A Word from the Director

Science first. It was an exceptionally rich year. The thematic program in Groups and Geometry began with a remarkably vigorous three-week session in group theory and low dimensional topology, with over one hundred participants for each of the three weeks. The workshops that followed were all great successes, and I hesitate to name just a few, for fear of offending those left out; I will however thank in passing our colleagues in Kingston, Eddy Campbell and David Wehlau, who put together a remarkable two-week session, with a large number of students and visitors. The holders of the Aisenstadt Chair this year were three absolutely exceptional mathematicians: Edward Frenkel, Laurent Lafforgue and George Lusztig. Lafforgue went on to receive a Fields medal later in the year. Lafforgue and Frenkel gave their lectures in tandem, and were accompanied by Robert Langlands, who also gave a series of talks. The year in all saw twenty or so lecture series, which had a considerable impact (thanks once again to those who gave them). If one adds to this the seminars of the various groups and laboratories attached to the CRM, the CRM-ISM Colloquium (my thanks to the organizers, Dana Schlomiuk and Tadashi Tokieda), it all adds up to a rich scientific atmosphere, unthinkable even ten years ago.

The 2001-2002 program was not even over yet when we started on the 2002-2003 program on the Mathematics of Computer Science. The CRM played host in May to two of the big conferences in theoretical computer science, STOC and CCC. There were a number of small satellite activities organized around this, and in June, a workshop on random number generators, organized in style by Pierre L'Écuyer. The summer also saw a school in quantum computing, directed by Gilles Brassard, with over eighty participants.

As ever, the two industrial networks, MITACS and ncm_2, had their share of events and developments. The main one was doubtless the official opening on December 6, 2001, of the new ncm_2 laboratory, the Laboratoire Universitaire sur le Temps Extrême (LUTE). This laboratory, with an important infusion in cash, personnel and computer time from Environment Canada, will work not only in the forecasting of extreme weather, but also on modelling its impacts, in collaboration with the various ncm_2 partners. A first workshop is taking place in the fall of 2002 on extreme values, and is co-organized with the finance group. The year also saw the creation of a second spin-off company, in data-mining applied to insurance. The first, in imaging, won the Entrepreneurship prize of the École des Hautes Études Commerciales de Montréal. The CRM research group in imaging has continued building up a research network in brain-imaging. One of the group's researchers, Jean-Marc Lina, is now sharing his time with the Institut Universitaire de Gériatrie de Montréal, and is now an associate researcher at INSERM (France). This Montréal-Paris collaboration has just been awarded an important grant from the Ministère de la Recherche, de la Science et de la Technologie.

The development of science does rely on continuous funding. This is an arduous constraint and the year from this point of view was exceptionally full. The CRM submitted last January a request for renewal to NSERC, as part of a reallocations process that included four institutes and twenty or so grant selection committees. It was a heavy task: choosing priorities, choosing programs, writing the proposal, organizing a site visit with over a hundred people to coordinate. Many of the CRM researchers took part in the proceedings, and I thank them. The whole process was a great success, with the CRM obtaining an 11% increase in funding, which puts it third in the reallocations exercise and gives it the same funding as the Fields Institute and PIMS. The additional resources obtained will be used mostly to increase funding of long-term visitors and of postdoctoral fellows.

On the provincial front, as these words are being written, the CRM has just submitted its application to FQRNT, the provincial research agency, for increased funding. The exercise, if it is crowned with success, will fund a certain number of laboratories associated to the CRM; it has already allowed the CRM to obtain

significant financial support from all the major Québec universities, and this for the first time.

An additional satisfaction occurred in the writing of the application, as I was listing the large number of talented mathematicians that are now in our universities, a large segment of them having just arrived. They will, I hope, have the resources that they deserve.

Jacques Hurtubise

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, 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 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 Institute 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 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.

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

the CRM 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 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 CRM-Fields and Aisenstadt prizes, and suggest new scientific ventures to explore.

Personnel 2001-2002

The Director's Office

Jacques Hurtubise	Director
Jean LeTourneux	Deputy Director, Publications
Yoshua Bengio	Deputy Director, Industrial Program
Anne Bourlioux	Deputy Director, Scientific Program
John Harnad	Deputy Director, Scientific Program (since January 2002)
Niky Kamran	Deputy Director, Scientific Program (until December 2001)
Diane Poulin	Secretary

Administration

Béatrice Kowaliczko	Head of Administration (until April 2002)
Vincent Masciotra	Head of Administration (since April 2002); Financial and Administrative Officer
Michèle Gilbert	Administrative Assistant
Muriel Pasqualetti	Administrative Assistant
Josée Simard	Secretary

Scientific Activities

Louis Pelletier	Coordinator
Josée Laferrière	Assistant Coordinator

Publications

André Montpetit	TeX Expert (1/2 time)
Louise Letendre	Technician
Diane Brulé-De-Filippis	Secretary

Computer Services

Daniel Ouimet	Systems Administrator
André Montpetit	Office systems manager (1/2 time)

Communications

Suzette Paradis	Communications Officer & Webmaster (1/2 time)

MITACS

Nicole Huron	Administrative Assistant

Scientific Personnel

Since its foundation in 1969, the CRM has been involved in a wide variety of research in mathematics 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 industries, and long-term visitors. The presence at 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, J.-F.
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, France

Bengio, Yoshua
DIRO,
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
DIRO,
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
School of Computer Science
McGill Univ.

Csürös, Miklos
DIRO,
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
Computer Science,
Concordia Univ.

El-Mabrouk, Nadia
DIRO,
Univ. de Montréal

Fournier, Richard
Dawson College

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

Gagnon, Langis
CRIM

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
DIRO,
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.

Van Vliet, Carolyne
Physics,
Univ. of Miami

Valin, Pierre
Lockheed Martin Canada

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's members. The list below includes only postdoctoral fellows in residence at CRM or funded or co-funded by CRM, with their funding source given in brackets. Some of the fellows were in residence at CRM for only part of the year – the affiliation is that where the doctoral degree was obtained.

Aguiar, Marcelo
Texas A&M Univ.
(CRM-ISM)

Allen, Steve
Univ. de Sherbrooke
(ncm_2-Lockheed Martin)

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

Brightwell, Mark
Univ. of Glasgow
(CRM-ISM)

Buono, Luciano
Univ. of Warwick
(NSERC)

Casesnoves, Raquel
Univ. de Montréal
(CRM)

Chapoton, Frédéric
Paris VI
(LACIM-CRM)

Corteel, Sylvie
Université de Paris-Sud
(CRM-ISM)

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

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

Guimond, Louis-Sébastien
Univ. de Montréal
(CRSNG)

Hagedorn, Thomas
Univ. of Lethbridge
(Sloan Fellowship)

Langerman, Stefan
Rutgers Univ.
(CRM-McGill)

Loutsenko, Igor
Univ. de Montréal
(ncm_2)

Maillot, Sylvain
Univ. Paul Sabatier
(CRM)

Masakova, Suzana
Czech Technical Univ.
(NATO)

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

Mei, Ming
Kanazawa Univ.
(CRM-McGill)

Pal, Ambrus
Colombia Univ.
(CRM-ISM)

Penskoi, Alexei
Univ. de Montréal
(CRM)

Polterovich, Iosif
Weizmann Institute of Science
(CRM)

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

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

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

Savitt, David
Harvard Univ.
(NSERC)

Schiffler, Ralf
UQAM
(FCAR)

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

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

Urquiza, José Manuel
Univ. Pierre et Marie Curie
(ncm_2)

Vénéreau, Stéphane
Institut Fourier
(CRM-McGill)

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

Wang, Sung Ho
Duke Univ.
(CRM-ISM)

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.

Bao, Weisheng
Institut de cardiologie
de Montréal

Bub, Gil
McGill Univ.

Caporossi, Gilles
Univ. de Montréal

Chavez, Francisco
Univ. of Toronto

Davidson, Joern
Univ. of Toronto

Deerakhchan, Katayoun
Institut de cardiologie
de Montréal

Hadjar, Ahmed
École Polytechnique de
Montréal

Hong, Gu
Univ. of Waterloo

Kagabo, Issa
École Polytechnique de
Montréal

Kanamori, Takafumi
Univ. de Montréal

Mladenovic, Nenad
École Polytechnique de
Montréal

Shinagawa, Kaori
Institut de cardiologie
de Montréal

Slimane, Leila
Univ. Laval

Stojkovic, Goran
École Polytechnique de
Montréal

Stojkovic, Mirela
École Polytechnique de
Montréal

Takeuchi, Ichiro
Univ. de Montréal

Tateno, Katsumi
McGill Univ.

Titcombe, Michele
McGill Univ.

Villeneuve, Daniel
École Polytechnique de
Montréal

Wang, Shaojun
Univ. of Waterloo

Ziarati, Koorush
HEC Montréal

Zou, Renqiang
Institut de cardiologie
de Montréal

Visitors

Each year the CRM hosts a large number of visitors. The majority comes to the centre to participate in scientific activities: in the year 2001-2002, 1667 such participants registered for workshops run solely by the CRM. In addition, the CRM helped fund about twenty other scientific events. The following list includes, only visitors who were in residence for long periods, ranging from a week to several months.

Akhperjanian, Ashot
Yerevan Physics Inst.

Aratyn, Henrik
Univ. of Illinois

Ben-Zvi, David
Univ. of Chicago

Berest, Yuri
Cornell Univ.

Biswas, Atanu
Indian Statistical Inst.

Blouza, Adel
Univ. Paris VI

Bridson, Martin
Pembroke College

Brinzanescu, Vasile
Inst. of Mathematics Simon Stoilow

Casselman, William A.
Univ. of British Columbia

Cojocaru, Alina Carmen
Queen's Univ.

Cressie, Noel A.C.
Ohio State Univ.

Dawson, Donald
Carleton Univ.

Deninger, Christopher
Univ. of Münster

Dorodnitsyn, Vladimir
Keldysh Inst. of Applied Mathematics

Du Cloux, Fokko
Univ. de Lyon I

Dumas, Laurent
Univ. Paris VI

Fleischer, Isidore

Fleischmann, Klaus
Weiestrass Inst. for Applied Analysis & Stochastics

Frenkel, Edward
Univ. of California, Berkeley

Gazeau, Jean-Pierre
U. Paris VII Denis Diderot

Geck, Meinolf
Univ. Claude Bernard (Lyon I)

Geiger, Jochen
Johann Wolfgang Goethe-Univ.

Greven, Andreas
Univ. Erlangen-Nürnberg

Grodzicky, Roman
Univ. de Montréal

Guillemin, Victor
MIT

Havin, Victor
McGill Univ.

Helmers, Roelof
CWI Amsterdam

Heusener, Michael
Univ. Blaise Pascal (Clermont-Ferrand II)

Houzel, Christian
UPS, 2065 CNRS

Itskov, Vladimir
Univ. of Minnesota

Jiang, Yu
Univ. Autonoma Metropolitana-Iztapalapa

Kalnins, Ernest Günther
Univ. of Waikato

Karrakchou, Jamila
École Mohammadia d'ingénieurs

Khesin, Boris
Univ. of Toronto

Kirillov, Alexandre
Univ. of Pennsylvania

Klaassen, Chris A.
Korteweg-de Vries Inst. for Mathematics, UvA

Knop, Friedrich
Rutgers Univ.

Kokotov, A.
Concordia Univ.

Lafforgue, Laurent
Univ. Paris-Sud

Ledrappier, François
École Polytechnique (Palaiseau, France)

Leitner, Frederick
Univ. of Arizona

Levi, Decio
Univ. di Roma Tre

Levy, Jason
Univ. of Ottawa

Lévy Véhel, Jacques
INRIA, Projet Fractales

Liben-Nowell, David
MIT

Longhi, Ignazio
Univ. of Münster

Lusztig, George
MIT

Lysionok, Igor
Steklov Mathematical Inst.

Ma, Li
Tsinghua Univ.

Magri, Franco
Univ. di Milano

Mélard, Guy
Univ. Libre de Bruxelles

Moody, Robert V.
Univ. of Alberta

Murty, Ram
Queen's Univ.

Murty, V. Kumar
Univ. of Toronto

Nieto, Luis Miguel
Univ. de Valladolid

Onn, Uri
Technion Inst.

Orlov, Aleksander
Oceanology Inst.

Osborn, Tom
Univ. of Manitoba

Ouansafi, Abdellatif
Univ. de Montréal

Patera, Jan
Czech Technical Univ.

Pelantova, Edita
Czech Technical Univ.

Pogosyan, George
Bogoliubov Laboratory of Theoretical Physics

Polanco Ruig, Luis B.
Univ. de Valencia

Popov, Vladimir
Steklov Mathematical Inst.

Pouryayevali, Mohamad Reza
Univ. of Isfahan

Racine, Michel
Univ. of Ottawa

Raffinot, Mathieu
Univ. de Versailles

Raoult, Annie
Univ. Joseph-Fourier

Rasmussen, Christopher
Univ. of Arizona

Roussarie, Robert
Univ. de Bourgogne

Sabin, Malcome
Numerical Geometry Ltd.

Sahakyan, Vardan
Yerevan Physics Inst.

Scott, Keith
Atlantic Nuclear Services Ltd.

Sengupta, Jyotirmoy
Tata Inst. of Fundamental Research

Sheftel, Mikhail B.
Feza Gursey Inst.

Sinha, Kaneenika
Queen's Univ.

Sorger, Christoph
Univ. de Nantes

Springer, Tonny A.
Univ. of Utrecht

Stembridge, John R.
Univ. of Michigan

Strasburger, Aleksander
Univ. of Bialystok

Strawdermann, William E.
Rutgers Univ.

Sujatha, R.
Tata Inst. of Fundamental Research

Svobodova, Milena
Czech Technical Univ.

Szmigielski, Jacek
Univ. of Saskatchewan

Thiriet, Marc
INRIA Rocquencourt

Thomova, Zora
SUNY Inst. of Technology

Touzi, Nizar
CREST

Tyurin, Andrei
Steklov Inst. of Mathematics

van Diejen, Jan Felipe
Universidad de Talca

Varsaie, Saad
Inst. for Advanced Studies in Basic Sciences

Verger-Gaugry, Jean-Louis
Univ. J. Fourier, Grenoble

Violette, Donald
Univ. de Moncton

Vogan, David A. Jr
MIT

Vulpe, Nicolae
Academy of Sciences of Moldova

Wakolbinger, Anton
Johann Wolfgang Goethe-Univ.

Walton, Mark
Univ. of Lethbridge

Zeron, Eduardo Santillan
Cinvestav-IPN (National Polytechnical Inst.)

Zhang, Yuanli
Univ. de Montréal

Zich, Jan
Czech Technical Univ.

Zuk, Andrzej
Univ. of Chicago

Management

Bureau de direction

The Bureau consists of members from the Université de Montréal (8 to 11 members) and from the outside (2 to 5 members). The rector of the Université 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-rector, Research
Univ. de Montréal

Cléroux, Robert
Univ. de Montréal

Hubert, Joseph
Associate Dean,
Research, FAS
Univ. de Montréal

Hurtubise, Jacques
Director CRM,
McGill Univ.

Hussin, Véronique
Univ. de Montréal

Ransford, Thomas
Univ. Laval

Rémillard, Bruno
UQTR

Rousseau, Christiane
Univ. de Montréal

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.

Craig, Walter
McMaster Univ.

Glynn, Peter
Stanford Univ.

Haiman, Mark
Univ. of California

Hambleton, Ian
McMaster Univ.

Hitchin, Nigel
Oxford 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 a secondary server Sun Sparc-1000 with eight 40-MHz processors and 384 Mb of memory for lightweight tasks. A new Linux server (single processor PC at 1.4-MHz and 2 Gb of memory) was added at the beginning of 2002 to offer a Linux environment to CRM researchers. This computing power is distributed through the offices and common rooms via 30 Sun workstations (from Sparc-4 to Ultra-10), several X-terminals, and four Linux workstations.

The software libraries include compilers (FORTE environment for C, C++ and Fortran, GNU compilers, Java, etc.), programs for symbolic manipulations and numerical computations (Mathematica, Maple, Macaulay, Matlab), several text editors, web browsers, mail tools, and most utilities common to the mathematical world (fftw-Discrete Fourier Transform, dstool-tool for dynamical systems, etc.). Upgrades to TeX and its dialects are uploaded whenever they are released. Unix applications to communicate with the PC and Mac world are also installed, such as SAMBA (PC file and printer server), OpenOffice (Office suite), and AUFS (file server for Macintosh). A Web server (Apache under Unix) with a secure SSL version and a recognized 128-bit Thawte certificate that enables secure registration for participants to CRM activities hosts the CRM web pages. In 2001, a new look was given to our web pages, including some Flash programming, and more information.

For security, many programs for surveillance and access control are in place, including frequent updates of the operating system. Most of our computers are connected to an alarm system.

Since 1999, 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 four 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 interordinateurs scientifique québécois) 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, through phone links to our PPP server and its four modems.

The support staff works on Sun stations or on Macintoshes tied to the Sun server for all services, such as mail and backups. A three-year plan for the replacement of all support staff computers started in 1999 and was completed this year. Phase 1 of a new database was completed at the end of 2001. This database helps support staff to better manage the contacts, activities, registrations to activities, and offices of CRM. Phase 2, which should be completed at the end of 2002, aims at enabling online printing of administrative forms and at standardizing the information needed at various stages of the preparation of scientific activities (registrations, announcements, reports, etc.) A dynamic directory on the Web will also replace the CRM static directory with secure access to the database.

Printing needs are served by two HP-8000DN workgroup printers (1200-dpi double-sided), as well as an ink-jet network printer Epson-900N for colour printing, and some small printers for support staff. The CRM established a printing quota system in 2001 in order to save paper.

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

In 2002, a new room with five X-terminals and three Mac computers was installed for conference participants at CRM to give them access to Telnet, FTP and SSH.

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

Homage to André Aisenstadt

On 4 October 2001, André Aisenstadt, the CRM's great benefactor, passed away. He declared once, in a conversation: "Age is without importance. It's what you do that counts." An exceptionally long life permitted him to demonstrate this assertion in striking ways.

The sciences

After leaving his native Russia, he began engineering studies in Darmstadt, during which he discovered a deeper interest for mathematics than engineering. He thus decided to change his studies to mathematics, which he pursued at the universities of Würzburg and Jena, afterwards completing doctoral studies in mathematical physics in Zurich under the direction of Erwin Schrödinger. He counted among his teachers Hermann Weyl and Andreas Speiser, and among his fellow students John von Neumann and Enrico Fermi. Even though Einstein had already left Zurich by then, he would return often and it is during one of these visits that André Aisenstadt established a friendship that lasted until the end of the great physicist's life.

Arrival in Canada

Having obtained his PhD, André Aisenstadt faced a dilemma: Herman Weyl began making approaches in England so that he could continue his research at Oxford or Cambridge, but his father, a prosperous businessman, worrying that his son would begin an academic career, invited him to join the family entreprise. The father won, but the son would always regret, it seems, having abandoned mathematics. In 1939, André Aisenstadt immigrated to Canada and settled in Montréal for cultural reasons. Soon after his arrival, Mackenzie King as hed him to participate in the creation of the Central Mortgage and Housing Agency and in the establishment of a housing building program for veterans. While working on these projects in Ottawa, he launched an enterprise in Montréal, the Parkdale Homes Development Corporation, which built large sectors of the city.

Charitable endeavours

Around 1967, his wealth established, André Aisenstadt abandoned the construction industry in order to focus on charitable activities. His wife, Niussia Rosenstein, an accomplished pianist, convinced him to actively participate in the establishment of the Marlboro Festival and Music School. All those who had the pleasure of meeting him know with what verve he would reminisce about Marlboro and more particularly about two of his friends, Rudolf Serkin and Pablo Casals. In these same years began his financial support of the CRM. A first donation led to the creation of the Aisenstadt Chair that enabled the Centre to invite during those years the most remarkable mathematicians of the time. Thanks to another financial gift, the André Aisenstadt Prize, that recognizes the excellence of young Canadian mathematicians, was established in 1991. And the building that houses the mathematical sciences at the Université de Montréal bears his name in recognition of a major financial contribution for its construction.

Mathematics first

It would be difficult to give an exhaustive list of all the organizations that benefited from André Aisenstadt's generosity, but a short list would include the Montréal Jewish Hospital, the Institut de recherches cliniques de Montréal and the Montréal Symphony Orchestra. It would seem though that he drew particular satisfaction from having contributed to the development of mathematics: "Thanks to my relationship with the CRM," he said in the same conversation quoted above, "I had a renaissance as a mathematician." It is therefore with always renewed pleasure that he would meet the holders of the Aisenstadt Chair and the winners of the Prize.

A love of art

The Aisenstadt university building, the Chair and the Prize will help future generations remember the debt they have towards the person who gave them their name. It is nonetheless important not to forget the values that underlay the charitable activities of this remarkable man. Didn't he say in that same conversation — *For me, art — and by art I mean mathematics as much as music, literature and painting — is neither an hors d'oeuvre nor a dessert, it is the main course of life*.

Jean LeTourneux
Deputy Director

An afternoon in memory of André Aisenstadt

On January 18th, 2002 the CRM hosted a small celebration of André Aisenstadt's role in the Montréal mathematical community, with three special speakers. The first, Niky Kamran, was the first recipient of the André-Aisenstadt prize (1991). The title of his talk was *L'opérateur de Dirac en géométrie de Kerr*. Francis Clarke, of the Institut Universitaire de France and the Université de Lyon, director of the CRM from 1984 to 1993, spoke on *La théorie du retour d'état (feedback) en théorie du contrôle: une introduction,* The last speaker, Jingyi Chen, the 2001 winner of the André-Aisenstadt prize, gave his prize lecture on *Quaternionic mappings between hyperkähler manifolds*. Reminiscences followed the scientific part of the afternoon: Anatole Joffe and Francis Clarke, who were successive directors of the CRM, spoke with some emotion of their association with André Aisenstadt, and Robert Lacroix, the Rector of the Université de Montréal, spoke of André Aisenstadt's role within the University. The afternoon's events were closed off with a reception, which recalled the memory of a man who not only loved science but who also had an unfailing sense of hospitality.

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. Preceding years' topics include: Probability and Stochastic Control (1992-93); Dynamical Systems (1993-94); Geometry and Topology (1994-95); Applied and Numerical Analysis (1995-96); Combinatorics and Group Theory (1996-97), Statistics (1997-98), Number Theory and Arithmetic Geometry (1998-99), Mathematical Physics (1999-00), Mathematical Methods in Biology and Medicine (2000-01). A 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 2001-2002:
Groups and Geometry

The role of group actions and groups in general is ubiquitous in geometry, and the year's program concentrated on some areas in which there has been important recent progress. The year consisted of two segments, the first more differential-geometric in flavour, and the other one concentrating specifically on the links between algebraic geometry, group theory and representation theory. There was a special focus on training, with intensive mini-courses, introductory series, and CRM-ISM graduate classes specially organized in conjunction with the thematic year. There were ten postdoctoral fellows with research interest connected to the theme year. For the first time, a grant of US$50,000 was received from the National Science Foundation with the specific purpose of funding US students and postdoctoral researchers interested in participating in CRM's theme year activities. There were a total of 1305 registered participants for the activities.

GROUPS, TOPOLOGY AND DIFFERENTIAL GEOMETRY

June-December 2001

Groups and Low-Dimensional Topology

June-July 2001
Org.: Steven Boyer (UQAM), Dani Wise (Brandeis & McGill)
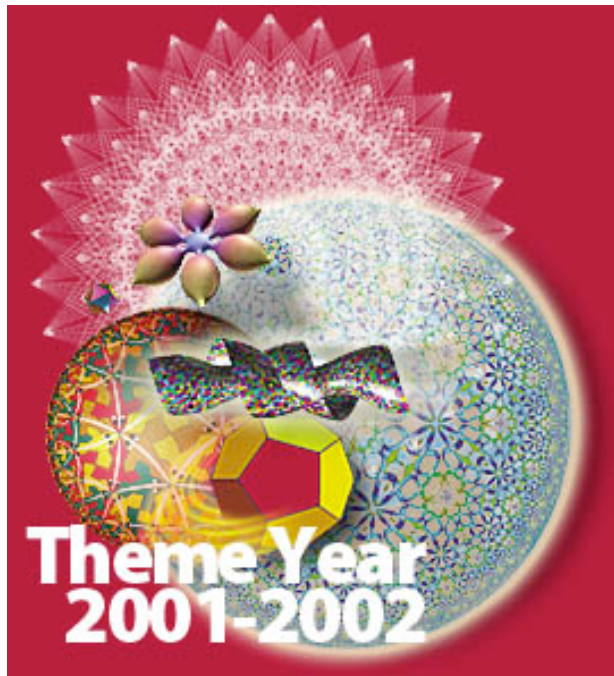
The two workshops and five mini-courses were a tremendous success by any measure. Each week had more than 100 participants, many of whom were involved in all three weeks. One of the most satisfying aspects was the attendance of a great number of graduate students who were drawn from six different continents. The format of sandwiching the mini-courses between the workshops meant that a great many students took part in weeks 1 and 3 as well, much to the delight of the more senior participants. Throughout the scientific level of the talks as well as their exposition qualities were of a very high order. The general feeling was that the

research areas covered were in a healthy state with a promising future.

The topics covered during the workshop on groups and 3-manifolds included geo-metrization of 3-dimensional orbifolds, non-hyperbolic Dehn fillings of hyperbolic 3-manifolds, the weak Lopez conjecture, the word-hyperbolicity of the fundamental groups of laminar 3-manifolds, the virtual Haken conjecture, the generalized Smale conjecture, Heegard splittings, representations of the braid group, and geometric cobordisms of manifolds.

The mini-course lecturers put a tremendous effort into the preparation and presentation of their subjects with the result that each did a truly exceptional job of presenting what was at times quite technical and demanding material. It is hard to imagine better or more accessible introductions to these areas.

