

# Bulletin du CRM

Centre de recherches mathématiques

Université de Montréal

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Michel  
Delfour



Michel Delfour, professeur au Département de mathématiques et de statistique et membre du CRM de l'Université de Montréal, a été nommé *Fellow de la John Simon Guggenheim Memorial Foundation* pour l'année 2003-2004. Cette nomination lui permettra de se consacrer à plein temps au projet de recherche en théorie intrinsèque des coques minces et asymptotiques. ■

David  
Sankoff



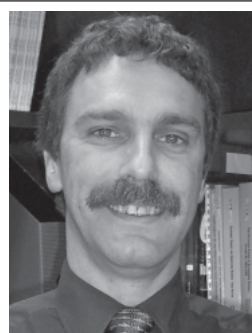
Professor David Sankoff, a member of the CRM, has been awarded the *Senior Scientist Accomplishment Prize of the International Society for Computational Biology*. Professor Sankoff is the first recipient of the award, and he received the prize at the ISCB Congress in Australia in June 2003. ■

## A Word from the Director

Last June, Jacques Hurtubise ended a four-year term as Director of CRM. His mandate has been one of consolidation. The CRM has expanded its scientific base by formalizing long-standing relationships with the other Québec universities as well as developing new ones. Under his helm, CRM has continued to stress the central role of mathematics not only for the development of the mathematics discipline (as it should!), but also for the development of science as witnessed, for instance, by the last *Thematic Year on the Mathematics of Computer Science*. Jacques has also played a major role on some of our partner organisations like MITACS, and *ncm*. Finally, the CRM budget has increased significantly under his leadership with an increase in the federal and provincial grants as well as new funding by the partner universities. In particular, the substantial increase in the provincial grant helps support eight laboratories in the mathematical sciences. For all of these accomplishments, the CRM community is indebted to him. I invite you to read Jacques's last column on page 2.

The Centre de recherches mathématiques is a major Canadian research institution. As such, it has a life of its own which continues even when there are changes at the Direction. I took over on an interim basis and will continue to lead CRM until a new Director is found (see the call for nomination on page 2). Many of you may be wondering why you don't know me. The fact that I am a statistician probably explains it. Since my nomination, I have been meeting many of you and I will be having many other opportunities to interact with you in the next few months. To help me, I have the pleasure of benefiting from the help of three Deputy Directors. Jean LeTourneau continues to run the publications of CRM. Tony

Humphries (McGill University) will help me with scientific activities while Patrice Marcotte (Université de Montréal) will be in charge of the industrial programme, including MITACS.



The new CRM director,  
Christian Léger

The current thematic year on *Geometric and Spectral Analysis* is well underway with many other workshops and courses still coming up (the French version of the programme starts on page 3, see the web site for the English version). A couple of workshops are coordinated with the thematic programme of the Fields Institute. We are also preparing the next *Thematic Year on the Mathematics of Complex Multiple-Scale Systems*. An out-

line of the programme is listed on page 6; our Web site will provide more details regarding the scheduling as soon as available. I invite you to pay attention to the announcement for postdoctoral fellowship positions for the thematic year and for the other CRM-ISM postdoctoral fellowships (see the call on page 5).

Many other exciting scientific activities will take place this year. In particular, I draw your attention to two short programmes which will take place next summer. The first is on *Riemannian Geometry* starting late June 2004 with the

first week devoted to summer courses followed by a two-week conference (see page 5). The second short programme is on *Stochastic Networks* and will feature three related activities (see page 7).

As usual, CRM is bustling with activities and, thanks to our dedicated staff, many others are at different stages of preparation. I invite you to consult our web site ([WWW.CRM.UMontreal.CA](http://WWW.CRM.UMontreal.CA)),

**(Director - continued on page 11)**

**"The CRM is an incredible institution and it is a great honour for me to help it move forward."**



## MOT DE JACQUES HURTUBISE

Nous venons de terminer une année fort bien remplie au CRM. Notre année thématique en *Mathématiques de l'informatique* a connu un grand succès avec la tenue de 19 ateliers, 4 grandes conférences, une école d'été et plusieurs sessions de travail intense avec au total, 1960 participants. Un des thèmes de l'année, les méthodes probabilistes, a pris une présence

grandissante. L'année s'est terminée de façon fort inspirante avec une session intense sur les techniques probabilistes en mathématiques discrètes ainsi qu'un atelier sur l'apprentissage automatisé. Ce thème se prolonge l'an prochain avec un *programme court sur l'analyse stochastique des réseaux* (voir page 7).

De plus, des ateliers sur le contrôle quantique, la superintégrantibilité, les probabilités, la théorie des groupes et l'analyse numérique, le choix de portefeuille, la gestion de revenus, sans compter les activités des équipes MITACS, les séminaires de nos boursiers post-doctoraux et les activités de recherche de nos visiteurs étaient à l'agenda.

Des changements structureaux à l'organisation du CRM ont élargi considérablement sa base d'opérations locales. La subvention FQRNT du CRM a augmenté d'un facteur de 2.5 et ces nouvelles ressources, ainsi que des ressources universitaires supplémentaires provenant de nouveaux partenaires, financeront les activités de huit laboratoires de recherche du CRM. Ces laboratoires serviront entre autres de foyers naturels d'activités et d'accueil pour nos boursiers post-doctoraux et nos visiteurs.

L'année en cours s'annonce aussi intense. Nous commençons notre année thématique en *Analyse géométrique et spectrale* avec une période de trois semaines sur l'analyse des variétés singulières, puis, avec une paire d'ateliers en relativité générale. Le reste de l'année se poursuit avec l'analyse

**De nouveaux partenaires financent 8 laboratoires, foyers d'accueil de boursiers et visiteurs."**

spectrale sous ses multiples aspects dont la théorie des nombres, la mathématique physique et la géométrie. Une exposition des œuvres d'art d'Eric Heller, inspirées de phénomènes physiques, dont certaines reliées au thème de l'année aura lieu également. Puis, deux programmes courts en géométrie Riemannienne et en analyse des réseaux stochastiques, une école d'été en bioinformatique, les ateliers (*Plasticité cérébrale, Espaces de modules*, etc.) et les activités des nouveaux laboratoires, complètent ce calendrier bien rempli.

Après quatre ans à la barre du CRM, j'ai tiré ma révérence en juin, laissant le CRM entre les bonnes mains de Christian Léger. Ce fut une période extrêmement stimulante pour moi et j'en ai de très bons souvenirs. Je me relance dans mes travaux de recherche et quel endroit peut être plus propice à le faire qu'au CRM, inaugurant ma sabbatique avec un atelier sur les structures algébriques et les espaces de modules. Le rôle essentiel des instituts dans notre vie mathématique s'étend tout naturellement à leurs anciens directeurs, non seulement pour moi mais pour mon collègue Nassif Ghousseub du PIMS qui est un visiteur au CRM cette année.

