), François Bergeron (UQAM), Christophe Reutenauer (UQAM);
- "Combinatorial and Geometric Group Theory", Olga G. Kharlampovich (McGill), Alexei Myasnikov (City College, New York), Vladimir Shpilrain (City College, New York), Daniel Wise (McGill);
- " Commutative Algebra and Algebraic Geometry", Irena Peeva (Cornell), Hema Srinivasan (Missouri-Columbia);
- "Curvature and Topology", Regina Rotman (Courant), Christina Sormani (Lehman College, CUNY), Kristopher R. Tapp (SUNY at Stony Brook);
- "Function Spaces in Harmonic Analysis and PDEs", Galia D. Dafni, Jie Xiao (Concordia);
- "Potential Theory", Paul M. Gauthier (Montréal), K. Gowri Sankaran (McGill), David H. Singman (George Mason);
- "Shape Theory in Dynamics", Alex Clark (North Texas), Krystyna M. Kuperberg (Auburn).
- "Spectral Geometry", Dmitry Jakobson (McGill), Yiannis Petridis (McGill and CRM).

Workshop on Group Theory and Numerical Analysis

May 26 - 31, 2003

Org. : P. Winternitz (CRM, Montréal), D. Gomez-Ullate (CRM), A. Iserles (Cambridge), D. Levi (Roma Tre), P. J. Olver (Minnesota), R. Quispel (Latrobe, Melbourne), P. Tempesta (CRM).

Speakers: A. Atoyan (Montréal), D. Baldwin (Colorado School of Mines, Golden), C. Bender (Washington), A. Bloch (Michigan) E. Celledoni (Center for Advanced Study), E. S. Cheb-Terrab (Maplesoft), P. A. Clarkson (Kent), C. Cyr-Gagnon (Montréal), V. Dorodnitsyn (Keldysh Institute of Applied Mathematics), D. Gomez-Ullate (CRM), W. Hereman (Colorado School of Mines), R. Kozlov (Oslo), F. Lemaire (Western Ontario), D. Levi (Roma Tre), D. Lewis (California, Santa Cruz), S. J. Malham (Heriot-Watt), E. L. Mansfield (Kent at Canterbury), P. J. Olver (Minnesota), B. Owren (Center for Advanced Study), J. Patera (Montréal), A. V. Penskoi (Montréal), R. Quispel (Latrobe) G. Reid (Western Ontario), N. Robidoux (Laurentian), V. Shapiro (Wisconsin, Madison), P. Tempesta (CRM), A. Turbiner (UNAM, Mexico), J. Tuszynski (Alberta), P. Winternitz (CRM), K. B. Wolf (UNAM, Mexico), R. Yamilov (Russian Academy of Sciences) W. J.M. Zakrzewski (Durham), A. Zhedanov (Donetsk Institute for Physics and Technology).

Number of participants: 50

The workshop brought together participants from several different scientific communities, working on closely related topics. One set of talks covered the area of symmetry preserving discretizations of ordinary and partial differential equations, including the use of conservation laws and the corresponding discrete version of the Noether theorem. A closely related area that was covered at the workshop is that of the group theoretical and geometrical formalism needed for studying symmetries and integrability of difference equations. New results on Lagrangian numerical schemes, geometric integration and related stability problems were presented. Several talks and demonstrations were devoted to symbolic computing in the context of difference equations. Specific applications discussed came from biophysics, many body problems, computer aided design, image processing, linear and nonlinear special function theory and quantum theories on lattices.

Interdisciplinary and Industrial Program

The Interdisciplinary and Industrial Program contains the different initiatives that the CRM undertakes in areas where the mathematical sciences interact with another science, as well as those involving industrial mathematics. Many of these are made within our participation in research networks such as ncm_2 and MITACS and are discussed in the section entitled Industrial Collaborations. In this section, we only include those activities organised or funded directly by the CRM.

Quantum Control: Mathematical and Numerical Challenges

October 6-11, 2002

Org.: André Bandrauk (Sherbrooke), Michel Delfour (CRM, Montréal), Claude Le Bris (CERMICS, École Nationale des Ponts & Chaussées, Paris).

Supported by: CRM, NSERC strategic Grant (Bandrauk) and Ministère de la Recherche, France (LeBris).

Speakers: O. Atabek (Paris Sud), A. D. Bandrauk (Sherbrooke), T. Brabec (Ottawa), Paul Brumer (Toronto), Tucker Carrington (Montréal), G. Chen (Texas A&M Univ.), R. de Vivie-Riedle (Max-Planck-Institut für Quantenoptik), M. Delfour (CRM, Montréal), M. Fortin (Laval), W. Hager (Florida), M. Y. Ivanov (Steacie Institute for Molecular Sciences). R. Kosloff (Hebrew), R. L. Kosut (SC Solutions, Inc.), S. Lacelle (Sherbrooke), R. Laflamme (Waterloo), C. Le Bris (École Nationale des ponts et chaussées), H. Lefebvre-Brion (Paris Sud), D. Lidar (Toronto), Y. Maday (Pierre et Marie Curie), S. K. Mitter (M.I.T.), Y. Ohtsuki (Tohoku), A. Peirce (UBC), H. Rabitz (Princeton), V. Ramakrishna (Texas at Dallas), G. Turinici (INRIA, Rocquencourt), J.-P. Zolésio (CNRS & INRIA Sophia Antipolis), E. Zuazua (Complutense de Madrid).

Number of participants: 63

The meeting involved 27 invited speakers who are international experts in laser molecule interactions, optimization, theory and control of molecular dynamics. It emphasized participation of graduate students (18) and postdoctoral fellows (12) in applied mathematics, theoretical chemistry and physics through special grants to attend the workshop and by reserving slots of time in the afternoons for their presentations.

The workshop concentrated on advanced numerical methods and new mathematical control and optimization approaches and tools for the quantum control of matter at the molecular level using current advanced laser technology. An entire new branch of science now known as "Laser Control of Molecular Processes" following the pioneering work of theoretical chemists such as Paul Brumer (Toronto), Herschel Rabitz (Princeton), Stuart A. Rice (Chicago), Moshe Shapiro (Weizmann Institute), David Tannor (Weizmann Institute) is steadily making an impact on the experimental and technological world, with many outstanding contributions by international distinguished scientists.

In parallel, mathematicians from control theory and numerical simulation, following the track opened by the late Jacques-Louis Lions (Collège de France), got progressively involved in this scientific endeavour, and contributed to it. This conjunction of efforts motivated this workshop.

This new field of research is dedicated to using current state of the art laser technology to control and manipulate the quantum behaviour and motion of matter at the molecular level. The basis of this new science is the encoding and control of quantum information at the molecular level in order to control the time evolution of molecular processes, such as guiding the final output of a reaction to a desired target. Most of the research in this area has been numerical and theoretical, involving multidimentional time-dependent Schrödinger equations. Coupling these molecular processes to the laser field equations (Maxwell's equations) results in a complex system of time-dependent partial differential equations. There are outstanding problems, both numerical and mathematical, that this workshop addressed by bringing together mathematicans, theoretical chemists and physicists working in the area of control and optimization of systems subject to quantum laws. The proceedings of the meeting were published in the CRM proceedings series.

Joint IMA-NCM_2 Workshop on Computational Methods for Large-Scale Integer Programs

October 14-19, 2002, Minneapolis, Minnesota

Org.: W. Cook (Rice), M. Gendreau (CRT, Montréal), G. Nemhauser (Georgia Tech), M.W.P. Savelsbergh (Georgia Tech).

Speakers: Karen Aardal (Georgia Tech), David Applegate (AT&T), Francisco Barahona (IBM), Dimitris Bertsimas (MIT), Daniel Bienstock (Columbia), Vasek Chvatal (Rutgers), Jacques Desrosiers (Ecole des Hautes Etudes Commerciales), Ismael Regis de Farias Jr. (Carnegie Mellon), Michel Gendreau (CRT, Montréal), Jean-Louis Goffin (McGill), Ralph E. Gomory (Sloan Foundation), Zonghao Gu (ILOG Inc), Pascal Van Hentenryck (Brown), Ellis Johnson (Georgia Tech), Alexander Martin (TU Darmstadt), William R. Pulleyblank (IBM), Rekha R. Thomas (Washington), François Vanderbeck (Bordeaux 1), Jean-Philippe Vial (Genève), Robert Weismantel (Magdeburg).

Number of participants: 70

In the past decade there have been significant theoretical and computational advances in the field of integer programming. As a result there has been a greatly increased use of integer programming software in industry. However, the need to solve even larger and more complex problems continues to grow. This workshop, brought together experts in various

areas of integer programming and its applications, including mathematicians and operations researchers working in discrete and combinatorial optimization, and computational scientists working in parallel computing, search, and constraint programming.
The goals of the workshop included building a research agenda for the next decade, defining new areas of application, and stimulating cooperation among the different disciplines that contribute to the field.
Theoretical and methodological topics included in the workshop were approximation algorithms for large-scale linear programs, stochastic integer programming, branch-and-cut and branch-and-price, algebraic and combinatorial methods, decomposition, constraint programming and parallel implementation. Application areas included supply-chain design and management, telecommunications, manufacturing, transportation, scheduling, and finance.

Joint IMA-CRT-CRM Workshop on Distribution Systems: Location and Vehicle Routing

December 2-6, 2002

Org. : Michel Gendreau (CRT, Montréal), Gilbert Laporte (GERAD, HEC)

Speakers: A. Balakrishnan (Texas), C. Barnhart (Massachusetts Institute of Technology), A. Corberan (Valencia), J. F. Cordeau (HEC), T. G. Crainic (UQAM), A. Dasci (HEC), M. Daskin (Northwestern), J. Desrosiers (HEC), E. Erkut (Alberta), B. Gendron (Montréal), P. Hansen (HEC), A. Hertz (École Polytechnique), M. Labbé (Univ. Libre de Bruxelles), A. Langevin (École Polytechnique), J.Y. Potvin (Montréal), M. Savelsbergh (Georgia Institute of Technology), M. Solomon (Northeastern), M.G. Speranza (Univ. degli Studi di Brescia).

Number of participants: 42

The questions surrounding distribution systems are of prime economic importance. The scale of these systems is increasing at a fast rate, because of the growth of international commerce and travel. The advent of e-commerce will only increase their scale, as well as change their nature; goods purchased over the internet must be delivered; also, they often get returned. Related to these questions is the rich field of network design problems, which arise in particular in transportation logistics and in telecommunications planning.

The theory of location is evolving, with questions such as competitive location or the location of non-punctual or structured objects being studied; in routing, the advent of better communication devices and increased computational power
make real-time dynamic routing a possibility. These changes imply that new problems with different mathematical properties must be tackled and new algorithmic strategies devised.

This workshop was comprised of a series of twenty surveys, covering both the more traditional and the newer subject areas. Areas covered included routing; location; economic aspects, pricing, e-commerce; fleet management; telecommunications; network design.

CRM Prizes

CRM-Fields Institute Prize

In 1994, the Centre de recherches mathématiques (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 Advisory Committee 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 (1995), G.A. Elliot (1996), J. Arthur (1997), R.V. Moody (1998), Stephen A. Cook (1999), Israel Michael Sigal (2000), William T. Tutte (2001) and John B. Friedlander. The CRM-Fields Institute 2003 Prize is awarded to John McKay and Edwin Perkins.

Professor John McKay
Concordia University

The work of Professor John McKay of Concordia University centers around the properties of finite groups, their representations and their symmetries. He has been at the origin of several of the most startling discoveries in mathematics of our time, and is world-renowned for launching two areas of mathematics by his observations and conjectures, one known as the McKay correspondence, and the other going under the fanciful name of monstrous moonshine, underlying the role of the largest sporadic simple group which is known as the monster. His wide knowledge of mathematics has allowed him to bring to the fore questions which have been deeply influential in the subsequent development of the discipline, for example the work of Richard Borcherds which was recognised by a Fields medal at the 1998 International Congress of Mathematicians. He is a fellow of the Royal Society of Canada.

Professor McKay, amongst other achievements, is a pioneer in the use of computers as a tool in algebra, either in the study of sporadic groups (he is the co-discoverer of two such groups) or in the explicit computation of Galois groups. He was also one of the actors in one of the feats of computational algebra of our time, the proof of the non-existence of a projective plane of order 10.

After obtaining his bachelor's degree in mathematics at Manchester, he went on to obtain a doctorate in computer science in Edinburgh. He held appointments at the Atlas laboratory in England, at Caltech and at McGill University before moving to Concordia in 1974.

Professor Edwin Perkins
University of British Columbia

Edwin Perkins received his B.Sc. in mathematics from the University of Toronto in 1975 and his Ph.D. from the University of Illinois (Urbana) in 1979. He is currently Professor of Mathematics and holds a Canada Research Chair at the University of British Columbia, where he has been since 1979. He received the Rollo Davidson prize for young probabilists in 1983, and the Canadian Mathematical Society's Coxeter-James and Jeffrey-Williams Prizes in 1986 and 2002. He was elected Fellow of the Royal Society of Canada in 1988 and held an NSERC Steacie Fellowship during 1992-94.

Edwin Perkins has made outstanding contributions to several areas of probability theory and is one of the world's leading probabilists. Much of his early work concerned the delicate analysis of the sample paths of stochastic processes. His most spectacular achievements are his contributions to the analysis of measure-valued diffusions, or "superprocesses," where he has been a pioneer in the development of the field. His accomplishments include deep and surprising results about the support of super-Brownian motion including identification of its Hausdorff dimension, the identification of the historical process as the correct way to understand genealogy in superprocesses, and the construction of a class of interacting superprocesses.

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), John Toth (1998), Changgeng Gui (1999), Eckhard Meinrenken (2000), and Jingyi Chen (2001). The CRM was delighted to award the 2002 André-Aisenstadt Prize to *Professor Alexander Brudnyi* of the University of Calgary.

Professor Alexander Brudnyi
University of Calgary

Mr. Brudnyi completed his Ph.D. Thesis in 1996 at the Technion, Israel. Afterwards he held a NATO postdoctoral fellowship at the University of Toronto and the Fields Institute. After spending some time at the Ben Gurion and Sundsval Universities, he joined the staff at the University of Calgary in 2000. Working in complex analysis and geometry, he has, in more than 25 articles, made significant contributions to four different areas: fundamental groups of compact Kähler manifolds, local inequalities for holomorphic and plurisubharmonic functions, limit cycles and the distribution of zeros of families of analytic functions, maximal ideals of the space of bounded analytic functions and matrix-valued corona theorem. Professor Brudnyi delivered a lecture on February 21, 2003, for which he wrote the following summary:

Center Problem for Ordinary Differential Equations

The classical H. Poincaré Center-Focus problem is to describe planar polynomial vector fields such that all their integral trajectories are closed curves around some point. This situation is called a center. In some cases this problem can be reduced to a similar one for ordinary differential equations. In the talk I present a new general approach to the Center problem for ODEs. I will also explain how in this approach the Center problem is related to the Hilbert 16th problem (on the number of limit cycles for planar polynomial vector fields), and the Composition problem for Lipschitz functions defined on the unit circle.

CAP-CRM Prize

Awarded for the first time in 1995, the CAP-CRM Prize is given for outstanding contributions to theoretical and mathematical physics by the Canadian Association of Physicists and CRM. It consists of a $2000 award and a medal. Previous winners were Werner Israel (1995), William G. Unruh (1996), Ian Affleck (1997), J. Richard Bond (1998), David J. Rowe (1999), Gordon W. Semenoff (2000), André-Marie Tremblay (2001) and Pavel Winternitz (2002). The 2003 CAP-CRM prize has been awarded to Professor Matt Choptuik of the University of British Columbia.

Professor Matthew Choptuik
University of British Columbia

Matt Choptuik, arguably the world's leading numerical relativist is being awarded the CAP-CRM Prize in Mathematical Physics for the leadership which he has shown in the field of numerical simulation of gravitational systems and for the remarkable effect which he discovered in the formation of black holes. The effect in question, now called the Choptuik effect, is that black holes demonstrate "critical" behavior in their formation, as do condensed matter systems undergoing phase transitions. The discovery of this result has potential implications for black hole thermodynamics, for understanding information loss in black hole evaporation, and as a model displaying a (mild) naked singularity. This is certainly the most important, and unexpected, result in classical relativity in recent years.

As B. Birger states in her Living Reviews article on "Numerical Approaches to Spacetime Singularities" http://www.livingreviews. org/Articles/Volume1/1998 7berger/node4.html "We note that this is the first completely new phenomenon in general relativity to be discovered by numerical simulation." Such discoveries take a rare blend of great technical proficiency (especially important in numerical work where coding or algorithmic errors can creep in all too easily), of the ability to recognize those faint hints of something new, and of the confidence and persistence to pursue those hints and refine the techniques until they reveal the new feature in all its glory.

Equally important has been his role in training and encouraging the next generation of Numerical Relativists. The younger researchers, from graduate students to faculty members around the world look to him as the leader in the field. He is also the recipient of the Basil Xanthopolous prize in General Relativity in 1998, a prestigious prize given to the top Relativist under 40 in the world every two years, the Rutherford medal of the Royal Society of Canada, was chosen by Maclean's Magazine as one of Canada's outstanding young researchers, and has been awarded and honourary degree by his alma mater, Brandon University.

Because of his technical skill in Computational Physics, his ability to then recognize and extract the Physics from the computation, and his leadership in the burgeoning field of numerical approaches to theoretical physics, he is this year's recipient of the CAP-CRM Prize.

B. Turrell and W. Unruh
University of British Columbia

CRM-SSC Prize

In 1999, the Centre de recherches mathématiques (CRM) and the Statistical Society of Canada created the CRM-SSC Prize in statistics in recognition of outstanding 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. Previous winners were Christian Genest (1999), Robert Tibshirani (2000), Colleen Cutler (2001), Larry A. Wasserman (2002). This year, the Centre de recherches mathématiques and the Statistical Society of Canada have awarded the CRM-SSC 2003 Prize in Statistics to Professor Charmaine B. Dean.

Professor Charmaine B. Dean
Simon Fraser University

The 2003 CRM-SSC Prize in Statistics has been awarded to Dr Charmaine B. Dean, Professor and Founding Chair, Department of Statistics and Actuarial Science, Simon Fraser University, for her outstanding contributions to the statistical sciences and her exemplary dedication to the profession, in Canada and abroad. The announcement was made at the 31st Annual Meeting of the Statistical Society of Canada (SSC), held in Halifax, Nova Scotia, June 8-11, 2003. This prestigious award, jointly sponsored by the SSC and the Centre de recherches mathématiques de Montréal (CRM), is given each year to a Canadian statistician in recognition of outstanding contributions to the discipline during the recipient's first 15 years after earning a doctorate.

Charmaine Dean was born in 1958 in San Fernando, Trinidad, in the West Indies. She immigrated to Canada at the age of 19 and completed an Honours Bachelor's Degree in Mathematics at the University of Saskatchewan in 1980. She then moved to Waterloo, Ontario, where she obtained an M. Math. in 1984 and a Ph.D. in statistics from the University of Waterloo in 1988, under the supervision of Professor Jerry Lawless. Her first appointment was at the University of Calgary, where she worked for one year before joining the Department of Mathematics and Statistics at Simon Fraser University in 1989. She played a major role in setting up the Department of Statistics and Actuarial Science, for which she became the founding Chair in 2001.
Charmaine's thesis concerned mixed Poisson models and regression methods for count data. Over the years, she has authored or co-authored some thirty papers on inference for overdispersed generalized linear models, the analysis of recurrent event data, as well as spatial and spatio-temporal modelling for disease mapping. Her most influential contributions have appeared in journals such as Biometrics, Statistics in Medicine, the Journal of the American Statistical Association and The Canadian Journal of Statistics. Much of her work has been motivated by direct applications to important practical problems, and she has contributed by implementing many of her methodological developments, notably with the Ministry of Health in British Columbia.

Charmaine has also made outstanding contributions to graduate training, to professional statistical societies in Canada and internationally, and to the organization of meetings. Of particular note are her presidency of WNAR, the Western North-American Region of the International Biometric Society, her presidency of the SSC's Biostatistics Section and her role in establishing a Committee on Women in Statistics for the Society, her Associate Editorship at Liaison, the SSC newsletters, her action as Program Chair for the joint IMS/WNAR conference held in Seattle in 1999, and six years of service to the Natural Sciences and Engineering Research Council of Canada, including two as President of the Statistical Sciences Grant Selection Committee.

Christian Genest, Université Laval
Chair of the CRM-SSC Prize Committee

National Program Committee

The three Canadian institutes in the mathematical sciences, CRM, Fields and PIMS, have initiated a program for the support of joint activities of a national stature in the mathematical sciences. A National Program Committee of members from the three institutes administers this program, funded to the tune of $100,000 per year. This committee makes recommendations to the three directors. The program has many mandates, the first being to fund conferences and workshops in the mathematical sciences across Canada. These funds are essentially allocated to activities that fall outside the main purview of the three institutes, or that would benefit from joint institute funding. The program also aims to support activities that are held at the meetings of the three mathematical sciences societies: CMS, CAIMS, and SSC, as well as to support the participation of graduate students at these scientific meetings. Finally, it coordinates international programs and other ventures where it is advantageous for the three institutes to act as a whole. Here is the list of activities which were supported by the National Program Committee in 2002-2003. Reports are presented in their original language.

CMS Summer Meeting

June 12-15, 2002, Univ. Laval, Québec

Org.: Claude Levesque (Directeur), N. Lacroix (Laval), Jean-Pierre Carmichael (Laval) Graham Wright (CMS), Monique Bouchard (CMS)

Supported by: NPC, Université Laval, Faculté des Sciences et de Génie de l'Université Laval, Département de mathématiques et de statistique de l'Université Laval, CICMA, LaCIM, ISM, Caisse populaire Desjardins de l'Université Laval, iCORE Alberta Informatics Circle of Research Excellence, Number Theory Foundation, Pepsi-Cola, Café Van Houtte, Rogers Communication.

Number of participants:409

The meeting which started with a public lecture on June 12 was the most attended CMS meeting since the CMS 2000 Winter Meeting held in Toronto. The quality of the scientific programmes and the large number of symposia contributed to the success of this meeting. A special lecture was given by Robert P. Langlands (IAS) a few hours before U. Laval gave him (during the CMS banquet) a *honoris causa* doctorate. A public lecture given by Jean-Marie De Koninck (Laval) attracted a large audience. This was an audio video show which used infography to explain some elementary notions like Richter scale, decibels, probabilities, the number π. The use of a short video featuring Jean-Marie De Koninck himself explaining some mathematics to two bar pillars was one of the best moments.

The CMS Jeffery-Williams lecture was given by Edwin Perkins (UBC), and the CMS Krieger- Nelson lecture, by Priscilla Greenwood (UBC, Arizona State).

The plenary lecturers were David W. Hendersen (Cornell), Nikolai Nikolski (Bordeaux, Steklov Inst.), Christophe Rentenauer (UQAM), Paul D. Seymour (Princeton) and Isadore M. Singer (MIT).

Lectures were encouraged to be accessible to all mathematicians. To quote I.M. Singer, "the first minutes of the lecture should be accessible to my landlord".

Fourteen symposia were also organized in Analysis, Arithmetic Algebraic Geometry, Associative Algebras, Category Theory, Cryptography, Differential Geometry, Dynamical Systems, Graph Theory, Mathematics Education, Mathematics of Finance, Number Theory, Probability Theory, and Universal Algebra.

There was a Contributed Papers section, which included a graduate students session (supported by the ISM) in which graduate students were invited to deliver short lectures on their work in progress.

It goes without saying that the beauty of the city of Québec played a positive role in attracting people to that meeting. Café Van Houtte provided free coffee during the whole meeting and Pepsi provided free Pepsi-Cola. Coffee, juice and doughnuts were available all day long. It is more and more difficult to hold a CMS Meeting on a university campus, but mathematicians appreciated the opportunity of having plenty of blackboards and counting on coffee and doughnuts at will. There were many opportunities for mathematicians to exchange ideas.