The topics covered during the workshop on geometric group theory included: Word-hyperbolic groups, decision problems, the boundary of a group, CAT(0) geometry, representation varieties, mapping class group, proof of the Tarski conjecture on the elementary theory of free groups, splittings of groups, isoperimetric functions, torsion groups, quasiconvex subgroups, group theoretical approaches to the geometrization conjecture.

WORKSHOP ON GROUPS AND 3-MANIFOLDS

June 25-29, 2001
Org.: Steven Boyer (UQAM), Dani Wise (Brandeis & McGill)

This workshop focused on recent progress on various open topological and geometric classification problems as well as some of the newer research directions.

Invited speakers: S. Bigelow (Univ. of Melbourne), M. Boileau, (Univ. Paul Sabatier), D. Calegari (Harvard Univ.), D. Cooper (Univ. of California, Santa Barbara), M. Culler (Univ. of Illinois at Chicago), N. Dunfield (Harvard Univ.), C. Gordon (Univ. of Texas at Austin), S. Kerckhoff (Stanford Univ.), M. Lackenby (Univ. of Oxford), D. Long (Univ. of California, Santa Barbara), J. Luecke (Univ. of Texas at Austin), Y. Moriah (Technion – Israel Institute of Technology), J. Porti (Univ. Autonoma de Barcelona), A. Reid (Univ. of Texas at Austin), Y. Rieck (Nara Women's Univ.), H. Rubinstein (Univ. of Melbourne), P. Shalen (Univ. of Illinois at Chicago), Y.-Q. Wu (Univ. of Iowa), X. Zhang (SUNY Buffalo).

MINI-COURSES

July 2-6, 2001

Michel Boileau (Univ. Paul Sabatier)
Geometrization of 3-dimensional orbifolds

Martin Bridson (Univ. of Oxford)
Non-positively curved spaces and hyperbolic groups

Ruth Charney (Ohio State Univ.)
The geometry of Coxeter and Artin groups

Benson Farb (Univ. of Chicago)
A crash course on the geometry of groups

Peter Shalen (Univ. of Illinois at Chicago)
Representations of 3-manifold groups

WORKSHOP ON GEOMETRIC GROUP THEORY

July 9-13, 2001
Org.: Steven Boyer (UQAM), Dani Wise (Brandeis & McGill)

The theory of infinite groups was revolutionized by an infusion of ideas from geometry and topology. This has led to the resolution of many old problems and the formulation of new problems and methods that have broadened the scope of the field. This workshop focused on these new developments in geometric group theory.

Invited speakers: Iain Aitcheson (Univ. of Melbourne), M. Bestvina (Univ. of Utah), B. Bowditch (Univ. of Southampton), Noel Brady (Univ. of Oklahoma), M. Bridson (Univ. of Oxford), S. Gersten (Univ. of Utah), I. Kapovich (Univ. of Illinois at Urbana-Champaign), M. Kapovich (Univ. of Utah), O. Kharlampovich (McGill Univ.), Bruce Kleiner (Univ. of Michigan at Ann Arbor), Igor Lysionok (Steklov Institute), J. McCammond (Texas A & M Univ.), John Meier (Lafayette), Lee Mosher (Rutgers), A. Miasnikov (CCNY), Graham Niblo (Southampton), P. Papazoglou (Univ. Paris-Sud), Michah Sageev (Technion), John Stallings (Berkeley), Paul Schupp (UIC), Zlil Sela (Hebrew Univ.). There was also an additional panel of nine contributed talks featuring: Patrick Dehornoy (U. Caen), Murray Elder (Texas A&M), Max Forester (Warwick), Daniel Groves (Oxford), Dan Guralnick (Technion), Chris Hruska (Cornell), Jan-Mark Iniotakis (Warwick), Tim Riley (Oxford), Eric Swenson (BYU).

Topology of Manifolds and Group Actions

August 20-24, 2001
Org.!: Ian Hambleton (McMaster), Ronnie Lee (Yale)

Recently there have been important breakthroughs in the study of the topology of manifolds and related topics on group actions, especially in the area of 3-and 4-dimensional manifolds with new input from the Seiberg-Witten theory and symplectic topology. This workshop provided an ideal setting to present these new advances and related developments in other areas of topology.

The workshop had 38 participants, including a nice mixture of mathematicians from different areas of geometric and algebraic topology. The aim of the conference to bring about formal and

informal discussion between different perspectives, was certainly realized in the relaxed and convivial setting of the CRM. The organizational support from the CRM was outstanding, as usual.

The program was interesting and varied, with a large number of talks by recent Ph.D.'s and postdoctoral fellows.

Invited speakers: J. Morgan (Columbia Univ.), R. Gompf (Univ. of Texas at Austin), T.-J. Li (Princeton Univ.), D. Ruberman (Brandeis Univ.), S. Vidussi (Univ. of California), F. Quinn (St. Francis Xavier Univ.), S. Krushkal (Yale Univ.), B. Williams (Univ. of Notre Dame), A. Edmonds (Indiana Univ.), M. McCooey (McMaster Univ.), M. Marcolli (Max-Planck-Institute für Mathematik), H. Boden (McMaster Univ.), R. Fintushel (Michigan State Univ.), P. Feehan (Rutgers Univ.), S. Strle (McMaster Univ.), S. Cappell (Courant Institute), P. Ozsvath (Princeton Univ.), J. Davis (Univ. of Toronto), H. Johnston (Vassar College), R. Schultz (Univ. of California), E. Miller (Polytechnic Univ.), G. Friedman (Yale Univ.), B. Owens (Trinity College), E. Pedersen (State Univ. of New York at Binghamton).

Infinite-Dimensional Lie Groups

October 29 to November 6, 2001
Org.: Niky Kamran (McGill), Boris Khesin (Toronto)

From a differential-geometric point-of-view, infinite-dimensional Lie groups arise as automorphism groups of various geometric structures on the manifolds, such as a volume form, a foliation, a contact structure or a symplectic structure. The study of these infinite-dimensional Lie groups becomes a fundamental problem in areas of mathematics as diverse as hydrodynamics and symplectic topology. Another wide class of infinite-dimensional Lie groups is formed by loop groups, Kac-Moody groups, and more generally, by gauge groups on manifolds of arbitrary dimension. The successes in the study of these groups have been immensely fruitful both in low-dimensional geometry and topology and in quantum field theory.

Infinite-dimensional Lie groups are also fundamental in the theory of integrable systems and their hierarchies. In this context, their action becomes quite explicit on spaces of pseudo-differential and Fourier integral operators. This two-week session started out two very beautiful series of four conferences given by Victor Guillemin (MIT) and A. Kirillov (Penn.). The following week was occupied by a workshop that reviewed a good sample of the topics mentioned above. Altogether, there were many very interesting discussions between people working on various aspects of the problem and the interactions were very fruitful.

Introductory Lectures
October 29-November 1, 2001

V. Guillemin (MIT)
The convexity theorem and moment polytopes

A.A. Kirillov (Pennsylvania)
The Virasoro group and related complex geometry

Workshop on the Geometry of Infinite-Dimensional Lie Groups
November 2-6, 2001

Invited speakers: O. Bogoyavlenskij (Queen's), V. Guillemin (MIT), J. Harnad (CRM & Concordia), L. Jeffrey (Toronto), M. Kapranov (Toronto), A. Kirillov (Pennsylvania), F. Lalonde (UdeM), J. Leslie (Howard), E. Meinrenken (Toronto), G. Misiolek (Notre Dame), P. Olver (Minnesota), H. Omori (Tokyo), V. Ovsienko (CNRS-Luminy), A. Pianzola (Alberta), M. Pinsonnault (UQAM), T. Ratiu (EPFL, Lausanne), T. Robart (Howard), C. Roger (Lyon I), P. Slodowy (Hamburg), R. Wendt (Fields Institute), P. Winternitz (CRM), C. Woodward (Rutgers Univ.), I. Zakharevich (Ohio State).

GROUPS AND ALGEBRAIC GEOMETRY

January-June 2002

The importance of algebraic geometry in representation theory has grown enormously during the past decades with the arrival of such techniques as D-modules and perverse sheaves. Geometry intervenes in a crucial fashion in the proof of such results as the Kazhdan-Lusztig conjecture, the construction of canonical bases for representations, and the work of Beilinson-Drinfeld on the Geometric Langlands program. A number of deep connections have arisen between the algebraic geometry and algebraic combinatorics, whose ramifications extend all the way to mathematical physics and topology. A special emphasis of the program will be in graduate training, and a variety of short courses will be organized, as well as graduate courses of a more introductory nature. Funding is available for graduate students wishing to attend.

Graduate courses

January-April 2002

The semester included several graduate courses run by ISM to prepare local students to the thematic year activities.

Abrahamm Broer (Montréal)
Hilbert schemes of points and their applications

Henri Darmon (McGill)
Automorphic forms

Eyal Goren (McGill)
Curves, vector bundles on curves and their moduli

Frédéric Lesage (Montréal)
Algèbres de Kac-Moody

WORKSHOP ON HILBERT MODULAR VARIETIES AND FORMS

January 3-6, 2002, Far Hills Inn, Québec
Org.: E. Z. Goren and H. Darmon (McGill)

The Workshop was dedicated to surveying recent developments in the study of Hilbert modular varieties and forms, such as: (i) stratification and classification of Hilbert modular varieties, special loci and cycles; (ii) Hilbert modular forms: congruences, and associated Galois representations; (iii) rational points on Hilbert modular varieties. Application to the Langlands program and the Fontaine-Mazur conjecture; (iv) periods of Hilbert modular forms. Application to the construction of rational points on elliptic curves and modular abelian varieties.

The workshop has been a tremendous success. It brought together experts and junior researchers in the area of Hilbert modular varieties and forms. We had an intensive program, consisting of 15 lectures in three days, given by some of the 28 participants. The ambient atmosphere, in a secluded cozy Laurentian resort, with the opportunity of walks in the woods, cross-country skiing and other activities, was a major factor in the success of the workshop in the sense of interaction between researchers in the field, and helped to establish the informal and dynamic atmosphere we were aspiring to achieve.

The scientific level of the workshop was very high. Much of the results reported were very new, not yet published, and helped bring the participants up to date with current research. The mathematical discussion was continued, during the joint meals, and well into the night in the lounge. Particular topics, such as the Serre conjecture for Hilbert modular forms, were *in the air*. It is clear that several participants of the workshop, who work on aspects of that conjecture, will use some of the results reported by the other participants.

Invited speakers: J. Achter (Columbia), F. Andreatta (Padua), N. Archinard (CICMA), S. Baba (CICMA), A. Brown (Tata), H. Darmon (McGill), L. Dembele (McGill), F. Diamond (Brandeis), J. Ellenberg (Princeton), A. Ghitza (MIT), E. Goren (McGill), P. Green (Harvard), F. Jarvis (Sheffield), E. Kani (Queen's), A. Logan (Berkeley), E. Nevens (Imperial College), M.-H. Nicole (McGill), U. Onn (Technion), A. Pal (CRM), A. Prasad (CRM), R. Pries (Columbia), R. Ramakrishna (Cornell), A. Saikia (CICMA), D. Savitt (CICMA), R. Sreekantan (Tata), M. Thillainatesan (Columbia), A. Tupan (CICMA), Chia-Fu Yu (Columbia).

Winter School on Computations in Coxeter Groups

January 21-28, 2002
Org. : W. Casselman (UBC), R. Bédard (UQAM), F. du Cloux (Lyon I), M. Geck (Lyon I)

Each lecturer gave five lectures. Bill Casselman gave the introductory lectures on Coxeter groups, Fokko du Cloux lectured on details of machine computations in Coxeter groups, Meinholf Geck lectured on character tables and Hecke algebras of finite Coxeter groups, and Robert Bédard summarized the state of current knowledge about Kazhdan-Lusztig cells in affine Coxeter groups. Evenings were spent in work sessions at computers, involving both lecturers and students. These were something of an experiment, and only partially successful, but the idea was basically a fruitful one. If this is to be repeated in the future, they should probably be made more formal.

It is intended that the entire series will be eventually available on the Internet. Still photographs were made of every blackboard written, and very soon the overhead transparencies will be scanned, also. These are c u r r e n t l y a v a i l a b l e a t http://www.math.ubc.ca/people/faculty/cass/coxeter/farhills/lectures.html along with a rewritten version of about half of the lectures by Casselman, currently being expanded.

The material covered in the courses is not at all currently available publicly in a digestible form, and the long-term benefit of the workshop will likely be the Internet notes.

Group Actions on Rational Varieties

February 27 to March 3, 2002
Org.: P. Russell (McGill)

The workshop had an international composition, with participants from Canada, Japan, Singapore, Taiwan, the USA, the Netherlands, France, Germany, Chile, Russia, Sweden, Switzerland and Poland. A special effort to bring graduate students and posdoctoral fellows to the

workshop paid off, ten attended and of these six gave talks.

Recent developments in group actions on affine spaces and related varieties with simple topology made up, as planned, the main theme of the workshop. Algebraic, complex analytic and topological aspects were covered. Interestingly, the workshop brought into sharp focus the important role played by Danielewski surfaces both in the study of surfaces with trivial Makar-Limanov invariant and the study of additive actions on affine 3-space. This surprising connection had only very recently become apparent.

An excursion to Mt. St. Hilaire was highly appreciated by all participants in the workshop. The excursion ended with a lively session on open problems at the Gault Estate. These are now in the process of being collected and will be made publicly available as part of the CICMA preprint series.

Invited speakers: A. Broer (Université de Montréal), P. Cassou-Noguès (Université Bordeaux I), D. Daigle (Université d'Ottawa), K. Fieseler (Uppsala University), G. Freudenburg (University of Southern Indiana), R. Ganong (York University), M. Gizatullin (Universidad Tecnica Federico Santa Maria), A. Hundemer (McGill University), Z. Jelonek (Polish Academy of Sciences), S. Kaliman (University of Miami), M. Kang (Taiwan National University), H. Kraft (Universität Basel), F. Kutzschebauch (Uppsala University), S. Marcello (Universität Regensburg), K. Masuda (Himeji Inst. of Tech.), M. Miyanishi (Osaka University), L. Moser-Jauslin (Université de Bourgogne), V. Popov (Steklov Mathematical Institute), M. Roczen (Humboldt-Universität zu Berlin), A. Sathaye (University of Kentucky), V. Shpilrain (The City College of New York), S. Vénéreau (CRM), D. Wright (Washington University), D. Zhang (National University of Singapore).

Classical Invariant Theory Workshop

April 8-19, 2002, Queen's University, Kingston
Org.: H.E.A. Eddy Campbell (Queen's), & David Wehlau (Royal Military College, Kingston)

Week One

The first week of the workshop was devoted to introductory lectures aimed at graduate students, younger mathematicians and for those who wished to acquire a breadth of knowledge across invariant theory. The workshop was part of the theme year on *Groups and Geometry* being held under the auspices of the Centre de recherches mathématiques.

During the first week, four distinguished mathematicians gave a series of lectures. They were Professors P. Fleischmann (Kent), Hanspeter Kraft (Basel), G. W. Schwarz (Brandeis), and Harm Derksen (Michigan).

Week Two

The second week was devoted to a workshop on Invariant Theory, for which many of the younger mathematicians stayed to listen. The experts listed below gave talks of 50 minutes duration, bearing in mind the audience. In this second week, the focus was on current problems in keeping with the workshop nature. The speakers included Loek Helminck, Julia Hartmann, Marcus Hunziker, Nondas Kechagias, Gregor Kemper, Frederich Knop, Alexander Kuehn, Lucy Moser-Jauslin, Vladimir Popov, Yasmine Sanderson, Mufit Sezer, Joel Segal, R. James Shank, Nicolas Thiery, and Wilberd van der Kallen.

Proceedings

A volume of proceedings of the Workshop is planned in the CRM Proceedings and Lecture Notes Series, published by the American Mathematical Society. The four main lecturers have submitted expository articles summarizing their lectures, and we expect to have 14 additional papers, all of which are being refereed at the time of this report. As well, there will be an article describing current problems with contributions from many of the participants.

Invited speakers: Jaydeep Chipalkatti, Jianjun Chuai, Harm Derksen, Peter Fleischmann, Julia Hartmann, Loek Helminck, Markus Hunziker, Wilberd van der Kallen, Dikran Karagueuzian, Kiumars Kaveh, Nondas Kechagias, Gregor Kemper, Friedrich Knop, Hanspeter Kraft, Alexander Kuehn, Lucy Moser-Jauslin, Mara Neusel, Vladimir Popov, Leonid Rybnikov, Yasmine Sanderson, Gerald Schwarz, Joel Segal, Mufit Sezer, R. James Shank, Alexander Smirnov, Nicolas Thiery, Oxana Yakimova.

Concentration Period on the Langlands Program for Function Fields

April 29 to May 17, 2002
Org.: H. Darmon (McGill), J. Hurtubise (CRM)

On a vu ces dernières années des percées spectaculaires dans le programme de Langlands sur des corps de fonctions tant en caractéristique zéro qu'en caractéristique p. Le but de cette période de concentration était de fournir aux participants un survol de quelques-unes des techniques essentielles du domaine ainsi que des nouveaux résultats. Le résultat fut une des séries de conférences les plus spectaculaires qu'a vues le CRM depuis plusieurs années.

April 8-26, 2002!
La première partie du programme fut occupée par des cycles de conférences de trois ou quatre heures donnés par des gens de la région de Montréal, pour étudiants de 2e et 3e cycles et

post-doctorants sur la matière nécessaire à une compréhension du programme de Langlands. La liste des conférenciers et de leurs sujets comprend!:

Abraham Broer (Montréal)
D-modules

Jacques Hurtubise (CRM & McGill)
The Hitchin systems

Jason Levy (Ottawa)
Trace formulae

Ram Murty (Queen's)
A Survey of the Langlands Program in number fields

Ambrus Pal (CRM)
Introduction to shtukas

Amritanshu Prasad (CRM)
Automorphic representations

David Savitt (McGill)
Étale cohomology

30 April to 16 May 2002

Cette période comprenait deux phases. La première a porté sur les multiples ingrédients des preuves des conjectures de Langlands; les conférences de la Chaire Aisenstadt de E. Frenkel et de L. Lafforgue ont constitué la deuxième. À travers ces deux parties, les personnes assistant à l'atelier eurent aussi la chance d'entendre sept conférences de R. Langlands les entretenant de ses idées récentes sur l'endoscopie.

The speakers were (with abstracts):

David Ben-Zvi (Chicago)
Opers

Opers are a remarkable class of connections on algebraic curves, arising in integrable systems, conformal field theory and representation theory, which play a central role in the work of Beilinson-Drinfeld on the geometric Langlands correspondence. A tour of some of the different places opers appear was offered, visiting the Hitchin system, Hamiltonian reduction of Kac-Moody algebras, differential operators and the KdV equations, projective structures and the Virasoro algebra, and vertex algebras.

David Goss (Ohio State)
Recent advances in characteristic p arithmetic

We will discuss recent advances in the theory of the finite characteristic arithmetic associated to Drinfeld modules. Included will be some recent ideas related to a possible Riemann hypothesis

for the L-series of such objects. Also discussed were advances in the associated theory of modular forms associated to Drinfeld modules. In particular, we will discuss Boeckle's association of Galois representations to cusp forms.

Edward Frenkel (UC Berkeley)
Aisenstadt Chair 2001-2002
Recent developments in the geometric Langlands Program

In recent years it was realized that the Langlands conjectures (in the function field case) might be formulated geometrically and hence over an arbitrary ground field, for instance, the field of complex numbers. In that case the role of the representation theory of groups over local non-Archimedean fields is played by the representation theory of affine Kac-Moody algebras, as can be seen from the recent work of A. Beilinson and V. Drinfeld. These lectures reviewed the geometric Langlands conjectures and various approaches to proving them. Also discussed were the intriguing parallels between the finite field and the complex field settings.

Laurent Lafforgue (IHES)
Aisenstadt Chair 2001-2002
Chtoucas de Drinfeld et correspondance de Langlands

La présentation a porté sur les grandes lignes de la démonstration de la correspondance de Langlands pour GL(r) sur les corps de fonctions, généralisant la preuve de Drinfeld dans le cas du rang r = 2. Plus particulièrement on s'est attaché à montrer le rôle des principaux ingrédients de la démonstration!: la géométrie des chtoucas de Drinfeld et de leurs compactifications!; la formule des traces d'Arthur-Selberg!; la formule des points fixes de Grothendieck-Lefschetz!; les propriétés connues des fonctions L de paires tant du côté automorphe que galoisien.

Robert Langlands (IAS)
Au-delà de l'endoscopie

Grâce aux travaux récents d'Arthur sur l'endoscopie et la formule des traces et à d'autres travaux pas moins importants de grand nombre de mathématiciens sur le lemme fondamental, nous commençons à mieux comprendre non pas seulement comment utiliser la formule des traces pour établir le transfert des formes automorphes d'un groupe à un autre, mais aussi quelle est la vraie portée, en particulier le contenu

géométrique ou topologique, des problèmes à première vue techniques qu'il faut surmonter.

Il n'en reste pas moins que les méthodes utilisées sont toujours d'un pouvoir limité et ne suffisent pas à la résolution générale des problèmes posés par la fonctorialité, en particulier ceux qui interviennent dans les conjectures d'Artin ou de Ramanujan-Selberg. Elles nous inspirent toutefois une grande confiance dans la formule des traces telles que développée dans les dernières années et, emporté par cette confiance, l'objectif dans ce cours fut de chercher une voie qui puisse nous permettre de dépasser ce qu'on a fait jusqu'à présent.

Le cours s'adressait aux jeunes mathématicien(ne)s spécialist(e)s de la théorie analytique ou de la théorie algébrique des nombres ou des formes automorphes voulant travailler dans la théorie moderne des formes automorphes, un sujet ou toutes ces théories se brassent. Quelques connaissances préalables des formes automorphes sur GL(2) étaient exigée aussi bien qu'une absence d'idées fixes. Le cours fut en grande partie axé sur un examen d'un point de vue inhabituelle de la formule des traces telles que décritent dans le livre de Jacquet-Langlands.

Alexander Polishchuk (Boston)
Introduction to perverse sheaves

These lectures focussed on the definition and presentation of some examples of perverse sheaves in two contexts: (1) complex geometry, (2) algebraic geometry in positive characteristic. Also discussed were the Riemann-Hilbert correspondence in case (1) and *faisceaux-fonctions* dictionary in case (2).

Christophe Sorger (Nantes)
Moduli stacks of G-bundles

After collecting preliminary material on algebraic stacks useful for moduli problems, moduli of G-bundles were introduced and some of the (by now) basic theorems as the uniformization theorem were proved.

Workshop in honour of Robert Langlands
May 17, 2002

Un atelier en l'honneur de R. Langlands fut tenu le 17 mai pour souligner son 65e anniversaire. Les conférenciers comprenaient quelques-uns de ses collaborateurs en théorie des nombres et en mécanique statistique, ainsi que deux de ses étudiants. L'atelier visait tout particulièrement à souligner ses contributions au développement des mathématiques à Montréal.

Invited speakers:
James Arthur (Toronto)
Développements en germes pour les groupes réels

Laurent Clozel (Paris-Sud & Caltech)
Rigidité et équipartition!: résultats et conjectures

Dennis Gaitsgory (Chicago)
On the geometric Langlands conjecture for GLn

Philippe Pouliot (Texas)
Finite number of states, de Sitter space, and quantum groups at roots

Yvan Saint-Aubin (Montréal)
Deux exemples simples de transition de phase!: la percolation et le modèle d'Ising

Computational Lie Theory
May 27 to June 7, 2002
Org.: W. Casselman (UBC), F. Knop (Rutgers)

There were two series of lectures by Meinholf Geck on applications of GAP in doing research involving Coxeter and algebraic groups, and by John Stembridge mostly on tensor product decomposition, with examples using Maple. The workshop complemented the Aisenstadt lectures given concurrently by George Lusztig.

The most surprising lecture was by Greg Warrington, who exhibited several counter-examples to what many people had earlier thought – that the μ coefficients for the symmetric groups were always 1. Really surprising was that this had been known for several years by Tim McLarnahan, but that his discoveries had not been published. Warrington had written his own programs to explore the phenomenon further.

Invited speakers: R. Bédard (UQAM), R. Bezrukavnikov (Chicago), M. Brion (Joseph Fourier), F. du Cloux (Lyon I), M. J. Dyer (Notre Dame), W. Fulton (Michigan), M. Geck (Lyon), G. J. Heckman (Nijmegen), A. G. Helminck (North Carolina State), F. Knop (Rutgers), J. McKay (Concordia), M. Noumi (Kobe), E. M. Opdam (Amsterdam), A. Ram (Wisconsin), Y. B. Sanderson (William Paterson) T. A. Springer (Utrecht), J. R. Stembridge (Michigan), B. Sturmfels (Berkeley), P. Trapa (Harvard), J. F. van Diejen (Chile), M. van Leeuwen (Poitiers), D. A. Vogan Jr (MIT), N. R. Wallach (California, San Diego), G. Saunders Warrington (Harvard), A. Zelevinski (Northeastern).

Algebraic Transformation Groups

June 10-14, 2002
Org.: A. Broer (Montréal), J. Carrell (UBC)

The purpose of the workshop was to bring together experts in algebraic groups, algebraic geometry, representation theory and related areas, especially those touching on: geometric methods in representation theory using tools like equivariant cohomology and perverse sheaves; the Hilbert scheme of points on a surface and its connection with the n!-conjecture in algebraic combinatorics; equivariant versions of cohomology and Chow groups related to flag manifolds and Schubert varieties; quantum cohomology and Schubert calculus.