Je termine donc ce mot, mon dernier, en remerciant tous ceux qui m'ont aidé au cours des dernières années : mes collègues de la communauté universitaire dont plusieurs ont contribué grandement au fonctionnement du CRM, mes collègues du  $rcm_2$  et de MITACS, les officiers à la barre des organismes qui nous subventionnent, la direction de nos universités partenaires (tout particulièrement l'Université de Montréal) et surtout, le personnel du Centre, qui par sa gentille efficacité ont su rendre ces dernières années une source de plaisir constant. ■

## CALL FOR NOMINATION

### Director of the Centre de recherches mathématiques

The candidate will be an accomplished mathematician. Previous experience in managing a department or a research centre is a definite asset. The initial appointment is for 4 years.

The Centre de recherches mathématiques (CRM) is the most senior of Canada's mathematics institutes, the other two being the Fields in Toronto and PIMS in Western Canada. The federal and provincial governments, an endowment, Université de Montréal and three other universities in Montreal provide the main financial support of the CRM. Its budget has been stable or increasing over the past few years, and is a little over \$3M CAN.

The CRM organizes 12 to 15 scientific meetings yearly, is home to several research teams, plays a crucial role in nurturing contacts between mathematicians and industry, publishes a dozen monographs or conference proceedings in its own collections and those in collaboration with the AMS, Springer Verlag and International Press, and is part of MITACS (Mathematics of Information Technology and Complex Systems), a Canadian Network of Centers of Excellence. The CRM's annual reports are available on line.

The CRM's director is appointed for a four-year renewable term. If desired a tenured position at Université de Montréal can be obtained. The Université de Montréal's working language is French. If necessary, French lessons will be provided.

You can help us by suggesting candidates and making the search process known to your colleagues. Any of the Search Committee members will gladly receive your comments and suggestions:

ALAIN CAILLÉ, Vice-President, Research, Université de Montréal; 514-343-7270. **Email:** [alain.caille@umontreal.ca](mailto:alain.caille@umontreal.ca)

HENRI DARMON, Professor, McGill University; 514-398-2263. **Email:** [darmon@math.mcgill.ca](mailto:darmon@math.mcgill.ca)

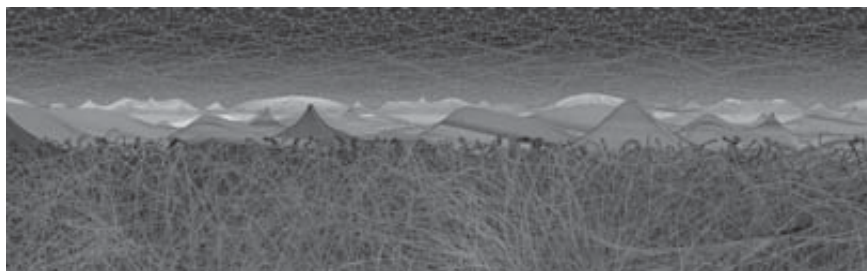
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DUONG H. PHONG, Professor, Columbia University; 212-854-8799. **Email:** [phong@math.columbia.edu](mailto:phong@math.columbia.edu)

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YVAN SAINT-AUBIN, Director, Département de mathématiques et de statistique, Université de Montréal; 514-343-6710. **Email:** [saint@dms.umontreal.ca](mailto:saint@dms.umontreal.ca)

# ANALYSE GÉOMÉTRIQUE ET SPECTRALE



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## Comité organisateur

E. BIERSTONE (Toronto), W. CRAIG (McMaster), F. FINSTER (Regensburg), D. JAKOBSON (McGill), V. JAKSIC (McGill), N. KAMRAN (McGill), Y. LAST (Hebrew), R. MELROSE (MIT), P. MILMAN (Toronto), C. PILLET (Toulouse), D.H. PHONG (Columbia), I. POLTEROVICH (Montréal), J. TOTH (McGill), S. ZELDITCH (Johns Hopkins).

L'analyse se retrouve traditionnellement au centre d'une foule d'activités de recherche en mathématiques. En particulier, les domaines de l'analyse spectrale et de l'analyse géométrique ont joué un rôle fondamental dans l'élaboration des thèmes majeurs de la recherche contemporaine en géométrie différentielle et en

mathématique physique et se répercutent maintenant en théorie des nombres et en géométrie algébrique. Ils sont, en effet, au cœur des développements les plus spectaculaires et les plus profonds des années récentes dans ces domaines.

L'année en analyse géométrique et spectrale est organisée autour de deux thèmes connexes : le premier, dont les divers sous-thèmes sont répartis tout au long de l'année thématique, cible diverses questions en analyse spectrale; il est constitué principalement d'un programme court portant sur l'analyse des espaces singuliers, ainsi que d'une période de concentration plus longue sur l'analyse spectrale en géométrie différentielle, en mathématique physique et en théorie des nombres. ■

## Programme court sur l'analyse et la résolution de singularités

18 août - 5 septembre 2003

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

Des méthodes effectives de résolution de singularités occupent maintenant une place centrale dans toute une génération moderne de problèmes en analyse et géométrie: la théorie spectrale et la théorie de Hodge pour les variétés algébriques, la stabilité d'intégrales oscillantes, l'existence de métriques de Kähler-Einstein, des versions fines des inégalités de Moser-Trudinger.

PREMIÈRE SEMAINE : atelier sur les intégrales oscillatoires et les exposants critiques d'intégrabilité

DEUXIÈME SEMAINE : mini-cours sur les méthodes effectives de résolution de singularité.

TROISIÈME SEMAINE : Atelier sur la résolution de singularités, les métriques et le Laplacien

Le théorème de Hodge qui décrit les formes harmoniques sur une variété algébrique lisse et les relie à la cohomologie, a eu un impact énorme sur la géométrie

différentielle et algébrique, ainsi que sur l'analyse différentielle. Pour le cas plus général d'une variété algébrique singulière, la description des formes harmoniques reste essentiellement ouverte, bien qu'on ait formulé des conjectures substantielles. Une approche qui passe par la résolution de singularités dépend d'une compréhension du comportement de la métrique canonique de Fubini-Study lors d'une résolution.

## Atelier sur le problème de Cauchy pour les équations d'Einstein

24 - 28 septembre 2003

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

Le problème de Cauchy en relativité générale a vu un nombre de percées importantes depuis quelques années. Ces percées comprennent la preuve de la stabilité non-linéaire de l'espace de Minkowski, la preuve de la conjecture de Penrose riemannienne et la description rigoureuse du comportement à l'infini de données de Cauchy admissibles.