Conférence Québec-Maine
Théorie des nombres (et sujets reliés)

October 12-13, 2002, Univ. Laval

Org.: J.M. De Koninck & C. Lévesque (Laval)

Plenary Speakers: E. Kani (Queen's), M. Kolster (McMaster), K. Murty (Toronto), R. Murty (Queen's), R. Ramakrishna (McGill).

Speakers: E. Benjamin (Unity College), D. Bradley (Maine), H. Brezinsky (Maine), C. J. Cummins (Concordia), J. Fearnley (Concordia), G. Frei (Laval et ETH), O. Kihel (Brock), R. Moraru (McGill), R. Osburn (McMaster), A. Özlük (Maine), S. Vénéreau (McGill).

Number of participants: 28

Une fois de plus, ce congrès annuel de deux jours s'est déroulé dans une athmosphère de franche camaraderie. Ce fut agréable d'accueillir cinq conférenciers pléniers, dont quatre de l'Ontario (E. Kani, M. Kolster et les deux frères Murty) et un de McGill (R. Ramakrishna). Les conférenciers invités provenaient du Maine, de Montréal, de la Suisse et de l'Ontario. Les sujets couverts furent variés, mais les conférenciers ont fait des efforts pour ne pas être trop techniques. L'accent fut mis sur l'enrichissement des connaissances et sur la diffusion de résultats récents dans les domaines suivants : K-théorie algébrique, courbes algébriques, théorie

des déformations, variétés algébriques, géométrie algébrique, théorie analytique des nombres algébriques, capitulation, cryptographie, équations diophantiennes. Un exposé portait sur l'histoire de la loi de réciprocité d'Artin. Le repas du samedi soir réunissait tous les participants et c'était une autre occasion pour poursuivre les échanges d'idées.

CMS Winter Meeting

December 8-10, 2002, Marriott Hotel, Ottawa

Org: Daniel Daigle (Directeur, Ottawa), Walter Burgess (Ottawa), André Dabrowski (Ottawa), Abdellah Sebbar (Ottawa), Graham Wright (SMC) et Monique Bouchard (SMC).

Principal Speakers: James Arthur (Toronto), Rene Carmona (Princeton), Victor Guillemin (MIT), Lisa Jeffrey (Toronto) - Prix Coxeter-James de la SMC, David Kerr (Tokyo et Rome) - Prix de Doctorat de la SMC, Robert Zuccherato (Entrust) - Conférence grand public, Maciej Zworski (Berkeley).

Supported by: the NPC, the Canadian Mathematical Society, the University of Ottawa, the Faculty of Science of the University of Ottawa and the Department of Mathematics and Statistics of the University of Ottawa.

Number of participants: 362

The Department of Mathematics and Statistics of the University of Ottawa hosted the 2002 Winter Meeting of the Canadian Mathematical Society. The meeting included four plenary lectures, two prize lectures and a public lecture, in addition to 217 talks given in twelve symposia and a session of contributed papers.

Symposia and organizers:

- Financial Mathematics (Luis Seco, Toronto);
- Financial Mathematics (Roger Pierre, Laval);
- History of Mathematics (Richard O'Lander et Ronald Sklar, St. Johns Univ. N.Y.);
- Lie Algebras and Moonshine (Abdellah Sebbar & Erhard Neher, Ottawa);
- Mathematical Education (Thomas Steinke, OCCDSB);
- Number Theory (Damien Roy, Ottawa & Kenneth Williams, Carleton);
- Operator Algebras (Thierry Giordano & David Handelman, Ottawa);
- Partial Differential Equations (Victor Ivrii, Toronto & John Toth, McGill);
- Real-World Problems in Search of Solutions (Andre Dabrowski, Ottawa);
- Representation Theory of Real and p-adic Groups (Jason Levy & Monica Nevins, Ottawa);
- Symplectic Geometry (Lisa Jeffrey & Eckard Meinrenken, Toronto);
- Theory and Applications of Point Processes (Gail Ivanoff & David McDonald, Ottawa);
- Contributed Papers (Walter Burgess & Abdellah Sebbar, Ottawa).

Canadian Operator Theory and Operator Algebras Symposium

May 21-23, 2003, Fredericton, New Brunswick

Org.: Dan Kucerovsky (University of New Brunswick)

Speakers: Ken Davidson (Waterloo), George Elliott (Toronto, & Copenhagen), Guihua Gong (Puerto Rico), Chris Phillips (Oregon), Gert Pedersen (Copenhagen), Mikael Rørdam (Southern Denmark).

The Canadian Operator Theory and Operator Algebras Symposium (COAS) has been one of the two most important annual meetings worldwide in this subject area (the other being the Great Plains Operator Theory Symposium). The meeting has been held annually since 1972, when Israel Halperin organized the first installment of the symposium at the University of Toronto. The general objective of the COAS has been, briefly, to further the field of operator algebras, both internally and in its interaction with other fields.

In order to keep this particular installment of the conference short, there were two parallel sessions during all three days of the conference. In spite of the level of general concerns about SARS and terrorism at that time, the conference was attended by fifty-five mathematicians from Canada, Bangladesh, Denmark, Germany, India, Iran, Ireland, Italy, the USA, and other countries. Feedback from participants was uniformly positive; they were impressed with the high level of the Conference presentations, its organization, and were favourably impressed by the recently-built conference centre where the meeting was held. We made great efforts to subsidize students and postdoctoral fellows, making the conference as accessible as possible to them.

In conclusion, the Symposium advanced the state of the art in the field of operator algebras, and introduced our visitors to the beauty of Canada, and the Atlantic region in particular. We are grateful to the CRM for allowing us to succeed in this goal.

31th Annual Meeting of the Statistical Society of Canada (SSC)

June 8 - 11, 2003, Dalhousie Univ., Halifax

Supported by NPC : (CRM, Fields, PIMS) & Dalhousie University.

Number of participants: 432

This meeting brought together researchers and users of statistics and probability from academia, government and industry.

Three workshops were held:

- "Mixed Effects Models for Longitudinal Data" by Edward Vonesh, Baxter Health Care Center; organized by the Biostatistics Section.

- "Panel Surveys" by Pierre Lavallée, Statistics Canada; organized by the Survey Methods Section.
- "Response Surface Methodology: Process and Product Optimization Using Designed Experiments" by Douglas Montgomery, Arizona State University; organized by the Business and Industrial Statistics Section.

There were 63 scientific sessions in total, plus a poster session. Topics ranged from theoretical probability, inference, and stochastic processes to applied sessions on environmental issues, statistical genetics, and machine learning methods.

Thanks in no small part to the funding from the NPC, the meeting included a large number of internationally known speakers. The particular speakers whose funding was wholly or partially covered by the grant from NPC, by session, were:

Special Session of the Pacific Institute for the Mathematical Sciences on Robustness (Elvezio Ronchetti, Univ. of Geneva, David Tyler, Rutgers Univ.).

Special Session of the Fields Institute on Matrices and Statistics (Jerzy K. Baksalary, University of Zielona Gora, Poland, Simo Puntanen, University of Tampere, Finland, Hans Joachim Werner, University of Bonn, Germany).

Special Session of the Centre de Recherches Mathématiques on Statistics and Finance (Christian Genest, Univ. Laval, Jin-Chuan Duan, Univ. of Toronto, Francois Watier, Univ. de Sherbrooke).

Douglas Wiens, Program Chair, SSC03

Members' Seminars and Special Events

The members of the CRM are encouraged to organize seminars and other scientific activities during their stay at the CRM. These activities take the form of courses, workshops and research seminars

Analysis Seminar (McGill Univ.)

Org.: Dimitry Jakobson (McGill Univ.)

August 14, 2002
R. Brooks, Technion Institute
Random Constructions of Riemann Surfaces I

August 19, 2002
R. Brooks, Technion Institute
Random Constructions of Riemann Surfaces II

August 30, 2002
R. Brooks, Technion Institute
Graphs and isospectrality

September 6, 2002
Jan Derezinski, Warsaw Univ.
Simple models of the infrared problem

September 19, 2002
E. Lifyand, Bar Ilan Univ.
Asymptotic behavior of the Fourier transform

September 27, 2002
B. Shiffmann, Johns Hopkins Univ.
Newton polytopes and statistical patterns in polynomials

October 18, 2002
William P. Minicozzi, Johns Hopkins Univ.
The structure of embedded minimal disks in 3-manifolds

October 24, 2002
John Stalker, Princeton Univ.
Dispersion near black holes

November 1, 2002
A. Baranov, St. Petersburg
Bernstein inequality in the de Branges spaces of the entire functions and the shift-coinvariant subspaces of the Hardy class in the upper half-plane

November 22, 2002
Nikolai Nikolski, Bordeaux & Michigan State Univ.
The Riesz turndown collar, polynomial free interpolation, and functional calculus

December 5, 2002
P. Deift, Courant Institute
Long-time behavior of solutions of the nonlinear Schrödinger equation with rough initial data

January 31, 2003
Dimiter Vassilev, UQAM
Overdetermined boundary value problems, quadrature domains and applications

February 7, 2003
A. Ruzmaikina, Purdue Univ.
Generalizing the results on edge distribution of eigenvalues of Wigner random matrices to slowly decaying distribution of entries

February 20, 2003
Alexander Brudnyi, Univ. of Calgary
Carten-Ramez type inequalities for analytic functions

March 14, 2003
Mikhail Shubin, Northeastern Univ.
Negligible sets in spectral theory of Schrödinger operators

March 28, 2003
Fedor Nazarov, Michigan State Univ.
Backward engineering of the mathematics of T. Bang: the plank problem and the quasi-analyticity problem

April 4, 2003
Kathryn Hare, Univ. of Waterloo
Energy, Hausdorff dimension and the Fourier transform

April 11, 2003
Zindine Djadli, Univ. Cergy-Pontoise & IAS
Best constants for optimal Sobolev inequalities for compact manifolds

April 25, 2003
V. Buslaev, St. Petersburg
On the structure of the phase space of general nonlinear Schrödinger type equations in neighborhoods of soliton states

May 16, 2003
Stephen Anco, Brock Univ.
Local and global well-posedness of generalized Yang-Mills equations in 2+1 dimensions.

May 23, 2003
Feder Nazarov, Michigan State Univ.
Dyadic techniques in the theory of Calderon-Zygmund operators and other thoughts

May 28, 2003
Steve Zelditch, Johns Hopkins Univ.
An anomaly in the large N limit of two dimensional gauge theory

Analysis seminar Univ. de Montréal
Org.: Paul Gauthier
(CRM & Univ. de Montréal)

June 4, 2002
P.V. Paramonov, Moscow State Univ.
Approximation by polyanalytic functions

June 11, 2002
Jean-Philippe Samson, Univ. de Montréal
Théorèmes de type Picard pour les séries de Dirichlet

June 25, 2002
Sébastien Manka, Univ. de Montréal
Familles normales de fonctions méromorphes

July 2, 2002
André Boivin, Univ. of Western Ontario
Approximation rationnelle: glovale v.s. locale

July 9, 2002
Jean-Philippe Samson, Univ. de Montréal
Prolongement analytique de la fonction zéta de Hurwitz

July 23, 2002
Paul M. Gauthier, Univ. de Montréal
Un théorème de type Carleman pour les plongements holomorphes

August 6, 2002
Paul M. Gauthier, Univ. de Montréal
Universalité par rapport à une suite d'automorphismes

August 13, 2002
André Boivin, Univ. of Western Ontario
Sur les séries de Fourier non harmoniques

September 30, 2002
Fabian Todor, Univ. de Montréal
Sur quelques techniques de régularisation avec la fonction zéta de Riemann et applications en pratique

October 7, 2002
Paul M. Gauthier, Univ. de Montréal
Approximation sur les ensembles fermés de C^n

October 21, 2002
Richard Fournier, Cégep Dawson & Univ. de Montréal
Sur l'inégalité de Visser

October 28, 2002
Dimiter Dryanov, Univ. de Montréal
Bound preserving multipliers

November 4, 2002
Paul M. Gauthier, Univ. de Montréal
Théorème de Cauchy pour les domaines arbitraires

November 11, 2002
André Boivin, Univ. of Western Ontario
Approximation méromorphe sur les surfaces de Riemann: le théorème de Vitushkin

November 18, 2002
Paul M. Gauthier, Univ. de Montréal
Approximation polynomiale d'une solution fondamentale I

November 25, 2002
Paul M. Gauthier, Univ. de Montréal
Approximation polynomiale d'une solution fondamentale II

December 2, 2002
Paul M. Gauthier, Univ. de Montréal
Approximation polynomiale d'une solution fondamentale III

Seminar in Non-Linear Analysis
Org.: Marlène Frigon (CRM & UdeM)

October 4, 2002
Emmanuel Montoki, Univ. de Montréal
Résultats de multiplicité pour des systèmes d'équations différentielles du second ordre I

October 25, 2002
Emmanuel Montoki, Univ. de Montréal
Résultats de multiplicité pour des systèmes d'équations différentielles du second ordre II

November 1, 2002
Tomasz Kaczynski, Univ. de Sherbrooke
Calcul d'homologie assisté par ordinateur : évolution des idées

November 8, 2002
Marian Mrozek, Univ. Jagellone, Krakow
Covering Relations in The Presence of Symmetries

November 9, 2002
Konstantin Mischaikow, CDSNS, Georgia Tech, Atlanta
Computational Homology and Geometric Data Processing

November 22, 2002
Abdelhafid Chekkal, Univ. de Montréal
Solutions renormalisées d'équations elliptiques non linéaires dont le second membre est une mesure

November 29, 2002
Paul Deguise, Univ. de Moncton
Diverses généralisations des applications de Ky Fan

December 13, 2002
Abdelhafid Chekkal, Univ. de Montréal
Solutions renormalisées d'équations elliptiques non linéaires dont le second membre est une mesure, II

February 7, 2003
Fabrice Colin, Univ. de Sherbrooke
Inégalités de Hardy sur des domaines non bornés

February 21-27, 2003
Fabrice Colin, Univ. de Sherbrooke
Lemmes de décomposition et applications à des problèmes de minimisation, I et II

March 21, 2003
Alina Stancu, Univ. de Montréal
Le flot par courbure cristalline en deux dimensions

March 28, 2003
Pietro Luciano Buono, CRM
Bifurcations d'équilibres dans les systèmes réversibles et équivariants

April 4, 2003
Octavian Cornea, Univ. de Montréal
Orbitres bornées de flots hamiltonniens et théorie de l'homotopie

April 24, 2003
Ludovic Rifford, Univ. de Lyon
Results on Control Lyapunov Functions

May 2, 2003
Madjid Allili, Univ. Bishop
Un modèle pour l'image basé sur la topologie algébrique

May 9, 2003
Edouard Wagneur, Institut de Communication et Cybernétique de Nantes & GERAD
Une application de la théorie des feuilletages à un problème de l'industrie

May 14, 2003
Marc Lassonde, Univ. des Antilles-Guyane
Convergence variationnelle, pentes et sous-différentiels

Junior CIRGET Seminar

Org.: Gabriel Indurskis (UQAM)

September 25, 2002
Baptiste Chantraine, UQAM
Espaces fibrés, I

October 1, 2002
Baptiste Chantraine, UQAM
Espaces fibrés, II

October 9, 2002
Gabriel Chenevert, Univ. de Montréal
La théorie des faisceaux

October 23, 2002
Gabriel Indurskis, UQAM
Orbifolds and Seifert fibre spaces, I

October 30, 2002
Gabriel Indurskis, UQAM
Orbifolds and Seifert fibre spaces, II

November 6, 2002
Roman Tymkiv, Univ. McGill
Courants, régularisation, indice de Kronecker, I

November 20, 2002
Roman Tymkiv, Univ. McGill
Courants, régularisation, indice de Kronecker, II

December 11, 2002
Baptiste Chantraine, UQAM
Dehn surgery and Kirby calculus

January 16, 2003
Julie Picard, UQAM
Des entrelacs non-triviaux ayant un polynôme de Jones trivial

February 6, 2003
Sylvain Maillot, UQAM
L'espace des structures euclidiennes sur le tore de dimension 2

February 21, 2003
Melisande Boisvert, Univ. McGill
Schemas

March 6, 2003
Gabriel Indurskis, UQAM
Equivariant Homology, Fox Calculus and the Alexander polynomial

March 21, 2003
Gabriel Indurskis, UQAM
The twisted Alexander polynomial

April 10, 2003
Olivier Rousseau, UBC
Théorie de Rham équivariante

Séminaire de combinatoire et d'informatique mathématique

Org.: Cédric Chauve & Gilbert Labelle (UQAM)

June 7, 2002
Valéry A. Liskovets, Institute of Mathematics Belarus
Enumeration of non-isomorphic objects based on group action orthogonality

June 13, 2002
Bruno Leclerc, École des Hautes Études en sciences sociales de Paris
Graphes d'arches

June 20, 2002
Pierre Leroux, Cédric Lamathe & Gilbert Labelle, UQAM
Énumération des 2 arbres k-gonaux

September 13, 2002
Frédéric Chapoton, UQAM
Combinatoire algébrique des forêts binaires

September 20, 2002
François Bergeron, UQAM
Polynômes quasi-symétriques

September 27, 2002
Cédric Chauve, UQAM
Factorisation de permutations signées

October 4, 2002
Christophe Reutenauer, UQAM
L'algorithme polynomial de primalité de Agrawal-Kayal-Saxena

October 11, 2002
Srecko Brlek, UQAM
Sur une classe de mots lisses

October 18, 2002
Sara Faridi, UQAM
Simplicial complexes as higher dimensional graphs with applications to commutative algebra

November 1, 2002
Gilbert Labelle, UQAM
Calcul de paramètres sur les polyominos à partir de mots décrivant leur contour

November 8, 2002
Manfred Schocker, UQAM
Noncommutative Q-Schur functions

November 22, 2002
François Lamontagne, UQAM
Bipartages, q, t-analogue de n! et polynômes diagonalement alternants

November 29, 2002
Xavier Provençal (en coll. avec G. Labelle & L. Laforest), UQAM
Sur l'arité de la racine d'un octree aléatoire

December 6, 2002
Cédric Lamathe, UQAM
Sur une classification des 2-arbres k-gonaux par rapport à leurs symétries

December 13, 2002
Ralf Schifler, UQAM
Algèbres enveloppantes quantiques et algèbres de Hall

January 17, 2003
Robert Bédard, UQAM
Sur les formes quadratiques faiblement positives

January 31, 2003
Cédric Chauve, UQAM
Diamètre de la distance de syntenie

February 7, 2003
Maurice Nivat, UQAM
Tomographie discrète : reconstruction avec contraintes périodiques

February 14, 2003
Pierre Leroux, UQAM
Problèmes d'énumération motivés par la théorie combinatoire de Mayer en mécanique statistique

February 21, 2003
Simon Plouffe, UQAM
Nouvelle formule pour les nombres de Bernouilli et 2 nouveaux résultats

March 7, 2003
Christophe Reutenauer, UQAM
Caractérisation combinatoire des singularités des variétés de Schubert

March 14, 2003
Christophe Reutenauer, UQAM
Caractérisation combinatoire des singularités des variétés de Schubert (suite)

March 21, 2003
Pierre Lalonde, UQAM
Combinatoire des matrices à signes alternants à un seul –1

March 28, 2003
Riccardo Biagioli, UQAM
Closed product formulas for extensions of generalized Verma modules

April 4, 2003
William Kocay, UQAM
Drawing Graphs on the Torus and Projective Plane

May 2, 2003
Andrei Gagarin, UQAM
Embedding Graphs containing K5-subdivisions

May 9, 2003
Gilbert Labelle, UQAM
Généralisations combinatoires du binome de Newton, exemples et applications

May 16, 2003
Mercedes Rosas, Univ. Simon Bolivar
Généralisations combinatoires du binome de Newton, exemples et applications

Geometry and Topology Seminar
Org.: Olivier Collin (UQAM)

September 13, 2002
François Lalonde, Univ. de Montréal
Groupes de difféomorphismes symplectiques des variétés rationnelles de dimension 4 et applications

September 20, 2002
Iosif Polterovitch, Univ. de Montréal
Combinatorics of heat invariants and trace regularizations

September 27, 2002
Dror Bar Natan, Univ. of Toronto
On Khovanov's categorification of the Jones polynomial

October 4, 2002
Sylvain Maillot, UQAM
Rigidité conforme globale en dimension 3

October 11, 2002
Ryan Budney, Univ. of Rochester
Configuration spaces in mapping class groups and knot theory

October 18, 2002
Paul Gauduchon, École Polytechnique-Paris
Le tenseur de Bochner d'une variété Kaehlérienne faiblement Bochner plate

November 1, 2002
A. Derdzinski, Ohio State Univ
Totally real immersions of surfaces

November 8, 2002
Selman Akbulut, Michigan State Univ.
The Cappell-Shaneson's 4-dimensional s-cobordism

November 15, 2002
Shelley Harvey, UCSD
Higher order polynomial invariants of 3-manifolds giving lower bounds for the Thurston norm

November 22, 2002
Yael Karson, Hebrew Univ. & Univ. of Toronto
Blow-ups of CP2 without torus actions

November 29, 2002
M. Ville, École Polytechnique-Paris
Milnor numbers for real surfaces in real 4-manifold

January 17, 2003
Gordon Craig, Stony Brook
Compactifications d'Einstein de variétés hyperboliques

January 17, 2003
Lisa Jeffrey, Univ. of Toronto
The residue formula and the Tolman-Weitsman theorem

January 24, 2003
Elsa Mayrand, UQAM
Chirurgie de Dehn, pentes toroïdales et longitudinales

January 31, 2003
Jacques Hurtubise, Univ. McGill
Géométrie des matrices R classiques

February 7, 2003
E. Lerman, Univ. of Illinois at Urbana-Champaign
Contact toric manifolds

February 14, 2003
Octav Cornea, Univ. de Montréal
Complexe de Floer et théorie de l'homotopie

February 21, 2003
Alexander Brudnyi, Univ. of Calgary
Topology of maximal ideal space of H∞ Grauert and Laz-Hamos type theorems and extension of matrices with entries in H∞

March 14, 2003
Saso Strle, McMaster Univ.
Homology lens spaces and four-ball genus of knots

March 21, 2003
Dmitri Vassilev, CRM-UQAM
The sharp constant in the Sobolev type embedding on a Carnot group

March 28, 2003
Roger Fenn, Univ. of Sussex
An introduction to biracks and their applications in knot theory, I

March 31, 2003
Roger Fenn, Univ. of Sussex
An introduction to biracks and their applications in knot theory, II

April 2, 2003
Roger Fenn, Univ. of Sussex
An introduction to biracks and their applications in knot theory, III

April 4, 2003
Alina Stancu, Univ. de Montréal
Un problème de Minkowski revisité

April 25, 2003
Stefano Vidussi, Kansas State Univ.
Surfaces lagrangiennes dans la même classe d'homologie : existence de tores lagrangiens noués.

Applied Mathematics Seminar

Org.: Nilima Nigam (McGill Univ.)