Invited speakers: K. Behrend (UBC), A. Bertram (Utah), T. Braden (Massachusetts), M. Brion (Grenoble), W. A. Casselman (British Columbia), V. Ginzburg (Chicago), M. Haiman (UCSD), G. Heckman (Nijmegen), R. B. Howlett (Sydney), F. Knop (Rutgers), A. Knutson (Berkeley), B. Kostant (MIT), S. Kumar (North Carolina), L. Manivel (Grenoble), E. Meinrenken (Toronto), I. Mirkovic (Massachusetts), H. Nakajima (Kyoto), D. Peterson (UBC), Y. B. Sanderson (William Paterson), T. A. Springer (Utrecht), D. E. Taylor (Sydney), E. Vasserot (Cergy-Pontoise), C. Woodward (Rutgers).

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 courses on a specialized subject. They are also invited to prepare a monograph. At the request of Dr. Aisenstadt, the first of their lectures should be accessible to a wide audience. Previous holders of the 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 and Arthur T. Winfree.

The CRM was honoured to have as Aisenstadt chairholders, during the 2001-2002 theme year in Groups and Geometry, Professors *Edward Frenkel* of the University of California at Berkeley, *Professor Laurent Lafforgue* of the Institut des Hautes Études Scientifiques and *Professor George Lusztig* of MIT.

Professor Edward Frenkel
University of California at Berkeley

On the week of May 6-14, 2002, Professor Edward Frenkel gave a series of eight conferences titled "Recent developments in the geometric Langlands Program" as part of the series of lectures on the Langlands program for function fields. Frenkel's lectures were greatly enjoyed by everyone in attendance for their remarkable clarity, they were one of the high points, along with those of Laurent Lafforgue, of the theme year. Here is the summary of the talks:

> In recent years it was realized that the Langlands conjectures (in the function field case) might be formulated geometrically and hence over an arbitrary ground field, for instance, the field of complex numbers. In that case the role of the representation theory of groups over local non-Archimedean fields is played by the representation theory of affine Kac-Moody algebras, as can be seen from the recent work of A. Beilinson and V. Drinfeld. In these lectures we will review the geometric Langlands conjectures and various approaches to proving them. We will also discuss the intriguing parallels between the finite field and the complex field settings.

Professor Frenkel obtained his undergraduate degree from Moscow in 1989 and his Ph.D. from Harvard in 1991 under the supervision of B.!Feigin. He was then appointed at the Harvard Society of Fellows and became in 1997 full professor at Berkeley. His mathematical interests cover a remarkably wide range of topics, including fields, quantum theory, integrable systems, representation theory and algebraic geometry.

Professor Laurent Lafforgue
Institut des Hautes Études Scientifiques

As part of the concentration period on the Langlands program for function fields, Professor Laurent Lafforgue gave a series of five conferences May 6-14, 2002, with the title *Chtoucas de Drinfeld et correspondance de Langlands*. Here is the summary of the talks:

On se propose de présenter les grandes lignes de la démonstration de la correspondance de Langlands pour GL(r) sur les corps de fonctions, généralisant la preuve de Drinfeld dans le cas du rang r=2. On s'attachera en particulier à montrer le rôle des principaux ingrédients de la démonstration:

> la géométrie des chtoucas de Drinfeld et de leurs compactifications;
> la formule des traces d'Arthur-Selberg;
> la formule des points fixes de Grothendieck-Lefschetz;

les propriétés connues des fonctions L de paires tant du côté automorphe que galoisien.

The following week, he gave us an additional series of three talks on several variations of Grassmannians and their compactification; some specific cases constitute a key ingredient of his proof for the Langlands conjecture for GL(r) over function fields; he has since greatly generalized the theory. The material of those three talks as well as those from the previous series will be published as a CRM monograph.

After graduating from the École Normale Supérieure, Laurent Lafforgue entered the CNRS as a research fellow in 1990. In 1994, he presented his thesis *D-Chtoukas de Drinfeld*, under the guidance of Gérard Laumon. First appointed as a professor at Orsay, he accepted an appointment as permanent professor at IHÉS in 2000. He was awarded the Cours Peccot at the Collège de France in 1996 and was an invited speaker at the International Congress of Mathematicians in Berlin in 1998. In 2002, he received the Fields Medal for this proof of the Langlands conjecture on the correspondence connecting arithmetic properties to analytic properties of automorphic representations.

Professor George Lusztig
MIT

On May 27, 2002, Professor George Lusztig gave a public conference entitled "Homomorphisms of the icosahedral group into reductive groups," in which he explored homomorphisms of finite groups, in particular the icosahedral group, into reductive groups. Those homomorphisms are strongly constrained and Professor Lusztig presented one classification. This conference was followed by a more specialized series, titled "Hecke algebras with unequal parameters," given as part of the workshop on computational Lie theory. Those talks were very well received and will be the object of an AMS-CRM monograph.

Holder of the Norbert Wiener Chair at MIT, Professor Lusztig is one of the greatest contemporary mathematicians and has had an impact during his very successful career on a wide range of mathematical problems. Among others, he has produced fundamental results on the representations of finite groups of the Lie type; a construction for canonical bases of representations based on quantum algebras; as well as results at the core of the cohomology methods in representation theory.

General Program 2001-2002

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 mathematical sciences at all levels. The program is quite flexible, to allow for opportunities as they arise.

Second public lecture of the *Canadian Journal of Statistics*

June 14, 2001, Simon Fraser University
Org.: Christian Genest (Laval), Richard Lockhart (Simon Fraser)

Dans le cadre du 29ᵉ congrès annuel de la Société statistique du Canada, tenu à l'Université Simon Fraser (Burnaby, Colombie-Britannique) du 10 au 14 juin 2001, le professeur Peter M. Hooper de l'Université de l'Alberta a présenté ses travaux de recherche concernant un modèle de régression flexible défini à partir d'une base de fonctions logistiques adaptatives.

L'article du professeur Hooper a ensuite fait l'objet d'un débat public, animé par le rédacteur en chef de *La revue canadienne de statistique* (RCS), le professeur Richard A. Lockhart. Plusieurs spécialistes du domaine ont commenté publiquement les travaux du professeur Hooper, soit Mary J. Lindstrom (University of Wisconsin at Madison), James O. Ramsay (McGill University), Nancy E. Heckman (University of British Columbia), ainsi que Hugh A. Chipman et Hong Gu (University of Waterloo). Les congressistes, présents en grand nombre à ce débat, ont également été invités à poser des questions ou à formuler des suggestions.

Les commentaires retenus, ainsi que les réponses du professeur Hooper, ont été publiés avec l'article dans le numéro de septembre 2001 de *La revue canadienne de statistique* (Vol. 29, No 3, 2001, pp. 343-378). Une version pdf de l'article est accessible en permanence sur la vitrine Internet de la RCS, à l'adresse http://www.mat.ulaval.ca/rcs

Étant donné le franc succès remporté par cette activité, la RCS et le CRM ont décidé de poursuivre leur collaboration en organisant, à Montréal cette fois, un 3ᵉ débat public. Celui-ci a eu lieu le 22 mars 2002.

Eighth Canadian conference of mathematics students

June 12-17, 2001, Université Laval
Org.: Pier-André Bouchard St-Amant (Laval), Jean-Philippe Boulet (Laval), Sylvain Hallé (Laval), Jean-François Plante (Laval)

Cette conférence annuelle s'adresse aux étudiants canadiens de premier cycle dont le programme d'études contient des mathématiques avancées. Les étudiants inscrits sont invités à présenter un exposé de 20 ou 50 minutes sur un sujet mathématique de leur choix. Aux exposés d'étudiants s'ajoutent cinq conférences données par des professeurs d'universités canadiennes. Ainsi, Nelly Simoes nous a fait un exposé très intéressant sur la théorie des files d'attente.

Évidemment, les étudiants ont également profité de l'occasion pour découvrir la ville de Québec. Ils avaient la possibilité d'aller visiter la citadelle de Québec ou simplement d'aller se promener dans le Vieux Québec, ce qui fût grandement apprécié.

Séminaire de mathématiques supérieures: *Modern Methods in Scientific Computation & Applications*

July 9-20, 2001, Université de Montréal
Org.: G. Sabidussi (Montréal), K. Mikula (Slovak Technical University), A. Bourlioux (Montréal), M. Gander (McGill), S. Lessard (Montréal), G. C. Papanicolaou (Stanford), A. Stuart (Warwick)

The 40ᵗʰ session of the Séminaire de mathématiques supérieures (9-20 July 2001) was devoted to *Modern Methods in Scientific Computation and Applications*. No session of the SMS during the last 25 years having dealt with numerical mathematics, the program for 2001 was specifically designed to show how wide the influence of scientific computing had become during that period. The main themes were image processing, mathematical finance, electrical engineering, thin films, moving interfaces, and turbulent combustion, the common thread running through these subjects being the numerical solution and analysis of the asymptotic behavior of the partial differential equations involved in these problems. The

following 8 mini-courses were given: Domain decomposition methods (L. Halpern, Paris XIII, and F. Nataf, École Polytechnique); Multigrid methods (G. Haase and U. Langer, Linz); Numerical aspects of deterministic and random dynamical systems (T. Humphries, Sussex, and A. Stuart, Warwick); Matrix analysis of extremely large systems (Z. Bai, UC Davis, and G. Golub, Stanford); Stochastic differential equations and volatility analysis (G. Papanicolaou, Stanford, and R. Sircar, Princeton); Applications of PDEs in image processing (K. Mikula, STU Bratislava, and J. Sethian, Berkeley); Asymptotic analysis of rupturing and fingering in thin films (A. Bertozzi and T. Witelski, Duke); Numerical combustion (P. Souganidis, Texas at Austin, and A. Bourlioux, Montréal).

In addition to the 16 speakers, 59 participants coming from 20 different countries attended the session. Besides the support by the CRM, the SMS benefited from support by NATO (through its Advanced Study Institutes Program), the Université de Montréal, and McGill University. Martin Gander (McGill) and Anne Bourlioux (Montréal) were the scientific organizers of the session.

The proceedings have been published by Kluwer Academic Publishers in the NATO Science Series II, Vol. 75.

Statistics 2001 Canada: The Fourth Canadian Conference in Applied Statistics

July 6-8, 2001, Université Concordia
Org.: Y. Chaubey (Concordia), F. Nebebe (Concordia)

The conference was a success. It attracted approximately 250 participants representing government, education and industry from all over the globe. Important problems associated with current issues in genomics, environment, health, networking and data management, along with theoretical developments in statistics were discussed. The conference featured 144 speakers in seven plenary sessions and 42 invited and contributed papers sessions. On overwhelming demand from the contributors, the organizers decided to publish refereed proceedings of the conference in a volume entitled *Recent Advances in Statistical Methods*, edited by Yogendra P. Chaubey and published by World Scientific Publishing (UK) Ltd.

FUSION 2001: 4th International Conference on Information Fusion

August 7-10, 2001, Montréal
261 participants
Org.: E. Shahbazian (Lockheed Martin Canada & CRM), D. Blair (Georgia Tech.), P. Willett (U. Conn.), P. Valin (Lockheed Martin Canada & CRM).

Fusion 2001 provided a forum for fusion research, applications, and technological advances by scientists and engineers working in all aspects of information and data fusion techniques and systems. This fourth incarnation of the International Conferences on Information Fusion was held on behalf of the International Society on Information Fusion (ISIF) in Montréal from August 7-10, 2001, during a record-breaking heat wave (35 days without rain!). The organization and sponsorship were shared between Lockheed Martin Canada, the Network for Computing and Mathematical Modeling (ncm_2), the Centre de Recherches Mathématiques (CRM) of the Université de Montréal, Defense Research Establishment Valcartier (DREV), the Canadian Space Agency (CSA), Mathematics of Information Technology and Complex Systems (MITACS), and was under the technical co-sponsorship of the IEEE AES Society.

Conference topics covered theoretical and technical advances for fusion algorithms and systems, and provided real-world applications. There were 146 technical contributions from 304 authors representing 19 countries. There were also seven organized sessions on Computationally Intensive Distributed Sensor Networks, Formal Methods, Image Fusion & Exploitation, Distributed Tracking, Situation Analysis and Situational Awareness, Knowledge Base Role in Information Fusion, Non-linear Filtering and Probabilistic Multi-Hypothesis Tracking. For a more detailed report, see
www.crm.umontreal.ca/fusion.

Seconde conférence à la mémoire de Gilles Fournier

August 13-15, 2001, Université de Sherbrooke
Org.: Marlène Frigon (Montréal), Andrzej Granas (Montréal), Tomasz Kaczynski (Sherbrooke)

Les thèmes principaux de cette seconde conférence dédiée à la mémoire de Gilles Fournier ont été la théorie des points fixes et la théorie de points critiques ainsi que leurs applications aux équations différentielles et aux systèmes dynamiques. À cette occasion, des développements récents de ces domaines ont été présentés par des experts conduisant à des échanges stimulants entre eux et les participants. Des conférences de nature historique ont aussi

été présentées notamment sur la contribution de Gilles Fournier.

La participation à cette conférence a été excellente. Cette conférence était suivie par un atelier sur l'indice de Conley. Ainsi, plusieurs personnes ont prolongé ou devancé leur séjour à Sherbrooke (selon le cas) pour participer aux deux conférences. Aussi, il y a eu une bonne participation d'étudiants de cycles supérieurs d'ici et de l'étranger.

Invited speakers: M. Allili (Lennoxville), F. Collin (Sherbrooke), P. Deguire (Moncton), Z. Dzedzej (Gdansk), N. El Khattabi (Maroc), A. Felshtyn (Greifwald), K. Geba (Gdansk), A. Granas (Montréal), A. Marino (Pise), M. Martelli (Cal St. Fullerton), J. Mawhin (Université Catholique de Louvain), K. Saadi Drissi (Maroc), N. Schlomiuk (Montréal), H. Steinlein (Munich), A. Szulkin (Stockholm).

Spectral Statistics and High Energy Eigenstates

August 25 to September 2, 2001, CRM
Org.: Dmitry Jakobson, John Toth, Yiannis Petridis (McGill).

The workshop brought together mathematicians and physicists working in the areas of Random Matrix Theory, Riemann-Hilbert Problems, Toeplitz Quantization, Analytic Number Theory (Automorphic Forms and L-functions), Semiclassical Theory and Partial Differential Equations, focusing on spectral statistics and asymptotic properties of high energy Eigenstates, and resulting in lively interaction among the participants. For many conference participants, this was their first visit to Montréal, and several of them mentioned to organizers their very positive impressions of the conference, the CRM and the city, and indicated their desire to come again.

Four very successful introductory courses were presented by: P. Bleher, *Semiclassical Asymptotics in Random Matrix Models 1,2,3*; Z. Rudnick, *Quantum Maps: Semiclassics and Number Theory 1,2,3*; A.!Uribe, *Berezin-Toeplitz Operators 1,2,3*; and S. Zelditch, 1. *Highly Excited Quantum Eigenstates*, 2. *Riemannian Manifolds with Extreme Eigenfunction Growth*, and 3. *Random Spherical Harmonics.*

Building on the success of the conference, and on the success of two sectional meetings of the AMS at CRM in May 2002 (on Random Matrices, and on Spectral Geometry and Analytic Aspects of Automorphic Forms), the organizers are planning three workshops related to the conference theme during the year in Analysis at CRM and Fields Institute in 2003/2004.

Invited speakers: A. Gamburd (Stanford), I. Vardi (IHES), P. Bleher (Indiana, Purdue), Z. Rudnick (Tel Aviv), R. Speicher (Queen's), I. Dumitriu (MIT), E. Duenez (Johns Hopkins), A. Bourget (McGill), H. Widom (Santa Cruz), K. Soundararajan (IAS), H. Donnelly (Purdue), P. Sarnak (Princeton), U. Smilansky (Weizmann), B. Eynard (CRM), T. Tate (Keio), A. Uribe (Michigan), M. Min-Oo (McMaster), V. Jaksic (Johns Hopkins), J. Harnad (CRM), W. Craig (McMaster), I. Rivin (Temple), M. Bertola (CRM).

Histoires de catégories

Septembre 13-14, 2001, CRM
Org.: Luc Bélair (UQAM), Liliane Beaulieu (CRM)

Cet atelier des 13 et 14 septembre, auquel ont participé des mathématiciens, des historiens et des philosophes des mathématiques, avait pour objectif principal de faire le point sur l'histoire de la théorie des catégories. La parole était largement donnée aux protagonistes de cette histoire. Les événements du 11 septembre 2001 ont chambardé l'horaire prévu, en empêchant C. Houzel et C. McLarty de faire le voyage. C. McLarty a pu reporter sa participation au 21 septembre. Les organisateurs tiennent à remercier les participants, et en particulier les conférenciers, pour avoir rendu ces journées fructueuses, dans un contexte international peu propice aux souvenirs du temps passé. Les comptes-rendus de ces journées seront publiés sous la direction de Liliane Beaulieu.

Invited speakers: L. Beaulieu (CRM), C. Houzel (Paris), J. Lambek (McGill), W. Lawvere (Buffalo), M. Makkai (McGill), C. McLarty (Case Western), G. Reyes (Montréal).

Journée statistique du CRM et 3ᵉ conférence publique de la Revue statistique du Canada

March 22, 2002, CRM
Org.: Christian Genest (Laval), Christian Léger (CRM, Montréal).

Le Centre de recherches mathématiques (CRM) et la Revue canadienne de statistique (RCS) se sont à nouveau associés afin de présenter la 3ᵉ Conférence publique de la RCS dans le cadre de la Journée statistique du CRM. Suite au succès obtenu lors de la présentation des deux premières conférences publiques tenues lors des deux derniers congrès annuels de la SSC, la RCS a innové en présentant sa troisième Conférence publique au CRM le 22 mars 2002.

La Conférence publique portait sur l'article intitulé *Box-Cox transformations in linear models: Large sample theory and tests of normality*, des auteurs Gemai Chen de l'Université de Calgary, ainsi que Richard A. Lockhart et Michael A. Stephens de l'Université Simon Fraser. En

étudiant la théorie asymptotique des estimateurs dans le modèle de transformation de Box et Cox, les auteurs ont constaté que la distribution de l'estimateur de régression dépend fortement du paramètre de transformation alors que si on normalise par le paramètre de dispersion des erreurs, la dépendance par rapport au paramètre de transformation est grandement diminuée. De plus, l'hypothèse de la normalité des erreurs est très importante et ils démontrent comment on peut tester cette hypothèse dans ce contexte de transformation. L'article a été commenté par Kjell Doksum de l'Université de la Californie à Berkeley et Richard A. Johnson de l'Université de Wisconsin-Madison, par Peter M. Hooper de l'Université de l'Alberta et par Peter J. McCullagh de l'Université de Chicago. Une réplique de la part des auteurs a conclu la session. La contribution des divers intervenants a permis de mieux comprendre ce problème important de la théorie de la régression.

La Journée statistique du CRM a débuté le matin avec des conférences sur les travaux récents de quatre des conférenciers commentant l'article de la Conférence publique. Deux des présentations portaient sur le thème des transformations en régression. Richard A. Johnson a introduit *A new family of power transformations to improve normality* alors que Kjell Doksum a parlé de *Robustness and stability of parameters and estimates*. Peter Hooper a présenté *Relating patterns of fetal growth to health outcomes at birth*.

Finalement, Peter McCullagh a discuté de *Statistical models for Monte-Carlo integration*. La participation des étudiants et des boursiers postdoctoraux a été particulièrement importante. L'expérience consistant à présenter une conférence publique de la RCS en dehors du congrès annuel de la Société statistique du Canada a donc été couronnée de succès.

Invited speakers: G. Chen (Calgary), K. Doksum (Berkeley), P. Hooper (Alberta), R. Johnson (Wisconsin at Madison), R.!Lockhart (Simon Fraser), P. McCullagh (Chicago), M.!Stephens (Simon Fraser).

CNTA VII Meeting of the Canadian Number Theory Association
May 19-25, 2002, CRM, Université de Montréal.
Org.: H. Kisilevsky (Concordia) & E. Goren (McGill)

The Canadian Number Theory Association (CNTA) was founded in 1987 at the International Number Theory Conference at Laval University. The purpose of the CNTA is to enhance and promote learning and research in Number Theory, particularly in Canada. To advance these goals the CNTA organizes major international conferences, with the aim of exposing Canadian students and researchers to the latest developments in number theory world wide. This year, the CNTA VII conference was immediately preceded by a three-week workshop on the Langlands Program for function fields at the CRM. Sessions covered topics in algebraic number theory, computational number theory, analytic number theory, diophantine analysis and approximation, and arithmetic algebraic geometry. There were 187 participants.

Invited Speakers: M.!Bennett (Urbana-Champaign), A.!Besser (Ben-Gurion), M.!Bhargava (Princeton), J.!Borwein (Simon Fraser), D.!Boyd (UBC), D.!Brownawell (Penn. State), Y.!Bugeaud (Strasbourg!I), D.!Burns (King's College), I.!Chen (Simon Fraser), H.!Cohen (Bordeaux), B.!Conrad (Michigan), C.!Consani (Toronto), J.!Cremona (Nottingham), H.!Darmon (McGill), C.!Deninger (Munster), W.!Duke (UCLA), R.!Dvornicich (Pisa), S.!Edixhoven (Rennes), J.!Friedlander (Toronto), D.!Goss (Ohio State), A.!Granville (Georgia), A.!Iovita (Washington), C.!Khare (Utah), H.!Kim (Toronto), J.!Lagarias (AT&T Labs), M.!Laurent (Luminy, CNRS), G.!Martin (UBC), W.!McCallum (Arizona), D.!McKinnon (Waterloo), K.!Murty (Toronto), R.!Murty (Queen's), K.!Ono (Wisconsin), G.!Pappas (Michigan State), C.!Pomerance (Bell Labs), B.!Poonen (Berkeley), C.!Popescu (Johns Hopkins), R.!Ramakrishna (Cornell), M.!Rapoport (Köln), Z.!Rudnick (Tel-Aviv), K.!Soundararajan (Michigan), W.!Stein (Harvard), C.!Stewart (Waterloo), V.!Vatsal (UBC), D.!Wan (UC Irvine), A.!Weiss (Alberta), T.!Wooley (Michigan).

Conférence *Constance van Eeden*!: Statistique mathématique 2002
May 24-25, 2002, CRM
Org.!: Marc Moore (École Polytechnique), Sorana Froda (UQAM), Christian Léger (CRM)

Les 24 et 25 mai dernier, le CRM a été l'hôte d'une conférence soulignant le 75e anniversaire de naissance de Mme Constance van Eeden ainsi que sa longue et remarquable carrière en recherche et en direction d'étudiants. Mme van Eeden est Professeur émérite à l'Université de Montréal ainsi que Professeur honoraire de l'Université de la Colombie Britannique.

Ancien étudiant à la maîtrise de Mme van Eeden, Louis-Paul Rivest de l'Université Laval a débuté la Conférence en présentant *Un modèle de statistique directionnelle pour la détection et la correction du «!crosstalk!» en cinématique humaine*. Puis Roelof Helmers, compatriote du CWI Amsterdam, a présenté ses travaux sur *Statistical estimation of Poisson intensity functions*. Denis Larocque des HEC, son dernier étudiant au doctorat à l'Université de Montréal, a fait un survol des plus récentes méthodes en statistique non paramétrique dans *A review of modern*

methods based on signs and ranks for multidimensional data. Bill Strawderman, de l'Université Rutgers et statisticien en résidence du Fonds Constance van Eeden à UBC en 1999, nous a entretenus de *Bayes minimax estimation of a normal mean vector for general quadratic loss*. Un autre compatriote de l'Université d'Amsterdam, Chris Klaassen, a présenté ses travaux sur *Asymptotic most accurate confidence intervals in the semiparametric symmetric location model.* Jim Zidek, un de ses plus fidèles collaborateurs de UBC, a présenté une très bonne conférence au titre fort intriguant de *Uncertainty*.

De plus, Yves Lepage de l'Université de Montréal et second étudiant au doctorat de Mme van Eeden a fait un survol de sa contribution exceptionnelle à la statistique non paramétrique ainsi qu'à la direction d'étudiants (plus de 13 au doctorat et 18 à la maîtrise). Finalement, François Perron de l'Université de Montréal a présenté un survol de ses plus importantes contributions, dont plusieurs sont récentes, à l'estimation dans des espaces paramétriques contraints.

Plus d'une cinquantaine de chercheurs, étudiants, ex-étudiants ou ex-collègues de Mme van Eeden ont pu bénéficier de cet excellent programme scientifique. Finalement un livre intitulé *Mathematical Statistics and Applications: Festschrift for Constance van Eeden* est présentement en préparation. Édité par Marc Moore de l'École Polytechnique et Sorana Froda de l'Université du Québec à Montréal, deux anciens étudiants au doctorat de Mme van Eeden, ainsi que par Christian Léger du CRM et de l'Université de Montréal, ce livre sera publié en 2003 conjointement par le CRM et l'IMS (*Institute of Mathematical Statistics*).

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 $5000 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), and William T. Tutte (2001). The CRM-Fields Institute 2002 Prize is awarded to *Professor John B. Friedlander.*
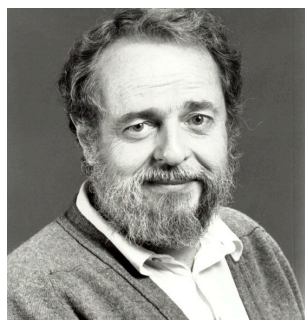
Professor Friedlander is one of the world's foremost analytic number theorists, and is a recognized leader in the theory of prime numbers and L-functions. He received his B.Sc. from the University of Toronto in 1965, a M.A. from the University of Waterloo in 1966, and a Ph.D. from Penn State in 1972. He was a lecturer at M.I.T. in 1974-76, and has been on the faculty of the University of Toronto since 1977, where he served as Chair during 1987-91. He has also spent several years at the Institute for Advanced Study where he has collaborated with E. Bombieri and many others. John Friedlander is a Fellow of the Royal Society of Canada (1988), was an invited lecturer at the 1994 ICM in Zurich and delivered the CMS Jeffery-Williams Lecture in 1999. He has contributed significantly to mathematics in other ways, especially in Canada, through his role at NSERC (Mathematics GSC, 1991-94), as Mathematics Convenor of the Royal Society of Canada (1990-93), and as a Council member (1989-95) and Scientific Advisory Panel member (1996-2000) of the Fields Institute. He has also served on the Editorial Board of the Canadian Journal of Mathematics and the Canadian Mathematics Bulletin for the past four years.