## Atelier sur les interactions de la gravitation avec des champs externes

1 - 5 octobre 2003

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

L'interaction de la gravitation avec des champs externes est régie par des systèmes d'équations aux dérivées partielles fortement couplés. L'analyse de ces systèmes mène à des résultats surprenants sur le rôle des champs externes dans la dynamique de l'effondrement gravitationnel et de la formation de singularités.

## Atelier sur les limites grand N de la théorie de jauge U(N) en physique et en mathématiques

5 - 9 janvier 2004

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

Cet atelier est voué à l'étude du développement asymptotique  $N$  grand en théorie quantique des champs, en particulier dans le contexte explicitement résoluble à deux dimensions. Pendant les années 90,

une série d'articles des physiciens tels que D. J. GROSS, W. TAYLOR, G. MATYTSIN, M. DOUGLAS, V. KAZAKOV, et G. MOORE, ont produit une série de développements asymptotiques pour des objets de la théorie de Yang-Mills en dimension deux avec groupe de jauge  $U(N)$ , telles que la fonction de partition d'une surface fermée de genre  $g$ , la fonction de partition d'un cylindre, l'espérance de la fonctionnelle de Wilson, ainsi que pour certains caractères  $\chi_R(U)$ . Ces quantités sont reliées à des traces et autres invariants de noyaux de la chaleur et à des volumes et des traces sur des espaces de modules de connexions plates. Les développements asymptotiques des fonctions de partition sont régis par la statistique de revêtements de surfaces avec points de branchement.

### Atelier sur la géométrie spectrale

4 - 6 mars 2004

ORGANISATEUR: *Iosif Polterovich (Montréal)*

Les relations entre les propriétés géométriques de variétés et le spectre du Laplacien sont des objets d'étude depuis plusieurs décennies. Il est bien connu que plusieurs invariants sont déterminés par le spectre, et inversement, le comportement du spectre dépend fortement de la géométrie et de la topologie sous-jacente. Néanmoins, notre compréhension de cette interaction entre géométrie et spectre est loin d'être complète. Au cours des années récentes des développements majeurs ont eu lieu dans différents domaines de la géométrie spectrale tels que les développements asymptotiques, les estimés de valeurs propres, l'isospectralité et d'autres.

### Atelier AARMS-CRM sur les opérateurs intégraux singuliers et les variétés de type CR

3 - 8 mai 2004

ORGANISATEURS: *Galia Dafni (Concordia), Andrea Fraser (Dalhousie)*

La théorie des opérateurs intégraux singuliers dans le contexte de sous-variétés de type CR de  $C^n$ , en particulier du groupe

de Heisenberg, a été un sujet d'étude des plus fructueux au cours des dernières trente années. Plus récemment, l'emphase s'est déplacée du côté des opérateurs intégraux singuliers qui ne s'insèrent pas dans la théorie standard de Calderon-Zygmund. Ces opérateurs comprennent ceux obtenus de noyaux produits sur des groupes de Lie nilpotents, ce qui mène aussi à l'étude de noyaux associés à des drapeaux. L'atelier se tiendra à Halifax (Nouvelle-Écosse).

### Atelier sur la théorie spectrale et formes automorphes

4 - 7 mai 2004

ORGANISATEURS: *D. Jakobson (McGill), Y. Petridis (CUNY)*

Les questions étudiées sur les familles de fonctions L comprennent la distribution de zéros et l'hypothèse de Riemann généralisée, les distributions de valeurs, les valeurs spéciales ainsi que les liens à des questions arithmétiques telles que la distribution des nombres premiers, la taille des groupes de classe, les rangs analytiques et les courbes elliptiques.

### Atelier sur les systèmes dynamiques hamiltoniens

(en collaboration avec le Fields Institute)

24 - 28 mai 2004

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

Conférence sur les techniques analytiques des systèmes dynamiques dont la théorie des perturbations, les méthodes variationnelles et la théorie de la stabilité. L'atelier couvre les systèmes hamiltoniens de dimension finie comme ceux de la mécanique céleste et les systèmes de dimension infinie, tels que ceux provenant des EDP ou d'autres systèmes dynamiques avec un nombre infini de degrés de liberté.

### Atelier sur la théorie semi-classique des fonctions propres et équations aux

#### dérivées partielles

1 - 5 juin 2004 (CRM)

7-11 juin 2004 (Fields)

ORGANISATEURS: *D. Jakobson (McGill), J. Toth (McGill)*

Un grand nombre de questions en chaos quantique sont motivées par le principe de

correspondance en mécanique quantique. Ce principe dit que certaines propriétés classiques d'un système se manifestent dans le comportement semi-classique (quand la constante de Planck tend vers zéro) d'une quantification du système classique. La relation exacte entre la dynamique classique et les propriétés asymptotiques des états propres à haute énergie de la quantification n'est pas encore complètement comprise, malgré des développements majeurs au cours des vingt dernières années. Ces questions comprennent l'existence et la valeur de bornes asymptotiques pour les fonctions propres des termes d'erreur de Weyl sous leur forme ponctuelle et sous leur forme intégrée et les phénomènes de « cicatrices ». Une autre question fondamentale se rapporte aux propriétés statistiques globales et locales de fonctions propres, leurs noeuds et leurs points critiques.

### Atelier sur la théorie spectrale des opérateurs de Schrödinger

26 - 30 juillet 2004

ORGANISATEURS: *V. Jaksic (McGill), Y. Last (Hebrew)*

Cet atelier ciblera la théorie spectrale des opérateurs de Schrödinger aléatoires et quasi-périodiques. En physique du solide, les opérateurs de Schrödinger aléatoires et quasi-périodiques sont des modèles de systèmes désordonnés tels que les alliages, les verres et les matériaux amorphes. Le désordre du système se reflète par la dépendance du potentiel de paramètres aléatoires.

D'un point de vue mathématique, les opérateurs de Schrödinger aléatoires ont un comportement assez remarquable. Si le système est suffisamment désordonné, les opérateurs ont un spectre ponctuel dense, avec des fonctions propres à décroissance exponentielle (localisation d'Anderson). Ces spectres denses reflètent le fait que du point de vue physique, les systèmes fortement désordonnés sont de mauvais conducteurs. On pense que dans le régime légèrement désordonné et en dimension plus grande que deux, ces opérateurs ont un spectre qui en partie est absolument continu, qui correspond à la conductivité non nulle du système. La preuve mathématique de cette transition de phase dans le spectre (délocalisation d'Anderson) est un problème fondamental en mathématique physique.