September 23, 2002
Michèle Titcombe, Univ. McGill
Asymptotic-Numerical Method for 2D Singular Perturbation Problems

September 30, 2002
Amik St-Cyr, Univ. McGill
Domain Decomposition methods: tools for software refactoring

October 7, 2002
Michael Mackey, Univ. McGill
Modeling Operon Dynamics: The Tryptophan and Lactose Operons as Paradigms

October 15, 2002
Dimitry Jakobson, Univ. McGill
Extremal problems in graph theory

November 4, 2002
Eric Cytrynbaum, UC Davis
Aggregation and centering in fish melanophore cells -a quantitative exploration of cytoskeletal dynamics

November 11, 2002
Bruce Reed, Univ. McGill
Rooted Routing

November 18, 2002
Lahcen Laayouni, Univ. McGill
Anisotropic a posteriori error estimations in convection-diffusion with dominant convection

November 25, 2002
Adrian Vetta, Univ. McGill
On the quality of competitive equilibria in games with submodular social objective functions

December 2, 2002
Daniel LeRoux, Univ. Laval
FEM discretization for Shallow Water Equations

January 20, 2003
Jian-Jun Xu, Univ. McGill
Asymptotic theory for disc-like crystal growth

January 27, 2003
Martin Glicksman, RPI
Dendritic Growth

February 3, 2003
Leon Glass, Univ. McGill
Dynamics of Genetic Networks

February 10, 2003
Tony Humphries, Univ. McGill
Dynamics of Adaptive Time-Stepping ODE solvers

February 17, 2003
Uri Keich, UCSD
On designing seeds for similarity search in genomic DNA

February 19, 2003
Pietro-Luciano Buono, CRM
Modeling of Central Pattern Generators with Symmetric ODEs: Examples from Locomotion and Heartbeat

March 3, 2003
David Gomez-Ullate, CRM
Integrable many-body problems: tricks of the trade and recent developments

March 17, 2003
Tadashi Tokieda, Univ. de Montréal
New ideas in vortex dynamics

March 24, 2003
Joseph Coyle, Monmouth Univ.
H(curl)-conforming Finite Elements

March 31, 2003
Moises Santillan, Instit. PoliNacional
Why the lysogenic state of phage lambda is so stable

April 7, 2003
Fernando Reitich, Univ. of Minnesota
Efficient high-order methods for acoustic and electromagnetic scattering simulations

Séminaire de mathématiques appliquées et calcul scientifique

Org.: Michel Delfour (CRM & Univ. de Montréal)

August 21, 2002
Denis Matignon, École Nationale Supérieure des Télécommunications
Modèles d'amortissement avec représentation diffusive d'opérateurs pseudo-différentiels : analyse énergétique, asymptotique et simulations

September 20, 2002
André D. Bandrauk, Univ. de Sherbrooke
Interaction laser-molécule dans le régime nonlinéaire-nonperturbatif à haute intensité : problèmes mathématiques dans les simulations et recherches d'applications

October 16, 2002
Jean-Paul Zolésio, INRIA & CNRS, Sophia-Antipolis
Formulation variationnelle de frontière libre dans un problème de plasma

Computational Science and Engineering Seminar

Co-Org.: Peter Bartello (McGill Univ.)

September 20, 2002
Luca Cortelezzi, Univ. McGill
Three-dimensional vortex modeling of Transverse Jets

October 4, 2002
Justin Wan, Univ. of Waterloo
Matrix-free multigrid approach to 3d Stefan Problems

October 18, 2002
Jeremy Cooperstock, Univ. McGill
Improving video quality with a limited number of photons and bits

November 1 2002
Alan Edelman, MIT
Fast multipole – a simplified view

November 29, 2002
Kevin Dempsey, Clarkson Univ.
Forced Dynamic Uplift of Floating Plates: Two Canonical Problems

February 14, 2003
Matthias Beck, Binghamton Univ.
Integer-point enumeration in polytopes

March 7, 2003
Claude Girard, Environnement Canada
Semi-Lagrangian advection and fine-scale orography in a mesoscale atmospheric model

March 21, 2003
Jorge Angeles, Univ. McGill
Geometrical and mechanical uncertainty, isotropy, and optimality in the design of robotic mechanical systems

April 4, 2003
Nilima Nigam, Univ. McGill
The good, the bad, and the ugly: truncation methods for infinite computational domain

Séminaire de physique mathématique

Org.: Pavel Winternitz (CRM & Univ. de Montréal)

October 1, 2002
Pavel Winternitz, CRM & Univ. de Montréal
Symétries des équations à différences finies, Lagrangiens, intégrales premières et solutions exactes

October 8, 2002
Bertrand Eynard, SPHT Saclay & CRM
Points critiques des modèles de matrices et la hiérarchie de Painlevé II

October 15, 2002
Siaka Kone, Univ. de Cocody (Côte d'Ivoire)
Mixed order systems of ordinary linear differential equations

October 22, 2002
Michel Grundland, CRM & UQTR
Sur les représentations de Weierstrass, applications harmoniques CP^N et surfaces à courbures moyennes constantes

October 29, 2002
Alexander Zhalij, CRM & Univ. de Montréal
Separation of variables in Pauli equations

November 5, 2002
David Gomez-Ullate, CRM
Quasi-exactly solvable extensions of quantum Calogero-Sutherland models

November 19, 2002
Miroslav Andrle, Technical Univ. Prague
Wavelets on Aperiodic Sets

November 26, 2002
Vladimir V. Sokolov, Landau Institute Moscow
New integrable Hamiltonians in rigid body dynamics

December 3, 2002
Alexei V. Penskoi, CRM
Poisson brackets for the Camassa-Holm equation

December 10, 2002
Pietro-Luciano Buono, CRM
Animal locomotion and symmetric network of differential equations

January 13, 2003
D. Gurevich, Univ. Valenciennes
Indice noncommutatif sur orbites quantiques

February 25, 2003
Thalia D. Jeffres, Univ. Michoacana
Regularity of the Heat Operator on a Cone

March 4, 2003
Pedro Fonseca, Rutgers Univ.
Symétries du modèle d'Ising et fonctions de corrélation

March 11, 2003
Pierre Valin, Lockheed Martin Canada
Dempster-Shafer classifiers for FLIR imagery and neural net fusion of complementary classifiers

March 18, 2003
Adil Belhaj, Univ. Mohammed V (Maroc)
Dualité entre F-théorie et M-théorie sur des variétés à groupe d'holonomie G2

March 25, 2003
Siaka Kone, Univ. de Cocody (Côte d'Ivoire)
A system of differential equations for a coil spring

April 8, 2003
Isidore Fleischer, CRM
Divergence for Continuous Flows

May 6, 2003
Michael Monastyrsky, CRM & ITEP, Moscow
Duality for spin systems with non-abelian symmetry

May 13, 2003
David Gomez-Ullate, CRM
Integrable many-body problems: Tricks of the trade and recent developments

May 20, 2003
R. Yamilov, Russian Academy of Sciences, Ufa
Classification results for integrable difference-differential equations

Séminaire de statistique de l'Université Laval

Org.: Christian Genest (Univ. Laval)

September 12, 2002
Raluca Balan, Univ. d'Ottawa
L'analyse de données longitudinales

September 19, 2002
Philippe Choquette, Isabelle Michaud, Nathalie Vandal & Lucie Veilleux, Univ. Laval
Rapports de stages d'été

September 26, 2002
Geneviève Gauthier, HEC Montréal
L'estimation du risque de crédit par la méthode du maximum de vraisemblance

October 3, 2002
Michel Delecroix, ENSAI, Rennes
Le modèle linéaire généralisé est-il nécessaire en actuariat?

October 10, 2002
Cyr-Émile M. Lan, Univ. McGill
Méthodes bayésiennes de calcul de taille d'échantillon pour les études cas-témoins

October 11, 2002
Marie-Hélène Roy-Gagnon, Johns Hopkins Univ.
Investigation théorique d'une nouvelle approche de régression parent-enfant dans le cadre d'une application à la scoliose idiopathique familiale

October 17, 2002
Jean-Marc Daigle & Pascale Otis, Univ. Laval
Comparaison de modèles de croissance appliqués à la grande oie des neiges

October 24, 2002
Sorana Froda, UQAM
Estimation de solutions d'EDO appliquée au système de Lotka-Volterra

November 7, 2002
Xiaowen Zhou, Univ. Concordia
The distribution of ruin time in perturbed risk models

November 14, 2002
Vartan Choulakian, Univ. de Moncton
L'analyse en composantes principales robuste dans L_1

November 21, 2002
Román Viveros-Aguilera, McMaster Univ.
CUSCORE charts and their application to monitoring a sawing process

November 28, 2002
Jean-Cléophas Ondo, Univ. Laval
Tests de Monte-Carlo exacts de détection de ruptures

December 5, 2002
Subhash C. Kochar, Institut indien de la statistique, Delhi
Stochastic comparisons of parallel systems

January 16, 2003
Pierre Lavallée, Statistique Canada
La méthode généralisée du partage des poids (ou le sondage indirect)

January 23, 2003
Anne-Laure Fougères, Institut national des sciences appliquées, Toulouse
Pit corrosion: Comparaison de deux traitements avec réponses distribuées suivant des lois de valeurs extrêmes

January 30, 2003
Regina Nuzzo, Univ. McGill
Functional data analysis of pharmacokinetic data

February 6, 2003
Claire Durand, Univ. de Montréal
Les sondages de l'élection présidentielle française de 2002: une catastrophe méthodologique ?

February 13, 2003
Sylvie Gervais, Univ. McGill
Une classe de tests basés sur des fonctions des rangs pour l'hypothèse d'absence de liaison entre plusieurs vecteurs aléatoires

February 20, 2003
Nathalie Plante, Institut de la statistique du Québec
Aspects méthodologiques de l'étude longitudinale du développement des enfants du Québec

February 27, 2003
Hélène Cossette, Univ. Laval
Étude de la dépendance en théorie de la crédibilité

March 13, 2003
Thierry Duchesne, Univ. Laval
Bas les masques! Méthodes d'inférence basées sur l'algorithme EM pour le modèle des risques concurrents lorsque les causes de panne sont masquées

March 20, 2003
Christian Francq, Univ. de Lille III
Test d'adéquation de modèles ARMA avec erreurs non indépendantes

March 27, 2003
Marvin Zelen, Harvard School of Public Health
The early detection of disease and stochastic models

April 3, 2003
Ivan Gentil, HEC Montréal
Filtration d'images pour la détection de trajectoires de cibles

April 10, 2003
Johanne Thiffault, Société de transport de Montréal
Deux enquêtes qui font du chemin : tout sur leur itinéraire

Séminaire de statistique McGill Univ.
Org.: George P.H. Styan (McGill Univ.)

September 5, 2002
James M. Curran, Univ. of Waikato, Hamilton
Interpretation of DNA evidence

October 3, 2002
Masoud Ashgarian, Univ. McGill
Asymptotic behaviour of the NPMLE based on cross-sectional sampling for diseases with stationary incidence

October 10, 2002
Russell J. Steele, Univ. McGill
Contemplating the effect of prior choice for finite mixture models

October 17, 2002
Kenji Fukumizu, The Institute of Statistical Mathematics, Tokyo & Univ. of California, Berkeley
Singularities of statistical models and divergence of likelihood ratio test statistics

November 5, 2002
Nicholas T. Longford, De Montfort Univ. Leicester
Is *Which Model?* the right question?

November 14, 2002
Robert Nadon, Univ. McGill
Introduction to microarray analysis

November 21, 2002
James A. Hanley, Univ. McGill
Design and data analysis options for clinical trials in infertility

November 28, 2002
Jonathan Taylor, Stanford Univ.
Incorporating spatial information into false discovery rate procedures

November 5, 2002
Keith J. Worsley, Univ. McGill
Heritability random fields

January 16, 2003
Benjamin James Morris, Univ. of California at Berkeley
Random walks on truncated cubes and sampling knapsack solutions

February 13, 2003
Éric Marchand, Univ. of New Brunswick & Univ. McGill
Improving on minimum risk equivariant estimators of a location or scale parameter which is bounded

March 7, 2003
Stephen E. Fienberg, Carnegie Mellon Univ.
In search of the magic lasso: the truth about the polygraph

Séminaire de statistique Univ. de Montréal
Org.: François Perron
(CRM & Univ. de Montréal)

September 26, 2002
Rachel McKay, UBC
Estimating the order of a Hidden Markov model

October 3, 2002
Karen Leffondré, Univ. McGill
Le modèle de Cox pour l'analyse des données cas-témoins : une étude de simulations

October 9, 2002
Michel Delecroix, CREST-ENSAI, Rennes
Le modèle linéaire généralisé est-il nécessaire en actuariat?

October 16, 2002
Alexandre B. Tsybakov, Univ. Paris VI
Adaptive Nonparametric Classification

October 23, 2002
William McCausland, Univ. de Montréal
Inférence bayésienne pour une théorie intrinsèquement stochastique de la demande des consommateurs

October 30, 2002
Assi N'Guessan, Univ. de Lille I
Multidimensional estimation of the mean effect of a measure on different sites and different types of accidents with control area for each site

November 6, 2002
François Perron, Univ. de Montréal
Sur des améliorations de l'algorithme Metropolis-Hastings indépendant

November 13, 2002
Mohamedou Ould-Mohamed-Abdel-Haye, HEC Montréal
Processus à longue mémoire

November 20, 2002
Silvia Gonçalves, Univ. de Montréal
Le bootstrap d'autorégressions dont l'hétéroscédasticité conditionnelle est de forme inconnue

November 27, 2002
Theodore Chang, Univ. of Virginia
Modelling Tectonic Plate Boundaries by an Ornstein-Uhlenbeck Process

January 10, 2003
Pierre Duchesne, HEC Montréal
Un test pour détecter des effets autorégressifs conditionnellement hétéroscédastiques dans les modèles de séries chronologiques vectoriels

January 17, 2003
Sneh Gulati, Florida International Univ.
Inference and Goodness of Fit from Incomplete Data

February 7, 2003
Makram Talih, Yale Univ.
Champs aléatoires de Markov sur des graphes qui changent avec le temps

March 17, 19, 24, 2003
Christian Francq, Univ. de Lille III & GREMARS
Séries chronologiques non linéaires et processus ARMA faibles

April 2, 2003
Pierre Lavallée, Statistique Canada
La méthode généralisée du partage des poids (ou le sondage indirect)

Séminaire de statistique UQAM/Concordia

Org.: Brenda MacGibbon (UQAM) & Xiaowen Zhou (Concordia Univ.)

October 4, 2002
Boyan Dimitrov, Kettering Univ. Michigan
Bernouilli Trials: Extensions Related Probability Distributions and modeling powers

November 15, 2002
Subash Kochar, Indian Statistical Institute
Stochastic Comparison of Parallel Systems

December 16, 2002
Alexandre Leblanc, HEC Montréal
Prior Density Estimation via Harr Deconvolution

Séminaire systèmes dynamiques

Org.: Pietro-Luciano Buono (CRM) & Mario Roy (Concordia Univ.)

September 11, 2002
Pietro-Luciano Buono, CRM
Systèmes dynamiques équivariants

September 18, 2002
Mario Roy, Univ. Concordia
Une preuve de la J-stabilite des familles analytiques de fonctions elliptiques hyperboliques

September 25, 2002
Yulin Zhao, CRM, & Univ. de Montréal)
The weakened 16th Hilbert problem for quadratic Hamiltonian system

October 2, 2002
Christiane Rousseau, Univ. de Montréal
Un apercu des théorèmes de formes normales pour les points singuliers élémentaires des champs de vecteurs analytiques

October 9, 2002
Christiane Rousseau, Univ. de Montréal
Le module d'Ecalle-Voronin pour un germe de difféomorphisme de C avec un point fixe parabolique et son déploiement

October 16, 2002
Mariusz Urbanski, Univ. of North Texas
Fractal properties of the maps from the exponential family

October 23, 2002
Wael Bahsoun, Univ. Concordia
Position dependent random maps in one and higher dimensions

October 30, 2002
Jacques Bélair ,Univ. de Montréal
Modeling the hematopoietic system: feedback, delays and oscillations

November 27, 2002
Felipe Gonzalez, Univ. of Warwick
Continued fractions transformation with restricted digits and the Laplace-Mellin transform

Geometric Group Theory Seminar

Org.: Dani Wise (McGill Univ.)

September 11, 2002
Dani Wise, Univ. McGill
Nonpositive immersions, local indicability, and coherent groups

September 18, 2002
Alexei Miasnikov, Univ. McGill
Infinite words in group theory

October 2, 2002
Inna Bumagin, Univ. McGill
Every countable group is an outer automorphism group

October 9, 2002
Olga Kharlmapovich, Univ. McGill
Infinite words and equations in groups

October 30, 2002
Inna Bumagin, Univ. McGill
On the Delzant-Potyagailo hierarch

November 6, 2002
Alexei Miasnikov, Univ. McGill
Algebraic extensions in free groups

November 13, 2002
Steven Boyer, UQAM
On Howie's proof of the Scott-Wiegold Conjecture

November 20, 2002
Chris Hruska, Chicago
Relative hyperbolicity and spaces with isolated flats

November 27, 2002
Iosif Polterovich, Univ. de Montréal
Trees, groups and asymptotic cones

December 4, 2002
Frédéric Haglund, Univ. de Paris-Sud 11
Commensurability of lattices in building

January 22, 2003
Alexandre Borovik, UMIST
Black Box groups and the Andrews-Curtis conjecture

January 29, 2003
Dani Wise, Univ. McGill
Sectional curvature, compact Cores, and local quasiconvexity

February 5, 2003
Olga Kharlmapovich, Univ. McGill
Reflections on the subject of algebraic extensions of finitely generated residually free groups

February 12, 2003
Inna Bumagin, Univ. McGill
On the coherence of coherent-by-cyclic groups

February 19, 2003
Dani Wise, Univ. McGill
Honeycombs and tori in C(6) 2-complexes

March 5, 2003
Bogdan Nica, McMaster Univ.
A guided tour to Kazhdan's property-T

March 19, 2003
Stuart Margolis, Bar Ilan Univ.
Some surprising undecidable problems for finite groups, graphs and other finite structures

March 26, 2003
Tim Hsu, San Jose State
Fixed subgroups of automorphisms of groups

April 2, 2003
Tadeusz Januszkiewicz, Univ. of Wroclaw
6-systolic spaces: properties, constuctions, applications

April 9, 2003
Lior Silberman, Princeton
Gromov's random groups have property T

April 23, 2003
Olga Macedonska, Silesian Univ. of Technology
Locally graded groups and Positive laws

Special Lecture

Org.: Michel Delfour (CRM & Univ. de Montréal)

July 4, 2002
Henry Wolkowicz, Univ. of Waterloo
An introduction to semidefinite programming and applications

July 16, 2002
Jan Sokolowski, Institut Elie Cartan, Univ. Henri Poincaré Nancy I
Smooth domain method for crack problems

July 16, 2002
Jan Sokolowski, Institut Elie Cartan,, Univ. Henri Poincaré Nancy I
On compactness and domain dependence of steady solutions to compressible isothermal Navier-Stokes equations

Special Lectures
CRM Short Course on Mathematical Theory of Quantum Computation
Org.: Michel Delfour (CRM & Univ. de Montréal)

August 12, 2002
Goong Chen, Texas A&M Univ.
Introduction to Quantum Computing and Devices

August 12 - 13, 2002
Goong Chen, Texas A&M Univ.
Quantum Circuits, Universality and Quantum Fourier Transform

August 14, 2002
Goong Chen, Texas A&M Univ.
Quantum Computing Algorithms I: Grover's Algorithm for Quantum Search

August 15, 2002
Goong Chen, Texas A&M Univ.
Quantum Computating Algorithms II: Shor's Algorithm for RSA Cryptography

August 16, 2002
Goong Chen, Texas A&M Univ.
Quantum Error Correcting Codes

Special Lecture
Org.: Jiri Pateta (CRM & Univ. de Montréal)

August 23, 2002
M. Baake, Univ. of Greifswald
Quasicrystalline Combinatorics and Dirichlet Series

Special Lecture
Org.: Dana Schlomiuk (Univ. de Montréal)

November 11, 2002
Adrien Douady, Univ. Paris-Sud 11
Champ de vecteurs polynomiaux en dimension 1 sur C

Special Lectures
Org.: Jean-Marc Lina & Fahima Nekka (CRM & Univ. de Montréal)

March 10, 2003
Alain Arneodo, Laboratoire de physique, ENS de Lyon
A la recherche d'informations structurales et dynamiques dans les sequences d'ADN a l'aide des techniques ondelettes

March 11, 2003
Alain Arneodo, Laboratoire de physique, ENS de Lyon
La méthode des maxima du module de la transformée en ondelettes: Applications en 2d et 3d

March 27, 2003
Jean-Louis Merrien, INSA-Rennes
Les interpolants monotones et convexes par la technique des subdivisions

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, organizes survey talks by distinguished mathematicians on topics of current interest.

Series in Mathematics

Org.: Tadashi Tokieda (UQAM & Univ. de Montréal)

FALL 2002

September 20
Brian Conrad, Univ. of Michigan
Prime values of polynomials

September 27
Yiannis Petridis, CUNY
Eisenstein Series and Modular Symbols

October 4
Alexei Miasnikov, Univ. McGill
Andrews-Curtis conjecture and Whitehead method

October 18
János Kollár, Univ. of Utah
The Nash conjecture on the topology of real algebraic threefolds

October 25
John Stalker, Princeton Univ.
Geometry of Black Holes

November 1
Greg Arone, Univ. of Virginia
Calculus of functors

November 8
Selman Akbulut, Michigan State Univ.
Smooth 4-manifolds, corks, and Leschetz fibrations

November 15/Prize CRM-FIELDS
John Friedlander, Univ. of Toronto
Sieve methods and he distribution of primes

November 22
Yael Karson, Hebrew Univ. et Univ. of Toronto
Sums and integrals over polytopes

December 6
Ravi Ramakrishna, Cornell Univ.et Univ. McGill
The use of Galois theory in arithmetic questions

WINTER 2003

January 17
Lisa Jeffrey, Univ. of Toronto
Symplectic quotients and their cohomology

January 24
Alexandre Borovik, UMIST, Manchester
Groups of finite Morley rank and a strange question from number theory

January 31
Maurice Nivat, Paris VII
Pavages du plan et suites bidimensionnelles homogènes

February 7
Eugene Lerman, Univ. of Illinois Urbana-Champaign
Contact group actions and stratified spaces

February 14
Chris Skinner, Univ. of Michigan
Eisenstein series and arithmetic

February 21
Alexander Brudnyi, Univ. of Calgary
Center problem for ordinary differential equations

March 14
Mikhail Shubin, Northeastern Univ.
Discreteness of spectrum for Schrödinger operators

March 21
Doron Zeilberger, Rutgers Univ.
The Devious and Divine DIAGONAL

March 28
Michael Monastyrsky, Institute of Theoretical and Experimental Physics
Topology and Physics, Old and New Applications

April 4
Kathryn Hare, Univ. of Waterloo
Fractal dimensions and the uncertainty principle in harmonic analysis

April 11
Pierre Cartier, École Normale Supérieure
Catégories, groupoïdes et théorie de Galois des équations différientielles

April 25
Michel Mendès-France, Univ. de Bordeaux
Zéros réels des polynômes réels

Series in Statistics

Org.: Christian Léger (CRM & Univ. de Montréal), Yogendra Chaubey (Concordia Univ.), Brenda McGibbon (UQAM), François Perron (Univ. de Montréal), George Styan (McGill Univ.).