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), and Dr. Eckhard Meinrenken (2000). CRM was delighted to award the 2001 André-Aisenstadt Prize to *Professor Jingyi Chen* of the University of British Columbia
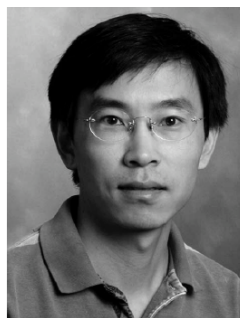
Mr. Chen obtained a Ph.D. from Stanford University in 1992. He has since been a professor at the Massachussetts Institute of Technology, at Northwestern University and the University of California. His works in geometric analysis have been recognized. He was awarded the Alfred P. Sloan Research Fellowship from the National Science Foundation (USA) Postdoctoral Fellowship. He has published over twenty articles and is an invited speaker all over the world. Professor Chen delivered a lecture on January 18, 2002. Here is the summary:

Quaternionic mappings between hyperkahler manifolds

Quaternionic maps (Q-maps) between hyperkahler manifolds are quaternionic analogues of Cauchy-Riemann equations of maps between Kahler manifolds and they arise naturally in higher dimensional gauge theory. Q-maps between quaternion numbers are just solutions to Cauchy-Riemann-Fueter equations. The Q-maps are energy minimizers in their homotopy classes, hence harmonic. We will discuss a necessary and sufficient condition on

when a Q-map becomes holomorphic with respect to some complex structures, and give examples of Q-maps that cannot be holomorphic. When the domain of Q-maps is real 4-dimensional, we will analyze the structure of the blow-up set of a sequence of Q-maps, and show that the singular set of a stationary Q-map is at most a 1-dimensional Hausdorff rectifiable set. We will also indicate possible applications of this compactness result.

CAP-CRM Prize

Awarded for the first time in 1995, the CAP-CRM Prize is given for outstanding contributions to theoretical and mathematical physics. 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), and André-Marie Tremblay (2001). The 2002 CAP-CRM prize has been awarded to *Professor Pavel Winternitz* of the Université de Montréal.
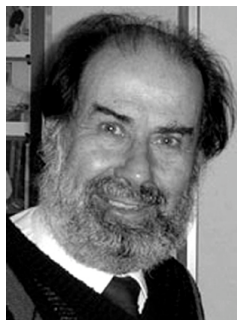
The Canadian Association of Phycisists (CAP) and the Centre de recherches mathématiques (CRM) are happy to announce that the 2002 CAP-CRM Prize in Theoretical and Mathematical Physics has been given to Pavel Winternitz, professor at the Département de mathématiques et de statistiques of the Université de Montréal for his work on symmetry methods in physics. In approximately 250 articles, he has made fundamental contributions to, amongst others, the following subjects: classification of Lie groups and algebras, their applications to the study of differential equations and difference equations, separation of variables in Hamilton-Jacobi and Schrödinger type equations, quantum groups and their applications. Born in Prague in 1936, Pavel Winternitz studied in the Soviet Union. After his bachelor and master's degree at the University of Leningrad, he obtained a Ph.D. in Theoretical Physics from Dubna's JINR (1966). In 1972, he joined the Université de Montréal. An international symposium was held at the CRM in 1997 to celebrate his sixtieth birthday as well

as that of his colleague and compatriot Jiri Patera.

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) and Colleen Cutler (2001). This year, the Centre de recherches mathématiques and the Statistical Society of Canada have awarded the CRM-SSC 2002 Prize in Statistics to *Professor Larry A. Wasserman* of Carnegie Mellon University, in Pittsburgh.

The 2002 CRM-SSC Prize in Statistics has been awarded to Dr Larry A. Wasserman of Carnegie Mellon University, Pittsburgh, for the breadth and originality of his contributions to statistical theory and his influence in the development and application of Bayesian methodology. The announcement was made at the Annual Meeting of the Statistical Society of Canada (SSC), held in Hamilton, Ontario, May 26-29, 2002.

Larry Wasserman was born in Windsor, Ontario, where he grew up. He studied mathematics and statistics at the University of Toronto (B.Sc., 1983; M.Sc., 1985; Ph.D., 1988). He has since been affiliated with Carnegie Mellon University, where he is now Professor of Statistics. The author or co-author of more than 60 scientific articles, he is widely recognized as one of the current leaders in Bayesian inference. He has brought his expertise to bear on the foundations of statistics and on numerous aspects of modern statistical theory, including sampling, mixture models, multiple testing, goodness-of-fit and robustness issues, and both nonparametric and causal inference. In addition, he maintains active

collaborations with astrophysicists and statistical geneticists.

Larry Wasserman's pathbreaking work has already earned him several distinctions. Winner of the SSC's Pierre Robillard Award for the best thesis in probability or statistics defended at a Canadian university in 1988, he was made a Fellow of the American Statistical Association and of the Institute of Mathematical Statistics in 1996.

He is also the 1999 winner of the Presidents' Award, given each year by the Committee of Presidents of Statistical Societies to an outstanding researcher under the age of 40. He has been an Associate Editor for *The Canadian Journal of Statistics* and the *Journal of Statistical Planning and Inference*. He continues to serve in that capacity for *The Annals of Statistics* and the *Journal of the American Statistical Association*.

Larry is married to an Italian statistician, Isabella Verdinelli. In his spare time, he enjoys reading novels, drinking fine wine, and hanging out in Rome.

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.

The International Workshop on Dynamical Systems and their Application to Biology

August 2-6, 2001, Cape Breton, Nova Scotia
Org.: Shigui Ruan (Dalhousie), Gail Wolkowicz (McMaster), Jianhong Wu (York)

The 45 participants came from Austria, Canada, China, Japan, Singapore, Spain, Taiwan, the UK, and the USA. Among them there were 14 PDFs and graduate students. On top of the 38 half-hour talks, there were two panel discussions on epidemiological models (chaired by Fred Brauer and Pauline van der Driessche) and population dynamics (chaired by Jim Cushing, Herb Freedman and Hal Smith). The workshop focused on (1) communication of current research results, ideas, and problems in dynamical systems and their applications in biology, (2) future research directions in dynamical systems and mathematical biology, and (3) initiating possible collaborations. It also provided a wonderful opportunity for young Canadian researchers and graduate students to communicate with the leading researchers and to present their research work. The proceedings of the workshop will be published as a volume in the Fields Institute Communications.

13th Canadian Conference on Computational Geometry

August 13-15, 2001
University of Waterloo, Ontario
Org.: T. Biedl, E. Demaine, M. Demaine, A. Lubiw (Univ. of Waterloo)
Supported by the NPC (CRM, Fields, PIMS), Univ. of Waterloo

The Canadian Conference on Computational Geometry (CCCG) focuses on the mathematics of discrete geometry from a computational point of view. Abstracting and studying the geometry problems that underlie important applications of computing (such as geographic information systems, computer-aided design, simulation, robotics, solid modeling, databases, and graphics) leads not only to new mathematical results, but also to improvements in these applications. Despite its international following, CCCG maintains the informality of a smaller workshop (70-85 attendees) and attracts a large number of students.

Second Workshop on the Conley Index and Related Topics

August 15-18, 2001, Univ. de Sherbrooke, Québec
Org.: Tomasz Kaczynski (Sherbrooke), Octav Cornea (Lille), Michael Dellnitz (Paderborn), Kontantin Michaikow (Georgia Tech), Marian Mrozek (Kraków), and Hiroe Oka (Ryukoku)
Supported by the NPC (CRM, Fields, PIMS) and the Faculté des sciences de l'Université de Sherbrooke

The workshop is a continuation of the first Conley Index Workshop held in the Banach Center (Warsaw, Poland) in June 1997. The objective of the workshop is to stimulate an exchange and collaboration on various problems related to extensions and applications of the Conley index theory as well as to the computation of the index. A particular place was given to infinite dimensional Conley index, computational topology and computational dynamics, and applications.

There were 63 participants from 14 countries. The principal speakers were Norman Dancer (Sydney), Marek Izydorek (Gdansk), William Kalies (Florida Atlantic U), Christopher McCord (Cincinnati), James Reineck (Buffalo), Roman Srzednicki (Kraków), James Yorke (Maryland), and Piotr Zgliczynski (Kraków). O. Cornea, K. Mischaikow, and M. Dellnitz also gave tutorial lectures.

UNB Workshop on Modelling & Scientific Computation

September 29-30, 2001, University of New Brunswick
Org.: V. Husain, J. Stockie and J. Watmough
Invited speakers!: Claudio Albanese (Toronto), Matt Choptuik (UBC), Leah Keshet (UBC), Brian Wetton (UBC)

The workshop was considered to be highly successful by the participants and organizers. Forty-two researchers from diverse mathematical disciplines participated. The four plenary speakers (Claudio Albanese, Matt Choptuik, Leah Keshet, and Brian Wetton) gave overviews of the problems and computational methods in their respective fields, mathematical finance, numerical relativity, computational biology, and fluid mechanics. Several contributed talks covered a broad range of topics in these fields, as well as in numerical analysis and physics.

The success of the workshop inspired discussion of establishing an annual or bi-annual series of such meetings in the Atlantic region.

CMS Winter Meeting

December 8-10, 2001
Toronto Colony Hotel, Toronto, Ontario
Org.: Tom Salisbury (president), Juris Steprans (local committee predident), Stan Kochman, Nantel Bergeron, Monique Bouchard (CMS)

Supported by the NPC Canadian Mathematical Society NPC (Fields/CRM/PIMS), Dean of Arts, York University Department of Mathematics and Statistics, York University Number of participants: 269

In 2001, the CMS's annual winter meeting included eight special sessions and nine plenary lectures (including one public lecture and two prize lectures). Four satellite conferences were planned in conjunction with the meeting. A grant from the National Program Committee provided the funding for two of the special sessions *Industrial Mathematics*, organized by Huaxiong Huang; *Moonshine*, organized by Chris Cummins). NPC funds were also used for the support of graduate students attending the meeting.

Invited speakers: Kai Behrend (UBC), Martin Golubitsky (University of Houston), Katherine Heinrich (University of Regina), Nathan Ng (University of Georgia), John Ockendon (Oxford University), Arturo Pianzola (University of Alberta), David Pimm (University of Alberta), Richard Schoen (Stanford University), Dan Voiculescu (Berkeley).

Western Canada Linear Algebra Meeting

May 10-11, 2002, University of Regina
Org.: Steve Kirkland

Supported by the NPC (CRM, Fields, PIMS), University of Regina Conference Fund, and the Faculty of Science of the University of Regina.

Held over two days, WCLAM 2002 featured 18 talks by speakers from Canada, the United States and Germany. The lectures covered a range of research areas associated with linear algebra, including matrix theory, operating theory, graph theory, applied mathematics, numerical analysis and combinatorics. The list of speakers included two winners of the Hans Schneider prize, which is given out every three years by the International Linear Algebra Society for outstanding contributions to research in linear algebra. As with previous WCLAM's, student and postdoctoral participation is encouraged, and WCLAM 2002 had ten such participants. Indeed two students were given financial support towards their travel expenses in order that they could speak at the meeting.

The meeting's atmosphere is informal, with no parallel sessions, and with plenty of time for one-on-one discussion. As a result, WCLAM 2002 is not only a forum for disseminating research results, but also a venue for establishing new research contacts and for making connections across a broad array of research interests.

Invited speakers: Jane Day (San Jose State Univ.), Ludwig Elsner (Univ. Bielefeld), Chris Godsil (Univ. of Waterloo)

The 30th Canadian Annual Symposium on Operator Algebras and Operator Theory

May 13-17, 2002, Lakehead University
Org.: Andrew J. Dean

The 30th Canadian Annual Symposium on Operator Algebras and Operator Theory took place at Lakehead University in Thunder Bay, Ontario. Our main speaker was Professor Adrian Ocneanu of Pennsylvania State University, who gave a series of three lectures on the geometrization of quantum subgroups and subfactors.

The conference was opened by Professor K. Davidson of the University of Waterloo and the Fields Institute, who spoke about his joint work with Laurent Marcoux on spans of unitary and similarity orbits. This bit of scheduling may have been a mistake on the part of the organizer, as

they continued to improve their result as the conference went on!

Also on the list of invited speakers were such regulars of Canadian Operator Symposia past as George Elliott, Man-Duen Choi, and Peter Rosenthal of the University of Toronto, and Heydar Radjavi of Dalhousie University.

Other invited speakers from abroad included Professor D. Hadwin of the University of New Hampshire, who spoke on an approach to Voiculescu's free entropy using covering numbers, and Professor Marius Dadarlat of Purdue University, whose topic was the problem of uniformly embedding a group into a Hilbert space.

In addition to the established researchers, the conference also provided a forum for several graduate students and postdocs from Canadian universities to present their work.

Invited speakers!: Adrian Ocneanu (Penn State U.), Man-Duen Choi (U. of Toronto), Marius Dadarlat (Purdue U.), Ken Davidson (U. of Waterloo), George Elliott (U of Toronto), Don Hadith (U. of New Hampshire), Heydar Radjavi (Dalhousie U.), Peter Rosenthal (U. of Toronto).

CMS Summer Meeting

June 2-4, 2001, University of Saskatchewan
Org.: K.Taylor, C. Soteros, M. Bremner, Y. Cuttle and F.-V. Kuhlmann (Saskatchewan)
Supported by the NPC (CRM, Fields, PIMS), and the University of Saskatchewan

The 2001 Summer Meeting of the Canadian Mathematical Society was both a scientific and an organizational success. There are relatively few mathematicians who live within easy traveling distance of Saskatoon, so the total of 279 registered participants exceeded most expectations and seems to be a record for a regular summer meeting.

David Boyd, University of British Columbia, gave the CMS Jeffery-Williams Lecture and Lisa Jeffrey, University of Toronto, gave the CMS Krieger-Nelson Lecture. The plenary lecturers were Georgia Benkart, Wisconsin-Madison; Zoe Chatzidakis, Paris; Geoffrey Grimmett, Cambridge; and Barry Simon, CalTech.

There were also ten well-attended special sessions in Abstract Harmonic Analysis, Geometric Topology, Graph Theory, Infinite Dimensional Lie Theory and Representation Theory, Mathematical Education: Cognition in Mathematics, Matrix Analysis, Model Theoretic Algebra, Number Theory - in Honor of David Boyd, Rigorous Studies in the Statistical

Mechanics of Lattice Models, and Scattering Theory and Integrable Systems.

CAIMS

8-10 June 2002
University of Calgary

Org.: P. Binding, T. Ware (University of Calgary)

The 23th Annual Meeting of CAIMS/SCMAI was hosted by the University of Calgary and attended by over ninety academics, postdoctoral fellows and graduate students from across Canada, but also from the United States and as far afield as Israel and the European Community. Despite the unusually wet weather, the atmosphere at the meeting was very positive. There was a lively interaction amongst the participants, whose interests included fluid dynamics, environmental mathematics, Hamiltonian dynamics, mathematical modelling, computational finance and computer graphics. There were five plenary talks, each of which was followed by three parallel sessions each focussing on one of the above areas. The presentations were of a consistently high standard, and the meeting provided an excellent showcase for the activities of Canadian applied and industrial mathematicians.

Invited speakers: J. Marsden (Caltech), A. Gargett (Old Dominion), G. Swaters (Alberta), N. Dyn (Tel Aviv), and H.!Ockendon (Oxford).

30th Annual Meeting of the Statistical Society of Canada (SSC)

May 26-29, 2002, McMaster University, Hamilton
Supported the NPC (CRM, Fields, PIMS) and McMaster University.

This meeting was an unequivocal success, with 379 registered participants. Three workshops were held:

> Design and Analysis of Cluster Randomization Trials by A. Donner, University of Western Ontario, and N. Klar, Cancer Care Ontario.
> Design and Analysis of Computer Experiments for Engineering by J. Sachs, Duke University, and W. Welch, University of Waterloo.
> Handling Missing Data by K. Nobrega and D. Haziza, Statistics Canada.

There were 46 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 statistics and governmental policy.

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:

Probability (Ilie Grigorescu, University of Miami),
Statistical Inference (Chris Klaassen, University of Amsterdam and William Strawderman, Rutgers University)

Statistics for Microarray Data Analysis (Michael Newton, University of Wisconsin at Madison and Terry Speed, University of California at Berkeley)
Statistics and Brain Mapping (Pedro Valdes-Sosa, Cuban Neuroscience Center and Moo Chung, University of Wisconsin at Madison)
Statistics and Public Policy (Miron Straf, National Academy of Sciences)
Split Plot Experiments in Industry (Robert McLeod, PhD student at University of Manitoba)
New Research Findings in Analysis Methods for Survey Data (Christian Boudreau, PhD student at University of Waterloo).

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 CRM-ISM
Org.: Paul Gauthier
(CRM & Univ. de Montréal)

June 1, 2001
Paul Gauthier, Univ. de Montéal
La fonction zêta de Riemann et les cercles de remplissage

June 8, 2001
Jie Xiao, Concordia Univ.
Isoperimetric inequalities via Hausdorff content

June 15, 2001
Alexandre Girouard, Univ. de Montéal
Rétraction de boule en dimension infinie

June 21, 2001
Pierre-Olivier Rathé, Univ. de Montéal
Produits de Blaschke

June 28, 2001
Jean-Phlippe Samson, Univ. de Montéal
Surconvergence

July 19, 2001
Sébastien Manka, Univ. de Montéal
Un théorème de sélection pour les relations

August 2, 2001
Victor Havin, Saint Petersburg
Sur la séparation des singularités de fonctions analytiques bornées

August 6, 2001
Abel Schroeder, ORT Braude College, Israel
Equations for linear fractional maps of operator balls

February 5, 2002
Paul Gauthier, Univ. de Montéal
Théorème de Bloch conforme-faux pour quasiconforme

February 12, 2002
Jie Xiao, Concordia Univ.
Corona theorem for conformal deformations

February 19, 2002
Nabil Ayoub
La constante de Bloch

February 26, 2002
André Boivin, Western Ontario Univ.
Théorèmes d'approximation et applications

March 12, 2002
Olivier Rousseau, Univ. de Montéal
Théorie du degré topologique de Brouwer et théorème de Jordan

March 19, 2002
Richard Fournier, Dawson College & Univ. de Montréal
Inégalités différentielles et univalence

March 26, 2002
Rasul Shafikov, SUNY at Stony Brook
Equivalence of domains in C^n

April 2, 2002
Richard Fournier, Dawson College & Univ. de Montréal
La suite universelle de Maurice Heins et autres pathologies

April 9, 2002
Sébastien Manka, Univ. de Montréal
Le théorème d'approximation de Carleman

April 16, 2002
Nabil Ayoub
Théorème de Bloch et théorème de Landau

April 30, 2002
Paul Gauthier, Univ. de Montréal
Propriété d'universalité de la fonction zêta de Riemann

May 7, 2002
Richard Fournier, Dawson College & Univ. de Montréal
Sur un homeomorphisme de l'ensemble des fonctions analytiques bornées

May 14, 2002
Jean-Philippe Samson, Univ. de Montréal
Une introduction aux séries de Dirichlet

May 21, 2002
Todor Fabian
Une interprétation probabiliste de la fonction Zêta de Riemann, sa représentation spectrale et applications

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

September 19 and 26, 2001
Isidore Fleischer, CRM
Sur les fonctions à variations bornées à valeurs dans les espaces métriques

October 3, 2001
Nicolas Beauchemin, Univ. de Montréal
Introduction à la catégorie de Lusternik-Schirelman

October 24 and 31, 2001
Nicolas Beauchemin, Univ. de Montréal
La catégorie relative

November 14, 2001
Nicolas Beauchemin, Univ. de Montréal
Théorie des points critiques pour des fonctionnelles multivoques

November 28 and December 5, 2001
Alexandre Girouard, Univ. de Montréal
Enlacement homologique

December 11, 2001
Donal O'Regan, National Univ. of Ireland
Integral Equations

January 11, 2002
Donald Violette, Univ. de Moncton
Différentiabilité de type univoque pour une certaine classe d'applications multivoques

January 30, 2002
Alexandre Girouard, Univ. de Montréal
Axiomatisation des inégalités de Morse

February 6-13 and 20, 2002
Nicolas Beauchemin, Univ. de Montréal
Introduction à la f-catégorie

March 13, 2002
Ron Stern, Concordia Univ.
A necessary condition for state constrained stabilization

March 27, 2002
Nicolas Beauchemin, Univ. de Montréal
La catégorie relative au sens de Szulkin

April 25 and May 2, 2002
Nicolas Beauchemin, Univ. de Montréal
Application de la catégorie relative aux équations différentielles

Special Lectures
Org.: N. Kamran & J. Hurtubise (CRM & McGill)

September 10, 13, 14 and 17, 2001
Li Ma, Tsinghua Univ.
Mean Curvature Flow for Lagrangian Submanifolds, I

Special Lecture
Org.: Adam Sikora (CRM)

July 13, 2001
Louis Kauffman, Univ. of Illinois at Chicago
Virtual Knot Theory

Special Lectures
Org.: Jean-Marc Lina (CRM)

October 3, 2001
Noel Cressie, Ohio State Univ.
Fast spatial prediction via multi-resolution tree-structured models

October 4, 2001
Noel Cressie, Ohio State Univ.
Fast spatial prediction via multi-resolution tree-structured models II

March 13, 2002
Bradley J. Lucier, Purdue Univ.
Wavelet Methods for Medical Tomography

Special Lectures
Org.: J. Harnad (Concordia & CRM)

September 26, 2001
A. N. Tyurin, Steklov Mathematical Institute
Quantization and theta-functions

October 3, 2001
A. N. Tyurin, Steklov Mathematical Institute
Symplectic geometry of moduli spaces of vector bundles

October 10, 2001
A. N. Tyurin, Steklov Mathematical Institute
Non-abelian theta-functions

Special Lectures
Org.: John Taylor (McGill)

September 28 and October 5, 2001
Francois Ledrappier, École Polytechnique (Palaiseau, France)
Brownian motion and negatively curved manifolds

October 12, 2001
Francois Ledrappier, École Polytechnique (Palaiseau, France)
Ergodic properties of some linear actions

October 19 and 26, 2001
Francois Ledrappier, Ecole Polytechnique (Palaiseau, France)
Aspects de la rigidité pour les variétés à courbure négative

Special Lecture CRM-ISM
Org.: Dana Schlomiuk (UdeM)

October 4, 2001
Jean-Paul Pier, Centre universitaire du Luxembourg
L'analyse fonctionnelle, une théorie omniprésente dans les mathématiques du 20ᵉ siècle

Special Lectures
Org.: Peter Russell (McGill)

March 8, 2002
Vladimir Popov, Steklov Institute
Colloque CRM-ISM
Modern developments in invariant theory

March 13, 2002
Vladimir Popov, Steklov Institute
Self-dual algebraic varieties and nilpotent orbits

March 13, 2002
Vladimir Popov, Steklov Institute
Automorphism groups of finite dimensional simple algebras

March 20, 2002
Vladimir Popov, Steklov Institute
Generators and relations of affine coordinate rings of semisimple groups

March 20, 2002
Vladimir Popov, Steklov Institute
Discrete complex reflection groups

Special Lectures
Org.: Jacques Hurtubise

March 19, 21, 26, 28 & April 2, 2002
Nizar Touzi, Univ. de Paris I Panthéon-Sorbonne
Contrôle stochastique et applications à la finance

April 22, 2002
Jonathan Borwein, Simon Fraser Univ.
Why Math is (Still) Hard: Challenges in Mathematical Computing

Special Lecture (CCC 2002)
Org.: Jacques Hurtubise

H. Cohen, Univ. de Bordeaux
Courbes elliptiques!: de la théorie à la pratique

CRM-CERCA
Org.: José Urquiza (CRM), Josée Manseau (École Polytechnique), Donatien N'dri (École Polytechnique)

October 18, 2001
Jean Deteix

Modélisation et design de pièces en composite: optimisation

November 8, 2001
Marc Thiriet, CNRS & Univ. Pierre et Marie Curie & INRIA, France
Traitements endovasculaires. Des modèles numériques aux outils médicaux

November 29, 2001
Patrick Terriault, École de Technologie Supérieure, Univ. du Québec à Montréal
Conception de dispositifs médicaux en alliages à mémoire de forme

December 13, 2001
Gérard Plante, Univ. de Sherbrooke
Présentation des activités du à l'Université de Sherbrooke

February 7, 2002
Dominique Pelletier, École Polytechnique de Montréal
Analyse de sensibilité et d'incertitude par la méthode de l'équation des sensibilités

February 21, 2002
Adel Blouza, Univ. de Rouen & Univ. Paris VI
Une version du lemme de Friedrichs et applications au modèle de coque de Koiter

February 21, 2002
Laurent Dumas, École Normale Supérieure de Paris & Univ. Paris VI
Optimisation de formes aérodynamiques dans l'industrie automobile

February 28, 2002
Laurent Dumas, École Normale Supérieure de Paris & Univ. Paris VI
Modèles de billard'étude asymptotique

February 28, 2002
Adel Blouza, Univ. de Rouen & Univ. Paris VI
Réduction algorithmique des systèmes cinétiques raides

March 21 and 28, 2002
Michel Delfour, CRM & Univ. de Montréal
Modèles de coques minces et de coques asymptotiques

April 4, 2002
Annie Raoult, LMC & TIMC, IMAG, Univ. Joseph Fourier, Grenoble
Nouveautés en modélisation hiérarchique de plaques

April 11, 2002
Annie Raoult, LMC & TIMC, IMAG, Univ. Joseph Fourier, Grenoble
Modélisation de l'orientation des fibres cardiaques

Seminar in Mathematical Physics
Org.: J. Harnad (CRM & Concordia) & Pavel Winternitz (CRM)

September 18, 2001
Ahmed Sebbar, Univ. de Bordeaux
Capacities, Jacobi Matrices, & Jacobi Forms

September 25, 2001
Misha B. Sheftel, St. Petersburg & Istanbul
Method of group foliation, non-invariant solutions of the heavenly equationand heavenly metrics

September 26, 2001
A.N. Tyurin, Steklov Mathematical Institute, Russian Academy of Sciences, Moscow
Non-abelian theta-functions and spin networks I

October 2, 2001
E.G. Kalnins, University of Waikato, New Zealand
Perturbations of Black holes and special functions

October 3, 2001
A.N. Tyurin, Steklov Mathematical Institute, Russian Academy of Sciences, Moscow
Non-abelian theta-functions and spin networks II

October 9, 2001
Michel Grundland, UQTR & CRM
Sur certains aspects géométriques des applications du modèle sigma CP2

October 10, 2001
A.N. Tyurin, Steklov Mathematical Institute, Russian Academy of Sciences, Moscow
Non-abelian theta-functions and spin networks III

October 16, 2001
Aleksander Strasburger, Univ. de Bialystok
On the ordering problem in QM and its connection with certain classes of Orthogonal Polynomials

October 23, 2001
David Calderbank, Univ. of Edinburgh
Integrable background geometries in dimensions one to four

November 1, 2001
Henrik Aratyn, Univ. of Illinois
Symmetries of Integrable Models and Applications to the Witten-Dijkgraaf-Verlinde Equations

November 13, 2001
Decio Levi, Univ. Roma Tre
Multiscale Reduction for Differential Difference equations and Integrability

November 20 and 22, 2001
Aleksander Orlov, Institute of Oceanology, Moscow & CRM
Hypergeometrical tau-functions

November 27, 2001
Eyal Markman, Univ. of Massachusetts (Amherst)
Elliptic Sklyanin systems

December 4, 2001
Ray McLenaghan, Univ. of Waterloo
Group invariant classification of separable Hamiltonian systems in the Euclidean plane

December 11, 2001
Zuzana Masakova, CRM
Combinatorial properties of cut and project sequences

January 15, 2002
Pavel Winternitz, CRM & DMS
Systèmes intégrables et superintégrables dans les espaces avec courbure

January 22, 2002
Dmitri Korotkin, Concordia Univ. & CRM
Some integrable systems on Hurwitz spaces

January 29, 2002
Simon Gravel, CRM & Univ. de Montréal
Systèmes superintégrables avec symétries du troisième ordre

February 5, 2002
Luis-Miguel Nieto, Univ. Valladolid
Higher order supersymmetric periodic potential

February 12, 2002
Mikhail Babich, Concordia Univ. & Steklov Mathematical Institute, St.Petersburg, Russia
Schlesinger system with 4 points, its symmetries, connections with Painlevé VI system and the algebraic surface theory

February 19 and 21, 2002
Fréderic Lesage, CRM
Théorie des champs intégrables et dualité

February 26, 2002
Jean-Louis Verger-Gaugry, Institut Fourier, Saint-Martin d'Hères, France
Un théorème de compacité pour l'ensemble des ensembles uniformément discrets de R^n et ses sous-ensembles : réseaux, ensembles modèles, ensembles de Delaunay, clusters.