Log on our Web site to read the English description of our 2003-2004 Theme Year activities:  
[WWW.CRM.UMontreal.CA](http://WWW.CRM.UMontreal.CA)

## Atelier sur la dynamique en mécanique statistique

2 - 6 août 2004

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

Au fil des dernières années, des efforts substantiels ont été voués à l'étude de systèmes ouverts à la fois classiques et quantiques. Notre compréhension de la structure mathématique de la mécanique statistique loin de l'équilibre a été grandement améliorée. Le but de cet atelier est de présenter les résultats les plus récents et de discuter des directions possibles de la recherche avec une emphase sur les sujets suivants: approches axiomatiques, modèles spécifiques, dynamiques markovienne.

### Cours offerts dans le cadre de l'année thématique:

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

Un appui financier est disponible pour les étudiants.

Faites parvenir votre demande à:

Louis Pelletier, CRM  
Université de Montréal,  
C.P. 6128,  
Succ. Centre-ville,  
Montréal, Qc CANADA H3C 3J7  
Courriel: [ACTIVITES@CRM.UMontreal.CA](mailto:ACTIVITES@CRM.UMontreal.CA) ■

## Dernière heure - Late News



The 2003-2004 André-Aisenstadt Prize goes to Vinayak Vatsal. Dr. Vatsal will give a lecture on April 2, 2004 at CRM. More information available in the next Bulletin. ■

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2003-2004

### Aisenstadt Chairholders

Professor S.T. Yau (Harvard), one of the 2003-2004 Aisenstadt Chairholders gave a series of lectures on October 2-4, 2003 at the CRM.



S.T. Yau

Details are available at:  
[WWW.CRM.UMontreal.CA/Aisenstadt/Aisenstadt2003-04.html](http://WWW.CRM.UMontreal.CA/Aisenstadt/Aisenstadt2003-04.html) ■

The series of Aisenstadt Lectures to be given by Professor Peter Sarnak (Princeton) this year will coincide with the *Workshop on spectral theory and automorphic forms* and will be held on the week of May 4-7, 2004. ■



Peter Sarnak

## SHORT PROGRAMME ON RIEMANNIAN GEOMETRY

June 28 - July 16, 2004 at CRM

ORGANIZING COMMITTEE : *V. APOSTOLOV (UQAM),  
A. DANCER (OXFORD), N. HITCHIN (OXFORD),  
M. WANG (MCMMASTER)*

Metrics whose curvature satisfies constraints (the so-called special geometries), as well as the relation between curvature and topology have been of interest since the beginning of differential geometry. More recently, such metrics have come to the fore in physical problems related to string theory. The short programme will be concerned with mainstream issues of the subjects and will have a three-week format. It will begin with a week of summer courses designed for graduate students and post-doctoral fellows, followed by a two-week conference. The summer courses will be given by Michael Anderson, Karsten Grove, Nigel Hitchin and Simon Salamon. Invited speakers for the two-week conference include O. Biquard, C. Boyer, R. Bryant, X.X. Chen, K. Galicki, G. Gibbons, D. Joyce, C. LeBrun, C. Pope, H. Bray, J. Cheeger, B. Chow, T. Golding, P. Li, G. Perelman, P. Petersen, G. Tian, B. Wilking, W. Ziller. ■

THEMATIC YEAR 2004-2005

## POSTDOCTORAL FELLOWSHIP

The CRM invites applications for postdoctoral fellowship positions at CRM for the 2004-2005 academic year. These fellowships provide an opportunity to spend at least one year engaged in research and participating in the research activities of the Centre, as well as interact with some of the members of the CRM Research Group on Applied Mathematics. Candidates for the Theme Year on Mathematics of Complex Multi-Scale Systems should apply to the CRM-ISM Postdoctoral Fellowship Program (see the next item) and indicate in their cover letter their interest in the Thematic Year. ■

## CRM-ISM POSTDOCTORAL FELLOWSHIP PROGRAM

The Institut des sciences mathématiques (ISM) and the Centre de recherches mathématiques (CRM) are inviting applications for their joint postdoctoral fellowship program starting in September 2004. The annual stipend is Can\$32,000 for one year, renewable for a second year. The stipend of the fellowship includes no teaching assignments. Extra stipend may be offered for teaching duties. CRM-ISM postdoctoral fellowships are awarded to beginning researchers who recently obtained a Ph.D. Researchers who received their doctorate more than five years before the application deadline are not eligible for the fellowship.

The ISM coordinates the graduate programs in mathematics of six Québec universities (Concordia, Laval, McGill, Sherbrooke, Université de Montréal and UQAM). The CRM is a national research center in the mathematical sciences. Each year, the CRM organizes a wide range of events attracting participants from around the world. The main theme for 2004-2005 is "Applied Mathematics", in particular the Mathematics of Complex Multiple-Scale Systems. However, high-quality applications in all fields of interest to the CRM or to the ISM are welcome. The theme for 2005-2006 will be "Number Theory and Analysis". ■

Applications must arrive at the ISM by Friday January 2, 2004. For further details log on to [www.math.uqam.ca/ISM/](http://www.math.uqam.ca/ISM/)

# THE MATHEMATICS OF STOCHASTICS AND MULTIPLE-SCALE MODELING

## 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, rheological fluids. 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 a useful model which captures well the global behaviour 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

August 2004

ORGANISERS: *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

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

### Multiscale Rheological Models for Fluids

Fall 2004

ORGANISER: *C. Le Bris (Cermics, ENPC, Paris)*

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

### Extracting Low-Dimensional Effective Dynamics of Biomolecules

Fall 2004

ORGANISERS: *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

ORGANISERS: *T. Souganidis (Texas), A. Bourlioux (Montréal)*

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

ORGANISERS: *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.

### Representing Unresolved Degrees of Freedom in the Atmosphere and Ocean

Spring 2005

ORGANISER: *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.

### Multiscale Modeling in Solids

Spring 2005

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

## THEME YEAR 2004-2005

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

### Integrative Multiscale Modeling and Simulation in Material Science, Fluids and Environmental Science

Spring 2005

ORGANISER: *T. Hou (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. ■

## WORKSHOP ON STOCHASTIC NETWORKS

July 18 - 23, 2004

Stochastic modeling of communications and processing networks is playing a significant role in enhancing our understanding of how to engineer, manage, and control complex systems ranging from the Internet to high-volume wafer fabrication facilities to wireless networks. These 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. In July 2004, CRM will bring together top researchers in this discipline, with the aim of both pushing forward the research frontiers and of contributing to the knowledge base that is critical to the many companies engaged in the networking domain. CRM's program in stochastic networks will have three distinct components.