January 24, 2003
Jerry Lawless, Univ. of Waterloo
Estimating State Occupancy Probabilities, with Application to Quality of Life and Cumulative Cost

January 31, 2003
Theophilos Cacoullos, Univ. of Athens
A Density Transform, Unified Stein-Type Identities and Variance Bounds, and the Local Limit Theorem

February 21, 2003
Mary Thompson, Univ. of Waterloo
Issues in the analysis of longitudinal binary data

February 28, 2003
David R. Bellhouse, Univ. of Western Ontario
Decoding Cardano's it Liber de Ludo Aleae

March 7, 2003
Stephen Fienberg
Conditional Distributions, Log-linear Models, and Disclosure Limitation Methods

March 14, 2003
Dipak Dey, Univ. of Connecticut
Bayesian criterion based model assessment for categorical data

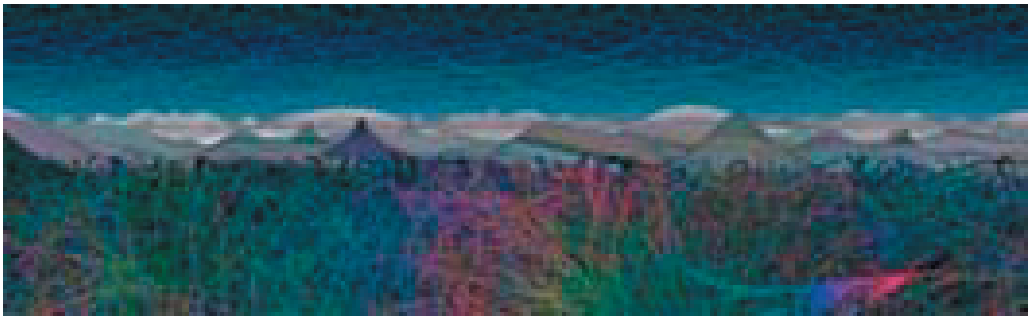
March 21, 2003
Christian Francq, Univ. de Lille 3 & GREMARS
L2 structures of standard and switching-regime GARCH models and their implications for statistical inference

March 28, 2003
Marvin Zelen, Harvard Univ.
The Early Detection of Disease and Stochastic Models

11 avril
Yoshua Bengio, Univ. de Montréal
Learning eigenfunctions to model highdim

Coming Activities

Theme Year 2003-2004: Geometric and Spectral Analysis



Credits: "Trichaotic" image is reproduced by courtesy of Eric J. Heller. Prof. Heller's artistic renditions of physical phenomena will be featured in an exhibition in Montreal during the thematic programme. Those interested in his work can also consult www.ericjhellergallery.com.

Organizing Committee

E. Bierstone (Toronto), W. Craig (McMaster), F. Finster (Regensburg), D. Jakobson (McGill), V. Jaksic (McGill), N. Kamran (McGill), Y. Last (Hebrew), R. Melrose (MIT), P. Milman (Toronto), C. Pillet (Toulouse), D.H. Phong (Columbia), I. Polterovich (Montréal), J. Toth (McGill), S. Zelditch (Johns Hopkins).

Overview

Analysis has traditionally stood at the center of a wide spectrum of research activities in mathematics. In particular, the fields of geometric and spectral analysis have played a fundamental role in shaping the major themes of current research in differential geometry and mathematical physics, and now touch in an important way onto areas such as number theory and algebraic geometry. They are at the core of several of the deepest and most spectacular advances in these fields.

The thematic year in geometric and spectral analysis will focus on a number of themes in which this interaction has been particularly fruitful. The year is organized around two interconnected themes: the first, whose different subthemes cover the whole year, is principally centered on various questions in spectral analysis; it comprises a short programme on analysis on singular spaces, and a more extended period on spectral analysis in geometry, mathematical physics and number theory. The second theme relates to the analysis of the Einstein equations, a subject on which there has been spectacular progress in recent years. It is concentrated in the fall of 2003.

These themes have been chosen for a balance between the geometric and spectral components of the scientific programme, and also with the objective of highlighting some of the most interesting current applications of analytic ideas to physics.

There will be a strong emphasis on training through the short courses which will precede the proposed workshops, as well as through the coordination of the graduate course offerings in analysis and geometry in the Montreal universities.

Aisenstadt Chair Lecture Series

There will be two chairholders for the year: P. Sarnak (Princeton) and S. T. Yau (Harvard).

Short programme on analysis and resolution of singularities

August 18-September 5, 2003

Org.: E. Bierstone (Toronto), R. Melrose (MIT), P. Milman (Toronto), D.H. Phong (Columbia)

Effective methods in resolution of singularities are becoming central to a modern generation of problems from analysis and geometry — for example, spectral theory and Hodge theorem for algebraic varieties, stability of oscillating integrals, existence of Kähler-Einstein metrics, sharp forms of Moser-Trudinger inequalities. The diversity of the problems and their very different origins and aims have led to a lack of communication among researchers on these and related topics. This programme, will bring together leading experts in resolution of singularities, complex differential geometry, real analysis and partial differential equations.

Week 1

Workshop on oscillatory integrals and critical integrability exponents

Topics include degeneracy of holomorphic functions in several variables, Legendre distributions and multiplier ideal sheaves.

Week 2

Short courses

The second week will consist of three short courses:

- Effective methods in resolution of singularities - ideas involved in desingularization algorithms, concrete examples with a view to applications in analysis and geometry.
- Stability questions in real and complex analysis; for example, stable forms of the method of stationary phase, stability of critical integrability exponents, ascending chain conditions, stability problems for degenerate Fourier integral operators.
- Real and complex blow up, resolution of metrics, configuration spaces and Lie algebras of vector fields - leading to a description of harmonic forms and L2 cohomology of various singular spaces

Week 3

Workshop on resolution of singularities, metrics and the Laplacian

The Hodge theorem, describing the harmonic forms on a smooth algebraic variety and relating them to its cohomology, has had wide impact on differential and algebraic geometry, and differential analysis. In the more general case of a singular projective variety, a description of the harmonic forms remains largely open, although there are substantial conjectures. An approach through resolution of singularities depends on understanding the structure of the Fubini-Study metric lifted to a resolution. The workshop will bring together researchers in geometric, algebraic and analytic areas related to these questions.

Workshop on the Cauchy problem for the Einstein equations

September 24-28, 2003

Org.: F. Finster (Regensburg), N. Kamran (McGill)

A number of major advances have been achieved over the past few years in the analysis of the Cauchy problem in general relativity. These include the proof of the non-linear stability of Minkowski space, the proof of the Riemannian Penrose conjecture and the rigorous description of the asymptotic behavior at infinity of the admissible Cauchy data. This workshop will bring together some of the key players who have been involved in these developments, and will provide an opportunity for exploring some of the remaining open problems.

The workshop will be preceded by two short courses given by A. Ashtekar (Penn State) and G. Huisken (MPI Golm).

Workshop on the interaction of gravity with classical fields

October 1-5, 2003

Org.: F. Finster (Regensburg), N. Kamran (McGill)

The interaction of gravity with external fields is governed by highly coupled systems of partial differential equations on manifolds. The analysis of these systems leads to rigorous analytical results on fundamental questions such as the scattering of waves by black holes and the role of external fields in the dynamics of gravitational collapse and black hole formation.

The workshop will be preceded by two short courses given by J. Smoller (Michigan). It will be simultaneous with the first series of Aisenstadt lectures for the year, to be delivered by S.T. Yau.

Workshop on large N limits of U(N) gauge theory in physics and mathematics

January 5-9, 2004

Org.: P. Bleher (IUPUI), V. Kazakov (École Normale) and S. Zelditch (Johns Hopkins)

This workshop is devoted to the large N expansion in quantum Yang-Mills theory, particularly in the explicitly solvable 2D setting. During the 90's a series of articles by such physicists as D. J. Gross, W. Taylor, G. Matytsin, M. Douglas, V. Kazakov, and G. Moore produced a series of conjectured expansions for objects of 2D Yang-Mills with gauge group $U(N)$, such as the partition function of a closed surface of genus g, the partition function of a cylinder, the expected value of the Wilson loop functional, as well as certain characters $\chi_R(U)$. These quantities are related to traces and other invariants of heat kernels, as well as to volumes and traces over moduli spaces of flat connections. The asymptotics of the partition functions are governed by statistics of branched covers of surfaces. Among the topics of the conference:

- The Matytsin asymptotics for the characters $\chi_R(U)$, recently proven by A. Guionnet and O. Zeitouni
- The Kazakov-Douglas phase transition in $g = 0$, recently proven by A. Boutet de Monvel and M. Shcherbina
- Zelditch's limit formula for the partition function on the cylinder Statistics of branched covers (integrals over Hurwitz spaces)
- Volumes and trace integrals over moduli spaces of flat bundles

- The large N limit of objects of S_N Relations between large N theory of YM_2 and random matrix models
- Relations with free probability
- The new, very fast developing work of Dijkgraaf-Vafa

Workshop on spectral geometry

March 4-6, 2004

Org.: I. Polterovich (Montréal)

Relations between the geometric properties of manifolds and the spectrum of the Laplacian have been actively studied for decades. It is well known that many important geometric invariants are determined by the spectrum, and, vice-versa, the behavior of eigenvalues is strongly dependent on the underlying geometry and topology. Still, our understanding of the interplay between geometry and the spectrum is very far from being complete. In the recent years some major developments have occurred in various areas of spectral geometry, such as spectral asymptotics, eigenvalue estimates, isospectrality, and others. These problems and their applications will be in the focus of the workshop.

AARMS-CRM - Workshop on singular integrals and analysis on CR manifolds

May 3-8, 2004, Halifax, Nova Scotia

Org.: Galia Dafni (Concordia), Andrea Fraser (Dalhousie)

The theory of singular integral operators in the context of analysis on CR submanifolds of C^n, in particular the Heisenberg group, has been studied and proven fruitful over the last 30 years. In recent years, the emphasis has shifted to singular integral operators which do not fall under the standard Calderon-Zygmund theory. These include operators arising from product kernels on nilpotent Lie groups, which in turn lead to the study of flag kernels. The workshop combines the areas of harmonic analysis, several complex variables, symmetric spaces and Lie groups. It will include two series of lectures, to be delivered by Alexander Nagel (Wisconsin) and Elias M. Stein (Princeton).

Workshop on spectral theory and automorphic forms

May 4-7, 2004

Org.: D. Jakobson (McGill), Y. Petridis (CUNY)

In the last 40 years it has been understood that there is a close connection between the spectral theory of hyperbolic manifolds and the theory of L-functions attached to automorphic forms. Trace formulas of Selberg and Kuznetsov-Bruggeman are extremely useful in studying the spectrum and eigenfunctions of the hyperbolic Laplacian. Surprising connections have also been discovered between subconvexity estimates for L-functions and the equidistribution results for Eisenstein series and cusp forms.

Analytical questions about families of L-functions include questions about the distributions of zeros and GRH, value-distribution, special values and applications, as well as connections with arithmetical questions (such as distribution of primes, size of class groups, analytic ranks of elliptic curves). One of the most fruitful approaches to the study of statistical properties of zeros of L-functions involves establishing connections with random matrix theory.

The goal of this workshop is to bring together leading researchers in those fields, to introduce young researchers and graduate students to the state of the art results and to give an account of applications of techniques from analytic number theory to problems in analysis.

The workshop will coincide with the second series of Aisenstadt lectures for the year, to be given by Professor Peter Sarnak.

Workshop on Hamiltonian Dynamical systems (jointly with the Fields Institute)

May 24-28, 2004

Organizing Committee: D. Bambusi (Milano), W. Craig (McMaster), S. Kuksin (Edinburgh), C.E. Wayne (Boston), E. Zehnder (ETH-Zentrum)

A conference on analytic techniques of dynamical systems, including perturbation theory, variational methods and stability theory. The workshop will cover both finite dimensional Hamiltonian systems such as in celestial mechanics, and infinite dimensional Hamiltonian systems, such as those arising from PDE or from other dynamical systems with infinitely many degrees of freedom. Part of the Fields Institute thematic programme, it follows a workshop on Integrable and Near-integrable Hamiltonian PDE, held the previous week in Toronto.

Workshop on semi-classical theory of eigenfunctions and PDEs

June 1-11, 2004

Org.: D. Jakobson (McGill), J. Toth (McGill)

Many questions in quantum chaos are motivated by the correspondence principle in quantum mechanics. It asserts that certain features of the classical system manifest themselves in the semiclassical (as Planck's constant $h \to 0$) limit of a quantization of the classical system. The exact relationship between classical dynamics and asymptotic properties of high energy eigenstates of a quantized system is still not completely understood, despite exciting developments in the last 20 years. Important issues related to the correspondence principle include asymptotic L^∞ (L^p) bounds for the eigenfunctions, integrated (and pointwise) Weyl errors and scarring. Another fundamental question concerns the local

and global statistical properties of eigenfunctions (eg. the random wave model), their nodal sets and critical points. These problems draw extensively on the theory of partial differential equations and so we propose to bring together experts in these areas.

The workshop will include several short courses. Harold Donnelly (Purdue), Nikolai Nadirashvili (Chicago) have been invited.

Workshop on spectral theory of Schrödinger operators

July 26-30, 2004

Org.: V. Jaksic (McGill), Y. Last (Hebrew)

This workshop will focus on the spectral theory of random and quasiperiodic Schrödinger operators. In solid state physics random and almost periodic Schrödinger operators serve as models of disordered systems, such as alloys, glasses and amorphous materials. The disorder of the system is reflected by the dependence of the potential on some random parameters.

From a mathematical point of view, random Schrödinger operators show quite " unusual" spectral behavior. If the disorder is large enough then these operators have dense point spectrum with exponentially decaying eigenfunctions (Anderson localization). The appearance of dense point spectra is a reflection of the physical fact that the strongly disordered systems are bad conductors. It is believed that in the weak disorder regime and for dimensions larger then 2 these operators have some absolutely continuous spectrum which corresponds to non-zero conductivity of the weakly disordered systems. The mathematical proof of this expected spectral phase transition (Anderson delocalization) is a fundamental open problem in mathematical physics.

This workshop will bring together the world leaders in spectral theory of random and quasiperiodic Schrödinger operators. Its goal is to review the state of the art of the field and to map new directions of the research.

The programme includes short courses to be given by M. Aizenman (Princeton), B. Simon (Caltech) (*), and S. Jitomirskaya (Irvine). The workshop is being held in conjunction with the following one, and many participants will be attending both.

Workshop on dynamics in statistical mechanics

August 2-6, 2004

Org.: V. Jaksic (McGill), C.-A. Pillet (Toulon)

During the recent years, significant efforts have been devoted to the study of dynamical properties of (classical and quantum) open systems. In particular, through the study of noisy or forced dissipative systems, or Hamiltonian systems with a large number of degrees of freedom, our understanding of the mathematical structure of nonequilibrium statistical mechanics has greatly improved. The aim of this meeting is to present the latest results and discuss the possible future directions of research in this area. The following topics will be discussed:

- *Axiomatic approaches*: Under appropriate hypotheses on the ergodic properties of the underlying dynamical system (chaotic hypothesis, asymptotic abelianness, etc), it is possible to prove various predictions of nonequilibrium thermodynamics (linear response, Kubo formula, Onsager's relations, etc.). This approach also lead to unexpected results, like the Gallavotti-Cohen fluctuation theorem.

- *Specific models*: Modern techniques (quantum field theory, algebraic quantum dynamical systems, spectral analysis, renormalization group, etc.) have been successfully applied to the study of various models (spin-boson, spin-fermion, Pauli-Fierz, Lorentz-gas, etc.). Elementary physical properties like return to equilibrium or existence and structural properties of nonequilibrium steady states, have been obtained in this way. More difficult questions, like the emergence of the Fourier law, are currently under investigation.

- *Markovian Dynamics*: It gives a natural mathematical framework to study the dynamics of various nonequilibrium processes — Hamiltonian systems coupled to reservoirs, exclusion processes on the lattice, noisy extended systems.

The program includes short courses to be given by H. Araki (Kyoto), B. Derrida (École Normale), J. Froehlich (ETH), J.-P. Eckmann (Geneva). The workshop is being held in conjunction with the preceding one, and many participants will be attending both.

Advanced Courses

Several advanced graduate courses are being given as part of the thematic programme, including:

- "Spectral structure of Anderson type Hamiltonians", V. Jaksic (McGill)
- "Quantum probability", Y. Pautrat (CRM)
- "Micro-local analysis", J. Toth (McGill)
- "Scarring and control on scarring in quantum maps", Stephan De Bievre (Lille, France)
- "Some rigorous results on the Sherrington Kirkpatrick spin glass model", Shannon Starr (CRM - McGill)

Theme Year 2004-2005: The Mathematics of Stochastic and Multiscale Modeling

Organizing Committee

A. Bourlioux (Montréal), Weinan E (Princeton), J.-P. Fouque (North Carolina State), T.Y. Hou (Caltech), C. Le Bris (Cermics, ENPC, Paris), A.J. Majda (Courant), R. Sircar (Princeton), T. Souganidis (Texas), A.M. Stuart (Warwick), P.F. Tupper (McGill), and E. Vanden-Eijnden (Courant).

Overview

The 2004-2005 thematic year will be dedicated to the applied mathematical tools (modeling, analysis, computation) needed to study multiscale systems which arise in a variety of areas in science and engineering. These systems present many novel challenges for applied mathematicians. The central difficulty is how to account for the wide range of scales and the large number of degrees of freedom in such systems. In particular, it is necessary to find an appropriate coupling between the mathematically distinct models used for the different scales in such a system.

The fields of application where these issues arise, and which will be discussed during the theme year, include climate modeling, front propagation, molecular dynamics, materials science, financial engineering, and rheological fluids.

Despite the diversity of applications, the challenges in these areas have much in common. A fundamental question is: How can one utilize knowledge about the dynamics of a system so as to design a useful mathematical model that accurately captures its global behaviour? One particularly promising approach is based on stochastic models: this will be the topic of the summer school and will also be a recurring theme throughout the various workshops. These will offer opportunities for interaction between applied mathematicians specializing in modeling and numerical simulation and scientists and engineers in the various fields of applications.

Summer School: Stochastic Calculus for Applications: Theory and Numerics

August 9-20, 2004, joint with MITACS

Speaker: E. Vanden-Eijnden (Courant)

The aim is to cover the essentials of stochastic calculus, including fundamental concepts such as Markov chains, Wiener processes, stochastic differential equations, as well as more elaborate ideas such as the Girsanov transformation and path integrals. The material will be presented at a semi-rigorous level by relying only on the standard tools of basic probability, linear algebra, and advanced calculus. Both theoretical and numerical aspects will be covered and illustrated via examples.

Aisenstadt Chair Lecture Series

A.J. Majda (Courant) will be the holder of the Aisenstadt Chair in the Fall 2004. He is well known for both his theoretical contributions to the study of partial differential equations and his applied contributions to diverse areas, most recently climate modeling and prediction. T.Y. Hou (Caltech) will be the Chair holder during the Spring 2005 semester. He is one of the leading experts in the modeling of free boundary and multiscale problems.

Workshops

Multiscale Rheological Models for Fluids

November 14-17, 2004

Org.: C. Le Bris (Cermics, ENPC, Paris)

This workshop will address the multiscale modeling of non-Newtonian fluids. Models for such systems could be built via constitutive laws, but those are typically very difficult to obtain and validate rigorously. An alternative strategy is to use kinetic theory to simulate the micro-structures that govern the fluid behaviour. (For polymeric fluids, those micro-structures would be polymer chains; for other fluids, it could be particles in suspension.) One then couples this microscopic description with macroscopic continuum equations for the fluid. This workshop will be an opportunity to discuss recent developments along these lines.

Front Propagation and Nonlinear Stochastic PDEs for Combustion and other Applications

January 26-30, 2005

Org.: A. Bourlioux (Montréal) & P. Souganidis (Texas)

The development of efficient large-scale models for the numerical simulation of turbulent premixed flames requires a good understanding of the mathematical principles governing the dynamics of self-propagating fronts. One of the most challenging issues is the analysis of the complex interactions, at small scales, between advection, reaction and diffusion, including stochastic effects due to the media or the advective flow randomness.

This workshop will be an opportunity for interaction between

mathematicians at the forefront of this area and scientists involved in the design of models and numerical methods for various applications, in particular, turbulent combustion.

Representing Unresolved Degrees of Freedom for the Atmosphere and Ocean

March 2-5, 2005

Org.: A.J. Majda (Courant)

A central problem in attempts to understand and predict the evolution of atmospheric or oceanic flows is how best to represent the unresolved scales in these flows. In the jargon of dynamic meteorology or physical oceanography this is called the parameterization problem, while in the jargon of turbulence it is called the closure problem. The most pertinent areas of analysis and applied mathematics are homogenization theory, probability and non-linear stochastic PDEs. The purpose of this workshop is to explore two complementary issues that arise in the context of the parameterization problem:

- the extent to which modern techniques in applied mathematics can be brought to bear on its formulation and partial solution;
- the extent to which problems in the representation of atmospheric and oceanic flows create fertile new areas of mathematical inquiry.

Extracting Macroscopic Information from Molecular Dynamics

April 6-10, 2005

Org.: P.F. Tupper (McGill), A.M. Stuart (Warwick)

Models used in molecular dynamics are high-dimensional dynamical systems (or stochastic dynamical systems) with multiple time-scales. A major challenge for computational mathematics is the extraction of accurate macroscopic information at minimal cost. This workshop will concentrate on two topics:

- the analysis and development of standard time-stepping algorithms in the context of molecular dynamics, with the purpose of the indirect calculation of macroscopic information;
- the design of new algorithms aimed at extracting macroscopic information directly.

Multiscale Modeling in Solids

April 27-May 1, 2005

Org.: Weinan E (Princeton), E. Vanden-Eijnden (Courant)

This workshop will focus on energetic and kinetic issues associated with defects, cross-slip, grain boundary migration, and phase boundary dynamics in solids. The objective is to develop mathematical models for complex multiscale phenomena such as crystal plasticity, nucleation and reconstruction of stepped surfaces, and the behaviour of nanomaterials in general.

Integrative Multiscale Modeling and Simulation in Materials Science, Fluids and Environmental Science

May 11-15, 2005

Org.: T.Y. Hou (Caltech)

Multiscale modeling and simulation have already impacted many scientific and engineering disciplines. Numerous developments have been scattered in various disciplines and there is a great need to integrate isolated efforts. This workshop will recapitulate previous activities, focus on the interdisciplinary interaction among these related fields, and try to develop new tools that combine mathematical analysis, multiscale modeling and computational analysis in an integrative way.

Stochastic Modeling in Financial Mathematics

June 1-5, 2005, joint with SAMSI

Org.: R. Sircar (Princeton), J.-P. Fouque (North Carolina State)

The theme of this workshop is emerging directions in financial mathematics, with emphasis on stochastic modeling of market uncertainties, theoretical and numerical approximations to pricing, hedging and portfolio optimization control problems, and data estimation issues. The goal is to bring together researchers in a variety of disciplines (mathematics, engineering, operations research and economics, for example) to emphasize different techniques and approaches.

Advanced Course: Multiscale Systems: Modeling and Simulation

Fall 2004

Speaker: C. Le Bris (Cermics, ENPC, Paris)

Theme year 2005-2006: Analysis in Number Theory

Organizing Committee

H. Darmon (McGill), A. Granville (Montréal), R. Murty (Queen's), V. Vatsal (UBC), plus the two Aisenstadt chairs.

In several different ways, number theory enjoys a privileged relationship with analysis, not unlike physics. Indeed number theory has been a fertile source of questions and motivated the development of sophisticated analytic theories both inside number theory and in analysis; for examples, the theory of the Riemann zeta-function and allied L-functions and their application to prime number theory; real harmonic analysis such as distribution of values of polynomials and the Kakeya problem; harmonic analysis and the representation theory of adelic groups and its crucial role in the all-encompassing Langlands program; and the foundations of *p*-adic analysis and their important recent role in the proof of the Dwork Conjectures and of *p*-adic variants of the Birch and Swinnerton-Dyer conjecture and the Stark conjectures.

The CRM 2005-2006 special year will be devoted to Number Theory and Analysis, focussing on the manifold interactions between these fundamental disciplines.

Main topics: Roughly speaking, one half of the special year will focus on the more classical aspects of analytic number theory and the analytic theory of automorphic forms, with a special emphasis on the following topics:

- Classical Erdös type analytic number theory; in particular distribution problems for character sums, for multiplicative functions and for aspects of the structure of the integers,
- Additive number theory and its interaction with "real harmonic analysis" (starting from the structure imposed by the Freiman-Ruzsa theorem).

as well as a minor focus on

- Recent developments in the analytic theory of automorphic forms,
- Artin L-functions; applications to Artin's conjecture and the classification of Euclidean number fields.