March 12, 2002
Charles P. Boyer, Univ. of New Mexico
Sasakian-Einstein Geometry

March 19, 2002
John Harnad, CRM & Concordia Univ.
Matrix models, integrable systems, duality, and all that

March 26, 2002
Maria Cristina Ciocci, Univ. of Gent
KAM for reversible systems

April 2, 2002
Michel Racine, Univ. d'Ottawa
Superalgèbres simples

April 4, 2002
Jan Zich, Technical Univ., Prague & CRM
Voronoi and Delone tiling of quasicrystals

April 9, 2002
G. Pogosyan, UNAM, Mexico & JINR, Dubna, Russia
Superintegrable potentials in N-dimensional Euclidean space

April 16, 2002
Marco Bertola, CRM
Fundamental systems of solutions for infinite recurrence relations arising in two-matrix models; applications to the Riemann-Hilbert problem

April 23, 2002
Jacek Szmigielski, Univ. of Saskatchewan
An Ansatz for the large n asymptotics of bi-orthogonal polynomials. The genus zero case

April 25, 2002
Miroslav Englis, Mathematics Institute, Academy of Sciences, Prague
A review of (Berezin and other) quantization methods

April 30, 2002
Bertrand Eynard, Saclay (France) & CRM
Discrete classical strings, Weyl functions, and integrable systems

May 7, 2002
T. A. Osborn, Univ. du Manitoba
Magnetic Curvature of Quantum Phase Space

May 14, 2002
Franco Magri, Univ. Milano-Bococca
A geometrical characterization of separable systems according to Levi Civita: classical roots and modern perspectives

Special Days in Dynamical Systems
Org.: Dana Schlomiuk (UdeM & CRM) & Christiane Rousseau (UdeM & CRM)

November 29, 2001

Dana Schlomiuk, UdeM & CRM
Équations différentielles algébriques dans le plan projectif complexe

Robert Roussarie, Univ. de Dijon
Intégrales abéliennes et cycles limites

Nicolae Vulpe, Académie des sciences de Moldavie
Differential operators and multiplicity of singular points for polynomial differential systems

Christiane Rousseau, UdeM & CRM
Points de selle normalisables et intégrables dans le système de Lotka-Volterra

CRM Postdoctoral Fellows Seminar
Org.: Pietro-Luciano Buono (CRM)

January 16, 2002
Marco Bertola, CRM
The (Bi)-Orthogonal Polynomial Approach to Random (Two)-Matrix Models

January 23, 2002
Diego Matessi, CRM
Mirror Symmetry according to the SYZ-conjecture

January 30, 2002
José Urquiza, CRM
Contrôle d'équations des ondes

February 16, 2002
Luciano Buono, CRM
Bifurcations, G-Transversality and Stratifications

February 20, 2002
Piergiulio Tempesta, CRM
Superintegrability, Classical Lie theory and Exact Solvability in Quantum Mechanics

Statistics Seminars
Org.: Jean-François Angers (UdeM) & Roch Roy (UdeM)

July 4, 2001
Guy Mélard, Univ. Libre de Bruxelles
Problèmes numériques relatifs aux processus VARMA

July 11, 2001
Atanu Biswas, Indian Statistical Institute, Calcutta
Adaptive designs for normal responses with prognostic factors

December 13, 2001
Kilani Ghoudi, UQTR
Estimateurs non-paramétriques des distributions de valeurs extrêmes multivariées

December 21, 2001
Christian Robert, Univ. Paris Dauphine & CREST
Estimation de mélanges de distributions!: Résultats récents et perspectives

January 11, 2002
Jacques Carrière, Univ. of Alberta
A Gaussian Process of yield rates calibrated with strips

February 6, 2002
Jean-François Angers, Univ. de Montréal
Tests pour vérifier l'égalite de deux fonctions

February 13, 2002
Luc Perreault, Hydro-Québec
Analyse bayésienne multisite d'une rupture dans des séquences de variables aléatoires hydrométéorologiques

February 20, 2002
Racula Balan, Univ. de Sherbrooke
Statistique bayésienne non-paramétrique dans le cas markovien

February 27, 2002
Denise A. Lievesley, Directrice de l'Institut de statistique, Unesco
Le mandat et les activités de l'Institut de statistique de l'UNESCO

March 27, 2002
Alain Latour, UQAM
Processus GARCH à valeurs entières

April 3, 2002
Alain Vandal, McGill Univ.
Utilisation des ondelettes pour élaborer des tests dans les modèles autorégressifs dans les durées conditionnelles

April 10, 2002
Pierre Duchene, HEC
Deux applications de la théorie des graphes à l'analyse de survie

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.

Fall 2001

Organizers: D. Schlomiuk (CRM & UdeM) & T. Tokieda (UQAM & UdeM)

Friday September 21
Henri Darmon, McGill Univ
Elliptic curves and Hilbert's twelfth problem

Wednesday September 26
Louis Nirenberg, Courant Institute of Math. Sciences
A problem on differential forms coming from economics

Friday October 5
Carolyn S. Gordon, Dartmouth College
Can you hear the shape of a manifold

Friday October 12
Andrei N. Tyurin, Steklov Institute
Three mathematical facets of SU(2) spin networks

Friday October 19
Paul Gauduchon, École Polytechnique (France)
Variétés kählériennes ortho-toriques

Friday October 26
Chris Sogge, Johns Hopkins Univ.
Riemannian manifolds with maximal eigenfunction growth

Friday November 2
David Ruelle, IHES
Nonequilibrium Statistical Mechanics: Entropy Production for Quantum Spin Systems

Friday November 9 (CRM-Fields Prize 2001
William T. Tutte, Univ. of Waterloo
Some adventures in Graph Theory

Friday November 16
Claude LeBrun, SUNY Stony Brook
Promotional Materials for Infinite-Dimensional Lie Groups

Friday November 23
Juan Maldacena, Harvard Univ.
QCD, strings and black holes

Friday November 30
Dorian Goldfeld, Columbia Univ.
Multiple Dirichlet series and moments of zeta and L-functions

Winter 2002

Friday December 7
Andrzej Zuk, The Univ. of Chicago
Groups with property (T)

Friday January 25
Izabella Laba, Univ. of British Columbia
A review of some tiling problems

Friday February 1
Martin J. Gander, McGill Univ.
The Jungle of Domain Decomposition Methods: Schwarz, Schur, Feti, Neumann-Neumann and More

Friday February 22
Boris Khesin, Univ. of Toronto
Trinity of Euler equations on the Virasoro group

Friday March 1
Hanspeter Kfrat, Univ. Basel
Separation of Orbits in Varieties

Friday March 8
Vladimir Popov, Steklov Institute, Moscow
Modern developments in invariant theory

Friday March 15
Askold Khovanskii, Univ. of Toronto
Newton polyhedra

Friday March 22
Ed Spiegel, Columbia Univ.
Continuum Equations for Rarefied Gases

Friday April 5
Yakov Eliashberg, Stanford Univ./IAS
Geometry of contact domains and transformations

Friday April 12
Goro Shimura, Princeton Univ.
The arithmeticity of Euler products and Eisenstein series on a unitary group

Friday April 19
Bernard Malgrange, Institut Joseph Fourier, Univ. de Grenoble 1
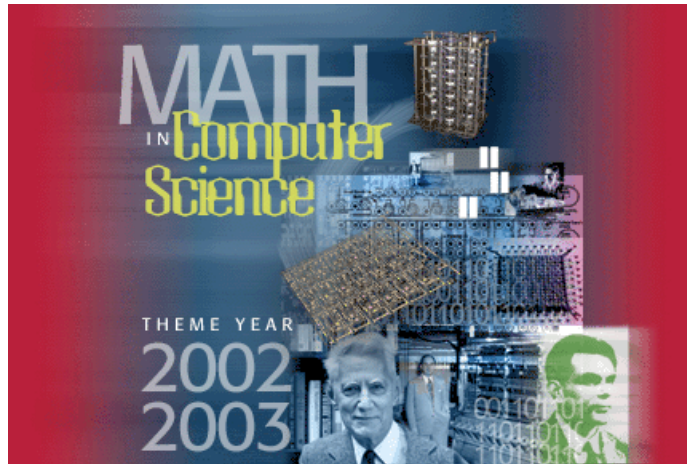*Théorie de Galois différentielle non-linéaire*

Friday April 26
Kumar Murty, Univ. de Toronto
Elliptic curves and Sieve methods

Friday May 2
Hassan Aref, Univ. of Illinois at Urbana-Champaign
Vortex crystals

Coming Activities

Theme Year 2002-2003:
Math in Computer Science

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), and Denis Thérien (McGill).

Overview

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 are based its spectacular development. The CRM special year in the mathematics of computer science proposes to explore in depth a significant spectrum of the many sub-areas that are core foundational material for modern computer science, that exhibit significant and new mathematical content, and that have indeed influenced the development of mathematics.

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)

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 is 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.

Invited 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.

Aisenstadt Chair lecture series

There will be three series of conferences associated with the Aisenstadt Chairs by *Manuel Blum* (Carnegie Mellon), *Laszlo Lovasz* (Microsoft Research), and *Endre Szemeredi* (Rutgers University).

CONCENTRATION PERIOD I

Complexity Theory, Analysis of Algorithms

May-June 2002
Org.: Pierre McKenzie (Montréal), Denis Thérien (McGill)

In May 2002, the CRM will host two of the most important international conferences in theoretical Computer Science, namely the ACM Symposium on Theory of Computing and the IEEE Conference on Computational Complexity. In addition, there will be several one-week workshops on topics that lie at the core of the theory of computing. Each workshop will bring together a number of leading scientists who will present both expository lectures and state-of-the-art research.

Lecture series on branching programs
May 13-17, 2002
Org.: Ingo Wegener (Dortmund)

ACM Symposium on Theory of Computing (STOC)
May 19-21, 2002

IEEE Conference on Computational Complexity
May 21-24, 2002

Randomness in Branching program
May 27-31, 2002

Random techniques play an important role in computer science, through algorithms, which give an efficient solution to problems for which no good deterministic solution is known, or through the probabilistic study of complexity. A week will be devoted to this theme, starting with the links between probabilistic methods and branching programs.

Verification and model-checking
June 3-7, 2002

In the past ten years, theoretical work in the area of verification has started to bear fruit. The workshop will cover the major areas of this development, in particular those linked to model-checking.

Descriptive complexity
June 10-14, 2002

An area that has come to the fore in recent years, descriptive complexity gives a tool that complements more classical approaches to complexity theory. After a survey of the area, the workshop will concentrate on links between branching programs and algebraic structures.

Invited speakers: D. Barrington, P. Beame, P.L. Crescenzi, R. Gavalda, N. Immerman, K.J. Lange, P. Pudlak, A. Razborov, M. Sachs, R. Raz, P. Schnoebelen.

CONCENTRATION PERIOD II
Quantum Foundations in the Light of Quantum Information

October 14 to November 2, 2002
Org.: Gilles Brassard (Montréal), Christopher A. Fuchs (Bell Labs, Lucent Technologies)

Rolf Landauer's best-known aphorism is *information is physical*. This workshop is centred on the belief that *physics is informational!* Our long-term purpose is to reformulate the foundations of quantum mechanics in the light of quantum information theory. Rather than being counterintuitive, could it be that quantum mechanics was inevitable for information to behave as we understand it now? For instance, what can we derive from the fact that unconditionally secure cryptographic key distribution is possible but bit commitment is not?

Invited speakers: M. Appleby, H. Barnum, C.H. Bennet, G. Brassard, H. Briegel, J. Bub, A. Cabello, C. Caves, R. Floreanini, C. Fuchs, N. Gisin, L. Hardy, P. Hayden, F. Markopoulou, D. Mayers, D. Mermin, D. Poulin, R. Schack, B. Schumacher, J. Smolin, R. Spekkens, C. Timpson.

CONCENTRATION PERIOD III
Combinatorics, probability and algorithms

May 2003
Org.: David Avis (McGill), Luc Devroye (McGill), Bruce A. Reed (Waterloo)

Leave nothing to chance. This cliché embodies the common belief that randomness has no place in well-planned methodologies, every *i* should be dotted and every *t* should be crossed. In discrete mathematics, at least, nothing could be further from the truth. Introducing random choices into algorithms can improve their performance. The application of probabilistic tools has led to the resolution of combinatorial problems which have resisted attack for decades.

A month-long concentration period will take place around this general theme. Lecturers at the

school will introduce participants to a number of weapons, mostly from the probabilistic arsenal, and their applications in combinatorics and in the study of algorithms. We anticipate a significant amount of collaboration between participants at the school during the month.

There will be five-hour mini-courses given by: V. Chvatal (Rutgers), A. Frieze (Carnegie-Mellon), L. Lovasz, (Microsoft), C. McDiarmid (Oxford), M. Molloy (Toronto), J. Pach (City College New York et Hungarian Academy of Sciences), E. Szemeredi (Rutgers).

INTERNATIONAL ANNUAL MEETINGS

ACM Symposium on Theory of Computing (STOC)
May 19-21, 2002

IEEE Conference on Computational Complexity
May 21-24, 2002
Org.: Pierre McKenzie (Montréal), Denis Thérien (McGill)

These two conferences are part of the concentration period on Complexity theory, analysis of algorithms.

Mathematical Foundations of Programming Semantics (MFPS)
March 19-22, 2003
Org.: Prakash Panangaden (McGill)

Conferences and workshops in this series, held annually since 1985, aim to provide a forum for researchers in all areas surrounding semantics to present their latest research results, and to improve communication and interactions between mathematicians and computer scientists who work in these areas. The areas of relevance include category theory, domain theory, logic and topology on the mathematics side, and type theory, semantics, and the design and implementation of programming languages on the computer science side.

IEEE Symposium on Logic in Computer Science (LICS)
June 20-26, 2003
Org.: Amy P. Felty (Ottawa), Philip Scott (Ottawa)

To be held at the University of Ottawa, the IEEE Symposium on Logic in Computer Science (LICS) is an annual international forum on theoretical and practical topics in computer science that relate to logic in a broad sense. The CRM will be sponsoring four satellite workshops for this conference.

WORKSHOPS

Random Number Generation and Highly Uniform Point Sets
June 17-28, 2002
Org.: Pierre L'Écuyer (Montréal)

This workshop will bring together the world leaders in 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 general theme is the development of practical random number generation software for various classes of applications, such as simulation, statistics, numerical analysis, computer games, lotteries, cryptology, etc. In simulation, highly uniform (or low-discrepancy) point sets can often advantageously replace the traditional random numbers. Their construction and analysis can be based on ideas and tools that are very similar to those used for random number generators and we want to strengthen this connection.

Invited speakers: P. Boyle, G.J. Chaitin, C. Crépeau, L.Y. Deng, M. Evans, H. Faure, M. Fushimi, J. Gentle, M. Goresky, S. Heinrich, A. Keller, A. Klapper, C. Lemieux, G. Leobacher M. Mascagni, M. Matsumoto, H. Morohoshi, S. Ninomiya, T. Nishimura, A.B. Owen, W. Schmid, I. Sloan, H. Wozniakowski.

Mathematical Models and Techniques for Analysing Systems
September 30 to October 4, 2002
Org.: Prakash Panangaden (McGill)

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, real-time systems and hybrid systems, that is, systems where the state space is partly discrete and partly continuous. Applications include flight management systems for aircraft, process control systems, telecommunication systems and battle management systems. In all of these 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 twenty 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 workshop would have two main speakers, who will each give five lectures: Prof. Marta

Kwiatkowska, U. Birmingham, *Probabilistic Model Checking*, and Dr. Jan Rutten, CWI Amsterdam, *Coinductive Calculus*.

Additional invited speakers: R. Alur, P. Caines, R. Jagadeesan, and D. Precup.

Finite Model Theory

March 2-9, 2003
Org.: Denis Thérien (McGill)

This workshop will focus on the expressive power of logics and on the deep relationship between logic and computational complexity. The principal speaker will be Phokion Kolaitis (U.C. Santa Cruz). The workshop will be held at the Bellairs Research Institute of McGill University.

Semigroups and Automata

March 9-16, 2003
Org.: Denis Thérien (McGill)

This workshop will discuss recent developments in the theory of automata and semigroups, in particular some dealing with long-standing open problems such as decidability of the dot-depth hierarchy and decidability of Rhodes complexity.

Cryptographic Reduction of Quantum and Classical Protocols

April 28 to May 2, 2003
Org.: Claude Crépeau (McGill)

Cryptographic protocols have been studied for two decades in the classical scenario under various computational assumptions. Such protocols as Bit Commitment, Oblivious Transfer and Multiparty Computations have been implemented and reduced to each other. Over the last few years, similar results are now achieved in the context of adversaries equipped with quantum computers. This workshop will bring together specialists of both classical and quantum cryptographic protocols who will present the state of the art in this fascinating area of research.

Invited speakers: D. Beaver, *C. Cachin, R. Cramer, C. Crépeau, I. Damgaard, P. Dumais, D. Gottesman, J. van de Graaf, *R. Impagliazzo, J. Kilian, D. Mayers, *M. Naor, *S. Rudich, L. Salvail, A. Smith, A. Tapp, S. Wolf, M. Yung.
*to be confirmed.

Recent Advances in Machine Learning

June 2-13, 2003
Org.: Yoshua Bengio (Montréal), Balázs Kégl (Montréal), Doina Precup (McGill)

Probabilities are at the core of recent advances in the theory and practice of machine learning algorithms. The workshop will focus on three broad areas where these advances are crucial: statistical learning theory, learning algorithms, and reinforcement learning. The workshop will therefore bring together experts from each of these three important domains. Among the sub-topics that will be covered, we note: variational methods, graphical models, the curse of dimensionality, empirical methods to take advantage of theories of generalization error, and some of the applications of these new methods.

Invited speakers: P. Bartlett, A. Barto, P. Frasconi, G. Hinton, M. Jordan, V. Koltchinskii, Y. Le Cun, M. Littman, G. Lugosi, S. Roweis, B. Scholkopf, D. Schuurmans, S. Singh, R. Sutton.

Theme Year 2003-2004:
Geometric and Spectral Analysis

Organizing Committee

E. Bierstone (Toronto), W. Craig (McMaster),
F. Finster (MPI), P. Gauthier (Montréal),
D. Jakobson (McGill), V. Jaksic (McGill),
N. Kamran (McGill), R. Melrose (MIT),
P. Milman (Toronto), D.H. Phong (Columbia),
and J. Toth (McGill).

Analysis has traditionally stood at the centre of gravity of much of the research activity 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 they stand indeed at the core of several of the deepest and most spectacular advances in these fields. There is now, for example a much deeper understanding of the eigenvalues and eigenfunctions of manifolds than there was even five years ago.

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 what is in essence two short programs, one on contact geometry and the other on analysis on singular space, and a more extended period on spectral analysis in mathematical physics and number theory. The two short programs have a particularly strong emphasis on developing new connections to other areas of mathematics. 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 so as to have a balance between the geometric and spectral components of the scientific program, 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 Montréal universities. In particular, a minimum of eight short courses is being planned in connection with the various workshops. Some of these short courses are listed in the detailed program given below.

Aisenstadt Chair Lecture Series

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

SPECTRAL ANALYSIS
Contact geometry and analysis

July 2003
Org.: R. Melrose (MIT), D. Auroux (MIT & École Polytechnique, France)

In the vigorous development of contact geometry, which has taken place over the past ten years or so, the notion of a tight (or conversely an overtwisted) contact structure has proved to be central, with many deep and important applications to three-dimensional topology. On the analytic side, the notion of the quantization of a contact manifold, that is the existence of a generalized Szegö projection, has come to play a central role in developments related to the algebra of pseudodifferential operators of Heisenberg type and related homological questions. Both endeavours are related to embedding, or fillability, questions which remain substantially open, especially in the three dimensional case. It is hoped that by bringing this group together they will be able to understand these relationships and their repercussions. The format is one of informal lecture series over two weeks, on subjects such as: Contact Floer homology and symplectic field theory, Approximate holomorphic geometry, Gauge theory and symplectic fillings, Heisenberg algebras, Toeplitz quantization, and Powers of circle bundles.

Analysis and Resolution of Singularities

August 2003
Org.: E. Bierstone (Toronto), 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 program, bringing together leading experts in resolution of singularities, complex differential geometry, and real analysis and partial differential equations, may have ground-breaking impact.

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*

Three short courses to be accessible to graduate students in analysis, given by the organizers or other participants.

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 L^2 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.

Sub-theme: Spectral Analysis in Mathematical Physics and Number Theory
All year

Integrable and Near-Integrable Hamiltonian Partial Differential Equations

May 2004
Org.: W. Craig (McMaster), P. Deift (Pennsylvania), H. Flaschka (Arizona), S. Kuskin (Heriot-Watt), P. Olver (Minnesota), P. Winternitz (CRM).

This workshop will provide a cross-section of the most significant current activity in the field of Hamiltonian PDEs, including integrability, asymptotics in the small dispersion limit, KAM theory, and Arnol'd stability. This workshop is organized in conjunction with the special year in analysis at the Fields Institute.

Spectral Theory of Schrödinger Operators

July 2004
Org.: V. Jaksic (McGill), Y. Last (Hebrew)

The spectral theory of Schrödinger operators has been the stage of spectacular developments over the last ten years. The emphasis has shifted to the problems involving semiclassical limits and limits of large numbers of particles (e.g., atomic Hamiltonians) and to the problems involving quasi-periodic and random structures. The goal of the workshop is to bring together the world leading experts, young researchers and the graduate students in this fast developing field. The state of the art research and results will be described in an accessible way, and the new directions of research will be pointed out.

Dynamics in Statistical Mechanics

July 2004
Org.: V. Jaksic (McGill), C.-A. Pillet (Toulon)

The past ten years have witnessed some major new developments in the field of non-equilibrium statistical mechanics, owing to an influx of fresh ideas from probability theory and C*-algebras. This progress is complemented by the study of concrete, physically relevant models of infinite particle systems, for which the zeroth and the second law have been now rigorously established. The goal of the workshop is to bring together the world's leading experts in the field.