The core activity will be the six day 2004 *Stochastic Networks Conference*, running from July 18 to July 23, 2004. The invited speakers include Eitan Altman (INRIA), Mor Armony (New York University), Dimitris Bertsimas (MIT), Sem Borst (CWI), Jim Dai (Georgia Tech), Christian Gromoll (Eurandom), Bruce Hajek (Illinois), Mor Harchol-Balter (Carnegie-Mellon), Mike Harrison (Stanford), John Hasenbein (Texas), Frank Kelly (Cambridge), P.R. Kumar (Illinois), Tom Kurtz (Wisconsin), Zhen Liu (IBM), Avi Mandelbaum (Technion), Balaji Prabhakar (Stanford), Leandros Tassioulas (Maryland), Ruth Williams (UC-San Diego), and Assaf Zeevi (Columbia). This conference, which will focus on both the mathematics and modeling of stochastic networks, will offer

participants plenty of time for informal discussion and will also feature a poster session for contributed papers.

In addition, a *Workshop on Internet and Network Economics* will be held on July 17 and July 18. This workshop will address some of the issues that are arising in the context of Internet routers and protocols that are capable of offering users choice among differentiated services and explicit bandwidth allocations. It is anticipated that complementary user-network and network-network interfaces, together with scalable pricing and billing mechanisms, will likely be deployed, in particular to give users incentives to employ the lower-quality classes-of-service for applications that can tolerate them. There is debate as to whether feasible flat-rate pricing paradigms are sufficient or if usage-based pricing approaches are needed. Extensive work has been done already on pricing of communications networks, in particular using game-theoretic approaches and optimization theory.

However, we still do not have real "network economics" that ties in pricing concepts together with control and incentives. The highly distributed nature of the Internet makes deployment of pricing and billing mechanism challenging. The goal of this workshop will be to develop a coherent overview of the joint work that has been done on the subjects of Internet economics, pricing, and network man-

agement, and to determine important new research directions.

The Call Center Forum (jointly sponsored by the Wharton School of Business) will follow the *Stochastic Networks Conference*. The Forum will bring together academics and practitioners from various disciplines in an effort to focus on the challenging problems that call center design and management are generating. Among the issues that arise are capacity decisions related to staffing (particularly in call center environments in which multiple skill sets are required) and control decisions related

**"In July of 2004, CRM will bring together top researchers in this discipline, with the aim of both pushing forward the research frontiers and of contributing to the knowledge base that is critical to the many companies engaged in the networking domain."**

to dynamic reallocation of staff. The design of such an operation, and the management of its performance, must be based on sound scientific principles. This is manifested by a growing body of academic multi-disciplinary research, devoted to call centers, and ranging from mathematics and statistics, through operations research, industrial engineering, information technology, and human resources management, all the way to psychology and sociology. ■

For details about Stochastic Networks, log on [www.CRM.UMontreal.CA/Stochastic2004/](http://www.CRM.UMontreal.CA/Stochastic2004/)

## LE PRIX CRM-SSC 2003 À CHARMAINE DEAN

Le Prix CRM-SSC en statistique a été décerné au professeur Charmaine B. Dean, directrice fondatrice du Département de statistique et d'actuariat de l'Université Simon Fraser afin de souligner l'excellence de son apport aux sciences statistiques et son dévouement exemplaire envers la profession. L'attribution du prix à Madame Dean a été confirmée au 31<sup>e</sup> Congrès annuel de la Société statistique du Canada (SSC) en juin 2003. Née en 1958 à San Fernando, Trinidad, M<sup>me</sup> Dean s'est établie au Canada à l'âge de 19 ans. Elle obtient son diplôme en mathématiques à l'Université de la Saskatchewan (1980) et complète sa maîtrise en statistique et son doctorat à l'Université de Waterloo (1988). Elle a occupé un poste à l'Université de Calgary pendant un an avant d'être recrutée par le Département de



*Christian Genest, Charmaine Dean, Mary Thompson et Christian Léger*

mathématiques et de statistique de l'Université Simon Fraser (1989). Elle est devenue la directrice fondatrice du Département de statistique et d'actuariat en 2001.

P<sup>r</sup> Dean s'intéresse aux modèles de mélange de Poisson et aux méthodes de régression pour données de dénombrement. Elle a signé ou cosigné une trentaine d'articles scientifiques. Elle a contribué elle-même à la mise en œuvre de plusieurs des méthodes qu'elle a développées, notamment pour le compte du Ministère de la Santé de la Colombie-Britannique. Pour plus de détails sur sa carrière, veuillez consulter la page Web:

[www.CRM.UMontreal.CA/prix/prixCRM-SSC/Charmaine\\_en.html](http://www.CRM.UMontreal.CA/prix/prixCRM-SSC/Charmaine_en.html). ■

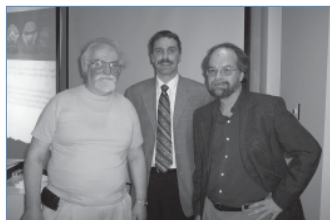
## WINNERS OF THE CRM-FIELDS PRIZE FOR 2002-2003

The recipients of the CRM-Fields Prize for mathematics are John McKay and Edwin Perkins. The prize, awarded annually by the Centre de Recherches Mathématiques in Montreal and the Fields Institute in Toronto, recognises exceptional contributions by a mathematician working in Canada.

### JOHN MCKAY

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

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



*Christian Léger with John McKay and Edwin Perkins*

### EDWIN PERKINS

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

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

## 2002-2003 ANDRÉ-AISENSTADT PRIZE

Professor Alexander Brudnyi completed his Ph.D. thesis in 1996 at the Technion, Israel. He then held a NATO postdoctoral fellowship at the



*Alexander Brudnyi*

University of Toronto and the Fields Institute. In 2000, after spending some time at the Ben Gurion and Sundsvall Universities, he joined the University of Calgary. Working in complex analysis and geometry, he has, in more than 25 articles, made significant contributions to four different areas: fundamental groups of compact Kähler manifolds, local inequalities for holomorphic and plurisubharmonic functions, limit cycles and the distribution of zeros of families of analytic functions, maximal ideals of the space of bounded analytic functions and matrix-valued corona theorem. ■

## 2002-2003 CAP-CRM PRIZE



*Matthew Choptuik*

Matthew Choptuik (UBC) was awarded the 2002-2003 CAP-CRM Prize in Theoretical and Mathematical Physics for his outstanding contributions to Numerical General Relativity. The