The other half of the special year will be devoted to the application of *p*-adic analysis to classical problems of number theory: most notably

- The work of Daqing Wan on Dwork's conjecture,
- The work of Coleman, Mazur and the recent conjectures of Buzzard on *p*-adic families of non-ordinary eigenforms,
- Applications of *p*-adic periods of classical modular forms to the construction of class fields and rational points on elliptic curves, and
- Stratifications of Hilbert modular varieties and more general Shimura varieties in characteristic p, and its applications to the theory of *p*-adic modular forms.

Long term participants: We have a strong desire to include senior graduate students, postdocs and junior faculty from around the world. Participants from outside Montreal will mostly be junior or mid-career. We will also ask some junior Canadian mathematicians in related areas to participate.

Summer School on Equidistribution in Number Theory

Org.: A. Granville (Montréal), Z. Rudnick (Tel Aviv).

In conjunction with the Séminaire de Mathématiques Supérieur, we are organizing a Summer School on *Equidistribution in number theory* encompassing results on points on varieties, values of polynomials mod *m*, chaotic maps, sequences in arithmetic progressions, etc. We hope that students and postdocs from the Special Year will be able to attend the School, and thus will give a background to several of the key topics from the upcoming Special Year.

Aisenstadt Chair Lecture Series

Two Aisenstadt Chair holders will speak on topics relevant to the thematic year We intend to have one chair who specialises in the arithmetic aspects of number theory and one who specialises in the analytical aspects.

Workshops

The *p*-adic Birch-Swinnerton Dyer and Stark conjectures

Org.: Henri Darmon (McGill)

This workshop will focus on recent progress on the *p*-adic Birch and Swinnerton Dyer conjectures and on the Stark conjectures (both classical and *p*-adic), emphasising the surprising connections that have recently emerged between these fundamental conjectures.

p-Adic Local Langlands Correspondence

Org.: Adrian Iovita (Concordia)

This workshop will focus on the recent progress that has been accomplished in *p*-adic cohomology, Fontaine's theory and its arithmetic applications, and the notion of *p*-adic variation and families of modular form which recently have shed much light on fundamental open problems of number theory.

Varieties in characteristic *p*: theoretical and computational issues.

Org.: Eyal Goren (McGill), Jonathan Pila(McGill)

This workshop will focus on the arithmetic of varieties in characteristic *p* both from a theoretical and computational standpoint.

Anatomy of integers

Org.: J.M. de Koninck (Laval), G. Tenenbaum(Bordeaux)

This workshop will discuss classical topics in analytic and algebraic number theory and questions related to integers, a fundamental object par excellence of number theory.

Diophantine Arithmetic by many methods

Org. : M. Bennett (UBC)

L-functions and their meanings

Org. : C. David (Concordia), R. Murty(Queen's)

General Program

Séminaire de mathématiques supérieures : Théorie structurale des automates, semi-groupes et algèbre universelle

July 7-18, 2003

Org.: I. Rosenberg (Montréal), V. Kudryavtsev (Moscow State).

Invited speakers: J. Almeida (Universidade do Porto, Portugal), J. Berman (Illinois), J. Dassow (Magdeburg, Allemagne), R. Freivalds (Latvia), A. Krokhin (Warwick), A. Letichevsky (Glushkov Institute of Cybernetics, Kiev), R. McKenzie (Vanderbilt), I. Rosenberg (Montréal), L. Shevrin (Ural State), M. Steinby (Turku, Finlande), M. Volkov (Ural State).

The lectures will cover a wide range of the theory of automata, semigroup theory and universal algebra. The topics of the lectures will mostly be related to at least two of the fields, will use concepts and techniques from other domains and will show some intrinsic connections. Two of the courses will be concerned with problems arising from the construction, via composition and feedback, of new automata from a given set of automata over the same input and output alphabets. The so-called constraint satisfaction problem is an important problem that appears in computer science, operations research, databases, and combinatorics. An algebraic approach to this problem will be presented. Commutator theory, a basic tool for the study of congruence modular varieties will also be covered. Finally, lectures on semigroups will deal with fundamental results often connected to the structural theory of automata and to universal algebra.

Workshop on Algebraic Stuctures and Moduli Spaces

July 14-20, 2003

Org.: Eyal Markman (Amherst), Hiraku Nakajima (Kyoto)

Invited speakers: Claudio Bartocci (Gênes), Alexander Braverman (Harvard), Jim Bryan (UBC), Andrei Caldararu (UPenn), Linda Chen (Beijing), Mark de-Cataldo (SUNY), Kenji Fukaya (Kyoto), Victor Ginzburg (Chicago), Hiroshi Iritani (Kyoto), Lisa Jeffrey (Toronto), Dimitry Kaledin (Moscou), Manfred Lehn (Mainz), Hiraku Nakajima (Kobe), Yoshinori Namikawa (Osaka), Keiji Oguiso (Tokyo), Zhenbo Qin (Missouri), Justin Sawon (Oxford), Michael Thaddeus (Harvard), Ravi Vakil (Stanford), Misha Verbitsky (Glasgow), Weiqiang Wang (Virginia), Kota Yoshioka (Kobe).

The topology of moduli spaces exhibits some quite intricate algebraic structure, and indeed has been the source of some very interesting algebra. Recent work in, for example, the topology of Hilbert schemes has only reinforced this tendency. The workshop will examine some recent developments in the area.

Séminaire de mathématiques supérieures : Morse theoretic methods in non-linear analysis and symplectic topology

June 21 to July 2, 2004

Org.: P. Biran (Tel Aviv), O. Cornea (Montréal), F. Lalonde (Montréal), L. Polterovich (Tel Aviv), Y. Saint-Aubin (Montréal), M.Schwarz (Leipzig), C. Viterbo (École Polytechnique).

Invited speakers: A. Abbondandolo (Scuola Normale di Pisa), P. Biran (Tel Aviv), R. Cohen (Stanford), O. Cornea (Montréal), M. Farber (Tel Aviv), K. Fukaya (Kyoto), H. Hofer (Courant), M. Izydorek (Technical University of Gdansk), Y.-G. Oh (Wisconsin, Madison), L. Polterovich (Tel Aviv), M.Schwarz (Leipzig), C. Viterbo (École Polytechnique).

The methods of algebraic topology have long been applied successfully in analysis. Early examples, now more than half a century old, include Brouwer's fixed point theory, classical Morse theory and Lusternik and Schnirelmann's category work.

More recently, the methods of Morse theory have been adapted to the infinite dimensional setting. In parallel with this evolution, the study of a certain type of dynamical phenomena has started to make use of objects and techniques provided by homotopy theory as exemplified by the development of the Conley index theory. This has led to a much better understanding of the way in which homotopical properties of manifolds are encoded in the behaviour of Morse-Smale flows. These two developments have presently started to mix in a remarkable way and Morse theory has become the mandatory interface necessary to approach homotopial type questions in an infinite dimensional setting. Meanwhile, the internal evolution of homotopy theory has led to the development of a number of tools whose application is considerably simpler than in the past.

The purpose of this SMS is to put together a number of specialists representative of this evolution such that the courses offered will give a good idea of the state of the art in the subject.

Short Program on Riemannian Geometry

June 28 to July 16, 2004

Org.: V. Apostolov (UQAM), A. Dancer (Oxford), N. Hitchin (Oxford), M. Wang (McMaster).

Metrics whose curvature satisfies constraints (the so-called special geometries), as well as the relation between curvature and topology have been of interest since the beginning of differential geometry. More recently, such metrics have come to the fore in physical problems related to string theory. The short programme will be concerned with mainstream issues of the subjects and will have a three-week format. It will begin with a week of summer courses designed for graduate students and post-doctoral fellows, followed by a two-week conference.

The summer courses will be given by Michael Anderson, Karsten Grove, Nigel Hitchin and Simon Salamon. Invited speakers for the two-week conference include Michael Anderson (SUNY), Olivier Biquard (Strasbourg), Roger Bielawski (Glasgow), Charles Boyer (Albuquerque), Hubert Bray (MIT), Robert Bryant (Duke), David Calderbank (Edinburgh), Jingyi Chen (UBC), Xiuxiong Chen (Madison), Jeff Cheeger (Courant), Andrew Dancer (Oxford), Maciej Dunajski (Cambridge), Kris Galicki (Albuquerque), Paul Gauduchon (Palaiseau), Ailana Fraser (UBC), Karsten Grove (Maryland), Pengfei Guan (Hamilton), Mark Herzlich (Montpellier), Nigel Hitchin (Oxford), Benette Chow (UCSD), Claude LeBrun (SUNY), Naichung Conan Leung (Minnesota), Peter Li (UCI), Joachim Lohkamp (Augsburg), Maung Min-Oo (Hamilton), Alexandre Nabutovsky (Toronto), George Papadopulos (Cambridge), Henrik Pedersen (Odense), Peter Petersen (UCLA), Yat-Sun Poon (UCR), Christopher Pope (Texas A & M), Regina Rotman (Toronto), Simon Salamon (Londres), Michael Singer (Edinburgh), Krishnan Shankar (Oklahoma), Andrew Swann (Odense), Xiaodong Wang (MIT), Burkhard Wilking (Munster), Wolfgang Ziller (UPenn).

Workshop on Algebraic K-theory 2004

October 2-6, 2004

Org.: Eric Friedlander (Northwestern), Dan Grayson (Illinois, Urbana-Champaign), Rick Jardine (Western Ontario), Manfred Kolster (McMaster).

Since its invention in the 1960's algebraic K-theory has developed into an indispensable tool that allows techniques of topology, mainly homotopy theory, to be applied to solve problems in algebraic geometry and algebraic number theory. We have recently seen the solution of the Milnor conjecture on the decomposability of the Galois cohomology of fields in the 2-torsion case (Voevodsky), and very significant progress has been announced on the Bloch-Kato l-torsion analog (Rost, Voevodsky). We now have a much better understanding of some of the major building blocks of motivic cohomology, with the introduction and development of motivic homotopy theory (Morel, Voevodsky), the introduction by Friedlander-Suslin and Levine of the global spectral sequence relating motivic cohomology and K-theory, and the work of Levine and Morel on algebraic cobordism. The topics covered at this meeting will include the most recent developments in algebraic K-theory and the closely allied areas of motivic homotopy theory, algebraic cycles, and motivic cohomology theory, along with applications in other areas of Mathematics.

Workshop Honouring Stanislav Molchanov on his 65th Birthday

Summer 2005

Org.: V. Jaksic (McGill)

Stanislav Molchanov is a leading probabilist and mathematical physicist who will turn 65 in 2005. He has written more than 300 scientific publications. His main contributions have been in the areas of boundary theory of Markov processes, diffusion on Riemannian manifolds and spectral theory, localization theory, percolation theory, averaging, intermittency, and diffusion in random media, hydrodynamics and oceanography, and chemistry kinetics. He has also supervised more than 50 students. The goal of the workshop is to bring together the world leading probabilists and mathematical physicists to celebrate and continue the rich contributions

Interdisciplinary and Industrial Program

Summer School: The Mathematics of Bioinformatics

August 27-29, 2003

Org.: Nadia El-Mabrouk (Montréal), David Sankoff (Ottawa).

Speakers: Anne Bergeron (UQAM), Guillaume Bourque (CRM), David Bryant (McGill), Miklós Csürös (Montréal), Nadia El-Mabrouk (Montréal), Mike Hallett (McGill), Jotun Hein (Oxford), John Kececioglu (Arizona), Mathieu Raffinot (Evry), David Sankoff (Ottawa).

Bioinformatics is a rapidly expanding field driven by the increasing availability of massive genomic data and the research perspectives of molecular biology and genetics. The purpose of this summer school is to survey the various aspects of bioinformatics, with attention to the mathematical, statistical and algorithmic aspects known as computational biology. Each presentation will include an introduction to the field, its concepts and general methods, followed by a discussion of current trends in research. Topics will include sequence alignment, the search for biological motifs, RNA structure prediction, genomic rearrangements, sequencing strategies, the analysis of DNA polymorphism, and the inference of metabolic, transcription and regulatory networks from microarray data. The speakers on each topic are all well-known researchers in this area.

Cerebral Plasticity: Imaging and Modelling

October 30-31, 2003

Org.: H. Benali (INSERM, CRM, Montréal), J. Doyon, (Montréal), B. Goulard (CRM, Montréal).

The brain is composed of complex functional networks, which adapt to changes in the environment. This process of adaptation called “cerebral plasticity”, may be, for example, in reaction to a cerebral lesion, the result of training or the effect of normal development. In the past ten years, the study of this concept has profited from major progress in the field of cognitive neuroscience, and from a better understanding of cerebral organization and the use of new functional imaging techniques, in particular. The aim of the present workshop on cerebral plasticity and imaging techniques is to bring together international experts in clinical and experimental neuroscience, neuroimaging methodology and mathematics, with a special interest in cerebral plasticity, functional connectivity and modelling. The focus will be on new developments in cognitive models, mathematical/statistical models and imagery including fMRI, EEG/MEG and optical imaging techniques.

Dependence Modelling : Statistical Theory and Applications in Finance and Insurance

May 20-22, 2004, Université Laval

Org.: C. Genest (Laval)

L’objectif de cette conférence internationale est de mettre en contact les chercheurs de partout dans le monde qui sont intéressés par la modélisation de la dépendance stochastique et la mesure de ses effets en statistique, en sciences actuarielles et en finance. La rencontre se veut le prolongement de la série de conférences sur les copules et leurs applications qui ont eu lieu à Rome (1990), Seattle (1993), Prague (1996) et Barcelone (2000). Comme dans les éditions précédentes, l’événement attirera les spécialistes des copules ainsi que les chercheurs en statistique intéressés par leur développement et leur utilisation dans la caractérisation et la modélisation de la dépendance (ordres stochastiques, lois à marges fixées, etc.). Toutefois, comme l’indique le titre du congrès, un accent particulier sera mis sur les aspects inférentiels de l’utilisation des copules ainsi que sur leur application en actuariat et en finance. Les questions reliées au traitement de la dépendance en analyse de survie et en théorie des valeurs extrêmes seront également au cœur des discussions de cette conférence. Un numéro spécial de la prestigieuse revue *Insurance: Mathematics and Economics* servira d’actes au congrès.

Workshop on Stochastic Networks

July 16-26, 2004

Org.: Donald Dawson (Carleton), George Kesidis (Pennsylvania State), Peter W. Glynn (Chair) (Stanford), Raj Srinivasan (Saskatchewan).

In July of 2004, the Centre de recherches mathématiques (CRM) will host several different activities as part of a short programme on stochastic networks. Stochastic networks form a class of mathematical models that are finding increasing applicability as descriptions of communications networks (both wireline and wireless), computer systems, production/processing networks, supply chains, and call centres. With new applications come new model structures and new mathematical questions. The activities associated with this short programme are intended to both provide a state-of-the-art perspective on the mathematical issues related to stochastic networks and to offer participants the opportunity to advance the field through the informal discussions necessary for significant research interactions.

The short programme has three main components :

Workshop on the Economics of Communication Networks
July 16-17, 2004

2004 Stochastic Networks Conference
July 18-23, 2004

Call Centre Workshop

Workshop on Mini-invasive procedures in medicine and surgery: mathematical and computational challenges

May 16-27, 2005

Org.: M. Delfour (Montréal), A. Fortin (Laval), A. Garon (École Polytechnique Montréal), C. Peskin (Courant), A. Quarteroni (École Polytechnique, Lausanne), M. Thieret (INRIA).

L'objectif de ce tandem école et atelier est de considérer plusieurs facettes des procédures en médecine et chirurgie, d'identifier les questions, les problèmes, les tendances et les défis dans leur modélisation mathématique et leur traitement numérique. La première semaine sera consacrée à une école de printemps alors que la deuxième prendra la forme d'un atelier.

Il sera organisé autour des thèmes suivants : l'imagerie médicale et la modélisation géométrique, les interactions fluide/structure dans les problèmes biomédicaux, la conception et le design statique/dynamique des dispositifs médicaux (implantables), les méthodes de design ou de fabrication par ordinateur basées sur les éléments finis.

CRM Collaborative Network

Within its general mandate of promoting mathematical research, the CRM maintains a wide network of collaborations at the local, national, and international levels.

A NATIONAL INSTITUTE

The CRM is strongly committed to its national mission and takes measures to ensure that the largest possible number of scientists across Canada benefits 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 organizers to make efforts to ensure the participation of the Canadian specialists in their activities; it organizes and supports scientific events across the country; it collaborates with Canadian institutes, societies and associations. A specific budget is set aside each year for the participation of Canadian graduate students in its programs. The CRM is the only national institute that 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, the Canadian Mathematical Society (CMS), the Canadian Applied and Industrial Mathematics Society (CAIMS), the Statistical Society of Canada (SSC), the Canadian Association of Physicists (CAP), and other societies as well as with other institutes abroad.

THE FIELDS INSTITUTE (FI) AND THE PACIFIC INSTITUTE FOR THE MATHEMATICAL SCIENCES (PIMS)

Since the early 1990's two other research institutes have joined the CRM on the Canadian scene: Toronto's Fields Institute (FI), and the Pacific Institute for Mathematical Sciences (PIMS). As well as coordinating their scientific activities, the three institutes have worked closely on a variety of initiatives, the most important of which has been the Mathematics of Information Technology and Complex Systems, of which more is described elsewhere in this report.

There are several other initiatives worthy of mention. One of these is the National Program Committee, described in a separate section. We also participate to the development of the mathematical sciences in the Atlantic provinces though AARMS; see the section on AARMS. The National Program on Complex Data Structures, funded through NSERC's last reallocation exercise, is a joint initiative of the three institutes and the Canadian statistical community. The broad goal of the program is to foster nationally coordinated projects with substantial interactions with the large community of scientists involved in analysis of complex data sets, and to establish a framework for national networking of research activities in the statistical community.

Other initiatives involved two institutes, such as the CRM-Fields prize awarded in recognition of outstanding accomplishments in the mathematical sciences in Canada. It was created in 1994. This year's winners are *John McKay* of Concordia University and *Edwin Perkins* of the University of British Columbia. The administrative responsibility in this matter alternates each year between the CRM and the FI. Scientific collaboration continues between FI and CRM, with a close coordination of the activities for the theme years 2003–2004 in analysis and partial differential equations with two series of two workshops that will alternate between the two institutes.

CANADIAN ASSOCIATIONS AND PROFESSIONAL SOCIETIES

The CRM maintains close ties with the different professional societies in the mathematical sciences: CMS, CAIMS, SSC, and CAP. The president of the CMS is an ex-officio member of the CRM advisory committee. We also financially support a number of initiatives of the CMS, such as the mathematical camps, the Canadian School Mathematics Forum 2003, as well as the travel grant program for students who will attend the joint Canada-France meeting in Toulouse in 2004. Together with the other institutes, the CRM organizes or sponsors special sessions at the CMS, CAIMS, and SSC meetings. The CRM awards a prize each year jointly with the SSC; similarly, together with CAP, it awards a prize each year in mathematical and theoretical physics. There is a section on this year's prize winners elsewhere in this report. Moreover, the CRM will host the 2004 Annual Meeting of the SSC.

INTERNATIONAL COLLABORATION

The CRM has exchange protocols with Osaka University, with Seoul's Asia-Pacific Center for Theoretical Physics, with the Institute of Mathematical Sciences at Nankai University, with the Czech Technical University of Prague and the University of Rome.

In its publications, the CRM is continuing its partnership with the American Mathematical Society, in particular with its two series of joint publications, the CRM Monograph Series and the CRM Proceedings and Lecture Notes. It also has two series with Springer-Verlag, in statistics and in mathematical physics. This year, CRM has also published a book jointly with the Institute of Mathematical Statistics. The CRM has publications exchange agreements with Fields Institute, PIMS, MSRI (Mathematical Sciences Research Institute), the Institute for Mathematics and its Applications, École Normale Supérieure (France), the Isaac Newton Institute, the Institut des Hautes Études Scientifiques (IHES, France), and the Banff International Research Station.

OUR ACADEMIC PARTNERS

All this activity rests on a solid base of cooperation with universities in the region, in particular the Montréal universities, and most particularly the Université de Montréal, whose support for the CRM has been indefatigable. The Université de Montréal releases five of its faculty members to work at the CRM each year, 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 nearby universities such as Laval, Sherbrooke, Queen's and Ottawa; some of these arrangements are being put on a more permanent footing. The partnerships of the CRM with the other research institutes in the Montréal area have been very profitable. More will be said about these in the next section.

NEURO-IMAGING INITIATIVE IN QUÉBEC

In recent years, CRM's PhysNum laboratory has developed a strong collaborative network with various partners in neuro-imaging in the Montréal area. This network was formalized with the constitution of the "Regroupement Neuro-imagerie Québec" (RNQ) under the umbrella of the Institut Universitaire de Gériatrie in Montréal. RNQ, with its 70 researchers, has recently purchased some key equipment in neuro-imaging through a very large grant ($11M). One of the strongest alliances of CRM within that network is its association with the INSERM laboratory for brain-imaging at Jussieu, France (director: Habib Benali).

INSTITUT DES SCIENCES MATHÉMATIQUES

Another important vehicle for collaboration with the Québec universities is the Institut des sciences mathématiques (ISM). This institute, which encompasses most of Québec'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 organizing two series of CRM-ISM colloquium, one in mathematics and one in statistics, and in organizing special courses for the CRM's thematic programs. During Summer 2003, the CRM will also participate in the undergraduate summer scholarships program, which allows postdoctoral fellows to supervise undergraduate students much like in NSERC's Undergraduate Student Research Awards Program (which does not permit postdoctoral fellows to supervise the students).

AARMS/ACSMA

The Atlantic Association for Research in the Mathematical Sciences (AARMS) was founded in 1995. AARMS exists to encourage and advance research in all mathematical sciences, including statistics and computer science, in the Atlantic region of Canada. In addition, AARMS acts as a regional voice in discussions of the mathematical sciences on a national level. Since its inception, AARMS has played an important role in the research activities in the Atlantic region, sponsoring or co-sponsoring numerous meetings and workshops. In the summer of 2002, AARMS initiated an annual Summer School for graduate students and promising undergraduates.

Since June 2002, AARMS can count on stable long-term funding thanks to co-sponsorship by the three mathematical institutes (CRM, Fields Institute, and PIMS) and the universities of New Brunswick, Memorial, and Dalhousie. Each of the six partners invests 30K$ per year into the Atlantic mathematical community. MITACS has also contributed important financial resources for industrial mathematical research in the Atlantic provinces. A Scientific Review Panel, including participation from the three institutes and the Atlantic mathematical community, helps the AARMS Director, Dr. Hermann Brunner, in the planning of scientific activities.

As part of the 2003-2004 thematic year on Geometric and Spectral Analysis, we are particularly proud to organize a joint workshop with AARMS. The workshop is on singular integrals and analysis on CR manifolds. It will be held in Halifax, Nova Scotia.

2002-2003 Scientific Programme

Nonlinear Differential Equations and Dynamical Systems with Applications

July 15-18, 2002, Memorial Univ. of Newfoundland

Org.: Hermann Brunner and Xiaoqiang Zhao (Memorial Univ.)

First Annual Summer School

July 22 to August 16, 2002, Memorial Univ. of Newfoundland

Org.: Edgar Goodaire, Hermann Brunner (Memorial)

International Workshop on Polynomials Identities in Algebras

August 29 to September 3, 2002, Memorial Univ. of Newfoundland

Org.: Y. Bahturin (Memorial Univ.), A. Giambruno (Palermo, Italy), A. Regev (Weizmann Institute, Israel), D. Passman (Wisconsin, U.S.A.)