Semi-Classical Theory of Eigenfunctions and Partial Differential Equations

June 2004, (to be held at the Fields Institute)
Org.: D. Jakobson (McGill), J. Toth (McGill)

Many questions in quantum chaos are motivated by the correspondence principle in quantum

mechanics. These include asymptotic bounds for the eigenfunctions, integrated and pointwise Weyl error terms, and scarring. Another fundamental question concerns the local and global statistical properties of the eigenfunctions, their nodal sets and critical points. These questions will from the main theme of the workshop.

Spectral Theory and Automorphic Forms

Org.: Y. Petridis (CUNY), J. Toth (McGill)

Analytic questions about families of L-functions include the distribution of zeros and the generalized Riemann hypothesis, value distribution, special values as well as connections with arithmetical questions such as the distribution of primes, size of class groups, analytic ranks and elliptic curves. This workshop will bring together some of the most active researchers in this rich and important area of mathematics, which lies at the boundary of analysis and number theory.

ANALYSIS OF THE EINSTEIN EQUATIONS

September-October 2003

Workshop on the Cauchy Problem for the Einstein Equations

September 2003
Org.: F. Finster (MPI), 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.

Workshop on the Interaction of Gravity with External Fields

October 2003
Org.: F. Finster (MPI), 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 has lead to surprising results on the role of external fields in the dynamics of gravitational collapse and singularity formation. These results include, in the spherically symmetric case, the existence of stable particle-like solutions of the Einstein-Yang Mills equations, and the non-existence of black hole solutions when the gravitational field is coupled to a Dirac spinor field. One of the objectives of the workshop will be to review these developments, and to discuss some of the directions for future research.

Short courses: H. Friedrich (MPI), F. Finster (MPI), J. Smoller (Michigan)

Theme Year 2004-2005:
Mathematics of Complex Multiple-Scale Systems

Organizing Committee

A. Bourlioux (Montréal), M. Delfour (Montréal), Weinan E (Princeton), M. Gander (McGill), T. Hou (Caltech), A.J. Majda (Courant), T. Souganidis (Texas), R. Sircar (Princeton), C. Schuette (Berlin), and A. Stuart (Warwick).

The 2004-2005 thematic year will be dedicated to the applied mathematical tools (modeling, analysis, computational) needed to study complex systems in various domains of science and engineering. Complexity is used generically in a broad sense to encompass a wide range of scales to be accounted for, a large number of degrees of freedom, couplings between several mechanisms in the model, general nonlinearities, and much more. The domains for applications include climate modeling, turbulence, fronts propagation, molecular dynamics, materials, finances, bio-mechanical systems in medicine, quantum control. Despite the diversity in the applications, some of the challenges and strategies to face them have much in common: how can one include any form of knowledge regarding the dynamic of the solution so as to produce an useful model which captures well the global behavior of the system? One particularly promising approach is based on stochastic models: this will be the topic for the summer school and will also be a recurring theme throughout the various workshops. Those will be an opportunity for interaction between applied mathematicians specializing in modeling and numerical simulation and researchers in the various fields of applications in science and engineering.

Summer School in Stochastic Methods in Applied Mathematics

July 2004
Org.: A. Bourlioux (Montréal), E. Vanden Eijnden (Courant)

This two-week intensive preliminary workshop will introduce graduate students and postdocs to the basic stochastic tools to be used and developed in the subsequent specialized workshops. General topics are: stochastic partial differential equations, stochastic differential equations/stochastic processes, numerical methods for SDE/SPDE.

Aisenstadt Chair Lecture Series

There will be two or three Aisenstadt Chair holders who will talk on topics relevant to the applications covered during the year, such as the mathematics of climate modeling, multi-scale simulations, and non-linear analysis applied to various domains.

Stochastic Partial Differential Equations and Models of Turbulence

Fall 2004
Org.!: Weinan E (Princeton)

The workshop will focus on tractable models which share some of the features believed to occur in 3D turbulence, typically models which include advection of a passive scalar, and randomly driven Burgers. The workshop will continue this work and explore more realistic problems, such as 2D turbulence and wave turbulence with the hope of firming up the mathematical formulation of the problem and the expected result, and identifying critical obstacles where numerical computations and simplified models might help.

Workshops
Representing Unresolved Degrees of Freedom in the Atmosphere and Ocean

Fall 2004
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: this is the parameterization problem in dynamic meteorology or physical oceanography or the closure problem in turbulence. The most pertinent areas of analysis and applied mathematics are homogenization theory, probability and non-linear stochastic PDEs.

Extracting Low-Dimensional Effective Dynamics of Biomolecules

Fall 2004
Org.: C. Schuette (FU Berlin), J. Maddocks (EPF Lausanne), A. Stuart (Warwick)

Complexity in biomolecular dynamics rises from fast rotating or oscillating modes super-imposed to the slow global motion of the molecule. Simply eliminating those fast modes would lead

to a very bad approximation on the time scale of interest. This workshop will discuss progress in analysis and algorithmic realization of different stochastic approaches to this problem.

Front Propagation, Homogenization Theory and Fully Nonlinear Stochastic Partial Differential Equations
Fall 2004
Org.: T. Souganidis (Texas)

Models in phase transitions and combustion give rise to interfaces moving with prescribed normal velocities. The theory of viscosity solutions provides a very good framework for the rigorous analysis of such models, in particular for the stochastic cases due to random media, turbulent advection, etc. This workshop will focus on the rigorous analysis of such systems as well as its applications to designing mathematical models and numerical algorithms for problems in reaction-diffusion, turbulent combustion, particle systems, phase transitions, Hamiltonian dynamics, etc.

Stochastic Modeling in Financial Mathematics
Spring 2005
Org.: R. Sircar (Princeton), J.P. Fouque (North Carolina State)

The theme of this week is emerging directions in financial mathematics, with emphasis on stochastic modeling of market uncertainties, asymptotic and numerical approximations to pricing and stochastic 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 emphasise different techniques and approaches.

Mini-invasive Procedures in Medicine and Surgery
Spring 2005
Org.: M. Delfour (Montréal), A. Fortin (Laval), A. Garon (École Polytechnique, Montréal), C. Peskin (Courant), A. Quarteroni (École Polytechnique, Lausanne), M. Thiriet (INRIA)

This extended concentration period will be concerned with complex medical biomechanical systems, bringing together several facets of mini-invasive procedures in medicine and surgery and identifying issues, problems, trends, and mathematical and computing challenges.

It will be structured around the following themes: medical imaging processing and geometrical modeling, fluid-structure interaction in health problems, static/dynamical design and control of (implantable) medical devices, finite element based computer aided manufacturing.

Integrative Multiscale Modeling and Simulation in Material Science, Fluids and Environmental Science
Spring 2005
Org.: T. Hou (Caltech)
Introductory short course
Potential lecturers: R. Phillips and M. Ortiz (Caltech)

This concluding workshop will focus on interdisciplinary interaction with the goal to develop some new tools that combine mathematical analysis, multiscale modeling and computational analysis in an integrative way across many scientific disciplines such as biology, chemistry, environmental science, fluid dynamics, geophysics, information science, and materials science. There have been many exciting recent, but problem-specific and fragmented, advances in multiscale analysis, modeling, and simulation. Hosting this workshop will provide a unique opportunity to make significant advances and bridge the gap in research, training, and knowledge transfer between mathematics and the application disciplines.

Quantum Control: Mathematical and Numerical Challenges II
Summer 2004
Org.: M. Delfour (Montréal), A. Bandrauk (Sherbrooke), C.!Le Bris (Cermics, ENPC, Paris)

This workshop will build on the one-week workshop organized in October 2002 (see below) on the same topic and expand its scope to a three-week program.

Even though it has a somewhat distinct flavour from the ones listed above, its definite interdisciplinary applied nature fits very well in the overall philosophy of the thematic year.

Interdisciplinary and Industrial Program

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

October 14-19, 2002, Minneapolis, Minnesota
Org.: W. Cook (Rice University), M. Gendreau (CRT, Montréal), George Nemhauser, M. W. P. Savelsbergh (Georgia Institute of Technology)

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. In this workshop, we will bring together experts in various areas of integer programming and its applications. Theoretical and methodological topics included in the workshop are 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 include supply-chain design and management, telecommunications, manufacturing, transportation, scheduling, and finance. The workshop will be of interest to mathematicians and operations researchers working in discrete and combinatorial optimization, computational scientists working in parallel computing, search, and constraint programming. Goals of the workshop include 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.

Joint IMA-NCM_2 Workshop on Distribution Systems: Location and Vehicle Routing

December 2-6, 2002, Montréal
Org.: Michel Gendreau (CRT, Montréal) & Gilbert Laporte (CRT, HEC)

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 will include a series of ten surveys, covering both the more traditional and the newer subject areas, with additional contributions by conference participants. Areas covered include routing; location; economic aspects, pricing, e-commerce; fleet management; telecommunications; network design.

Invited speakers: G. Laporte, A. Corberan, J.J. Salazar, D. Vigo, M. Salomon, S. Nickel, T. Lowe, P. Hansen, O. Berman, G. Wesolowsky, J. Thisse, P. Marcotte, B. Gavish, M. Gendreau, M. Savelsbergh, J.Y. Potvin, A. Balakrishnan, M. O. Ball, B. Jaumard, M. Labbé, C. Colbourn, T. Crainic, T. Magnanti

Quantum Control: Mathematical and Numerical Challenges

October 7-11, 2002
Org.: A. Bandrauk (Sherbrooke), M. Delfour (Montréal), C.!Le Bris (ENPC, Paris)
Sponsors: NSERC, CRM, Ministère de la recherche, France

This workshop will concentrate on advanced numerical methods and new mathematical and 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 *Coherent Control of Molecular Processes* following the pioneering work of theoretical chemists such as Paul Brumer (Toronto), Moshe Shapiro (Weizmann Institute), Stuart A. Rice (Chicago), and other international and Canadian distinguished scientists is steadily making an impact on the experimental and technological world.

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 multidimensional time-dependent Schrödinger equations, TDSEs. Coupling these molecular processes to the laser field equations, Maxwell's equations, results in coupled parabolic (TDESs) and hyperbolic (Maxwell) partial differential equations. There are outstanding problems, both numerical and mathematical, which this workshop will address by bringing together mathematicians, theoretical chemists and physicists working in the area of control and optimization of systems subject to quantum laws.

The workshop will involve 20-30 international experts in laser molecule interactions, optimization, theory and control of molecular dynamics. It will emphasize participation of graduate students in applied mathematics, theoretical chemistry and physics.

Molecular and Electron Control

Invited speakers: O. Atabek (Orsay), A. D. Bandrauk (Sherbrooke), T. Brabec (Ottawa), P. Brumer (Toronto), R. de Vivie-Riedle (MPI, Garching, Germany), R. Kosloff (Hebrew University), R. Kosut (Sc Solutions Inc.), H. Lefebvre-Brion (Paris-Sud), Y. Ohtsuki (Tohoku, Japan), H. Rabitz (Princeton).

Quantum Control: Mathematical Problems & Theory

Invited speakers: G. Chen (Texas A&M), M. Delfour (Montréal), S. K. Mitter (MIT), V. Ramakrishna (Texas, Dallas), J.-P. Zolésio (École des Mines), E. Zuazua (Complutense, Madrid).

Quantum Computing

Invited speakers: M.Y. Ivanov (NRC-Ottawa), S. Lacelle (Sherbrooke), R. Laflamme (Waterloo), D. Lidar (Toronto).

Numerical Methods

Invited speakers: T. Carrington (Montréal), M. Fortin (Laval), W. Hager (Gainesville), C. Le Bris (CERMICS, ENPC, Paris), Y. Maday (UPMC, Paris), A. Peirce (UBC), M. Schoenauer (INRIA, France), G. Turinici (INRIA-Rocquencourt), R. Wyatt (Texas).

Summer School in Computational Biology

July 2003
Org: N. El-Mabrouk (Montréal) and D. Sankoff (Ottawa)

The school will deal with recent progress in computational biology: cellular networks, structural molecular biology, and comparative genomics.

Stochastic Networks

Summer 2004
Org.: D. Dawson (Carleton), P. Glynn (Stanford), D. Macdonald (Carleton)

Stochastic modelling of communications and processing networks is playing a significant role in enhancing our understanding of now to engineer and manage complex systems ranging from the Internet to high volume wafer fabrication facilities. These new technologies are leading to an array of new mathematical problems and model formulations that have brought new intellectual stimulation to the area, and have created new opportunities for applications impact.

General Program

Topology of Moduli Spaces

July 2003
Org.: E. Markman (U. Mass.) & H. Nakajima (Kyoto)

There have been many deep results in recent years concerning the topology of moduli space, whether of curves, vector bundles, instantons or Hilbert schemes. One recurrent theme has been the discovery of deep algebraic structures which govern the topology: an early prototype is the operad structure developed for loop spaces and applied with success to moduli problems. A particular emphasis will be put on the exploration of these underlying structures. Many deep links have been discovered, and they have attracted much interest.

Group Theory and Numerical Analysis

May 2003
Org.: P. Winternitz (Montréal), D. Levi (Rome), A. Iserles (Cambridge), R. Quispel (La Trobe)

Topics to be covered include Lie group methods in numerics, symmetries of numerical differential equations (discretization preserving symmetries), symmetries of discrete systems, symbolic algebra calculations, discrete differential forms, the Hopf algebra structure, infinite-dimensional algebras of vector fields and groups of integrators, dynamical systems.

Short Program on Riemannian Geometry

Summer 2004
Org: V. Apostolov (UQAM), A. Dancer (Oxford), N. Hitchin (Oxford), M. Wang (McMaster)

Metrics whose curvature satisfies constraints, as well as the relations between curvature and topology have been of interest ever since the beginning of differential geometry. More recently, such metrics have come to the fore in physical problems related to string theory.

Week 1: *Special metrics.* The workshop will focus on three types: 1. Einstein metrics. Studied since the 1920s in the context of relativity; a recent source of interest has been the concept of holography in physics. 2. Self-dual geometry. Due to the applicability of holomorphic methods, an important source of examples. 3. Special holonomy. Not only the Calabi-Yau metrics, but also the G_2 and Spin(7) examples are of physical interest.

Week 2: *Short courses.* The aim is to present material, which graduates students, and others need in order to tackle some of the mainstream problems in the area. Topics to be covered include special holonomy, homogeneous and cohomogenity one methods, comparison techniques.

Week 3: *Curvature and topology.* The relationship between positive or negative aspects of curvature and the global structure of manifolds is a well-established one, and interacts with the special properties of metrics (e.g., in the Einstein case, the boundedness of the Ricci curvature from below).

Short Program on Integrable Systems

Summer 2005
Org.: J. Harnad (Concordia), A. Its (IUPUI), P. van Moerbeke (Louvain), C. Tracy (UC Davis)

The topic of integrable systems has many ramifications throughout geometry, mathematical physics, dynamical systems and nonlinear PDE. This program will survey some of the most important recent developments in three related sub-areas: 1. the geometry of integrable systems, 2. isomonodromic deformations, 3. random matrices and related problems. These subjects have seen some of the most interesting developments in recent years, with ties to theoretical physics (duality in string theory), number theory, geometry (for example, in mirror symmetry), as well as Lie theory. The organizing committee consists of international leaders in the area.

Each week there will be a series of lectures of an expository nature given in the mornings, and seminar type talks in the afternoons.

Week 1: *The geometry of integrable systems.* Topics covered include isospectral flows, loop algebras, moduli spaces, Hitchin systems, classical and quantum R matrices, Darboux-Bäcklund transformations, separation of variables, applications of integrable systems to gravitation, conformal theory, Yang-Mills, Seiberg-Witten theory, hydrodynamic equations, Frobenius manifolds.

Week 2: *Isomonodromic deformations and applications.* Topics covered include the inverse monodromy method, Riemann-Hilbert problem, nonlinear WKB approximation, asymptotics of solutions, Hamiltonian structure, duality, Painlevé transcendents, Garnier systems, Schlesinger transformations, birational

transformations, relations to root lattices, reductions to linear systems, classical solutions.

Week 3: *Random matrices and related problems.* Topics covered include the spectral theory of random matrices, relations to orthogonal polynomials, asymptotics, scaling limits, Fredholm determinants, Riemann-Hilbert methods, Toeplitz determinants, Hankel determinants, random sequences and growth rates, number-theoretic correlates.

Short Program on Non-commutative Combinatorics

Summer 2005
Org.: F. Bergeron (UQAM), N. Bergeron (York), and C. Reutenauer (UQAM)

The understanding of certain non-commutative structures in algebra is intimately linked to certain combinatorial problems. For example, the characters of finite Coxeter groups and Iwahori-Hecke algebras tie in to Young tableaux, partitions and compositions. In a parallel vein, there are intimate links between descent algebras and non-commutative symmetric functions, as defined by Gelfand, Lascoux, et al., with bases naturally indexed by compositions. Problems under study include the explicit computation of bases in these algebras underlying the corresponding combinatorial structures.

Week 1: *Short courses.* The aim is to present basic notions in a format accessible to graduate students. Subjects for lectures include: descent algebras, quasi-symmetric functions, non-commutative symmetric functions, and quasi-determinants.

Weeks 2 and 3: *Workshop.* There is to be an extended two-week workshop, with plenty of opportunity for interaction. Part of the program will include survey lectures on subjects actually or potentially related to the topic of the workshop, such as hyperplane arrangements or non-commutative geometry.

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. The CRM 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 Commitee, described in the next section. Another one is the CRM-FI prize awarded in recognition of outstanding accomplishments in the mathematical sciences in Canada. It was created in 1994. This year's winner is *John B. Friedlander* of University of Toronto. The administrative responsibility in this matter alternates each year between the CRM and the FI. Scientific collaboration continues between the FI and the CRM, with a close coordination of the activities for the theme year 2003–2004 in analysis and partial differential equations. One major common initiative this year was the set-up of a sound financial basis for the Atlantic Association for Mathematical Sciences/Association des chercheurs en sciences mathématiques de l'Atlantique (AARMS/ACSMA).

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, and together with the other institutes, the CRM organizes special sessions at CMS meetings. The SSC meetings have been funded through the national program; as well, the CRM gives out 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.

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. It has publications exchange agreements with Fields Institute, PIMS, MSRI (Mathematical Sciences Research Institute), the Institute for Mathematics and its

Applications, École Normale Supérieure (France), and the Isaac Newton Institute.

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 each year five of its faculty members to work at the CRM, and the support of these faculty members is an essential asset for the CRM's scientific activities. There is in addition a regular program of teaching release with the other Montréal universities, bringing the equivalent of another two positions to the CRM each year. On an ad-hoc basis linked to the theme program, the CRM has also been arranging release of research personnel from 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 has just been formalized with the recent 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 just been awarded a very large grant ($11M) towards the purchase of equipment in neuro-imaging. 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

One important vehicle for collaboration with the Québec universities is the Institut des sciences mathématiques. 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 the CRM-ISM colloquium, and in organizing special courses for the CRM's thematic programs.

AARMS/ACSMA

One of the great success stories this year was the constitution of a sound financial basis of a regional association for mathematical research, the Atlantic Association for Research in Mathematics/Association des chercheurs en sciences mathématiques de l'Atlantique. Founded in 1995, AARMS brings together university researchers from the Atlantic region. This community, after several years of struggle, is experiencing a rebirth with twenty new researchers hired in the past two years.

During a visit past June, the three Canadian mathematics institutes' directors, along with AARMS director, Professor Hermann Brunner, met with the top administrators of the three most important Atlantic universities: Memorial, Dalhousie, and the University of New Brunswick. A formula for co-sponsorship was set-up with each of the six partners contributing 30K$ to AARMS activities. The MITACS network has also offered to the Atlantic community important financial resources for industrial mathematical research. This new version of AARMS will be run by a board of directors and an advisory committee with the participation of the three Canadian institutes and of the Atlantic mathematical community.

AARMS is already organizing a variety of activities, partially funded through the National Program Committee of the institutes. Here are some recent activities:

International Workshop on Groups, Rings, Lie and Hopf Algebras (Memorial, May 28 to June 1, 2001).

International Workshop on Dynamical Systems and Their Application to Biology (Cape Breton, August 2-6, 2001).

Workshop on Modelling and Scientific Computation (University of New Brunswick, September 28-30, 2001).

APICS Meeting 2001 (St. Francis Xavier University, September 19-21, 2001).

This year's scientific program was also funded by NPC and included a summer school on algebra, fractal geometry, graph theory and differential equations, that took place July 22 to August 6, 2002, as well as two workshops:

Combinatorial Methods in Polynomial Identity Theory (Memorial, August 2002).

31st Annual Canadian Operator Theory and Operator Algebras Conference (University of New Brunswick, May 20-24, 2003).

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 Centre interuniversitaire de recherche en analyse des organisations (CIRANO), the Centre de recherche sur les transports (CRT), and the Groupe d'études et de recherche en analyse des décisions (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.

NSERC funding for ncm_2 with a yearly grant of about $650,000 came to an end this year. The new projects funded in the last phase of the NSERC grant included:

Analyse des écarts de rendements à échéance entre les obligations corporatives et gouvernementales
G. Gauthier, GERAD

Receptor-ligand molecular associations
François Major, CERCA and **Yoshua Bengio**, CRM

Integration of real-time weather data and Geographic Information System (GIS) for use in transportation.
Charles Lin, CERCA

Modélisation et test d'Ipv6
Rachida Dssouli, CRM

The Real Options Approach to Risk Management
Pierre Lasserre and **Andrey Pavlov,** CIRANO

Ingénierie des réseaux de distribution multifournisseur
André Langevin and **Diane Riopel**, GERAD

Planification et confection d'horaires en milieu hospitalier
Brigitte Jaumard, CRT

Gestion des risques financiers: critères prudentiels, décentralisation et contrôle de performance
René Garcia, CIRANO

Localisation des sources d'activité en magnéto-encéphalographie par maximum d'entropie en moyenne et modèles graphiques hiérarchiques
Bernard Goulard, CRM

Overall, the projects have involved the participation of 70 researchers in the network centres, and 63 postdoctoral fellows and graduate students. The total value of the contributions of our partners in 2001-2002 was $602,000 in cash and $500,000 in kind. The industrial partners involved at some point with ncm_2's research projects are: ADOPT Technologies Inc., Air Canada, ANIQ R&D Inc., AstraZeneca Banque nationale du Canada, Bell Mobilité, Biochem-Pharma, Boehringer-Ingelheim, CardiaNove, Centre universitaire de santé McGill (MUHC), CHUM Informatique (Centre hospitalier de l'Université de Montréal), CLSC Côte-des-Neiges, Royal Victoria Hospital, Santa Cabrini Hospital, Hôpital Sainte-Justine, Hydro-Québec, IFM2, Merck Frosst, Société de l'assurance automobile du Québec, Société canadienne des postes.

In December 2001, ncm_2 was the host of Joe Keller (Stanford) as part of the lecture series *Grandes Conférences*. He gave a talk on the *Mathematics of Visual Perception: Color vision.*

As part of a series of breakfast meetings, the directors of the network were able to meet Pavel Hamet (research director for the "Centre de Recherche du Centre hospitalier de l'Université

de Montréal"), Réal Decoste (director of Ouranos), and Marc Garneau (president of the Canadian Space Agency).

A special day on health care issues titled *Comment les techniques d'optimisation peuvent ameliorer la gestion dans le domaine de la santé* was organized by Brigitte Jaumard (GERAD) and Bernard Gendron (CRT), with about forty participants.

Bernard Larrouturou, president-director of INRIA (France), visited Montréal in January. His talk focussed on INRIA's research program in computer science and applied mathematics, with a particular emphasis on life sciences.

Two special days were organized in April by Fahima Nekka and Jean-Marc Lina from CRM on the topic of *Fractals, wavelets and medical imaging* with Jacques Lévy-Vehel (INRIA) as a keynote speaker for a workshop on *Multifractal analysis of signals and images*, followed by a conference on *Multifractal image denoising*.

There was also a workshop-conference organized in May by Pierre Lasserre and Audrey Pavlov (CIRANO, IFM2) on real options.

LABORATOIRES UNIVERSITAIRES BELL

The CRM is an active participant in the ncm_2's Laboratoires universitaires Bell, 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's official launch took place on December 6, 2001, with above 130 participants in attendance at McGill University. Four speakers presented talks on extreme weather and its impact on society:

Isztar Zawadzki, Director, Marshall Radar Observatory, McGill University and Lead Scientist Canadian Weather Research Program
Nowcasting and Climatology of Extreme Weather.

Gordon McBean, Chair, Policy, Institute for Catastrophic Loss Reduction Chair, Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)
Dangerous Weather – What Canadians Need to Know.

Georges Beauchemin, Ministère de la Sécurité Publique, Gouvernement du Québec, Président du conseil, Projet OURANOS
Affronter le temps extrême: faits saillants de la nouvelle loi sur la sécurité civile et ses défis.

Richard Anthes, President, University Corporation for Atmospheric Research (UCAR), Colorado
Global Weather Services in 2025: An Update.

INSTITUTE FOR MATHEMATICS AND ITS APPLICATIONS

The ncm_2 has arranged for an exchange program 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. As

well, the IMA will host a certain number of ncm$_2$ postdoctoral fellows during the year.

MITACS

This network of centres of excellence on Mathematics of Information Technology And Complex Systems (MITACS) is one of 22 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 300 researchers, 400 students and postdoctoral fellows, and more than 75 companies.

The 31 research projects are spread among universities across Canada. Following the review of the report presented by MITACS to the NCE in March 2001, a new grant of $10.8M was announced by Brian Tobin, who was then the minister for industry, for each of the year 2003-2004 and 2004-2005.

The third annual meeting took place at the University of British Columbia in Vancouver, in May 2002. This was a large-scale event, with over 350 participants from Canada and the US, including many of the network's researchers, a large number of students (whose travel expenses were partly covered by MITACS) and numerous industrial partners.