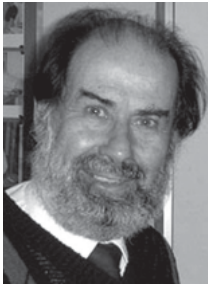
world's leading numerical relativist, Dr. Choptuik has shown his leadership in the field of numerical simulation of gravitational systems and for the remarkable effect which he discovered in the formation of black holes. The effect in question, now called the Choptuik effect, is that black holes demonstrate "critical" behavior in their formation, as do condensed matter systems undergoing phase transitions. ■

Details on CRM Prizes are available on-line:

[WWW.CRM.Umontreal.CA/prix/prix\\_an.html](http://WWW.CRM.Umontreal.CA/prix/prix_an.html)



## DR. PAVEL WINTERNITZ : NEW MEMBER OF THE ACADEMIA MEXICANA DE CIENCIAS



Pavel Winternitz

On April 1, 2003, Pavel Winternitz was enrolled as a Correspondant Member to the Academia Mexicana de Ciencias at the Auditorio del Centro de Ciencias Fisicas, UNAM. On this occasion, he gave a conference entitled *Superintegrable Systems in Classical and Quantum Mechanics*.

Dr. Pavel Winternitz, Professor at the Mathematics and Statistics Department and member of the Centre de Recherches Mathématiques at Université de Montréal, is internationally recognized for his distinguished career in the field of Theoretical Physics and Applied Mathematics, distinguishing himself in the use of symmetry methods. He is considered as a top-rank

expert in the applications of Group Theory. Recently, Dr. Winternitz has centered his attention on the analysis of non-linear differential equations using methods of group theory to find analytical solutions. An example of these is his studies on the Toda equation, produced in collaboration with his colleague Decio Levi. His prolific scientific production includes 246 articles and letters in prestigious reviewed magazines, 95 contributions to conference and school proceedings, as well as 17 co-authored or co-edited books.

Of the main distinctions he has received, we can highlight the CRM-CAP Prize in Mathematical and Theoretical Physics awarded jointly by the CRM and the Canadian Association of Physicists (2002); the Prize in Theoretical Physics awarded by the International Institute for Nuclear Research of Dubna, Russia (2001) and the Medal on First Degree of the Technical University of Prague (1998). Dr. Winternitz has contributed brilliantly to the development of high-level researchers. ■

**In its September 21, 2002 issue, the newspaper Lidove Noviny confirms Pavel Winternitz as being one of the 10 most cited Czech scientist in the world since 1980 with more than 2000 quotes.**

## NOMINATION DE DIRECTEURS ADJOINTS AU CRM



Patrice Marcotte

Patrice Marcotte est professeur titulaire au Département d'informatique et de recherche opérationnelle de l'Université de Montréal depuis 1993. Auparavant, il a été membre du corps professoral du Collège Militaire Royal de St-Jean. Il a fait ses études en mathématiques à l'Université de Montréal avant d'obtenir son doctorat en recherche opérationnelle de la même université. Il a également détenu des tâches de professeur invité dans plusieurs universités d'Europe.

Il a publié plus d'une soixantaine d'articles dans des revues scientifiques et contribué à de nombreux livres. On ne compte plus ses participations à des congrès scientifiques à titre de présentateur et de conférencier. Ses intérêts de recherche portent sur l'optimisation non linéaire, les modèles d'équilibre et affectation du trafic, la programmation à deux niveaux, les inéquations variationnelles et les problèmes de tarification optimale. P. Marcotte est en poste comme directeur adjoint au CRM depuis septembre 2003, il est chargé du programme industriel. ■

## JEAN-MARC LINA À L'ÉCOLE DE TECHNOLOGIE SUPÉRIEURE (ÉTS)



Jean-Marc Lina

Jean-Marc Lina a accepté un poste de professeur à l'ÉTS. Bien qu'il démissionne de son poste de chercheur adjoint à l'Université de Montréal, il demeure actif comme chercheur au sein du Laboratoire PhysNum du CRM.

Nous remercions Jean-Marc pour le travail accompli au CRM. Que ce soit comme chercheur, comme superviseur d'étudiants, Jean-Marc a fait de nombreux efforts d'interdisciplinarité: créant de nouveaux outils à la frontière de la physique et des mathématiques ou de la statistique, faisant de la recherche à la frontière des centres de recherche et de l'industrie, supervisant des étudiants à la frontière des départements de physique et de mathématiques et de statistique, à la frontière de l'industrie et de l'université (via les stages notamment). ■

## UNE ÉDITION FRANÇAISE



Suite à la parution de son livre *La relativité animée* chez Le Griffon d'argile au Québec en 1999, Stéphane Durand, membre du CRM, a connu un tel succès d'estime que l'éditeur français *Belin/Pour la science*, l'a réédité à Paris en 2003. La presse scientifique n'a pas manqué d'apprécier l'oeuvre : «CE PETIT LIVRE EST UN BIJOU PÉDAGOGIQUE ET CULTUREL.» *Bulletin de l'Union des Physiciens, mars 2003*.

«PARLER DE LA RELATIVITÉ DU GRAND EINSTEIN, L'UNE DES THÉORIES LES PLUS ARDUES DE LA PHYSIQUE, EN MOINS DE 100 PAGES, EST UN PARI PLUS QU'AUDACIEUX. EH BIEN C'EST UN PARI RÉUSSI !» *Science et Vie junior, mai 2003*.

«UN REMARQUABLE PETIT LIVRE [...] UN OUVRAGE FASCINANT, LUDIQUÉ ET INTELLIGENT [...] PRÉCIPITEZ-VOUS SUR LA RELATIVITÉ ANIMÉE.» *Guillaume Cannat, émission Ciel de nuit, Chaîne Météo mars-avril 2003*. ■

En septembre 2003, il est nommé directeur adjoint au CRM. Il assistera le directeur dans l'organisation des activités scientifiques. ■



Tony Humphries

Né dans le West Sussex au Royaume-Uni, Tony Humphries a obtenu son doctorat en mathématiques de l'University of Bath (1994) en Angleterre. Il occupe le poste d'assistant de recherche postdoctoral au School of Mathematics

à l'University of Bristol jusqu'en 1995, année au cours de laquelle il a travaillé à Stanford avec Andrew Stuart. De 1996 à 2002, P. Humphries est maître de conférences au School of Mathematical Sciences à l'University of Sussex. Depuis juillet 2002, il est professeur agrégé au département de mathématiques et statistique de l'Université McGill. Tony Humphries inscrit une vingtaine de publications sur sa feuille de route et ses intérêts de recherche portent sur l'analyse numérique des systèmes dynamiques, les équations différentielles de réseau et les solutions numériques d'équations différentielles.