Numerical Analysis and Scientific Computation

October 19-20, 2002, Mount Allison Univ., Sackville, New Brunswick

Org.: Paul Muir (St. Mary's), Pat Keast, Ray Spiteri (Dalhousie)

Ring Theory (in memory of Patrick N. Stewart)

October 19-20, 2002, Mount Allison Univ., Sackville, New Brunswick

Org.: Margaret Beattie (Mount Allison), Michael Parmenter (Memorial)

31st Annual Canadian Operator Theory and Operator Algebra Symposium

May 20-24, 2003, Univ. of New Brunswick, Fredericton

Org.: D. Kucerovsky (Univ. of New Brunswick)

Industrial Collaborations

The main vehicles for the CRM's efforts in this area are the research networks to which it belongs. There are two of these, one the Network for Computing and Mathematical Modelling (ncm_2), involving eight research centres in the Montréal area in a multidisciplinary consortium, and MITACS, a national network focussing on the mathematics of information technology and complex systems.

NETWORK FOR COMPUTING AND MATHEMATICAL MODELLING (NCM_2)

The CRM serves as the organizational centre for the Network for Computing and Mathematical Modelling, ncm_2 (in French: Réseau de calcul et de modélisation mathématique, rcm_2), a collaboration which allows the network to respond to the needs of industry in a large number of fields related to a common area of computing and mathematical modelling, mostly around five major themes: (1) risk management, (2) information processing, imaging and parallel computing, (3) transport and telecommunications, (4) health and (5) electronic commerce.

The five centres that established the network were the CRM, the Centre de recherche en calcul appliqué (CERCA), the Center for Interuniversity Research and Analysis on Organizations (CIRANO), the Center for Research on Transportation (CRT), and the Group for Research in Decision Analysis (GERAD). Since then, three new members joined the network: the Cooperative Centre for Research in Mesometeorology (CCRM), the Centre de Recherche Informatique de Montréal (CRIM) and the Institut National de la Recherche Scientifique – Télécommunications.

Let us now see the scientific accomplishments of the year. As part of its *Grandes Conférences* series, ncm_2 hosted Tim Palmer (European Centre for Medium-Range Weather Forecasts, Reading, UK) in January 2003. He spoke on "Ensemble Prediction of Weather and Climate: A Risky Business". This was followed by a series of talks given by Zoltan Toth (National Centres for Environmental Prediction, USA), Peter Houtekamer (Meteorological Service of Canada), and Jacques Derome (McGill).

The network organized two joint workshops with the Institute for Mathematics and its Applications (IMA). Reports for these activities can be found in the Interdisciplinary and Industrial Program section. They are:

- "Computational Method for Larger Scale Integer Programs", in Minneapolis in October 2002, and
- "Distribution systems: location and vehicle routing" in Montréal, in December 2002, co-organized by CRT.

A CIRANO-ncm_2 joint conference dealing with financial econometry was held in October 2002, entitled "Extremal Events in Finance". It presented recent research developments in modeling of extreme events and distribution queues, as well as applications to finance.

In March 2003, a CIRANO-MITACS-ncm_2 joint series of talks dealing with Portfolio Choices was organized by J. Detemple (Boston University and CIRANO), M. Rindisbacher (University of Toronto and CIRANO), É. Renault (Université de Montréal, CIRANO and CIREQ), and R. Garcia (Université de Montréal, CIRANO and CIREQ).

BELL UNIVERSITY LABORATORIES

The CRM is an active participant in the ncm_2's Bell University Laboratories, part of a joint project between the ncm_2 and Bell. The laboratories aim 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 Laboratories are: a deep integration with the university environment; a balance between exploratory research, applied research and applications development; a multidisciplinary approach.

These objectives and guiding principles are made possible thanks to a $12M investment which is used to finance research projects, to endow chairs and to finance a research infrastructure. The laboratory has two locations, the main one being in downtown Montréal, next to CIRANO. As well as offices, it contains a state-of-the-art simulation laboratory for electronic commerce and experimental economics. The other component is located at the Université de Montréal, and is devoted to multimedia research.

LABORATOIRE UNIVERSITAIRE SUR LE TEMPS EXTRÊME (LUTE)

The summer of 2001 saw the birth of a new ncm_2 laboratory, the Laboratoire Universitaire sur le Temps Extrême (LUTE). The laboratory involves a contribution of $300,000 per year from Environment Canada, a significant contribution ($1M) in computer time, as well as the presence in the university environment of a good number of Environment Canada's researchers. The laboratory will involve not only meteorological research but also an extensive study into impacts as well as mitigating measures.

LUTE financed eight research projects in 2002, with the universities of Toronto, McGill, Alberta, Dalhousie, and British Columbia being among the recipients.

Among the scientific activities of the LUTE, a workshop on "Extreme weather, climate and finance" was organized in October 2002. It featured two presentations:

- "What can climate models tell us about extreme weather in a changed climate?" by Dr. Francis W. Zwiers, Canadian Centre for Climate Modelling and Analysis, Meteorological Service of Canada, Victoria, B.C., and
- "Weather derivatives – the convergence of insurance, capital market and weather sciences" by Dr. Lixin Zeng, Senior Vice President, Willis Re, Minneapolis, Minnesota.

A round table discussion followed dealing with "The impacts of extreme weather and climate on the financial and related industry" with Rodney White, Director, Institute for Environmental Studies, University of Toronto, and David Grimes, Meteorological Service of Canada.

INSTITUTE FOR MATHEMATICS AND ITS APPLICATIONS (IMA)

This year, ncm_2 is organizing a series of exchanges with the Institute for Mathematics and its Applications in Minnesota. This institute is the US's major research institute in Applied Mathematics. As part of the IMA's 2002 program, the ncm_2 will be hosting a workshop on distribution networks in the fall of 2002.

MITACS

This network of centres of excellence on Mathematics of Information Technology And Complex Systems (MITACS) is one of 21 such networks set up by the federal government. MITACS was put together by the three Canadian mathematical institutes (CRM, Fields, PIMS) in 1998, and research began in the spring of 1999. The MITACS network covers the whole country, with the participation of more than 285 researchers, 443 students and postdoctoral fellows, working in collaboration with more than 144 partner organizations. The network includes 35 research projects and three consortiums affiliated with 31 universities spread over 17 Canadian cities. MITACS has just completed its fourth year of existence and is already engaged in renewing its NCE grant for another cycle of seven years to begin in 2005.

The fourth annual meeting took place at the National Arts Centre in Ottawa in May 2003. Ottawa's Interchange followed by a day of mini-courses were held just prior the annual meeting. This showed MITACS' commitment to the training of highly qualified personnel and its willingness to help them find careers in mathematics in Canada.

During the Interchange, 91 posters were presented in the poster competition. This was a large increase on last year's participation. Three First Prizes, three Second Prizes, and four Third Prizes were awarded. A complete list of the winners, as well as their picture, can be found on the MITACS web site at www.mitacs.math.ca/AC2003. During the Banquet of the Annual Meeting, a special tribute was given to Dr. Nassif Ghoussoub for his longstanding contribution to MITACS.

The Head Office management team grew during the year. Indeed, Jim Brookes joined MITACS as Chief Operating Officer while John Stockie became Associate Scientific Director.

Many new MITACS initiatives were launched this year, including an Industry-University Internship Program and the MITACS Interchanges. The first MITACS Interchange took place in Halifax in March 2003. Many new research programs were funded, including one on the spread of infectious diseases following the rise of the SARS epidemic.

Other MITACS activities include:

Summer School on Quantum Information Processing
July 16-20, 2002

Séminaires MITACS - CRM - CIRANO - DIRO sur l'apprentissage statistique
Fall 2002 - Winter 2003

Ncm_2 - MITACS Portfolio Choice Conference
March 7, 2003

Simulation Based and Finite Sample Inference in Finance
May 1-3, 2003

Conference on Financial Econometrics
May 9-10, 2003

RM2003 : Revenue management workshop
May 15-16, 2003

Workshop on Cryptographic reduction of quantum and classical protocols
May 20-23, 2003

International Summer School on Multiple Critical Decision Aid 2003
May 26 to June 6, 2003

Awards, Distinctions and Landmarks

Researchers play a key role in a research centre such as ours and we are particularly proud of the group that we have assembled. Their scientific and academic influence is outstanding. Here is a short list of the main prizes and awards that they have received in the last year.

S.Twareque Ali of Concordia University is the director of the Institut des sciences mathématiques (ISM).

André Bandrauk from Université de Sherbrooke was awarded a Canada Research Chair in Computational and Photonic Chemistry.

Henri Darmon was awarded the Ribenboim Prize for distinguished research in number theory by the Canadian Number Theory Association in 2002. He was also the 2003 Earle Raymond Hedrick Lecturer of the Mathematical Association of America, and won the Carrie Derick Award for Excellence in Graduate Supervision and Teaching from McGill.

Michel Delfour of Université de Montréal received a John Simon Guggenheim Memorial Foundation fellowship for the year.

Adrian Iovita from Concordia University was appointed as a Canada Research Chair in Research in Number Theory in January 2003.

Dmitry Jakobson was appointed a William Dawson Scholar at McGill in 2003.

Niky Kamran was awarded a James McGill Professorship at McGill in 2003.

Dmitry Korotkin was named to a Concordia University Research Chair.

Jim Ramsay was president of the Statistical Society of Canada for the year.

Thomas Ransford of Université Laval was awarded a Canada Research Chair in Spectral Theory.

Christiane Rousseau of Université de Montréal continues as president of the Canadian Mathematical Society of Canada until June 2004.

David Sankoff of the University of Ottawa is the first ever recipient of the Senior Scientist Accomplishment Award of the International Society for Computational Biology.

Pavel Winternitz of Université de Montréal was enrolled as a member of the Academia Mexicana de Ciencias in April 2003.

Keith Worsley of McGill University was the P.C. Mahalanobis Lecturer at the Indian Statistical Institutes in 2003.

Research Laboratories

The CRM now encompasses several research laboratories at the heart of the Québec mathematical community. These research centers act as focal points for local scientific activity and participate actively in the science direction of the CRM.

CICMA

Centre Interuniversitaire en Calcul Mathématique Algébrique

This centre comprises researchers working in number theory, group theory and algebraic geometry. Contemporary number theory follows two major courses. On the one hand, there is the theory of special values of L-functions attached to arithmetic objects, originating in the work of Gauss and Dirichlet and leading to the modern conjectures of Deligne, Beilinson and Bloch-Kato. On the other hand, the Langlands program postulates a close link between arithmetic L-functions and automorphic representations. An area where these two currents intersect is the study of elliptic curves. The center is particularly well represented in this regard with Darmon, Iovita, and Kisilevsky. On the group theory side, Kharlampovich and Miasnikov are world-renowned specialists on group varieties and McKay is one of the originators of the moonshine program.
Among the problems to be studied by the group in the coming years include the construction of rational points on elliptic curves both from algorithmic and theoretical viewpoints; Zeta functions of varieties over finite fields on the algorithmic approach; canonical lifting of elliptic curves and Abelian varieties; cryptography, Abelian varieties, and many aspects of analytic number theory.

Members of the laboratory:

Director
Henri Darmon (McGill)
Algebraic number theory, geometry, arithmetic, L-functions, diophantine equations, elliptic curves.

Chris J. Cummins
(Concordia)
Group theory applications to mathematical physics, modular functions and their relation to sporadic groups.

Chantal David (Concordia)
Elliptic curves, Drinfeld modules.

Jean-Marie De Koninck
(Laval)
Analytic number theory: distribution of prime numbers, factorisation of numbers, asymptotic behaviour of arithmetic functions, Riemann zeta function.

Dave Dummit (Vermont)
Algebraic number theory, arithmetic algebraic geometry, computational mathematics.

David Ford (Concordia)
Computational number theory.

Eyal Goren (McGill)
Arithmetic geometry, algebraic number theory, moduli spaces of Abelian verieties, Hilbert modular forms, p-adic modular forms.

Andrew Granville
(Montréal)
Algebraic number theory, arithmetic geometry, combinatorics.

Adrian Iovita
(Concordia)
Number Theory.

Olga Kharlampovich
(McGill)
Combinatorial theory of groups and Lie algebras.

Hershy Kisilevsky
(Concordia)
L-functions, Iwasawa theory, elliptic curves, class field theory.

Claude Lévesque (Laval)
Algebraic number theory, units, class number, cyclotomic fields.

Michael Makkai (McGill)
Mathematical logic.

John McKay (Concordia)
Computational group theory, sporadic groups, computation of Galois groups.

Alexei Miasnikov (McGill)
Group theory.

Ram Murty (Queen's)
Number Theory: Artin's conjecture, Elliptic curves, Modular Forms, Automorphic forms, Langlands Program, Selberg's conjectures, Sieve Methods, Cryptography.

Jonathan Pila (McGill)
Number theory, especially algorithmic and diophantine problems.

Ravi Ramakrishna
(Cornell)
Galois representations, modular forms, elliptic curves.

Damien Roy (Ottawa)
Transcendental Number Theory.

Peter Russell (McGill)
Algebraic geometry.

Francisco Thaine (Concordia)
Cyclotomic fields, cyclotomy, rational points on curves.

Highlights of the activities of the laboratory and of its members in 2002-2003:
The 2002-2003 academic year was an exciting one for CICMA, and was marked by the arrival of two new members, Andrew Granville (hired to a Canada Research Chair) at the Université de Montréal and Jonathan Pila at McGill.

Adrian Iovita led a successful seminar on Main Conjectures of Iwasawa Theory for Elliptic Curves in the Supersingular Setting, which has led to a joint paper with Darmon.

The Quebec-Vermont Number Theory seminar continued to meet regularly, once every two weeks (sometimes more).

Goren and Darmon were organizers of the Second CICMA-CRM Far Hills Workshop, "The Langlands' Program and its applications."

Pila spent 2002/03 at the IAS. He was an invited speaker at the Lenstra Treuerfeest (conference for Lenstra's retirement from UC Berkeley). He also coorganized, with Lenstra and Pomerance, a workshop at the AIM (Palo Alto) on "Future directions in algorithmic number theory".

Jean-Marie de Koninck was awarded the Abel Gauthier Prize by l'Assoiciation mathematique du Quebec in 2002.

Darmon was awarded the Ribenboim Prize for distinguished research in number theory by the Canadian Number Theory Association in 2002. This prize has only once previously been awarded, in 1999 to Granville. Darmon was also the 2003 Earle Raymond Hedrick Lecturer of the Mathematical Association of America, and won the Carrie Derick Award for Excellence in Graduate Supervision and Teaching from McGill.

The vibrant CICMA post-doctoral program continued unabated, with the presence of seven postdoctoral fellows; Natalia Archinard (PhD ETH 2001), Adam Logan (PhD Harvard 1999), Nathan Ng (PhD UBC 2001), Ambrus Pal (PhD Columbia 2000), Amritanshu Prasad (PhD Chicago 2001), Anupam Saikia (PhD Cambridge 2000), Mak Trifkovic (PhD Harvard 2002).

Centre interuniversitaire de recherches en géométrie et topologie

Geometry and topology are fundamental disciplines of mathematics. Their richness and vitality throughout human history reflects their deep link to our experience of the universe. They are at a crucial crossing point of modern mathematics and in effect several domains of mathematics have recently shown a strong trend towards a geometrization of ideas and methods: two cases in point are mathematical physics and number theory. During the last fifteen years, a group of researchers of international calibre in geometry and topology has been hired by Quebec universities. The research centre, based at UQAM, now comprises fifteen professors-researchers.
The main themes to be pursued in the coming years include Dehn surgery and Thurston geometrization; quantization of Hitchin systems and geometric Langlands program; classification of special Kähler metrics; the study of symplectic invariants, especially in dimension 4; Hamiltonian dynamical systems.

Members of the laboratory:

Director
Steven Boyer (UQAM)
Topology, manifolds, knot theory, 3-dimensional manifolds, Dehn surgery, character varieties.

Syed Twareque Ali (Concordia)
Coherent states, wavelets, quantization techniques, harmonic analysis, Wigner functions.

Vestislav Apostolov (UQAM)
Differential geometry, relativity and gravitation, general relativity, complex and symplectic 4-dimensional manifolds, (almost) Hermitan Kähler and Einstein metrics.

Abraham Broer
(Montréal)
Algebraic geometry, algebraic transformation groups, Lie theory, representation theory, commutative algebra, invariant theory.

Olivier Collin (UQAM)
Low-dimensional topology, differential geometry, gauge theory.

Octavian Cornea
(Montréal)
Algebraic topology, dynamical systems.

John Harnad (Concordia)
Mathematical physics, classical and quantum physics, geometrical methods, integrable systems, group theoretical methods, random matrices, isomonodromic deformations, isospectral flows.

Jacques Hurtubise (McGill)
Algebraic geometry, integrable systems, gauge theory, moduli spaces.

André Joyal (UQAM)
Algebraic topology, theory of categories.

Niky Kamran (McGill)
Differential geometry, partial differential equations.

François Lalonde
(Montréal)
Symplectic topology and geometry, global analysis on manifolds, infinite dimensional transformation groups.

Iosif Polterovich (Montréal)
Complex analysis, functional analysis, spectral theory, potential theory, Jensen measures.

Peter Russell (McGill)
Algebraic geometry.

Tadashi Tokieda
(Montréal)

Daniel Wise (McGill)
Algebraic topolobgy, algebra, finite residual groups, low dimensional topology, 3-dimensional manifolds, coherent groups.

Highlights of the activities of the laboratory and of its members in 2002-2003:
It has been a year of growth and restructuring for CIRGET. We welcomed three new members:
- Octav Cornea, UdM, algebraic topology, dynamical systems.
- Iosif Polterovich, UdM, geometric applications of spectral analysis.
- Dani Wise (McGill), geometric group theory, low-dimensional topology.

With this increase in numbers CIRGET has been organised into two teams whose themes are:
- the study of smooth manifolds and other geometric objects from the topological, algebraic and analytic viewpoint (Team leader : S. Boyer).
- the theoretical development of symplectic geometry and the application of geometric methods in the study differential equations which arise in mathematical physics (Team leader : F. Lalonde).

Both teams were awarded FQRNT grants in the 2002-03 competition.

Our seminars have been quite active. There were 28 speakers in the geometry-topology seminar organized by Olivier Collin of which 19 were from outside Montreal. The geometric group theory seminar, organized by Dani Wise, met twenty times. We have also run a weekly working group on contact topology in dimension 3.

One of this year's highlights was the creation of the CIRGET JUNIOR seminar. The goal of this weekly meeting is to cover topics which are essential for their research development, but rarely seen in our graduate courses. It is run by our graduate students, who also do the lecturing. Gabriel Indurskis was the principal organizer.

Two workshops organized by CIRGET took place in April 2003. The first, a joint project with LaCIM and the CRM – the Journées Joyal — was a celebration of the mathematical work of André Joyal, one of our most distinguished colleagues and a CIRGET member. The second was "Contact Topology in Montreal," organized by Olivier Collin. Both are described elsewhere in this report.

We had an impressive group of postdoctoral fellows this year: I. Bumagin, M. Bertola, A. Deruelle, D. Gomez-Ullate, F. Harou, S. Maillot, D. Matessi, E. Mayrand, R. Mohammadalikhani, R. Moraru, A. Penskoi, M. Pinsonnault, A. Sikora, D. Vassilev, and S. Venereau. Of the Fellows who finished or are finishing this year, M. Bertola obtained a tenure track position at Concordia, A. Sikora is spending a year at the IAS before going to SUNY Buffalo on a tenure track position, M. Pinsonnault and R. Moraru are in Toronto on postdoctoral fellowships, S. Mailhot has been offered a position at Strasbourg, and R. Mohammadalikhani has obtained an NSERC postdoctoral fellowship.

This year's visitors to CIRGET included
- Felix Finster (Regensburg) who worked with Niky Kamran on black hole geometry.
- Roger Fenn (Sussex) who worked with Steven Boyer on the theory of biracks and their application to 3-manifold topology.
- Paul Gaudichon (École Polytechnique Paris) and D. Calderbank (Edinburgh) who worked with Vestislav Apostolov on Hamiltonian 2-forms in Kaehler Geometry.

Finally, it is a great pleasure to congratulate our colleague Niky Kamran who was awarded a James McGill Professorship by McGill University.

Mathematical Analysis Laboratory

At the same time classical and central to modern mathematics, analysis involves studying continuous systems from dynamical systems to solutions of partial differential equations and spectra of operators. The analysis laboratory was formed just one year ago. Currently the laboratory has 33 members working at eight different universities in Quebec and France, with a particular concentration at Université de Montréal, Laval and McGill. Many of the main currents of modern analysis are studied by the group. Among the research subjects of the group, one finds conjectures on random waves and quantum chaos, Hamiltonian formalism in statistical mechanics far from equilibrium, asymptotic properties of wave functions, Hilbert 16th problem and Hardy conjecture.

Besides four active seminars (McGill, Laval, Seminar in Nonlinear Analysis and Dynamical Systems (Montréal), Analysis and Related Topics (joint colloquium series, University of Sherbrooke and Bishop's University), members of the lab are currently organizing a Year in Geometric and Spectral Analysis at CRM in 2003-2004 which will include twelve conferences and workshops.

Members of the laboratory:

Director

Dmitry Jakobson (McGill)
Pure mathematics, global analysis, spectral geometry, quantum chaos, harmonic analysis, eigenvalues and eigenfunctions.

Line Baribeau (Laval)
Complex and functional analysis, Banach algebras, holomorphic iterations, discrete groups.

Francis Clarke
(Claude Bernard, Lyon 1)
Nonlinear and dynamic analysis, control theory, calculus of variations.

Galia Dafni (Concordia)
Harmonic analysis, partial derivative equations, complex variables.

Donald Dawson (Carleton)
Probability, stochastic process.

S.W. Drury (McGill)
Harmonic analysis, matrix theory.

Richard Duncan
(Montréal)
Ergodic theory, probability.

Richard Fournier
(Dawson College)
Probability, stochastic processes.

Marlène Frigon
(Montréal)
Nonlinear analysis, differential equations, fixed point theory, critical point theory, multivalent analysis.

Martin Gander (McGill)
Domain decomposition, preconditioning.

Paul Gauthier (Montréal)
Complex analysis, holomorphy, harmonicity, analytic approximation.

Pawel Gora (Concordia)
Ergodic theory, dynamic systems, fractal geometry.

Frédéric Gourdeau (Laval)
Banach algebras, cohomology, amenability, functional analysis.

Kohur GowriSankaran
(McGill)
Potential theory.

John Harnad (Concordia)
Mathematical physics, classical and quantum physics, geometrical methods, integrable systems, group theoretical methods, random matrices, isomonodromic deformations, isospectral flows.

Vojkan Jaksic (McGill)
Quantum mechanics, statistics, random Schrödinger operators.

Tomasz Kaczynski
(Sherbrooke)
Topological methods, Conley index, applications to dynamical systems.

Niky Kamran (McGill)
Differential geometry, partial differential equations, mathematical physics.

Ivo Klemes (McGill)
Harmonic analysis, trigonometric series.

Paul Koosis (McGill)
Harmonic analysis.

Dmitry Korotkin (Concordia)
Integrable systems, isomonodromic deformations, classical and quantum gravity, Frobenius varieties.

Javad Mashreghi (Laval)
Complex analysis, harmonic analysis, Hardy spaces.

Nilima Nigam (McGill)
Applied analysis, numerical methods in electromagnetism.

Yiannis Petridis (CUNY, Lehman College)
Automorphic Forms and
Spectral Theory.
L-Functions, Quantum chaos.

Iosif Polterovich
(Montréal)
Complex analysis, functional analysis, spectral theory, potential theory, Jensen measures.

