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*In this issue / Dans ce numéro*

<b>Editorial</b> .....	2
<b>NSERC Reallocation</b> .....	3
<b>2001 CMS Doctoral Prize</b> .....	5
<b>Education Notes</b> .....	9
<b>Awards/Prix</b> .....	11
<b>Book Review: Topics in Probability and Lie Groups : Boundary Theory</b> .....	12
<b>Book Review: Bäcklund and Darboux transformations, the geometry of solitons</b> ....	14
<b>CMS Winter Meeting 2002 Réunion d'hiver de la SMC 2002</b> .....	19
<b>Math In Moscow Update</b> .....	33
<b>34th Canadian Mathematical Olympiad Winners</b> .....	36
<b>Obituary/Avis de décès</b> .....	39
<b>News from Departments</b> .....	40
<b>Calendar of events / Calendrier des événements</b> .....	42
<b>Rates and Deadlines / Tarifs et Échéances</b> .....	43

## DU BUREAU DU PRÉSIDENT



*Christiane Rousseau*

### Premier message du président (English version on page 32)

C'est le premier message que je vous adresse à titre de présidente de la Société mathématique du Canada. Grâce au travail et au dévouement de centaines de membres de la communauté mathématique canadienne depuis 57 ans la SMC est maintenant une grande société. De plus notre discipline est bien mieux positionnée qu'il y a quelques années. L'infrastructure de recherche est maintenant très développée avec trois instituts et BIRS dont la programmation scientifique couvre un large spectre de domaines des sciences mathématiques. Nous avons resserré

les liens avec l'industrie et défendu le rôle des sciences mathématiques dans toute stratégie d'innovation et nous commençons à en recueillir les fruits. Il est en effet plus facile de défendre notre discipline auprès des organismes subventionnaires. Les activités grand public que nous avons menées ces dernières années et plus particulièrement pendant l'année mathématique mondiale ont contribué à redorer l'image des mathématiques auprès des médias et du public. Nous nous sommes rapprochés des milieux d'éducation et nous pouvons espérer jouer un rôle de leadership en enseignement des mathématiques au pays.

Nous devons cependant rester vigilants car le ciel n'est pas sans nuage. Comment va évoluer le monde des publications scientifiques? Ce sont les revenus provenant de nos publications qui nous permettent de financer beaucoup de nos autres activités. Si le marché des publications s'effondre nous devons couper dans les budgets alloués aux activités éducatives, services électroniques ou activités de recherche. De plus, alors que beaucoup de membres de notre communauté prennent leur retraite nous devons convaincre les jeunes recrues des universités canadiennes de devenir membres de la Société mathématique du Canada et de travailler avec nous.

*(continued on page 33)*

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## EDITORIAL



S. Swaminathan

Since the invention of printing from movable type about six centuries ago and more especially since the development of journals in mid-seventeenth century, dissemination of information through printing has been taken for granted. This situation changed with the advent of computers. The rise of technology associated with them and progress in electronic processing of words have yielded enormous advantages to scientific and technical information transfer. Electronic processing is now used extensively by authors and publishers for composition and editing of journal articles and books. Software packages have been developed to handle complex mathematical typesetting including diagrams and photographs. Many journals have on-line versions available now. Springer Verlag has announced recently that their Lecture Notes Series is also going on-line. As we move into a paperless communication environment we need to examine its profound implications for many individuals and institutions including authors, users, publishers and libraries.

The International Mathematical Union Executive Committee has approved recommendations on electronic information communication at their meeting in April 2002 in Paris. They have identified a number of "best practices" for those involved with mathematical literature. The recommendations concern all forms of scholarly publishing. A brief announcement concerning this is included elsewhere in this issue of the NOTES with a URL reference for detailed information.

Depuis l'invention de l'imprimerie à partir de caractères amovibles, il y a six cents ans, et plus particulièrement depuis la création des journaux et revues, vers la moitié du dix-septième siècle, on tient pour acquis la diffusion de l'information sur un support papier. Mais l'arrivée de l'ordinateur a tout chamboulé. Les avancées technologiques associées à l'ordinateur, ainsi que les progrès réalisés en traitement de texte ont été très avantageux pour le transfert électronique d'information technique ou scientifique. Les auteurs et les éditeurs font maintenant un usage poussé du traitement électronique aux étapes de la composition et de la révision des articles de revues et des livres. Des logiciels permettent en outre de régler les problèmes complexes associés à la composition de problèmes ou de formules mathématiques, ainsi que les diagrammes et les photographies. Un grand nombre de revues sont désormais offertes en version électronique. Dernièrement, Springer Verlag a annoncé que sa collection de Notes de conférences serait aussi offerte sous peu en version Web. Comme nous nous dirigeons vers un monde de communication sans papier, nous devons examiner les profondes répercussions qu'auront ces transformations sur un grand nombre de personnes et d'organismes, y compris les auteurs, les lecteurs, les éditeurs et les bibliothèques. À sa réunion d'avril 2002 tenue à Paris, le comité exécutif de l'Union mathématique internationale a approuvé des recommandations concernant l'information et la communication électroniques. Le comité a dressé une liste de « pratiques exemplaires » pour les personnes du domaine de la publication d'ouvrages mathématiques. Les recommandations portent sur toutes les formes de publication scientifique. Ailleurs dans les NOTES, vous trouverez une brève annonce à ce sujet ainsi qu'une adresse électronique où vous pourrez obtenir plus de détails.