En septembre 2003, il est nommé directeur adjoint au CRM. Il assistera le directeur dans l'organisation des activités scientifiques. ■

## INTERPLAY BETWEEN GEOMETRY AND ALGEBRA

One of the most fruitful interactions of modern mathematics has been the interplay between geometry and algebra; one simply has to think of the role homogeneous spaces have played in illuminating and expanding various concepts of representation theory. Conversely, a good algebraic action is often the key to understanding the geometry and the topology of a geometrical object. This was the central theme of a conference on *Algebraic Structures and Moduli Spaces* held at the CRM from July 14-20, 2003.

### Hidden Algebraic Structure

The usefulness of uncovering “hidden” algebraic structure in the topology of various spaces is of course not new. An early manifestation of this was the Lefschetz decomposition theorem of Kähler geometry. A Kähler structure on a compact complex manifold is determined by a closed two-form on the manifold with certain properties. The operations of taking exterior product with this two form and of contracting by the same two-form define an action of the Lie algebra of  $sl(2, \mathbb{C})$  on the harmonic forms on the manifold, and so on the cohomology. Decomposing the cohomology into irreducible representations gives a lot of information on the structure of the manifold. Another example of a truly intricate algebraic structure, of a more topological nature, has its origins in the study of the space  $\text{Map}^*(S^n, X)$  of based maps from the  $n$ -sphere  $S^n$  into a space  $X$ . The space of maps is tied to configurations of points in the  $n$ -plane, and one obtains an intricate algebra of operations on the homology of this space in terms of natural operations on points in the plane. This algebraic structure and others like it were formalised into what is called an operad, and twenty years later, it was realised that this structure had important applications in the understanding of moduli spaces.



### Fundamental Objects

These moduli spaces are fundamental objects in algebraic geometry and differential geometry. They parametrise geometric objects of a given type; one speaks, for example, of the moduli space of curves, or the moduli space of holomorphic vector bundles on a manifold, or of the moduli of instantons on a four manifold. These spaces have a remarkably beautiful structure in their own right; they also yield deep and detailed information on the base space over which they are defined: for example, the instantons over a four-manifold  $Y$  are remarkably fine tools for studying  $Y$ , or the holomorphic and pseudo-holomorphic maps from a Riemann surface into a holomorphic or symplectic manifold  $Z$  give us detailed invariants of the structure. Moduli spaces also have a remarkable habit of popping up all over the place in physics, and physicists have been at the origin of an astounding variety of deep conjectures on these spaces.

### Nakajima and Grojnowski discoveries

At the conference, one example that was the subject of a beautiful four hour series of talks by M. Lehn was the Hilbert scheme  $\text{Hilb}^n(X)$  of  $n$  points on a complex surface  $X$ . This variety parametrises 0-di-

mensional subschemes of  $X$  of length  $n$ ; the generic element of  $\text{Hilb}^n(X)$  corresponds to  $n$  unordered distinct points of  $X$ ; when the points collide,  $\text{Hilb}^n(X)$  in some sense remembers some information about the way they did it. There are natural subvarieties of  $\text{Hilb}^n(X) \times X \times \text{Hilb}^n(X)$  which can be used to define operations on the cohomology of the union of these schemes; it was the discovery of Nakajima and Grojnowski that these operations define an action of an infinite dimensional Heisenberg algebra on the cohomology. An extension of this representation to a larger vertex algebra, explains much of the structure of the cohomology rings of the Hilbert schemes. This, and further developments, were explained by Lehn. In a separate lecture, W. Wang related the tau-function of the 2-Toda hierarchy to a generating function, arising from the equivariant cohomology of Hilbert schemes of points in the affine plane.

### Remarkable conjectures by Nekrasov

In another vein, H. Nakajima and K. Yoshioka gave another very stimulating four hour series of talks on instanton counting on blow-ups. There are some remarkable conjectures by Nekrasov relating Seiberg-Witten prepotentials for supersymmetric gauge theories to integrals over the moduli space of instantons; the lecturers explained their proof of this conjecture using the relations between torsion free sheaves on a blow-up of  $P^2$  and on  $P^2$ . A. Braverman, later in the conference, gave his own constructions on a related moduli space, tying these integrals to intersection cohomology on a suitable compactification.

The talks covered many aspects of the structure of moduli spaces and the invariants obtained from them: Gromov-Witten invariants and stable maps (J. Bryan, M. Thaddeus), Floer homology (K. Fukaya, H. Iritani), Hochschild cohomology and orbifold cohomology (A. Caldararu, L. Chen, D. Kaledin), Fourier-Mukai and Nahm-Fourier transforms (C. Bartocci, Y. Namikawa, J. Sawon), links to representation theory (V. Ginzburg, L. Jeffrey, R. Vakil). One of the basic cases for testing various aspects of the theory is the moduli space of K3 surfaces, and these surfaces were a substantial feature of several of the talks, notably those of K. Oguiso and M. Verbitski. The Lefschetz theorem, while several decades old, resurfaced in a recent version during the conference in a talk by M. de Cataldo.

The workshop was held over a full week, with four hours of lectures per day and a long break at lunch for discussion. The fourth day was held at McGill's Gault estate at Mont Saint-Hilaire, a beautiful forested location by a lake; after a morning session, the group adjourned for a walk in the woods. All made it back to the bus that afternoon, bringing with them, it is hoped, a few additional theorems. These, and an account of the talks at the conference, will appear in a Proceedings in the CRM-AMS series. ■

JACQUES HURTUBISE

Log on our Web site for more details:

[WWW.CRM.UMontreal.CA/Algebraic/](http://WWW.CRM.UMontreal.CA/Algebraic/)

## LÁSZLÓ LOVÁSZ ON SAMPLING, MIXING AND MARKOV CHAINS



During the concentration period on *Combinatorics, probability and algorithms*, the eminent researcher and recipient of the 2002-2003 André-Aisenstadt Chair, Professor László Lovász, gave on May 13-15, 2003, a series of four lectures on the theme *Sampling, Mixing, and Markov Chains*. Here is the summary of these talks:

*Sampling can be viewed as a general algorithmic problem, analogous to searching, maximization, or counting. One general method for sampling is the use of rapidly mixing*

*Markov chains. In this series of talks, we give an introduction to this theory and survey the most common techniques for proving mixing time bounds: eigenvalues, isoperimetric inequalities, coupling, stopping rules. One motivating example is volume computation: since the first polynomial-time algorithm by Dyer, Frieze and Kannan, this problem has motivated a good part of the work in the area, and also in convex geometry.*

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

### Continued from page 1 - Director

you may note that the section on Scientific Activities has been greatly improved. This summer, a very successful workshop on *Algebraic Structures and Moduli Spaces* took place and an account is given on page 10. In this Bulletin, you will also learn more about the winners of the CRM Prizes, the new CRM publications, as well as many news from our members.