Thomas Ransford (Laval)
Complex and harmonic analysis, functional analysis and theory of operators, spectral analysis, potential theory.

Dominic Rochon (UQTR)
Numbers, analysis, dynamic complexes.

Christiane Rousseau
(Montréal)
Dynamical systems, bifurcations, qualitative theory, polynomial systems, analytic invariants, integrable systems.

Dana Schlomiuk
(Montréal)
Global analysis, dynamical systems, singularities, bifurcations, algebraic curves, primary integral.

Georg Schmidt (McGill)
Control of partial differential equations.

Ron Stern (Concordia)
Functional analysis and theory of operators, linear and non-linear systems, non-smooth analysis, stability, optimal order.

John Toth (McGill)
Spectral theory, semi-classical analysis, micro-local analysis, Hamiltonian mechanics.

Highlights of the activities of the laboratory and of its members in 2002-2003:

The members of laboratory held three FQRNT team grants (team leaders were T. Ransford, C. Rousseau, D. Jakobson).

It is a great pleasure to congratulate our colleagues Niky Kamran who was awarded a James McGill Professorship by McGill University; Tom Ransford who was awarded a CRC chair at Laval University; and our director Dmitry Jakobson who was awarded a Dawson Professorship by McGill University.

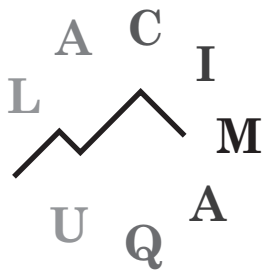
In addition to the very active seminar programmes (Analysis Seminars at Laval (27 speakers) and McGill (22 speakers), Nonlinear Analysis and Dynamical Systems seminar at the University of Montreal (19 speakers), Complex Analysis seminar at the University of Montreal (7 speakers)) the following conferences have been recently organized by the members of the laboratory:

- AMS meeting, UdeM, May 2002: Session in “Potential Theory” (org. Gauthier, Gowri et al).
- AMS meeting, UdeM, May 2002: Session in “Function Spaces in Harmonic Analysis and PDEs” (org: G. Dafni, J. Xiao).
- AMS meeting, UdeM, May 2002: Session in “Spectral Geometry” (org. Jakobson, Petridis).
- Dynamical Systems Day, July 2002 at CRM (org. C. Rousseau et D. Schlomiuk).
- NATO Advanced Study Institute, CRM, July 2002: “ Normal forms, bifurcations and finiteness problems for differential equations” (org. Rousseau).
- CMS meeting, Laval, June 2002: Session in “Analysis” (org. Ransford).
- CMS meeting, Ottawa, December 2002: Session in “Microlocal analysis and PDE’s” (org. V. Ivrii, J. Toth).

A Joint Colloquium Series (University of Sherbrooke and Bishop’s University) in Analysis and Related Topics has been recently established and partially funded by the Analysis Lab.

The following postdoctoral fellows have been recently supervised by the members of the laboratory: J. Xiao, Y. Petridis, D. Vassilev, A. Bourget, K. Kellay, H. Shriri, P. Vitse, A. Blanco, M. Boumazgour, F. Colin.

The members of the laboratory have hosted the following long-term visitors: J. Derezinski (Warsaw), C.-A. Pilllet (Toullon) and L. Rey-Bellet visiting V. Jaksic, F. Nazarov visiting P. Koosis and D. Jakobson, V. Havin visiting P. Koosis, R. Brooks visiting D. Jakobson, J. Xiao visiting G. Dafni, Y. Petridis visiting J. Toth, Z. Djdali (visiting I. Polterovich), S. Zelditch (visiting D. Jakobson, J. Toth and V. Jaksic).



LaCIM
(Laboratoire de combinatoire et d'informatique mathématique)

LaCIM is a research laboratory of the Université du Québec à Montréal, which was officially established in 1989. Its research activities concentrate on enumerative algebra, algebraic combinatorics, computer science and their applications to other scientific domains, such as the analysis of algorithms, statistical mechanics and computational biology. Since 2002 LaCIM is one of the eight research laboratories of the CRM.

Research areas

Discrete mathematics has lately become an important field of practical research, witness the new heading in Mathematical Reviews 05E of algebraic combinatorics with subheadings indicating interactions with the newest areas of mathematics, such as group representations, quantum groups, discrete algebraic geometry, special functions. Combinatorics benefits from the revival of the concrete computational aspect in mathematics after decades of abstract structuralism. Algebra is enriched in a fundamental manner by combinatorics, as the commutative algebra book by Eisenbud demonstrates, highlighting constructive geometric methods. Moreover, combinatorics applies to computer sciences (theory of automata, analysis of algorithms), to statistical physics (computation of configuration spaces and of critical exponents, discrete models), bio-informatics (combinatorics of words applied to genomic sequences). The youth, dynamism, utility and applicability of this research domain are highlighted in the modern world, where discrete structures (trees, graphs, permutations) are more and more present in communications, networks and research engines, of which the use is growing exponentially in this 21st century.

The researchers

The laboratory is comprised of twelve principal researchers, ten of them professors at UQAM, one at McGill and one at UdM; of eleven associate members in North America, one in Chile and two in Europe. Notably, Christophe Reutenauer (regular member) and Nantel Bergeron (associate member, York University) hold Canadian research chairs. A team of four LaCIM members is supported by a grant from FCAR. André Joyal, past member of LaCIM and current member of CIRGET, is involved in several activities at LaCIM, both formal and informal. LaCIM is the largest research group in combinatorics in Canada and is known worldwide in its field. The UQAM team has contributed to the emergence and establishment of combinatorics as a mathematical discipline. For example, several LaCIM members have played and continue to play an important role in the organization of the international colloquium Séries formelles et combinatoire algébrique, which is bilingual and is held yearly, alternately in Europe and North America. Its success is without question.

Research activities at LaCIM

A. Joyal enriched the counting theory of Polya by including the theories of group representations and symmetric functions. Under the name of theory of species, this theory marked the emergence of the UQAM combinatorics group about twenty years ago. From that time research has diversified greatly at LaCIM: a) classical enumerative combinatorics and its applications (counting of discrete configurations and planar maps); b) algebraic combinatorics; c) theoretical computer science; d) bio-informatics.

Members of the laboratory

Director
Christophe Reutenauer (UQAM)
Algebraic combinatorics, non-commutative algebra, automata, codes, free algebras.

Marcelo Aguiar
(Texas A&M University)
Combinatorics and algebra.

Robert Bédard (UQAM)
Representations of finite groups, Lie theory.

Luc Bélair (UQAM)
Mathematical logic, model theory.

Anne Bergeron (UQAM)
Bio-informatics.

François Bergeron (UQAM)
Combinatorics, algebras, representations of finite groups.

Nantel Bergeron (York Univ.)
Applied algebra.

Srecko Brlek (UQAM)
Combinatorics of words, algorithmics.

Pierre Bouchard (UQAM)
Commutative algebra, algebraic geometry and combinatorics.

Cedric Chauve (UQAM)
Enumerative combinatorics, trees, bio-informatics.

Sylvie Corteel (CNRS, France)
Combinatorics.

Adriano Garsia
(Univ. of California at San Diego)

Sylvie Hamel (Montréal)
Bio-informatics and algorithms, language and automaton theory, algebraic combinatorics.

André Joyal (UQAM)
Algebraic topology, theory of categories.

Gilbert Labelle (UQAM)
Enumerative combinatorics, analysis.

Jacques Labelle (UQAM)
Combinatorics, topology.

Louise Laforest (UQAM)
Data structures, combinatorics, asymptotical analysis, quaternary trees.

Pierre Leroux (UQAM)
Combinatorics.

Vladimir Makarenkov (UQAM)
Computational biology, mathematical classification.

Denis Thérien (McGill)
Theory of complexity of computation, logic, combinatorics, probability.

Xavier G. Viennot (LaBRI, Univ. Bordeaux I)
Combinatorics and algorithmics.

Timothy Walsh (UQAM)
Algorithmics, enumerative combinatorics, graphs.

Highlights of the activities of the laboratory and its members in 2002-03:

There continues to be a high level of activity at LaCIM this year. Since its inception more than 20 years ago, the Combinatorics and Theoretical Computer Science Seminar attracts on average 25 attendees per seminar, a level of participation that reflects the dynamism of the laboratory and of its research groups. This year, there were 27 talks presented in the seminar series.

Among this year's visitors to the laboratory were M. Nivat (Académie des Sciences, Paris), a leader and innovator in theoretical computer science in France, and M. Mendes France (Bordeaux), a specialist in combinatorics as well as a renowned number theorist. Nivat and Mendes France are in fact collaborating with researchers of LaCIM. Other notable visitors to LaCIM this year were J. Karhumaki (Finland), C. Kassel (Strasbourg) and D. Zeilberger (Rutgers).

There were 5 postdoctoral fellows in 2002-2003: Manfred Schocker (Ph.D., Kiel, Germany) who is currently a postdoctoral fellow at Oxford (and who produced ten articles during his 12-month stay at LaCIM); Frédéric Chapoton (Ph.D., Paris; who had the opportunity to work with Fomin and Zelevinsky during his stay here; and who now has a research position at CNRS); R. Biagoli (Ph.D., Rome); Mercedes Rosas (Ph.D., Boston); Andrei Gagarin (Ph.D., Winnipeg); and Sara Faridi (Ph.D., Ann Arbor).

There were thirteen Master's students registered, two of whom completed their degree in 2002-2003. LaCIM also had ten doctoral students, two of whom obtained their doctorate this year.

In the summer of 2002, we had eleven summer students (undergraduates at UQAM) starting out in research, as well as two students from Brébeuf and Marianopolis colleges. They were supervised by our professors and participated in the "combinatorics mini school".

The members of LaCIM, jointly with the CRM, organized a symposium in combinatorics for the CMS summer meeting at Université Laval in June 2002, as well as organizing the Journées Joyal in collaboration with CIRGET and the CRM in April 2003.

Several researchers at LaCIM were invited speakers of national and international conferences: F. Bergeron (SIAM, San Diego, August 2002); A. Bergeron (Mathematics and Phylogeny, IHP Paris, 2003; Algorithms in Biology, Lyon, 2003); F. Bergeron and G. Labelle (50th Séminaire Lotharingien de Combinatoire, France, March 2003); and C. Reutenauer (57th Colloque des Sciences Mathématiques, UQAM, April 2002; Journées Montoises in Theoretical Computer Science, Montpellier, September 2003; Plenary session at the CMS summer meeting, Université Laval, June 2002).

LaCIM, through its researchers A. Bergeron, V. Makarenkov and C. Chauve, is making its mark in bioinformatics. In particular, these three are part of the project on "Comparative and Integrative Bioinformatics," which brings together researchers from the four Montréal universities and from Université Laval, and that received a grant of $500,000 from Génôme Québec.

The Governor General's Award was bestowed upon Ralf Schiffler for his thesis under the supervision of R. Bédard, a regular member of LaCIM.

The book entitled *Algebraic Combinatorics on Words* and written collectively by several authors (including C. Reutenauer), was published by Cambridge University Press in 2002 under the pseudonym M. Lothaire.

Applied Mathematics laboratory

Applied and Computational Mathematics is a very active area of research with a long tradition as well as many young faculty members in the greater Montreal area. With modern computing equipment, it has become possible to simulate problems and compute solutions which one was only able to dream of a few decades ago: this has been a tremendous driving force in recent developments in applied and computational mathematics.

The laboratory members work in a wide range of applications (fluids, solids, physics, biology etc.) using a wide variety of tools (optimisation, numerical analysis, dynamical systems, etc). The objective of the new applied math laboratory is to further encourage scientific exchanges both amongst its members and outside group. It is characterized by the intensity of its multidisciplinary collaborations, with all its members working on the development of mathematical models and numerical methods for applications to science and engineering. The laboratory has two regular seminars running during the academic year, a weekly applied mathematics seminar and a biweekly computational science and engineering seminar. It also supports postdoctoral fellows and summer students as well as Canadian and international visitors.

Members of the laboratory:

Directors

Anne Bourlioux
(Montréal)
Modeling, numerical simulation in turbulent combustion.

Martin Gander
(McGill)
Domain decomposition, preconditioning.

Paul Arminjon (Montréal)
Numerical methods in fluid mechanics.

André Bandrauk
(Sherbrooke)
Quantum chemistry.

Peter Bartello (McGill)
Turbulence, CFD.

Michel Delfour
(Montréal)
Control, optimization, design, shells, calculus, biomechanics.

Tony Humphries (McGill)
Numerical analysis, differential equations.

Sherwin A. Maslowe (McGill)
Asymptotic methods, fluid mechanics.

Nilima Nigam (McGill)
Applied analysis, numerical methods in electromagnetism.

Georg Schmidt (McGill)
Control of partial differential equations.

Jean-Paul Zolésio (INRIA)
Control, optimization.

Highlights of the activities of the laboratory and of its members in 2002-2003:

The members of the new applied mathematics laboratory have been very active in research as well as in training, with a very large group of supervised students and post-docs. One characteristic of this lab is its members involvement with other research groups:for example, Nilima Nigam is involved with RQMP (Regroupement québecois des matériaux de pointe), M. Gander and M. Delfour with Giref, A. Bourlioux with Cerca, and P. Bartello and A. Bandrauk have joint or primary appointements outside mathematics etc. – because of its format, this reports hardly reflects this type of involvement. One objective of the new laboratory is to create an organized forum for the Montreal applied mathematicians, with more visibility within the mathematics community, to complement all the applied initiatives that already exist outside of mathematics. Integrating the applied mathematics seminars at University of Montreal and McGill will be one element of the strategy to unify the applied math community; the creation of an annual activity in numerical analysis targeted at the high performance computing community of Quebec – the Montreal Scientific Computing Days - will also be part of the strategy to give it high visibility.

Four of the lab's ten regular members have been hired within the last four years (Bartello, Gander, Humphries, Nigam), with A. Humphries arriving just this past year from Sussex, England. With those new additions to the existing core of applied mathematicians, there exists now in Montreal a critical mass of active applied mathematicians and the timing for the creation of the lab could not be better.

Although the lab is just starting, three seminars in the field have been active this past year (or part of it): the applied math seminar (fall only), organized at University of Montreal by M. Delfour, the McGill applied math seminar, organized by N. Nigam, and the McGill computational science and engineering seminar, co-organized by P. Bartello – in all, 32 speakers.

For the first time, SIAM and CAIMS are holding a joint annual conference and it will take place in Montreal, June 2003. A. Bourlioux is on the scientific organizing committee, M. Delfour is one of the plenary speakers, N. Nigam, M. Gander, P. Tupper, T. Humphries, and A. Bandrauk will be involved as mini-symposium organizers or speakers.

Martin Gander was an invited professor at the University of Geneva for the 2002-2003 academic year.

The lab hosts a large group of 11 post-docs. One should add to this list Paul Tupper, NSERC postdoc with M.Grant, physics, McGill – Paul is already a very active member of the lab's seminar and is expected to become more so in the future.

Congratulations to the " McGill team", including Gander, Nigam, Tupper and students Kwok and Loisel, which was one of the twenty winners of the SIAM "100 Digits -100 Dollar" contest organized by Prof. N. Trefethen, Oxford.

Congratulations to M. Delfour, who is the recipient of one of the prestigious Guggenheim fellowships for 2003-2004.

A. Bandrauk, M. Delfour and C. Lebris (EPNC, Paris) were the organising committee for the " Workshop on Quantum Control", Oct 6-11 2002 (CRM).

Mathematical Physics Laboratory

Mathematical physics represents one of the traditional strengths of the CRM ever since the arrival of J. Patera and P. Winternitz at the Centre at the beginning of the 1970s. The group has grown considerably in the last few years through the hiring of new researchers, and at present has a total of twenty full-time academic researchers affiliated to seven Québec universities. Working with these at present are fourteen postdoctoral fellows, two research assistants, about forty graduate students, and numerous scientific collaborators who come for visits of various durations throughout the year.
The group carries out research in several domains, including some of the most active research areas in mathematical physics, These include: classical and quantum integrable systems, with applications to nonlinear coherent fluids, plasmas and optics; quantum spin systems; analysis of partial differential equations and difference equations via symmetry; spectral theory of Schrödinger operators; random matrices; quasi-crystals; percolation; theory of conformal fields; quantization techniques; wavelet analysis for signal processing; and statistical mechanics, both classical and quantum.

Members of the laboratory:

Director
John Harnad (Concordia)
Mathematical physics, classical and quantum physics, geometrical methods, integrable systems, group theoretical methods, random matrices, isomonodromic deformations, isospectral flows.

Syed Twareque Ali
(Concordia)
Coherent states, wavelets, quantization techniques, harmonic analysis, Wigner functions.

Marco Bertola (Concordia)
Axiomatic quantum field theory, invariant theory of discrete groups, random matrices, isomonodromic deformations.

Chris Cummins (Concordia)
Group theory applications to mathematical physics, modular functions and their relation to sporadic groups.

Alfred Michel Grundland (UQTR)
Symmetry of differential equations in physics.

Richard L. Hall (Concordia)
Quantum mechanics, geometry, spectral inversion, many-body problem.

Jacques Hurtubise (McGill)
Algebraic geometry, integrable systems, gauge theory, moduli spaces.

Véronique Hussin
(Montréal)
Quantum mechanics, differential equations, Lie groups, Lie algebras, group deformations, supersymmetries.

Dmitri Jakobson (McGill)
Quantum Chaos, Spectral Geometry, Harmonic Analysis.

Vojkan Jaksic (McGill)
Mathematical physics, quantum statistical mechanics, random Schrodinger operators.

Niky Kamran (McGill)
Differential Geometry, partial differential equations, mathematical physics.

Dmitry Korotkin (Concordia)
Integrable systems, isomonodromic deformations, classical and quantum gravity, Frobenius varieties.

Fancois Lalonde (Montréal)
Symplectic topology and geometry, global analysis on manifolds, infinite dimensional transformation groups.

Jean LeTourneux
(Montréal)
Symmetry properties os systems, special functions.

Pierre Mathieu (Laval)
Conformal field theory, classical and quantum integrable systems, affine Lie algebras.

Jiri Patera (Montréal)
Applications of group theory,quasi-crystals, Lie algebras.

Yvan Saint-Aubin
(Montréal)
Conformal field theory, statistical mechanics, 2-dimensionalphase transition model.

John Toth (McGill)
Partial differential equations, mathematical physics and spectral theory.

Luc Vinet (McGill)
Symmetric properties of systems, special functions.

Pavel Winternitz (Montréal)
Methods of group theory in physics, nonlinear phenomena, symmetries of difference equations, superintegrability.

Associate Members:

Stéphane Durand
(Collège Edouard-Montpetit)
Classical and quantium physics, mathematical physics, simmetries, parasupersymmetries, fractional supersymmetries, KdV, quantum mechanics, relativity.

Carolyne Van Vliet
(Miami)
Non-equilibrium statistical mechanics, fluctuations and stochastic processes, quantum transport in condensed matter, electronic behavior in submicron quantum devices.

Highlights of the activities of the laboratory and of its members in 2002-2003:
It has been an active year for the MathPhys group. We welcomed one new full-time faculty member, Prof. Marco Bertola (Concordia), who was previously a CRM/ISM postdoctoral fellow. A number of awards and distinctions were accorded to members of the MathPhys group this year. We are very pleased to congratulate the recipients for their scientific contributions and continuing outstanding work, for which these honours give well deserved recognition:

- Pavel Winternitz was awarded the 2002 CRM/CAP prize for theoretical and mathematical physics, as well as being named member of the Mexican Academy of Science. He was also awarded the First Prize in Theoretical Physics of the International Institute or Nuclear Research in Dubna, Russia, for a series of articles on Contractions of Lie Algebras and Separation of Variables, (jointly with A.Izmestiev, G.Pogosyan and A.Sissakian).
- Dmitry Korotkin was named to a Concordia University Research Chair.
- Michel Grundland was awarded the Alan Richards Fellowship at the University of Durham.

There have been continued interactions and shared activities with the CIRGET group, in which several of our members also participate.

A new research team has been formed, concerned with symplectic geometry and the application of geometric methods to the study of differential equations which arise in mathematical physics. The participating members from the MathPhys group are: S.T. Ali, M. Bertola, J. Harnad, J. Hurtubise, N. Kamran, D. Korotkin, F. Lalonde (team leader).

A large number of scientific activities involving members of the MathPhys group took place throughout the past year. This included ongoing research collaborations as well as some new initiatives, participation and invited lectures given by members of the group at several national and international workshops and conferences, and organization of seminar series and workshops, both at the CRM and elsewhere. To list all these activities would be impossible within the space of this short summary report, so we limit ourselves to mentioning international conferences and workshops of which members of the group have been principal organizers, and a list of those seminars and workshop talks given at the CRM.

International conferences and workshops organized by members of the CRM MathPhys group:
- International Colloquium on Geometrical Methods in Physics, Bialowieza, Poland, July 2002. (S.T. Ali)
- International Workshop on Wavelets, Quantization and Differential Equations, Havana, Cuba, Feb. 2002. (S.T. Ali)
- International Colloquium on Group Theoretical Methods in Physics, Paris, July 2002. (International Advisory Committee members, S.T. Ali, P. Winternitz)
- CRM Workshop, “Symmetry in Physics. In memory of Robert T. Sharp”, September 12- 14, 2002, (Organzing committee members included: P.Winternitz (Chairman), J.Harnad, J.Patera).
- CRM Workshop, “Superintegrability in Classical and Quantum Systems”, September 16 - 22, 2002. (Organizing committee members included: P.Winternitz (Chairman), J. Harnad , P. Tempesta).

Statistics Laboratory

Statistics is undergoing a revolution in its techniques and in its approaches, stimulated by the presence of very large and complex data sets, as well as by the advent of powerful computational tools. The discipline is now attacking more complicated problems, such as images or data from genome analysis and is developing new methods for large-scale data, such as those from data mining. The laboratory's aim is to structure the Québec statistical community to take part in this revolution, at a time when there is a major renewal in professorial staff. This structure would also allow the statistical community in Québec to benefit from a new pan-Canadian program in complex data analysis organized by the three Canadian mathematical institutes. The laboratory brings together leading minds in statistical training in Quebec who are working on subjects such as statistical learning and neural networks, functional data analysis, statistical image analysis, dependence structures, Bayesian analysis, time series and financial data analysis, and resampling methods.

Members of the laboratory:

Director

Christian Léger (Montréal)
Resampling methods, adaptive estimation, model selection, robustness, applications in data mining.

Jean-François Angers (Montréal)
Desision theory, Bayesian statistics, robustness with respect to prior information, function estimation.

Yoshua Bengio (Montréal)
Statistical learning algorithms, neural networks, nucleus models, probabilistic models, data mining, applications in finance and statistical language modelling.

Martin Bilodeau (Montréal)
Multidimensional analysis, decision theory, asymptotic methods.

Yogendra Chaubey (Concordia)
Sampling, linear models, resampling, survival analysis.

René Ferland (UQAM)
Probability, statistic processes, applications to mathematical finance.

Christian Genest (Laval)
Multidimensional data analysis, dependence measures, nonparametric statistics, decision theory, applications in actuarial science, finance and psychology.

Nadia Ghazzali (Laval)
Multidimensional data analysis, neural networks and genetic algorithms, applications in astrophysics and biostatistics.

Brenda MacGibbon (UQAM)
Mathematical statistics, decision theory, biostatistics.

Francois Perron (Montréal)
Decision theory, multidimensional data analysis, Bayesian statistics.

Jim Ramsay (McGill)
Functional data analysis, smoothing and nonparametric regression, curve registration.

Bruno Rémillard (HEC)
Probability, empirical processes, time series, nonlinear filtering, applications in finance.

Louis-Paul Rivest (Laval)
Linear models, robustness, directional data, sampling, applications in finance.