These meetings play a key role to establish new collaborations and to maintain a strong cohesion between the researchers working on different sub-domains in applied mathematics: bio-medical research, industrial and business applications, information technology, manufacturing, and financial mathematics. Each MITACS project belongs to one of those themes; in addition to the general annual meeting, each theme leader organizes specialized annual meetings where technical details can be discussed in more details.

During the annual meeting, each research group reported on their progress. There were also many interesting presentations by industry researchers describing their more pressing mathematical needs and describing the links that have already been established between MITACS researchers and industrial partners.

The poster session was the opportunity for the students affiliated with MITACS to present their work relevant to MITACS themes. Awards were given to the best among the 70 posters, including three first prizes and five second prizes. Among

the second prize winners, were C. Voisin, from École Polytechnique de Montréal, supervised by B.!Jaumard from Université de Montréal, and A.!Boukhtouta, supervised by B.!Lamond, from Université Laval.

Several important administrative changes took place this past year. Since March 2002, MITACS is a non-profit corporation. Also, on September 1, 2002, John Schwenk was appointed as Chief Operating Officer and Network Business Manager. A position for an associate scientific director was also created.

MITACS Activity at CRM:
Spring School on Optimization.
May 14 – 18, 2001

This joint CRM-CRT-MITACS activity was started in 2001 by Pierre Hansen of the École des Hautes Études Commerciales and Patrice Marcotte from the Université de Montréal. A second edition took place in 2002 with a spring school on logistic and distributic, which took place May 8-10 at HEC, with Gilbert Laporte as its director. The school was an opportunity for students to enlarge their horizons in the area of deterministic optimization and mathematical programming, with an emphasis on industrial applications.

Other MITACS activities involving the CRM included:

Séminaires CRM-MITACS sur l'apprentissage statistique
September 2001 - February 2002, CRM

4e International Conference on Information Fusion
August 7-10, 2001, Montréal

Theme Meeting of Information Technology
November 10-12, 2001, CRM

Colloque CRDE-MITACS sur les Méthodes de rééchantillonnage en économétrie
October 13-14, 2001, Université de Montréal

Journée Finance CIRANO-MITACS!: New Statistical Methods for Old Financial Problems
October 19, 2001, CIRANO

Emerging Market Risk Management
November 9, 2001, CIRANO

Financial Derivatives
December 7, 2001

Conférence CIRANO-MITACS sur les Méthodes de Monte Carlo et numériques en finance
March 15, 2002, CIRANO

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.

Francis Clarke was elected senior member of the Institut Universitaire de France (September 2001).

Henri Darmon of McGill University received the prestigious Steacie Memorial fellowship from NSERC.

Andrew J. Granville was awarded the Canada Research Chair in number theory.

Michel Grundland of the Université du Québec à Trois-Rivières was awarded the Alan Richards Fellowship from Durham University.

Dmitry Jakobson from McGill University received a Sloan Fellowship (May 2001).

Niky Kamran was elected member of the Royal Society of Canada.

François Lalonde of Université de Montréal, was awarded the Canada Research Chair in differential geometry and topology.

John McKay from Concordia University was elected member of the Royal Society of Canada in 2000. He also received the faculty excellence award in 2001.

Alexei Miasnikov from McGill University was awarded the Canada Research Chair in combinatorial algebra.

Christophe Reutenauer from UQAM has been appointed as the Canada Research Chair in combinatorial algebra and mathematical computing.

Christiane Rousseau from the Université de Montréal started her mandate as president of the Canadian Mathematical Society in June 2002, for a term of two years.

David Sankoff from the University of Ottawa has been named the Canada Research Chair in Mathematical Genomics.

John Toth has been appointed as a Dawson scholar at McGill (May 2001).

Pavel Winternitz from the Université de Montréal received the 2002 ACP-CRM prize in mathematical physics. The Czech newspaper *Lidove Noviny* also named him as one of the ten most cited Czech scientists since 1980 (September 21, 2002).

Research Laboratories

The CRM now covers 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 scientific 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, Kisilevsky and Ramakrishna. 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 and Abelian varieties.

Members of the Laboratory

Director:
H. Darmon (McGill)
Algebraic number theory, geometry, arithmetic, L-functions, diophantine equations, elliptic curves.

Director:
H. Kisilevsky (Concordia)
L-functions, Iwasawa theory, elliptic curves, class field theory.

C. David (Concordia)
Elliptic curves, Drinfeld modules.

E. Goren (McGill)
Arithmetic geometry, moduli spaces of Abelian varieties, Hilbert modular forms, p-adic modular forms.

A. Granville (UdeM)
Algebraic number theory, arithmetic geometry, combinatorics.

A. Iovita (Concordia)
Number theory.

O. Kharlampovich (McGill)
Combinatorial theory of groups and Lie algebras.

C. Lévesque (Laval)
Algebraic number theory, units, class number, cyclotomic fields.

M. Makkai (McGill)
Mathematical logic.

J. McKay (Concordia)
Computational group theory, sporadic groups, computation of Galois groups.

A. Miasnikov (McGill)
Group theory.

R. Ramakrishna (McGill)
Galois representations, modular forms, elliptic curves.

P. Russell (McGill)
Algebraic geometry.

F. Thaine (Concordia)
Cyclotomic fields, cyclotomy, rational points, rational points on curves.

Highlights of the activities of the Laboratory and of its members in 2001-2002.

Among the numerous activities in which members of the centre were involved, either as participants or as organizers, is the concentration period on the Langlands program on function fields, organized by H. Darmon and J. Hurtubise in April-May 2002. As part of the program, there were a graduate course, a three-week workshop including a series of lectures by R. Langlands himself and a special day in his honour.

This period was immediately followed by the 2002 Conference of the Canadian Number Theory Association. E. Goren was one of the organizers.

Several ISM lectures were offered to Montréal graduate students in the context of this thematic year, as for example, an introduction to automorphic forms (H. Darmon) and an introduction to algebraic geometry (E. Goren).

In the course of the year, the Québec-Vermont Number Theory Seminar (http://www.crm.umontreal.ca/fr/niveau2/index_gro.html) took place alternately in Montréal and Burlington, totalling about forty talks.

CIRGET
(Le Centre inter-universitaire de géométrie différentielle et de topologie)

Geometry and topology are fundamental disciplines of mathematics. Their richness and vitality throughout human history is reflected by 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 number theory has been hired by Québec universities. The research centre based at UQAM now comprises fourteen professors-researchers and one research associate.

The main themes to be pursued in the coming years include Dehn surgery and geometrization à la Thurston; 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!:
S. Boyer (UQAM)
Knot theory, geometry of 3-dimensional manifolds, Dehn surgery, character manifolds.

S. T. Ali (Concordia)
Mathematical physics, quantization, coherent states.

V. Apostolov (UQAM)
Riemannian geometry, general relativity, complex and symplectic 4-dimensional manifolds, (almost) Hermitian, Kähler and Einstein metrics.

A. Broer (UdeM)
Algebraic transformation groups and invariant theory.

O. Collin (UQAM)
Gauge theory and topology of 3-dimensional manifolds.

J. Harnad (Concordia)
Integrable systems, symplectic geometry, random matrices.

J. Hurtubise (McGill)
Integrable systems, gauge theory, moduli spaces.

A. Joyal (UQAM)
Homotopy, categories, algebraic topology.

N. Kamran, (McGill)
Differential geometry, differential systems, geometric integrability, conservation laws, spectra of operators, Lie algebras.

F. Lalonde (UdeM)
Symplectic geometry and topology, Hamiltonian mechanics

I. Polterovich (UdeM)
Heat equation, Riemannian manifolds, asymptotic developments, combinatorial identities.

K. P. Russell (McGill)
Affine algebraic geometry, group actions.

J. Toth (McGill)
Spectral theory, semi-classical analysis, micro-local analysis, Hamiltonian mechanics.

D. Wise (McGill)
Residually finite groups, low dimensional topology, 3-dimensional manifolds.

Highlights of the activities of the laboratory and of its members in 2001-2002.

The CRM just ended a thematic year in Groups and Geometry, which considerably pushed forward the CIRGET in several important domains: during the 2001 summer, a concentration period on 3-dimensional manifolds and geometric group theory attracted more than a hundred participants during three weeks, of whom one half were graduate students, to the most important conference in the subject in several years. During the fall, a conference on infinite dimensional Lie groups shed some light on a difficult and diverse subject. The second semester was devoted to the study of the links between group theory and algebraic geometry, with an extended period on Langlands theory for function fields, which focussed attention on a leading subject to which access is quite difficult.

Aside from these events, thirty talks (twenty of which by speakers from outside Montréal) were given in the context of the weekly CIRGET seminar (http://www.math.uqam.ca/cirget/seminar01-02.html) organized by Olivier Collin. Also, two CIRGET workshops took place at UQAM in April 2002: *Casson's Invariant: 17 years on* (April 13-14, organized by Olivier Collin) and *The hyperbolic volume conjecture* (April 20-21, organized by Steven Boyer and Adam Sikora).

In conclusion, we wish to congratulate Niky Kamran for his election to the Royal Society of Canada.

LACIM
(Laboratoire de combinatoire et d'informatique mathématique)
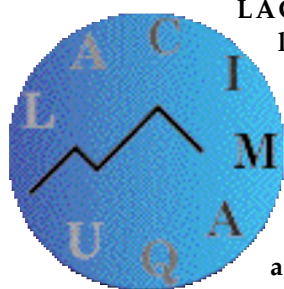
LACIM is a research laboratory of the Université du Québec à Montréal, which was officially established in 1989. Its research activities concentrate on enumerative algebra, algebraic combinatorics, computer science and their applications to other scientific domains, such as the analysis of algorithms, statistical mechanics and computational biology.

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, all professors at UQAM, four associate members in North America and thirteen 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!:
C. Reutenauer (UQAM)
Algebraic combinatorics, non-commutative algebra, automata, codes, free algebras.

R. Bédard (UQAM),
Representations of finite groups, Lie theory.

A. Bergeron (UQAM)
Bio-informatics.

F. Bergeron (UQAM)
Combinatorics, algebras, representations of finite groups.

S. Brlek (UQAM)
Combinatorics of words, algorithmics.

C. Chauve (UQAM)
Enumerative combinatorics, trees, bio-informatics.

G. Labelle (UQAM)
Enumerative combinatorics, analysis.

J. Labelle (UQAM)
Combinatorics, topology.

L. Laforest (UQAM)
Data structures, combinatorics, asymptotical analysis, quaternary trees.

P. Leroux (UQAM)
Combinatorics.

V. Makarenkov (UQAM)
Computational biology, mathematical classification.

O. Marcotte (UQAM)
Operational research, combinatorial optimization, graph theory.

T. Walsh UQAM)
Algorithmics, enumerative combinatorics, graphs.

Highlights of the activities of laboratory and of its members in 2001-2002.

Since January 2001, C. Reutenauer has held a senior Canada Research Chair.

The 57e Colloque des Sciences mathématiques du Québec was organized in April 2002 by R. Bédard, P. Bouchard and L. Bélair (the latter two being collaborating members at LACIM).

R. Bédard also co-organized the CRM winter school on Coxeter groups in January 2002.

A special AMS session on combinatorial Hopf algebras was organized in May 2002, by F. Bergeron, C. Reutenauer and M. Aguiar (the latter being a collaborating member at LACIM).

A session parallel to the 2002 SMC summer meeting was organized by C. Chauve, P. Leroux and Sylvie Corteel (the latter being a collaborating member at LACIM). C. Reutenauer was one of the plenary speakers at this meeting.

F. Bergeron was an invited speaker at the SIAM colloquium in San Diego in August 2002.

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 Québec group of analysts has lately recruited an impressive number of researchers. The creation of a laboratory allowing them to pursue their development will be welcome. The group members belong to six Québec universities with a particular concentration at 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 two active seminars, the program of the laboratory includes a plan of intense activities, a thematic year in analysis, focussing on spectral analysis and geometric analysis, including a short program on contact geometry and contact analysis, a short program on the analysis of singular spaces, two workshops in analysis of general relativity and five workshops on different aspects of spectral analysis.

Members of the Laboratory

Director!:
D. Jakobson (McGill)
Harmonic analysis, spectral geometry.

L. Baribeau (Laval)
Complex and functional analysis, Banach algebras, holomorphic iterations, discrete groups.

F. Clarke (Univ. Lyon I)
Nonlinear and dynamic analysis, control theory, calculus of variations.

G. Dafni (Concordia)
Harmonic analysis, partial derivative equations, complex variables.

D. Dawson (McGill)
Probability, stochastic processes.

S. Drury (McGill)
Harmonic analysis, matrix theory.

R. Duncan (UdeM)
Ergodic theory, probability.

R. Fournier (Dawson)
Complex analysis, univalent functions, conformal transformations.

M. Frigon (UdeM)
Nonlinear analysis, differential equations, fixed point theory, critical point, theory.

P. Gauthier (UdeM)
Complex analysis, holomorphy, harmonicity, analytic approximation.

P. Gora (Concordia)
Ergodic theory, dynamic systems, fractal geometry.

F. Gourdeau (Laval)
Banach algebras, cohomology, amenability, functional analysis.

K.N. GowriSankaran (McGill)
Potential theory.

V. Jaksic (McGill)
Mathematical physics.

T. Kaczynski (Sherbrooke)
Topological methods, Conley index, applications to dynamical systems.

I. Klemes (McGill)
Harmonic analysis, trigonometric series.

P. Koosis (McGill)
Harmonic analysis.

J. Mashreghi (Laval)
Complex analysis, harmonic analysis, Hardy spaces.

I. Polterovich (UdeM)
Partial derivative equations, spectral theory, differential geometry.

T. Ransford (Laval)
Complex analysis, functional analysis, spectral theory, potential theory, Jensen measures.

D. Rochon (UQTR)
Numbers, analysis, dynamic complexes.

C. Rousseau (UdeM)
Dynamical systems, bifurcations, qualitative theory, polynomial systems, analytic invariants, integrable systems.

D. Schlomiuk (UdeM)
Global analysis, dynamical systems, singularities, bifurcations, algebraic curves, primary integral.

R. Stern (Concordia)

Highlights of the activities of the laboratory and of its members in 2001-2002.

The members of the laboratory worked as participants and organizers at numerous conferences. For example:

NATO Advances Study Institute, CRM, July 2002: *Normal forms, bifurcations and finiteness problems for differential equations,* organized by C. Rousseau.

Session in Analysis, CMS meeting, Laval, June 2002, organized by T. Ransford.

AMS meeting, UdeM, May 2002:

- Session in *Potential Theory*, organized by P. Gauthier, K.N. GowriSankaran et al.
- Session in *Functions Spaces in Harmonic Analysis and Partial Derivative Equations*, organized by G.!Dafni, J. Xiao.
- Session in *Spectral Geometry*, organized by D. Jakobson, Y. Petridis.

Workshop on *Spectral Statistics and High Energy Eigenstates* at CRM, Aug. 25-Sept. 2 2001, organized by J. Toth, D. Jakobson, Y. Petridis.

55th Quebec Mathematics Colloquium at Bishop's University, April 28, 2001

Special day on *Dynamic Systems*, organized yearly by C. Rousseau and D. Schlomiuk.

As a complement of these activities, regular seminars are co-organized at McGill by G. Dafni, D. Jakobson, V. Jaksic, at Université de Montréal by P. Gauthier and at Laval by T. Ransford. Moreover, D. Schlomiuk is co-organizer of the CRM-ISM Colloquium.

Concerning prizes, we note the Sloan Fellowship held by D. Jakobson and the Dawson Fellowship held by J. Toth both obtained in May 2001.

Applied Mathematics Laboratory

The new Montréal laboratory in applied mathematics and scientific computation reflects an expanding domain as many of its members have been recruited lately. It is characterized by the intensity of its multidisciplinary collaborations, since all its researchers are working on the development of mathematical models and numerical methods for multiple applications to science and engineering.

Another notable characteristic of this group is the intensive use of cutting edge computer science means for advanced numerical computations. The augmentation of the number of researchers in this domain in Montréal reflects indeed the spectacular expansion of the computation power in Montréal.

Members of the Laboratory

Director:
A. Bourlioux (UdeM)
Modeling, numerical simulation in turbulent combustion.

Director!:
M. Gander (McGill)
Domain decomposition, pre-conditioning.

P. Arminjon (UdeM)
Numerical methods in fluid mechanics.

A. Bandrauk (Sherbrooke)
Quantum chemistry.

P. Bartello (McGill)
Turbulence, CFD.

M. Delfour (UdeM)
Control, optimization, design, shells, calculus, bio-mechanics.

A. Humphreys (McGill)
Numerical analysis, differential equations.

S. Maslowe (McGill)
Asymptotic methods, fluid mechanics.

N. Nigam (McGill)
Applied analysis, numerical methods in electromagnetism.

G. Schmidt (McGill)
Control of partial differential equations.

J.P. Zolésio (INRIA)
Control, optimization.

Highlights of the activities of the laboratory and of its members in 2001-2002.

The members of the laboratory maintained an extensive complete calendar of seminars in Montréal: applied mathematics seminar at Université de Montréal, organized by M. Delfour; computational science and engineering seminar at McGill University (see http://www.math.mcgill.ca/~chang/CSE), organized by Martin Gander, twelve speakers; applied mathematics seminar at McGill (see http://www.math.mcgill//nigam/AMCSEseminar.htm), organized by Nilima Nigam, 18 speakers.

A. Bourlioux and M. Gander were scientific directors of the *Séminaire de Mathématiques Supérieures* in July 2001, on the theme *Modern methods in scientific computation and applications*.

Martin Gander and Nilima Nigam were members of the McGill team that won the first prize at the competition in numerical analysis organized by N. Trefethen, *Decimal Decathlon,* and publicized by SIAM.

Michel Delfour and André Bandrauk in collaboration with C. LeBris from CERMICS, Paris, co-organized a group of activities in quantum control, which was the theme of a workshop in fall 2002. Furthermore, M. Delfour also collaborates with André Garon and his group of engineers at *École Polytechnique* of Montréal and with Marc Thiriet and his team at INRIA on a major initiative in mathematical modeling and numerical simulation in medicine.

André Bandrauk was given a Canada Research Chair in computational and photonic chemistry.

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 1970's. The group has considerably grown in the last years through the hiring of new researchers with a total of twenty academic researchers affiliated to seven Québec universities.

Mathematical and theoretical physics has broadened its spectrum of activities in the last twenty years and has become an important source of conjectures in pure mathematics.

The group carries out research in several scientific domains among the most active ones in mathematical physics, for example: nonlinear coherent fluids systems, plasmas and optics, integrable systems and classical and quantum supranaturalisms, analysis of partial differential equations via symmetry, spectral theory of Schrödinger operators and random matrices, quasi-crystals, percolation, theory of conformal fields, statistical quantum mechanics and symmetry of finite different equations.

Members of the Laboratory

Director :
J. Harnad (Concordia)
Geometric methods, integrable systems, isospectral flows, loop algebras.

S. T. Ali (Concordia)
Coherent states, wavelets.

M. Bertola (Concordia)
Axiomatic quantum field theory, invariant theory of discrete groups.

C. Cummins (Concordia)
Group theory, modular functions, Moonshine.

S. Durand (É.-Montpetit)

M. Grundland (UQTR)
Symmetry of differential equations in physics.

R. Hall (Concordia)
Quantum mechanics, geometry, spectral inversion, many-body problem.

J. Hurtubise (UdeM)
Integrable systems, gauge theory, moduli spaces.

V. Hussin (UdeM)
Quantum mechanics, differential equations, groups, Lie algebras, group deformations, supersymmetries.

D. Jakobson (McGill)
Quantum chaos, spectral geometry, harmonic analysis.

V. Jaksic (McGill)
Quantum mechanics, statistics, random Schrödinger operators.

N. Kamran (McGill)
Differential geometry, partial differential equations.

D. Korotkin (Concordia)
Integrable systems, classical and quantum gravity.

F. Lalonde (UdeM)
Symplectic topology and geometry, global analysis on manifolds, infinite dimensional transformation groups.

R. Langlands (Princeton)
Automorphic forms, critical phenomena, Ising models, percolation, phase transition, finite models in statistical physics.

J. LeTourneux (UdeM)
Symmetry properties of systems, special functions.

P. Mathieu (Laval)
Conformal field theory, classical and quantum integrable systems, affine Lie algebras.

J. Patera (UdeM)
Applications of group theory, quasi-crystals, Lie algebras.

Y. Saint-Aubin (UdeM)
Conformal field theory, statistical mechanics, 2-dimensional phase transition model.

J. Toth (McGill)
Spectral theory, semi-classical analysis, micro-local analysis, Hamiltonian mechanics.

L. Vinet (McGill)
Symmetric properties of systems, special functions.

P. Winternitz (UdeM)
Methods of group theory in physics, nonlinear phenomena, symmetries of difference equations, superintegrability.

C. Van Vliet (Miami)

Highlights of the activities of the laboratory and of its members in 2001-2002.

S.T. Ali was part of the organizing committee of the 21st workshop on *Geometrical Methods in Physics*, in Bialowieza, Poland, July 2002. John Harnad was a plenary speaker there for a series of three talks on the theme of random matrices, isomonodromic deformations, duality, and so on. S.T Ali was also co-organizer of the 4th workshop on *Wavelets, Quantization and Differential Equations*, which found place in La Havana, Cuba, in February 2002.

C. Cummins organized the *Moonshine* session of the SMC winter meeting 2001.

John Harnad co-organized several CRM workshops, beginning in May 2000 with a workshop on isomonodromic deformations and their applications to physics, the proceedings of which will be published by the CRM. Then in September 2002, he was member of the organizing committee (together with P. Winternitz, C.!S. Lam and J. Patera, the former being in charge of it) of the workshop on symmetries in physics to the memory of R.!T. Sharp. Later in the month, another workshop on superintegrability in classical and quantum systems was organized in collaboration with P. Winternitz, P. Tempesta, W. Miller, G. Pogosyan and M. Rodriguez.

Niky Kamran gave a plenary talk at the 2001 AMS meeting. Together with B. Khesin, he organized a workshop at the CRM on the geometry of Lie groups in infinite dimension in October 2001.

P. Mathieu was invited to participate to an IPAM (UCLA) workshop on conformal fields, where he presented four talks and lectures.

Pavel Winternitz received the 2001-2002 ACP-CRM prize in mathematical and theoretical physics. He was also acknowledged by the Czech journal *Lidove Noviny* of September 21, 2002, as belonging to the very prestigious club of the ten most quoted Czech scientists since 1980. He was invited many times to give plenary talks, as for example at the SYMPHYS conference in Yerevan, Armenia, July 2001; to the NEEDS conference, Cadiz, June 2002, and to the European Conference of the Newton Institute, Cambridge, August 2001 (two talks in the subject *What is Integrability?*).

John Harnad and Niky Kamran are very involved in NSERC committees. Harnad is a member of the physics committee and responsible for the *membership* committee. Kamran heads the B committee in pure and applied mathematics.

PhysNum
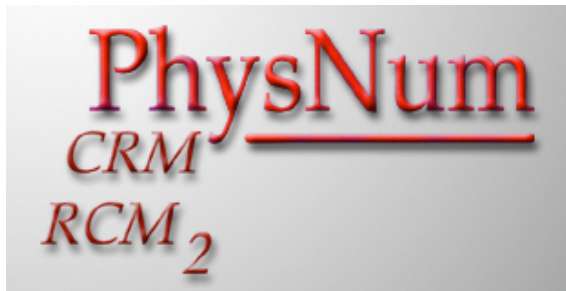
During the last year, the PhysNum group developed its research activities in brain imaging by pursuing the study of the inverse problem in MEG (magneto-encephalography) and beginning the study of problems of the same type in optical imaging. This work involves the main researchers of the group (B. Goulard, J.M. Lina and F. Lesage) as well as graduate students (E. Lapalme, F. Levac, MD).

Another direction of research concerns the analysis of wavelets applied to the study of one-dimensional signals (turbulence, EEG) and mammography imaging. In this direction, one studies random process attached to nodes of a tree or a graph whose depth is different resolution, from the coarser to the finer scale. This work is lead by the researchers of PhysNum (J.M. Lina, B. Goulard) together with PhD students (P. St-Jean, D. Clonda) and the Master's students (G. Sitzia). Notable is the presence of a junior analyst (Y. Basile-Belavance) who is in charge of the developpement, for the group, of some of the computation libraries used in this research.

Members of the Laboratory

B. Goulard (UdeM)
Brain imaging.

H. Benali (INSERM, France)
Brain imaging.

F. Lesage (CRM)
Conformal theory, integrable systems, inverse problems.

J.M. Lina (CRM)
Imaging, statistical inference, wavelets.

F. Nekka (UdeM)
Fractal analysis.

K. Worsley (McGill)
Geometry of random images in medicine and astrophysics.

Highlights of the activities of the laboratory and of its members in 2001-2002.

The ability of visualizing *in vivo* cerebral regions used in cognitive tasks by the human brain has modified deeply most of the domains in neurosciences. Until recently, the study of human cognition was mostly founded on the analysis of cerebral lesions. With the help of new techniques in functional imaging (IRM, MEG, NIRS, etc.), this discipline made remarkable progress in the comprehension of the spatial-temporal mechanisms managing the operation of the brain. It remains that the problems of detecting cerebral activity and connectivity, between the cerebral regions spatial as well as temporal, remain important subjects of research, the main concern of neuroscientists being to solve these problems beyond any doubt as to the hypotheses guaranteeing the uniqueness of the solution. The mathematical and statistical approaches studied by the PhysNum group, in collaboration with the INSERM U494 unit tend to define a methodology based only on reliable hypotheses and knowledge at the anatomical and physiological levels. Two domains are principally concerned by this study: Magneto-Encephalography and optical imaging.