## NSERC REALLOCATION EXERCISE 2000-2002

Every four years, up to 10% of NSERC's Research Grants Program budget is redistributed according to the changing needs and priorities of the Canadian scientific research community. In addition to the effect this has on the individual Grant Selection Committee (GSC) budgets, it influences planning in the disciplines and is useful in communicating the importance of scientific research in Canada.

In each discipline the GSC establishes a Steering Committee, which consults the community and prepares a submission to NSERC's Reallocations Committee. The steering committees were set up in the summer of 2000 and their reports were due in January 2002. NSERC's funding decisions were released in July (see the President's report and the report by the Steering Committee Chair, Richard Kane, in this issue).

The Steering Committee for Pure and Applied Mathematics has the following members:

James Arthur (Toronto)  
 Peter Borwein (SFU)  
 Ken Davidson (Fields Institute/Waterloo)  
 Michel Delfour (Montréal)  
 Nassif Ghossoub (PIMS/UBC)  
 Katherine Heinrich (Regina)  
 Jacques Hurtubise (CRM/McGill)

Richard Kane (UWO), Chair  
 Hershy Kisilevsky (Concordia)  
 Robert Moody (BIRS/Alberta)  
 Richard Nowakowski (Dalhousie)  
 Edward Vrscaj (Waterloo).

The members of the NSERC Reallocations Committee are:  
 Robert Birgenau (University of Toronto)  
 Elizabeth Cannon (University of Calgary)  
 Michael Fryzuk (UBC)  
 Brian Hall (Dalhousie University)  
 Barbara Keyfitz (University of Houston)  
 Larry Mayer (University of New Hampshire)  
 Peter Nicholson (BCE Inc.)  
 Robert Papineau (École de technologie supérieure)  
 David Schindler (University of Alberta)  
 David Turpin (University of Victoria)  
 Sidney Wolff (National Optical Astronomy Observatories)  
 The Committee is chaired by Gilbert Drouin (NSERC Council, Valorisation-recherche Québec).

The *CMS Notes* plans to publish the submission of the pure and applied mathematics Steering Committee in instalments. The first of these follows, consisting of the introduction and the first two parts.

### Report of the Steering Committee for Pure and Applied Mathematics

Mathematics in Canada is represented by an energetic and cohesive community with international impact, a very effective infrastructure for the support and dissemination of research (through its 3 mathematical institutes and their impressive initiatives), and a strong involvement in cross-disciplinary activities. In the past decade, Canadian mathematics has undergone a fundamental restructuring and has emerged with a clear awareness of the discipline's central and pervasive role in Canadian society and of the urgent need to fashion a strategy, built on that reality, for the community. The foundation for this activity is the stable funding of individual researchers and their research groups, the majority of which is provided through GSCs 336/337.

To build on our momentum, we are focusing our goals for the funding pro-

posals on both excellence and the future: namely, on top researchers, tomorrow's leaders, and new applicants. Our proposals will request the following:

(1) Proposal A: targeted funding for recognized top researchers who can assume a leadership role involving an active focused group; (2) Proposal B: targeted funding for younger emerging leaders whose research and training activities have moved to a higher level; and (3) Proposal C: adequate entry grants for the very large number of junior and senior new applicants who will be applying to GSC 336/337 over the next 4 years.

The document is structured as follows: Parts 1 and 2 provide the vision and strategy for Canadian mathematics and the funding proposals for achieving them; Part 3 is a report on the Canadian mathematics commu-

nity; Part 4 provides an overview of the 3 mathematical institutes; Part 5 is a report on new initiatives in infrastructure; Part 6 addresses the training of highly qualified personnel (HQP); Part 7 provides further considerations on the funding proposals and the consequences of no increased funding; and Part 8 is an appendix containing details concerning each of the mathematical institutes.

#### Part 1: A Vision for Mathematics in Canada

##### A New Reality

The role and impact of the mathematical sciences within the global scientific, technological, and biomedical enterprise has grown at an astonishing rate over the past decade. The conceptual and computational tools of mathematics have become essential for progress in many areas of the

life sciences, information and communications technologies, nanosciences, and financial and industrial sectors. This is a new reality for mathematics. The interdisciplinary nature of mathematics and its “critical role in advancing interdisciplinary research” was stressed in the recent NSF (US National Science Foundation) budget statement before the House Appropriations Committee. Mathematics is a “powerful tool for insight and a common language for science and engineering.” In what is described as a centerpiece of NSF’s core investments, the NSF proposed to double its funding for mathematical research over the next few years. Canadian mathematics is fully engaged in this new reality. Over the past 10 years, Canadian mathematicians have forged substantial links to a broad spectrum of scientific disciplines and emerging directions of research, and to financial and technological sectors. There is a need to maintain such momentum. The full participation of Canadian science and technology in this highly mathematical and interdisciplinary world can be achieved only with a strong force of mathematically-literate and mathematically-sophisticated scientists. The training of HQP in mathematics is a high priority.