Roch Roy (Montréal)
Time series analysis, predictive methods, applications in econometrics and epidemiology.

David B. Wolfson (McGill)
Changepoint problems, survival analysis, Bayesian statistics, optimal design, applications in medicine.

Keith Worsley (McGill)
Statistics of brain mapping, geometry of random images in medicine and astrophysics.

Highlights of the activities of the laboratory and its members in 2002-2003:
The main scientific achievement of the laboratory this year was creating the CRM-ISM Statistics Colloquium in the winter of 2003. Previously, each of the four Montréal universities ran its own seminars on a more-or-less weekly basis. With so many seminars in statistics, few researchers would go from one university to another to attend the talks. As well, the lack of available funding resulted in fewer invited speakers. The four Montréal universities pooled their efforts towards the new colloquium and the results were very positive: researchers and graduate students attended the colloquium in greater and greater numbers as the weeks progressed. At the same time, the statistics seminar at Université Laval continued with its usual fervour. In November 2002, Bayesian Statistics Day was organized to take advantage of the presence of the recipient of the CRM-SSC Prize. The invited speakers were Lawrence Joseph (McGill), Hal Stern (UC Irvine), and Larry Wasserman (Carnegie Mellon), the recipient of the CRM-SSC Prize. In June 2003, a workshop entitled "Advances in Machine Learning," organized by Yoshua Bengio, took place during the Theme Year on Mathematics in Computer Science.

One part of the year's achievements was the renewal of Keith Worsley's FQRNT group grant on statistical methods for spatio-temporal data of brain mapping, as well as a new grant for the research group headed by Roch Roy on time series modelling and applications in finance and macroeconomy. Other members of the laboratory work with the group headed by Christian Genest.

The academic and scientific leadership of the group was recognized in many ways throughout the year. Keith Worsley was once again distinguished by being named the P.C. Mahalonibis Lecturer of the Indian Statistics Institute. Previous P.C. Mahalonibis Lecturers included S. Karlin, T.W. Anderson, P. Hall, P. McCullagh, I.A. Ibragimov, D.R. Cox, J.O. Berger and J. Wu! Jim Ramsay was president of the Statistical Society of Canada and Jean-François Angers was its public relations officer. Yoshua Bengio was on the selection committee for NSERC Discovery Grants in computer science, and Christian Leger played the same role for the statistics committee. Yoshua Bengio was on the organizing committee for the conference Learning 2002, and Christian Léger was on the program committee of Joint Statistical Meetings 2002 in New York.

At times research has surprising spin-offs. In data mining, a company was created by three doctoral students in statistical learning and Professor Bengio. The startup company has already won many prizes including the innovation contest of the Centre of Entrepreneurship, as well as the startup company contest of *La Soirée des Anges Financiers* and the regional finals in the category "Technological Innovation" of the Québec Entrepreneurship Contest.

The members of the Statistics Laboratory are dedicated to the training of highly qualified personnel. In fact, approximately 40% of graduate students in mathematics and statistics departments are in statistics. However, the job market in statistics is such that postdoctoral fellows are rather rare. Nevertheless, the postdoctoral fellows P.-J. L'Heureux, G. Caporossi, X. Wang, R. Nuzzo, I. Gentil, C. Bouhaddioui and P. Lafaye de Micheaux have contributed greatly to the activities of the members of the laboratory.

The laboratory had several long-term visitors:

- Yves Grandvalet (CNRS) worked with Yoshua Bengio on estimating the variance of cross-validation estimators;
- Michel Delecroix (ENSAI, Rennes, France) and Christian Genest explored semi-parametric estimation methods for multivariate data;
- Simplice Dossou-Gbete (Université de Pau et des Pays de l'Adour) collaborated with Nadia Ghazzali on a study of shape recognition;
- Subhash C. Kochar (Indian Statistical Institute) and Christian Genest studied dependence structures of order statistics of a random sample;
- Anne-Laure Fougères (INSA, Toulouse, France) spent half of her sabbatical year at Université Laval, where she carried out research in collaboration with Belkacem Abdous and Christian Genest on modelling and inference having to do with multivariate extremal values;
- Christian Francq (Université Lille III and GREMARS) visited Roch Roy to pursue research on goodness-of-fit tests for time series. During his stay, he also presented a series of three talks on ARMA models with non-independent linear innovations.

PhysNum CRM

PhysNum has the particularity of having been created at the CRM and a great part of its research activity takes place within its walls. This particularity, which contributes to the Centre's visibility within the field of applied mathematics, explains its relatively small size compared to the extent of its collaborations within the milieu of brain imaging in Montréal and elsewhere. PhysNum collaborates with Regroupement Neuro-Imagerie Québec (headed by Y. Johanette and J. Doyon), GRENE (headed by F. Lepore, Psychology, Univ. de Montréal), and the group Imagerie Quantitative of INSERM'S Unité 494 in Paris (headed by H. Benali). The greater part of financial resources areinvested on student researchers at the CRM. Our research with these groups pertains to mathematical imaging, essentially in medicine, within the following themes:

- Analysis and modeling of wavelets (thermodynamic formalism, graphic models);
- Fractal and multifractal analysis (analysis of materials, angiogenesis, turbulent signals)
- Probabilistic approach to the resolution of inverse problems (maximum entropy inference, independence graphs)

These tools are used in a number of clinical and cognitive domains detailed below. The different teams centred on neurology mentioned above are interested in the development of " fine methods" within their particular research domains and are thus interested in pursuing a longterm relationship

Members of the Laboratory:

Director

Bernard Goulard (Montréal)
Brain imaging.

Alain Arnéodo (ENS, Lyon)
Fractal and wavelets.

Habib Benali (INSERM, CHU Pitié-Salpêtrière, Paris)
Brain imaging.

Line Garnero
(CNRS UPR 640-LENA, Paris)

Frédéric Lesage (ART Recherches et Technologies Avancées Inc.)
Conformal theory, integrable systems, inverse problems.

Jean Marc Lina (CRM)
Wavelets, statistical modeling and brain imaging, algorithms for statistical learning.

Fahima Nekka (Montréal)
Fractal analysis.

Keith J. Worsley (McGill)
Geometry of random images in medicine and astrophysics.

Highlights of the activities of the laboratory and of its members in 2002-2003:

Cerebral imaging (MEG)

In the context of Magneto-Encephalography applied to the study of cerebral functional connectivity, important developments can be summarized as:

- Probabilistic model based on graphic models applied to hidden Markov variables and resolution of the inverse problem by maximal entropy,
- MiniMax approach on entropy and reduction of the *space of features* (space of data) MEG.
- PCA approach on the direct problem and reduction of the *space of sources* (space of dipoles distributed on the cortical surface) of activation. This study was conducted mostly by the members of the U494 unit headed by H. Benali at the INSERM.

The researchers developed (in a coordinated fashion) computing tools that permit the computation of simulated or real data.

The collaboration between CRM-INSERM (U494) was formalised by the nomination of H. Benali and J.M. Lina to the status of member researchers at both institutions. Also notable is the emergence of another international collaboration with

the Center of Excellence in Taiwan, which invited one of the group members (J.M. Lina) to give a series of seminars at the Central National University of Taipei.

Cerebral imaging (NIRS)

In a context similar to the preceding one, optical imaging offers possibilities of analysis of how the brain operates on objects, usually difficult to observe with conventional tools (IRM, MEG, EGG). One thinks of people with Parkinson's, young children including newborns, and so on. At the moment, there exists no robust method for detecting the active cortical zones from the infra-red (IR) optical signal interacting with the brain. Such a method, as is the case with MEG, must take into account certain knowledge about the solution. One speaks of the regularization of the inverse problem through a priori knowledge. The approach developed in MEG (see preceding section) is certainly transposable into the context of optical imaging. The goal being probably more interesting for neuroscientists because of the flexibility of the technique used (compared to IRM or MEG imaging), PhysNum has defined a research axis devoted to the resolution of the inverse problem for this kind of imaging. Up to now, the researchers involved in this direction have concentrated their efforts in understanding the problem in terms of the physics of interactions between laser beam and biological material and the transport equations that describe the progression of the laser beam trough the gray and white matter, starting from the source (placed on the surface of the scalp) to the detectors (situated on the surface of the scalp).

Graphical models and wavelets

The PhysNum group made its name in the context of multiresolution analysis in studying and applying Daubechies complex wavelets. During the last year, the work of one of its students (D. Clonda) has underlined the role of the phase of the coefficients in complex wavelets in the multiresolution treatment of images. Two typical applications were considered: estimation (*denoising*) and classification (textures segmentation). In both cases, the study proved that better results are obtained by taking into account the phase of th coefficients in the wavelets within the model.

Models in cascade, Scale invariance and fractal analysis

Some members of the PhysNum group (J.M. Lina, B. Goulard, P. St-Jean, D. Clonda, G. Sitzia) are involved in work related to analysis through continuous wavelets and particularly to analytical tools in imaging for breast cancer.

Most of this research is conducted in collaboration with academics (J. Doyon, F. Lepore, UdeM), foreign research organizations (H. Benali, INSERM; L. Garnero, CNRS, France) and a hospital (L. Lalonde, CHUM).

In engineering sciences, the autocorrelation function is widely used to characterize the properties of a signal. F. Nekka and her students have shown that the autocorrelation function can degenerate in the fractal case and have modified it for such an instance. This led to a wide-scale method that allows for a better characterization of scale invariance by combining two simple and well-known concepts, namely fractal dimension and autocorrelation. Surprisingly, the preliminary results indicate that this method can also be used to estimate the Hausdorff dimension. This is a major advance in the field, as this result had not been found since the Hausdorff dimension was first introduced. At present, this study is being extended to multifractals by introducing an equation inspired by multifractal formalism and combining this with the autocorrelation method. Analyses of turbulence data are in progress.

Modelling the process of resistance to antibiotics

The emergence of resistance to antimicrobial agents during therapy threatens the efficacy of treatment of many bacterial infections and, in certain cases, can increase the risk of propagation between individual resistant organisms. F. Nekka has launched a study on the antibiotic resistance acquisition process and its pharmocokinetic modelling. This study is being pursued in collaboration with the Faculty of Veterinary Science of Université de Montréal.

Publications

The CRM publishes monographs, lecture notes, proceedings, software, videos and research reports. 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. Since 1992, two collections, edited by CRM, have been published and distributed by the AMS. 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. The following list of *Recent Titles* contains books that have appeared during the year 2002-2003 or that will be published soon. An asterisk preceding an author indicates that this is a monograph from an Aisenstadt Chair holder.

Recent Titles

AMS: CRM Monograph Series

- *George Lusztig, *Hecke Algebras with Unequal Parameters*, vol. 18, 2003.
- *Laurent Lafforgue, *Chirurgie des grassmanniennes,* vol. 19, 2003.
- Joel Feldman, Horst Knörrer & Eugene Trubowitz, *Riemann Surfaces of Infinite Genus*, vol. 20, 2003.
- Andrei Tyurin, *Quantization, Classical and Quantum Field Theory and Theta Functions*, vol. 21, 2003.
- Montserrat Alsina & Pilar Bayer, *Quaternion Orders, Quadratic Forms, and Shimura Curves*, vol. 22 (to appear).

AMS: CRM Proceedings & Lecture Notes

- John Harnad & Alexander R. Its (eds.), *Isomonodromic Deformations and Applications in Physics*, vol. 31, 2002.
- Vadim B. Kuznetsov (ed.), *The Kowalevski Property*, vol. 32, 2002.
- André D. Bandrauk, Michel C. Delfour, & Claude Le Bris (eds.), *Quantum Control: Mathematical and Numerical Challenges*, vol. 33, 2003.
- Pavel Winternitz, John Harnad, C.S. Lam, Jiri Patera (eds.), *Symmetry in Physics: In Memory ot Robert T. Sharp*, vol. 34, (to appear).
- H.E.A Campbell, D.L. Wehlau, *Invariant in all Characteristics*, (to appear).

Springer-Verlag: CRM Series in Mathematical Physics

- *Roman Jackiw, *Lectures on Fluid Dynamics*, 2002.
- David Sénéchal, André-Marie Tremblay & Claude Bourbonnais, *Theoretical Methods for Strongly Correlated Electrons,* (to appear).

Les Publications CRM

- Armel Mercier, *Fonctions de plusieurs variables: Différentiation*, 2002.
- Luc Lapointe, Ge Mo-Lin, Yvan Saint-Aubin & Luc Vinet, *Proceedings of the Canada-China Meeting on Theoretical Physics*, 2003.

In Collaborations with Institute of Mathematical Statistics: Lecture Notes-Monograph Series

- Marc Moore, Sorana Froda & Christian Léger (eds.), *Mathematical Statistics and Applications: Festschrift for Constance van Eeden*, vol. 42, 2003.

* Publication of the Aisenstadt Chair

Previous Titles

AMS: CRM Monograph Series

- Michael Barr, *Acyclic Models*, vol. 17, 2002.
- *Joel Feldman, Horst Knörrer & Eugene Trubowitz, *Fermionic Functional Integrals and the Renormalization Group*, vol. 16, 2002.
- Jose I. Burgos, *The Regulators of Beilinson and Borel*, vol.15, 2002
- Eyal Z. Goren, *Lectures on Hilbert Modular Varieties and Modular Forms,* vol. 14, 2002
- Michael Baake & Robert V. Moody (eds.), *Directions in Mathematical Quasicrystals*, vol. 13, 2000.
- Masayoshi Miyanishi, *Open Algebraic Surfaces*, vol. 12, 2001.
- Spencer J. Bloch, *Higher Regulators, Algebraic K-Theory, and Zeta Functions of Elliptic Curves*, vol. 11, 2000.
- James D. Lewis, *A Survey of the Hodge Conjecture*, 2e Édition (with an appendix by B. Brent Gordon), vol. 10, 1999.
- Yves Meyer, *Wavelets, Vibrations and Scaling*, vol. 9, 1997.
- Ioannis Karatzas, *Lectures on Mathematics of Finance*, vol. 8, 1996.
- John Milton, *Dynamics of Small Neural Populations*, vol. 7, 1996.
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Financial Report at 31 May 2003

The CRM benefits from several sources of funding to sustain its various sectors of activity. This report distinguishes the amounts awarded to *the CRM* from those awarded to the Centre's *researchers*.

The Centre's Funding

The various sources of funding are presented in Table 1. In 2002-2003, the CRM received the fourth instalment of $874,650 of a four-year NSERC institutes grant. This grant enables the Centre to fulfil its national mandate focussed on the annual organization of scientific activities (postdoctoral fellowships, student scholarships, visiting researchers, thematic and general scientific programs, and research support personnel). (For more details, see below the section titled "Financial statements".)

The Comité d'étude et d'administration de la recherche (CÉDAR) of the Université de Montréal provided an operating grant of $836,000 in 2002-2003. This budget is principally allocated for the remuneration of the scientific personnel of the Centre. The budget also covers the costs associated with invited researchers, the release time of the faculty members who direct the CRM, and a part of the salary of the administrative staff as well as some operating and computer expenses.

The FQRNT (formerly FCAR) also supports the operations of the CRM. The Centre received an additional instalment of $210,000 in operating funds fro 2002-2003. This grant covers a part of the salary expenditures for the research support personnel, the publications personnel, the administrative personnel and operating costs. An annual amount of $14,000 from this grant is set aside for the research activities of two college (CEGEP) researchers on release time to the CRM.

As one of the three mathematics institutes in Canada that jointly established the Mathematics of Information Technology and Complex Systems Network of Centres of Excellence (MITACS), the CRM supervises the activities of six of the Network's research projects. It also promotes networking activities. The CRM received $73,000 in 2002-2003 for these tasks from the overall NCE funding provided to MITACS. In addition, the research projects just mentioned received $491,250 in NCE funding and $172,653 in industrial and commercial matching funds during the fiscal year. These last amounts are not accounted in the financial statement of the Centre because they are awarded directly to the researchers.

The CRM manages the collective scientific activities and the general administration of the Network for Computing and Mathematical Modeling (ncm_2). A budget of $53,342 was provided for these tasks in 2002-2003.

The André Aisenstadt endowment contributed revenues of $27,617 in 2002-2003 to the CRM. These funds serve for the Centre's scientific activities, particularly the annual André Aisenstadt Prize and Aisenstadt Chairs. Since 2001 the CRM also receives (with the university's departments of mathematics and computer science) revenue from the estate of the late Serge Bissonnette ($5,468 in 2002-2003). In addition, the Centre received funding from the National Science Foundation (USA) valued at nearly $60,000 (Cdn) to finance the participation in CRM thematic year activities of students and postdoctoral fellows from the United States. The grant from the Canadian Institute for Advanced Research (CIAR) completes the list of other grants.

The CRM received other contributions totalling $376,240 from universities and partner organizations. The Institut des sciences mathématiques (ISM) contributed funds for joint CRM-ISM postdoctoral fellowships ($85,800) and the joint colloquium series ($8,331). Researchers from Montréal and Québec universities contributed $175,751 for joint postdoctoral fellowships (CRM-ISM and others) and $41,870 for joint student scholarships. The Institut universitaire de gériatrie de Montréal contributed funds for half the salary of an associate researcher. In addition, Professor André Bandrauk of the Université de Sherbrooke contributed $20,000 of his funds for the Quantum Control workshop. A contribution of $5,000 was contributed for the Cerebral Plasticity Workshop to be held in October 2003.

The CRM generated revenues of $37,075 from its publishing programs (sales and royalties from the CRM's series with the American Mathematical Society and Springer-Verlag New York, and from the CRM's in-house collection). Revenue from registrations to thematic year activities totalled $21,466. Other scientific events generated registration revenue of $11,777. Other funds came from compensation for services rendered and operating costs ($18,227) in addition to the ncm_2 amount mentioned above.

Table 1

Main sources of funding of the CRM, 2002-2003

Source	$ Amount
NSERC (Institutes and Initiatives Program)	874 650
Université de Montréal (CÉDAR)	836 000
FQRNT-FCAR (Research Network Program, ncm_2)	210 000
National Centres of Excellence (MITACS)	73 000
Contributions from universities & partners	376 240
Other grants & revenue from endowments	159 560
Sales, registrations & other revenues	133 887
Total	**2 663 338**

Funding for Research

In addition to the CRM's grants, its researchers obtain funding for their research projects in the form of grants and contracts. Table 2 provides details on funding awarded by granting agency and by category of research partnerships. Only amounts managed at the CRM are given below. Total research funding of the CRM members was circa $2.5M in 2002-2003.

Table 2

Research grants (individual and team) of CRM researchers, 2002-2003, by source

Source	Number	$ Amount
NSERC grants	7	203 100
NCE-NSERC-MITACS grants	1	17 000
FQRNT team grants	3	85 000
Bell Univ. Labs contracts	2	142 000
ANIQ contract	1	10 000
Total	**14**	**457 100**

Financial Statement

The following financial statement presents, on a cash accounting basis, the revenues and expenditures of the CRM for the fiscal year that ended on May 31, 2003. The financial statement does not include the research funding of individual researchers.

Expenditures are divided in three broad categories: Scientific Activities, Publications, and Administration.

The main line items under *Scientific Activities* are:

Scientific personnel, that is, remuneration of professors and research fellows at the Université de Montréal who undertake research on a full-time basis at the CRM; expenses associated with the release of professors and researchers from other institutions for prolonged periods; travel and accomodation expenses of invited researchers (including Aisenstadt Chairs and visiting researchers taking part in the scientific activities of the Centre); postdoctoral fellowships and student scholarships;
Scientific programs, that is, the annual thematic program; the general scientific program made up of events organized by the CRM and of contributions to off-site scientific activities and events, mini-programs on particular topics, colloquia series organized jointly with the ISM, and expenses associated with the four prizes of excellence in the mathematical sciences (the André Aisenstadt Prize, the CRM-Fields Institute Prize, the CAP-CRM Prize in Theoretical and Mathematical Physics, and the CRM-SSC Prize in Statistics); and finally, the scientific programs of the two networks, MITACS and ncm_2 (workshops, seminars, lectures, conferences);

the *Scientific programs support personnel* involved directly in the organization and management of the scientific programs; and

the *Research support personnel* delivering computer services and electronic-publishing services for the preparation of research reports.

The rubric *Publications* includes production costs associated with the CRM's publishing programs (remuneration of personnel preparing publications as well as direct costs such as printing of in-house collection publications).

Finally, the rubric *Administration* covers the remuneration of the CRM's executive, the administrative personnel, the computer systems analysts (who support the Centre's network, hardware and software used in its management, communications and administrative activities), and the communications personnel (Web, newsletter and annual report), as well as expenses related to executive and advisory business meetings, current operating costs, and computer equipment and maintenance costs.

Financial Statement 2002-2003

	NSERC-Centre	FQRNT-Centre	NCE-MITACS	Univ. de Montréal	Other sources	Overall Total
Scientific Activities						
Scientific personnel						
Visitors and Chairs	59 896	-	-	11 537	25 776	97 208
Partnerships	-	-	-	10 000	32 750	42 750
Université de Montréal	-	-	-	552 825	46 629	599 454
Postdoctoral fellows	153 189	-	-	-	292 157	445 347
Research professionals	-	-	-	-	(8 486)	(8 486)
Students (participation in activities)	-	-	-	-	56 525	56 525
Students (research scholarships)	9 250	-	-	-	31 400	40 650
Total Scientific personnel	222 335	-	-	574 362	476 752	1 273 449
Scientific programs						
Thématic years						
Groups and Geometry	*52 946*	-	-	-	*47 986*	*100 931*
Maths in Computer Science	*161 361*	-	-	-	*97 978*	*259 339*
Geometric and Spectral Analysis	*4 500*	-	-	-	-	*4 500*
Summer school on Quantum Information Processing	*16 566*	-	-	-	*8 977*	*25 542*
Total Thematic years	235 372	-	-	-	154 941	390 313
General scientific program	94 034	-	-	-	72 548	166 583
Network activities	-	-	43 203	457	6 663	50 323
Other	9 835	7 872	-	-	3 943	21 651
Total Scientific programs	339 242	7 872	43 203	457	238 094	628 869
Personnel - Scientific programs	140 696	-	-	-	-	140 696
Personnel - Direct research support	82 958	38 403	-	-	-	121 361
Total Scientific Activities	**785 230**	**46 276**	**43 203**	**574 820**	**714 846**	**2 164 374**
Publications						
Personnel	-	104 539	-	-	-	104 539
Direct publications costs	-	-	-	-	4 679	4 679
Total Publications	**-**	**104 539**	**-**	**-**	**4 679**	**109 217**
Administration						
Personnel						
Executive	*36 364*	-	*7 163*	*48 068*	-	*91 596*
Administration	*24 822*	*59 316*	*47 435*	*59 762*	*50 897*	*242 232*
Systems experts and communications	-	-	-	*30 167*	*14 792*	*44 959*
Total Personnel	61 186	59 316	54 598	137 997	65 689	378 787
Advisory and other committees	5 380	-	-	-	1 399	6 779
Operating expenses	30 427	7 202	1 328	15 339	10 020	64 315
Computer equipment and software	4 028	17 341	48	386	20 234	42 037
Total Administration	**101 021**	**83 859**	**55 974**	**153 722**	**97 342**	**491 919**
Total Expenditures	**886 251**	**234 674**	**99 177**	**728 542**	**816 867**	**2 765 511**
Revenues						
Operating grants	874 650	210 000	-	836 000	-	1 920 650
Research networks, equipment and other grants	-	-	73 000	-	159 560	232 560
Contributions from universities and partners	-	-	-	-	376 240	376 240
Sales, registrations and other revenues	-	-	-	-	133 887	133 887
Total Revenues	**874 650**	**210 000**	**73 000**	**836 000**	**669 688**	**2 663 338**
Surplus (Deficit)	**(11 601)**	**(24 674)**	**(26 177)**	**107 458**	**(147 180)**	**(102 173)**