Cerebral imaging (MEG)

In the context of Magneto-Encephalography applied to the study of cerebral functional connectivity, this subject acknowledged important developments can be summarized in the following way:

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.

This 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. 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)

Optical imaging offers possibilities of analysis of how the brain operates on objects usually difficult to observe with conventional tools (IRM, MEG, EGG). At the moment, there exists no strong method for detecting the active cortical zones from the infra-red (IR) optical signal interacting with the brain. Such a method, as it 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 stake being probably more interesting for neuroscientists because of the flexibility of the technique used (compared to IRM or MEG imaging), PhysNum has defined of 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 of research 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 the Daubechies complex wavelets. During the last year, the work of one of its students (D. Clonda) have 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 a modeling of the signal taking into account the phase of the coefficients in wavelets gives better results.

Models in cascade

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).

Scale invariance and fractal analysis

F. Nekka and her students have pursued their work of classification of complex structures, in particular those representing a spatial scale invariance through derived tools of fractal analysis. This team perfected a method based on the spectrum of Hausdorff measures (when the Lebesgue measure degenerates) in order to distinguish the sets that are not via fractal dimension. This method was validated on sets called *thin* fractals. One obtains in this way one index allowing not only to distinguish sets of the same dimension, but also to classify them with respect to their homogeneity degree. The use of this method was extended to sets known as *fat* fractals. These sets have a practical interest, since they are considered as synthetic models of porous material. The whole method was written into a Matlab software. This software allows also the analysis of real images for classification.

Statistics Laboratory

Statistics is undergoing a revolution in its techniques and its approaches. This revolution has been driven by the need to analyze very large complex data sets and by the advent of powerful computers. For example, statistical methodology is central to the analysis of genome data generated by micro-array images. Data-mining is one of the tools used. The laboratory aims at structuring the Québec community in order to engage with this revolution at a time of an important renewal of academic personnel.

This structure will also allow the Québec community to benefit from a new pan-Canadian program in analysis of complex data organized by the three Canadian mathematics institutes. The laboratory is composed of the leaders of the Québec school of statistics who work on subjects such as statistical learning and neuronal networks, analysis of functional data, statistical analysis of images, dependence structures, Bayesian analysis, analysis of chronological series, of financial data and resampling methods.

Members of the Laboratory

Director :
Christian Léger (UdeM)
Resampling methods, adaptive estimation, model selection, robustness, data mining applications.

Jean-François Angers
(UdeM)
Decision theory, Bayesian statistics, robustness with respect to prior information, function estimation.

Yoshua Bengio (UdeM, DIRO)
Algorithms for statistical learning, neural networks, Kernel methods, probabilistic models, data mining, applications to finance, applications to statistical modeling of language.

Martin Bilodeau (UdeM)
Multivariate analysis, decision theory, asymptotic methods.

Yogendra Chaubey
(Concordia)
Sampling, linear models, resampling, survival analysis.

René Ferland (UQAM)
Probability, stochastic processes, applications to financial mathematics.

Christian Genest (Laval)
Multivariate analysis, measure of dependence, nonparametric statistics, decision theory, applications to actuarial sciences, finance and psychology.

Nadia Ghazzali (Laval)
Multivariate analysis, neural networks and genetic algorithms, applications to astrophysics and biostatistics.

Brenda MacGibbon (UQAM)
Mathematical statistics, decision theory, bio-statistics.

François Perron (UdeM)
Decision theory, multivariate analysis, Bayesian statistics.

Jim Ramsay (McGill)
Functional data analysis, smoothing and nonparametric regression, curves scaling.

Bruno Rémillard (HEC)
Probability, empirical processes, time series, non-linear filtering, applications to finance.

Louis-Paul Rivest (Laval)
Linear models, robustness, directional data, sampling, diverse applications.

Roch Roy (UdeM)
Time series analysis, forecasting methods, applications to econometrics and epidemiology.

David Wolfson (McGill)
Change points problems, survival analysis, Bayesian analysis, optimal design, applications to medicine.

Keith Worsley (McGill)
Geometry and analysis of random images in medicine and astrophysics.

Highlights of the activities of the laboratory and of its members in 2001-2002.

The researchers of the laboratory were very busy this year and several distinguished themselves. Yoshua Bengio has held the Canada Research Chair on algorithms of statistical learning since 2001. Moreover, Keith Worsley is the first Killam Fellow in statistics. The academic and scientific leadership of the group was acknowledged in several ways this year. For instance, in 2002, Jim Ramsay was president-elect and Louis-Paul Rivest was past-president of the Statistics Society of Canada. Christian Genest and Bruno Rémillard were members of the statistics and probability committee in the context of the reallocations exercise at NSERC. Yoshua Bengio is a member of the selection committee of the discovery grants committee of NSERC in computer science. Even our students distinguished themselves: Alexis Gerbeau, Masters student of Roch Roy, was recipient of the gold medal of the Governor General.

The laboratory took part in the organization of the conference *Statistics 2001 Canada* at Concordia University, in the presentation of the third public conference of the *Canadian Journal of statistics* in March 2002, as well as to the conference *Statistique mathématique 2002* the honour of the 75th anniversary of Constance van Eeden. Yoshua Bengio was a member of the organizing committee of the conference *Learning 2002*. Roch Roy organized a session at the *Joint Statistical Meetings 2001* in Atlanta and Christian Léger was part of the program committee of the *Joint Statistical Meetings 2002* in New York. Among the main conferences to which the researchers of the laboratory were invited, there are the *International Conference and Instructional Workshop on Wavelets and their Applications* in Chennai, India (Jean-François Angers) and *Neural Networks for Signal* (Yoshua Bengio). The researchers gave talks around the world, notably at UCLA (Christian Genest) and at the Université Montpellier II (Martin Bilodeau). Finally, four research seminars series were organized by members of the laboratory, namely the CRM Statistics Seminar, the Statistics Seminars of McGill and Laval Universities and the joint UQAM-Concordia Statistics Seminar.

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 2001-2002 or that will be published soon.

Recent Titles

AMS: CRM Monograph Series

Eyal Z. Goren, *Lectures on Hilbert Modular Varieties and Modular Forms,* vol. 14, 2002

Jose I. Burgos, *The Regulators of Beilinson and Borel*, vol.15, 2002

Joel Feldman, Horst Knörrer & Eugene Trubowitz, *Fermionic Functional Integrals and the Renormalization Group*, vo. 16, 2002.

Michael Barr, *Acyclic Models*, vol. 17, 2002.

AMS: CRM Proceedings & Lecture Notes

Israel M. Sigal & Catherine Sulem, *Nonlinear Dynamics and Renormalization Group*, vol. 27, 2001.

J.C. Taylor (ed.), *Topics in Probability and Lie Groups: Boundary Theory*, vol. 28, 2001.

Alan Coley, Decio Levi, Robert Milson, Colin Rogers & Pavel Winternitz (eds.), *Bäcklund and Darboux Transformations: The Geometry of Soliton,* vol. 29, 2001.

John McKay & Abdellah Sebbar (eds.), *Proceedings on Moonshine and Related Topics*, vol. 30, 2001.

John Harnad et Alexander R. Its (eds.), *Isomonodromic Deformations and Applications in Physics*, vol. 31, 2002 .

Vadim B. Kuznetsov (éd.), *The Kowalevski Property*, vol. 32, 2002.

Springer-Verlag: CRM Series in Mathematical Physics

Yvan Saint-Aubin & Luc Vinet (eds.), *Theoretical Physics at the End of the XXth Century.* 2001.

Roman Jackiw, *Lectures on Fluid Dynamics*, 2002.

David Sénéchal, André-Marie Tremblay & Claude Bourbonnais, *Theoretical Methods for Strongly Correlated Electrons,* (to appear).

CRM Subseries of the Springer-Verlag Series: Lecture Notes in Statistics

S. Ejaz Ahmed & Nancy Reid (eds.), *Empirical Bayes and Likelihood Inference,* 2001.

Marc Moore (ed.), *Spatial Statistics*, 2001.

Les Publications CRM

Nadia El-Mabrouk, Thomas Lengauer & David Sankoff (eds.), *Currents in Computational Molecular Biology 2001.*

Armel Mercier, *Fonctions de plusieurs variables!: Différentiation*, 2002.

Previous Titles

AMS: CRM Monograph Series

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.

Eugene B. Dynkin, *An Introduction to Branching Measure-Valued Processes*, vol. 6, 1994.

Andrew M. Bruckner, *Differentiation of Real Functions*, vol. 5, 1994.

David Ruelle, *Dynamical Zeta Functions for Piecewise Monotone Maps of the Interval*, vol. 4, 1994.

V. Kumar Murty, *Introduction to Abelian Varieties*, vol. 3, 1993.

Maximilian Ya. Antimirov, Andrei A. Kolyshkin, & Rémi Vaillancourt, *Applied Integral Transforms*, vol. 2, 1993.

Dan V. Voiculescu, Kenneth J. Dykema, & Alexandru Nica, *Free Random Variables*, vol. 1, 1992.

AMS: CRM Proceedings & Lecture Notes

John Harnad, Gert Sabidussi & Pavel Winternitz (eds.), *Integrable Systems: From Classical to Quantum*, vol. 26, 2000.

Decio Levi & Orlando Ragnisco (eds.), *SIDE III - Symmetry and Integrability of Difference Equations*, vol. 25, 2000.

B. Brent Gordon, James D. Lewis, Stefan Müller-Stach, Shuji Saito & Noriko Yui (eds.), *The Arithmetic and Geometry of Algebraic Cycles*, vol. 24, 2000.

Pierre Hansen & Odile Marcotte (eds.), *Graph Colouring and Applications*, vol. 23, 1999.

Jan Felipe van Diejen & Luc Vinet (eds.), *Algebraic Methods and q-Special Functions*, vol. 22, 1999.

Michel Fortin (ed.), *Plates and Shells*, vol. 21, 1999.

Katie Coughlin (ed.), *Semi-Analytic Methods for the Navier-Stokes Equations*, vol. 20, 1999.

Rajiv Gupta & Kenneth S. Williams (eds.), *Number Theory*, vol. 19, 1999.

Serge Dubuc & Gilles Deslauriers (eds.), *Spline Functions and the Theory of Wavelets*, vol. 18, 1999

Olga Karlampovich (ed.), *Summer School in Group Theory* (Banff, 1996), vol. 17, 1998.

Alain Vincent (ed.), *Numerical Methods in Fluid Mechanics* (Montréal, 1995), vol. 16, 1998.

François Lalonde (ed.), *Geometry, Topology and Dynamics*, (Montréal, 1995), vol. 15, 1998.

John Harnad & Alex Kasman (eds.), *The Bispectral Problem* (Montréal, 1997), vol. 14, 1998.

Michel Delfour (ed.), *Boundaries, Interfaces and Transitions* (Banff, 1995), vol. 13, 1998.

Peter G. Greiner, Victor Ivrii, Luis A. Seco & Catherine Sulem (eds.), *Partial Differential Equations and their Applications* (Toronto, 1995), vol. 12, 1997.

Luc Vinet (ed.), *Advances in Mathematical Sciences: CRM's 25 Years* (Montréal, 1994), vol. 11, 1997.

Donald E. Knuth, *Stable Marriage and its Relation to Other Combinatorial Problems. An Introduction to the Mathematical Analysis of Algorithms*, vol. 10, 1996.

Decio Levi, Luc Vinet, & Pavel Winternitz (eds.), *Symmetries and Integrability of Difference Equations* (Estérel, 1994), vol. 9, 1995.

Joel S. Feldman, Richard Froese, & Lon M. Rosen (eds.), *Mathematical Quantum Theory II: Schrödinger Operator* (Vancouver, 1993), vol. 8, 1995.

Joel S. Feldman, Richard Froese, & Lon M. Rosen (eds.), *Mathematical Quantum Theory I: Many-Body Theory and Group Theory* (Vancouver, 1993), vol. 7, 1994.

Guido Mislin (ed.), *The Hilton Symposium 1993 : Topics in Topology and Group Theory* (Montréal, 1993), vol. 6, 1994.

Donald A. Dawson (ed.), *Measure-valued Processes, Stochastic Partial Differential Equations and Interacting Systems* (Montréal, 1992), vol. 5, 1994.

Hershy Kisilevsky & M. Ram Murty (eds.), *Elliptic Curves and Related Topics* (Sainte-Adèle, 1992), vol. 4, 1994.

Andrei L. Smirnov & Rémi Vaillancourt (eds.), *Asymptotic Methods in Mechanics*, vol. 3, 1993.

Philip D. Loewen, *Optimal Control via Nonsmooth Analysis*, vol. 2, 1993.

M. Ram Murty (ed.), *Theta Functions. From the Classical to the Modern*, vol. 1, 1993.

Springer-Verlag: CRM Series in Mathematical Physics

Yvan Saint-Aubin & Luc Vinet (eds.), *Algebraic Methods in Physics - A Symposium for the 60th Birthday of Jíri Patera and Pavel Winternitz*, 2000.

Jan Felipe van Diejen & Luc Vinet (eds.), *Calogero-Moser-Sutherland Models*, 1999.

Robert Conte (ed.), *The Painlevé Property: One Century Later*, 1999

Richard MacKenzie, Manu B. Paranjape & Wojciech J. M. Zakrzewski (eds.), *Soliton: Properties, Dynamics, Interactions, Applications*, 1999

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

Les Publications CRM

James G. Huard & Kenneth S. Williams (eds.), *The Collected Papers of Sarvadaman Chowla, I, II, III, 2000.*

Michael Barr & Charles Wells, *Category Theory for Computing Science*, 1999

Maximilian Ya. Antimirov, Andrei A. Kolyshkin & Rémi Vaillancourt, *Mathematical Models for Eddy Current Testing*, 1998.

Xavier Fernique, *Fonctions aléatoires gaussiennes, vecteurs aléatoires gaussiens*, Montréal, 1997.

Faqir Khanna & Luc Vinet (eds.), *Field Theory, Integrable Systems and Symmetries*, Montréal, 1997.

Paul Koosis, *Leçons sur le théorème de Beurling at Malliavin*, 1996.

David W. Rand, *Concorder Version Three: Concordance Software for the Macintosh*, Montréal, 1996 (software and user guide).

Decio Levi, Curtis R. Menyuk, & Pavel Winternitz, *Self-Similarity in Stimulated*

Raman Scattering (Montréal, 1993), Montréal, 1994.

Jacques Gauvin, *Theory of Nonconvex Programming*, Montréal, 1994.

Rémi Vaillancourt, *Compléments de mathématiques pour ingénieurs*, Montréal, 1993.

Robert P. Langlands & Dinakar Ramakrishnan (eds.), *The Zeta Functions of Picard Modular Surfaces* (Montréal, 1988), Montréal, 1992.

Florin N. Diacu, *Singularities of the N-Body Problem*, Montréal, 1992.

Jacques Gauvin, *Théorie de la programmation mathématique non convexe*, Montréal, 1992.

Pierre Ferland, Claude Tricot, & Axel van de Walle, *Analyse fractale: Application W indows ™ 3.x d'initiation aux ensembles fractals*, Montréal, 1992 (software and user guide).

Stéphane Baldo, *Introduction à la topologie des ensembles fractals*, 1991.

Robert Bédard, *Groupes linéaires algébriques*, Montréal, 1991.

Rudolf Beran & Gilles R. Ducharme, *Asymptotic Theory for Bootstrap Methods in Statistics*, Montréal, 1991.

James D. Lewis, *A Survey of the Hodge Conjecture*, Montréal, 1991.

David W. Rand & Tatiana Patera, *Concorder: Concordance Software for the Macintosh*, Montréal, 1991 (software and user guide).

David W. Rand & Tatiana Patera, *L e Concordeur: un logiciel de concordances pour le Macintosh*, Montréal, 1991 (software and user guide).

Véronique Hussin (ed.), *Lie Theory, Differential Equations and Representation Theory* (Montréal, 1989), Montréal, 1990.

John Harnad & Jerrold E. Marsden (eds.), *Hamiltonian Systems, Transformation Groups and Spectral Transform Methods* (Montréal, 1989), Montréal, 1990.

M. Ram Murty (ed.) *Automorphic Forms and Analytic Number Theory* (Montréal, 1989), Montréal, 1990.

Wendy G. McKay, Jirí Patera & David W. Rand, *Tables of Representations of Simple Lie Algebras. I. Ex-ceptional Simple Lie Algebras*, Montréal, 1990.

Anthony W. Knapp, *Representations of Real Reduc-tive Groups*, Montréal, 1990.

Wendy G. McKay, Jirí Patera & David W. Rand, *SimpLie User's Manual–Macintosh Software for Representations of Simple Lie*

Algebras, Montréal, 1990 (software and user guide).

Francis H. Clarke, *Optimization and Nonsmooth Analysis*, Montréal, 1989.

Hedy Attouch, Jean-Pierre Aubin, Francis Clarke & Ivar Ekeland (eds.), *Analyse non linéaire* (Perpignan, 1987), Montréal & Gauthiers-Villars, Paris, 1989.

Samuel Zaidman, *Une introduction à la théorie des équations aux dérivées partielles*, Montréal, 1989.

Lucien Le Cam, *Notes on Asymptotic Methods in Statistical Decision Theory*, Montréal, 1974.

AMS/International Press

Duong H. Phong, Luc Vinet & Shing-Tung Yau (eds.), *Mirror Manifolds and Geometry*, AMS/IP Studies in Advanced Mathematics, Amer. Math. Soc., Providence, RI, Internat. Press, Cambridge, MA, & CRM, Montréal, 1998(vol.10).

Aisenstadt Chair Collection

Yuri I. Manin, *Quantum Groups and Noncommutative Geometry*, Les Publications CRM, 1988.

Laurent Schwartz, *Semimartingales and Their Stochastic Calculus on Manifolds*, Presses de l'Université de Montréal, 1984.

Yuval Ne'eman, *Symétries, jauges et variétés de groupe*, Presses de l'Université de Montréal, 1979.

R. Tyrrell Rockafellar, *La théorie des sous-gradients et ses applications à l'optimisation, fonctions convexes et non convexes*, Presses de l'Université de Montréal, 1979.

Jacques-Louis Lions, *Sur quelques questions d'analyse, de mécanique et de contrôle optimal*, Presses de l'Université de Montréal, 1976.

Donald E. Knuth, *Mariage stables et leurs relations avec d'autres problèmes combinatoires*, Presses de l'Université de Montréal, 1976.

Robert Hermann, *Physical Aspects of Lie Group Theory*, Presses de l'Université de Montréal, 1974.

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Financial Report at 31 May 2002

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 2001-2002, the CRM received the third 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 scientific program as well as a general program of scientific activities, 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 $820,000 in 2001-2002. This budget is principally allocated for the remuneration of the scientific personnel of the Centre. The budget also covers the release time of the faculty members who direct the CRM and a part of the salary of administrative staff as well as some operating and computer expenses.

The Fonds FCAR also supports the operations of the CRM. The Centre received the final instalment of $210,000 of a three-year operating grant in 2001-2002. 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.

The CRM manages the collective scientific activities and the general administration of the Network for Computing and Mathematical Modeling (ncm_2). A budget of $83,894 was allocated for these tasks in 2001-2002. In addition, the CRM received $110,000 from the Network to finance the research projects of three of its members. These amounts come from the Network's annual NSERC grant of $648,894. The balance of this amount goes to the research projects of the four other founding centres of ncm_2: the Centre de recherche en calcul appliqué (CERCA); the Centre interuniversitaire de recherche en analyse des organizations (CIRANO); the Centre de recherche sur les transports (CRT); and the Groupe d'études et de recherche en analyse des décisions (GERAD).

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 $97,000 in 2001-2002 for these tasks from the overall NCE funding provided to MITACS. In addition, the research projects just mentioned received $623,000 in NCE funding in the fiscal year. This last amount is not accounted in the financial statement of the Centre because it is awarded directly to the researchers.

The CRM's André Aisenstadt endowment contributed revenues of $76,206 in 2001-2002. These funds serve for the Centre's scientific activities, particularly the annual André Aisenstadt Prize and Aisenstadt Chairs. The CRM also received in fiscal year 2001-2002 (with the university's departments of mathematics and computer science) revenue from the estate of the late Serge Bissonnette ($4,527). In addition the Centre received a grant from the Canadian Institute for Advanced Research (CIAR).

The CRM received other contributions totalling $420,181 from universities and partner organizations. The Institut des sciences mathématiques (ISM) contributed funds for joint CRM-ISM postdoctoral fellowships ($64,467) and the joint colloquium series ($7,685). Researchers from other Montréal and Québec universities contributed $290,825 for joint postdoctoral fellowships, student scholarships, research fellows, research professionals and invited scholars. In addition, there were sponsorships for two international conferences, RECOMB2001 and STOC 2002, and a contribution of $4,500 for the 2001 annual conference of the Canadian Number Theory Association" The three events were held in connection with the CRM's thematic years.

The CRM generated revenues of $51,646 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 scientific activities was much higher than usual in 2001-2002 because three international conferences were accounted during fiscal year. These conferences were RECOMB2001 (registrations totalling $265,200), STOC2002 ($129,155) and CCC2002 ($29,980). Other scientific events generated registration revenue of $31,615. Other funds came from compensation for services rendered and operating costs ($12,724).

Table 1

Main sources de funding of the CRM, 2001-2002

Source	$ Amount
NSERC (Institutes and Initiatives Program)	874!650
Université de Montréal (CÉDAR)	820!000
FCAR (Research Centres Program)	210!000
NSERC (Research Network Program, ncm_2)	193!894
National Centres of Excellence (MITACS)	97!000
Contributions from universities & partners	420!181
Other grants et revenue from endowments	201!535
Sales, registrations & other revenues	520!320
Total	**3!337!581**

Funding for Research

In addition to the CRM's grants, its researchers obtain in funding for their research projects in the form of grants and contracts. Total funding for the research projects of CRM members was about $2.5M in 2001-2002. The CRM directly managed about $672,000 in research grants.

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, 2002. 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 accommodation expenses of invited researchers (this includes the Aisenstadt Chairs and the 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 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 *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 scientific, 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.

The 2001-2002 year-end surplus is minimal.

Financial Statement 2001-2002

	NSERC-Centre	NSERC-ncm_2	FCAR-Centre	NCE-MITACS	Univ. de Montréal	Other sources	Overall Total
Scientific activities	!	!	!	!	!	!	!
Scientific Personnel	!	!	!	!	!	!	!
Visitors and Chairs	67 682	-	1 561	-	-	21 955	91 198
Partnerships	-	-	-	-	15 000	45 000	60 000
Université de Montréal	-	-	-	-	690 498	50 559	741 057
Postdoctoral fellows	135 825	22 013	-	-	2 427	280 871	441 136
Research professionals	-	-	-	-	-	18 645	18 645
Students	3 127	83 995	-	-	-	17 700	104 821
Subtotal: Scientific personnel	206 633	106 008	1 561	-	707 925	434 730	1 456 857
Scientific Programs	!	!	!	!	!	!	!
Thematic Years	!	!	!	!	!	!	!
Math. Methods in Biology and Medicine	*42*	-	-	-	-	*258 092*	*258 133*
Groups and Geometry	*169 681*	-	-	-	-	*61 404*	*231 085*
Math in Computer Science	*13 456*	-	-	-	-	*104 415*	*117 871*
Subtotal: Thematic years	183 179	-	-	-	-	423 910	607 089
General scientific program	148 678	-	-	-	-	40 174	188 852
Network activities	-	8 436	-	38 989	-	200	47 625
Other	12 719	-	6 631	-	9 892	14 181	43 422
Subtotal: Scientific programs	344 576	8 436	6 631	38 989	9 892	478 465	886 988
Personnel - Scientific programs	155 637	-	-	-	-	-	155 637
Personnel – Direct research support	81 112	-	35 527	-	-	-	116 639
Total: Scientific Activities	**787 957**	**114 444**	**43 719**	**38 989**	**717 817**	**913 195**	**2 616 121**
Publications	!	!	!	!	!	!	!
Personnel	-	-	88 668	-	-	-	88 668
Direct publication expenses	-	-	-	-	-	6 143	6 143
Total: Publications	**-**	**-**	**88 668**	**-**	**-**	**6 143**	**94 811**
Administration	!	!	!	!	!		!
Personnel	!	!	!	!	!		!
Executive	*42 450*	*15 000*	-	*181*	*46 536*	-	*104 168*
Administration and research	*57 513*	*42 914*	*76 454*	*57 401*	*71 406*	*6 699*	*312 388*
Systems experts & communications	-	*5 969*	-	-	*31 437*	*861*	*38 267*
Subtotal: Personnel	99 964	63 883	76 454	57 583	149 379	7 560	454 822
Advisory and other committees	13 919	-	-	-	-	3 724	17 643
Operating expenses	37 231	1 321	8 914	2 213	12 353	11 656	73 688
Computer equipment	8 469	2 193	16 181	-	3 168	14 271	44 282
Total: Administration	**159 583**	**67 397**	**101 548**	**59 795**	**164 901**	**37 211**	**590 435**
Total Expenditures	**947 540**	**181 841**	**233 936**	**98 784**	**882 717**	**956 548**	**3 301 367**
Revenues	!	!	!	!	!	!	!
Operating grants	874 650	-	210 000	-	820 000	-	1 904 650
Research networks, equipment and other grants	-	193 894	-	97 000	-	201 535	492 429
Contributions from universities and partners	-	-	-	-	-	420 181	420 181
Sales, registrations and other revenues	-	-	-	-	-	520 320	520 320
Total Revenues	**874 650**	**193 894**	**210 000**	**97 000**	**820 000**	**1 142 037**	**3 337 581**
Surplus (Deficit)	**(72 890)**	**12 053**	**(23 936)**	**(1 784)**	**(62 717)**	**185 489**	**36 214**