The CRM is an incredible institution and it is a great honour for me to help it move forward. I conclude by calling upon you to help us find the next Director. Don't hesitate to get in touch with any member of the nominating committee to suggest possible candidates or to apply. ■

## COLLOQUE SUR LA GESTION DU REVENU (MITACS)

La gestion du revenu, ou l'art d'améliorer le rendement d'une entreprise par le biais de la tarification et de la gestion de l'offre, prend tout son sens pour des firmes où les coûts d'investissement sont élevés et les coût d'opérations marginaux faibles. L'idée, qui a initialement fait son chemin dans le domaine du transport aérien, se propage maintenant dans des secteurs aussi divers que la location de véhicules, l'hôtellerie, les entreprises de

**“L'art d'améliorer le rendement d'une entreprise.”**

télécommunication, le transport ferroviaire, l'industrie du loisir. Dans le domaine aérien, par exemple, il est possible d'influencer considérablement le rendement d'un transporteur en déterminant une tarification qui tienne compte de la capacité des appareils, de la topologie du réseau aérien, des tarifs de la compétition ainsi que du comportement de la clientèle. D'un point de vue scientifique, les modèles de gestion du revenu font appel à des techniques diverses, allant de la simulation numérique et de l'optimisation stochastique jusqu'à la l'optimisation combinatoire et l'économie mathématique.

Depuis quelques années, une équipe de recherche basée au CRT-GERAD et dirigée par Patrice Marcotte et Gilles Savard a développé un modèle de gestion du revenu basé sur la paradigme de la programmation à deux niveaux. Encouragés par les subventions obtenues du  $rcm_2$  et de MITACS, il leur est apparu opportun d'organiser, à l'intention de la communauté universitaire, un colloque réunissant plusieurs des meilleurs chercheurs du domaine, provenant principalement des États-Unis, mais également du Canada et d'Europe.

Selon la formule consacrée, le colloque s'est avéré un franc succès. Les auditeurs, des étudiants inscrits à la maîtrise ou au doctorat pour la plupart, ont pu prendre connaissance du large éventail des techniques scientifiques du domaine ainsi que leur mise en oeuvre dans diverses industries.



Nous tenons à remercier les organismes qui d'une façon ou d'une autre, ont permis la tenue de cet événement. Par ordre alphabétique: Air Canada, CIRANO, le CRM, le CRT, l'École Polytechnique, le GERAD, MITACS et l'Université de Montréal. Enfin, last but not least, Nicole Huron pour son dévouement à l'organisation du colloque.

PATRICE MARCOTTE

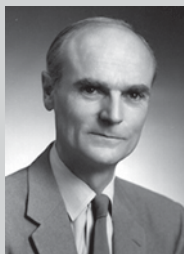
GILLES SAVARD

*Renseignements complémentaires et photos disponibles sur les pages Web suivantes:*

- [www.CRM.UMontreal.CA/RM2003/](http://www.CRM.UMontreal.CA/RM2003/)
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## Donald Coxeter

It is with deep regret that we learned that Donald Coxeter passed away on March 31, 2003. Donald joined the Department of Mathematics at the University of Toronto in 1936 and he spent the next 67 years actively engaged at the University. He was the soul and spirit and the most active member of the geometry seminar. Donald had been described by many as the greatest living geometer. Undoubtedly the world's best known geometer, Professor Coxeter has made contributions of fundamental importance to the Theory of Polytopes, Non-Euclidean geometry, Discrete Groups, and Combinatorial Theory. He is best known for his introduction of what are now referred to as Coxeter groups. His name is attached to a number of mathematical concepts including the Coxeter diagram, Coxeter complex, Coxeter element, Coxeter graph, Coxeter number, and Coxeter system. Donald was a most prolific writer. He had over 200 publications including several



books. His work was influential not only in geometry but also in many other branches of mathematics. Donald cherished the connection to music and arts. He was intimately involved in Escher's work.

Donald was widely recognized and honoured. He was a Fellow of the Royal Society of Canada (1947), Fellow of the Royal Society, London (1950), and Companion of the Order of Canada (1997). He holds a number of honorary degrees. Donald remained active to the end. In July 2002 he gave an invited address at the conference in honour of Janos Bolyai on Hyperbolic Geometry in Budapest, Hungary, and he had just completed the final touches on his last paper. He was 96 when he passed away. Donald is survived by his daughter Susan Thomas and his son Edgar. ■

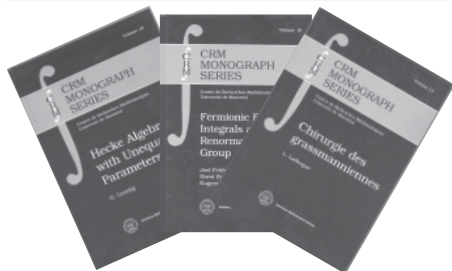
JOHN BLAND, CHAIR, DEPARTMENT OF MATHEMATICS (TORONTO)

Learn more about Donald Coxeter by logging on :

• [www.science.ca](http://www.science.ca)

• [www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Coxeter.html](http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Coxeter.html)

## CRM Recent Publications



1. JOEL FELDMAN, HORST KNÖRRER, AND EUGENE TRUBOWITZ, *Fermionic Functional Integrals and the Renormalization Group*, AMS, CRM Monograph

This book, written by well-known experts in the field, offers a concise summary of one of the latest and most significant developments in the theoretical analysis of quantum field theory. ■

2. L. LAFFORGUE, *Chirurgie des grassmanniennes*, AMS, CRM Monograph Series 2003, 170 pp.

The material is an outgrowth of Laurent Lafforgue's lectures and seminar at the Centre de Recherches Mathématiques where he held the 2001-2002 Aisenstadt Chair. ■

3. G. LUSZTIG, *Hecke Algebras with Unequal Parameters*, CRM Monograph Series 2003, 136 pp.

Hecke algebras arise in representation theory as endomorphism algebras of induced representations. One of the most important classes of Hecke algebras is related to representations of reductive algebraic groups over  $p$ -adic or finite fields. In 1979, in the simplest (equal parameter) case of such Hecke algebras, Kazhdan and Lusztig discovered a particular basis (the KL-basis) in a Hecke algebra, which is very important in studying relations between representation theory and geometry of the corresponding flag varieties. It turned out that the elements of the KL-basis also possess very interesting combinatorial properties. ■

## LE BULLETIN DU CRM

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