#### **A Strong Discipline**

Mathematics is a rich and active science with its own internal dynamics and its own sources of fundamental problems and conjectures in addition to being a conceptual framework and source of powerful tools for science and technology. The long-term importance and relevance of mathematics to scientific endeavor as a whole has been shown, over and over again, to be based on the strength and vigour of its own core research. Furthermore, the ability of Canadian mathematics to participate in the greatly expanding role of the mathematical sciences is necessarily founded on the quality of its researchers. The rise of Canadian mathematics to its current level

has been a 20-year process, achieved through constant recruitment and development of talented new researchers. The current generation of younger researchers is internationally prominent in many major areas.

#### **Priorities**

The priorities of Canadian mathematics are:

(1) to strengthen its leadership in fundamental and interdisciplinary research, providing crucial mathematical resources for science and technology; and (2) to increase its capacity to recruit, support, and train HQP in mathematics.

#### **Mathematical Institutes**

The presence of 3 mathematical institutes capable of providing innovation and leadership in research is a major force behind the recent success of Canadian mathematics. The research institutes in the mathematical sciences – Le Centre de Recherches Mathématiques (CRM), the Fields Institute for Research in Mathematical Sciences (Fields), and the Pacific Institute for the Mathematical Sciences (PIMS)– have had a tremendous influence on the Canadian mathematical community. The institutes have organized numerous scientific programs in major areas of current research, with emphasis on outreach, interdisciplinary, and international activities. They have led the way in building bridges between Canadian mathematics and other disciplines, and have acted as major training centres for young talent. The institutes have also pioneered the building of partnerships between Canadian mathematicians and the industrial and financial world. As part of this activity, they brought together researchers from mathematical sciences and industry to form the national network, MITACS, and the Montreal-based network, NCM<sub>2</sub>. The most recent institute innovation is the Banff International Research Station (BIRS), a collaboration between PIMS and the Mathematical

Sciences Research Institute in Berkeley (through NSERC, the NSF, and the Alberta government). BIRS will provide Canadian mathematicians and users of mathematics with a major forum for research-intense workshops, promoting both mathematical research and its interactions.

The mathematical institutes are a vivid demonstration of the fact that many frontiers of knowledge are concentrated in areas that cut across traditional disciplines, but possess mathematical tools as their common denominator. Mathematics is the only discipline in Canada to have created such large scale (and effective) institutions for interdisciplinary activity.

#### **Part 2: Strategy and Funding Proposals**

The need for increased funding in mathematics is pervasive. In this proposal, however, we limit our requests to the case of certain key groups of researchers. In the last Reallocation Exercise, taking this approach proved highly effective in advancing mathematical research and training.

#### **Implementation of Previous Proposals**

The 1998 Reallocation Committee provided resources to GSCs 336/337 for two categories of researchers: \$539K for new applicants and younger researchers, and \$323K for top researchers. This infusion of funding has had a significant impact on a large number of researchers and on the training of HQP. The following 3 statistics convey this impact and demonstrate where much of these allocated funds were applied: (i) there was an increase in the number (from 32 to 59) of mathematicians with grants of \$30K or larger (i.e., roughly twice the average grant in GSCs 336/337) in the period 1997/2001. In the process, these 59 mathematicians received an extra \$570K of funding, as the total value of their grants rose from \$1.6M to \$2.17M;

*(continued on page 37)*

# The Distribution Factor of Values of the Summatory Function of the Möbius Function

by Nathan Ng (Université de Montréal)

This note summarizes the part of my CMS doctoral prize lecture that focussed on the summatory function of the Möbius function. The lecture was titled “Limiting distributions and zeros of Artin L-functions” and was presented in Toronto at the CMS Winter meeting in December 2001.

I wish to thank the Canadian Mathematical Society for the honour of being chosen as the recipient of the 2001 CMS doctoral prize. I would like to thank my supervisor, Professor David Boyd, who diligently guided me, generously gave of his time, and shared of his extensive knowledge of mathematics.

### The summatory function of the Möbius function

The Möbius function is defined as the generating sequence for the reciprocal of the Riemann zeta function, that is,

$$\frac{1}{\zeta(s)} = \sum_{n=1}^{\infty} \frac{\mu(n)}{n^s}. \tag{1}$$

This translates to  $\mu(n) = (-1)^k$  if  $n = p_1 \dots p_k$  is square-free and  $\mu(n) = 0$  otherwise. The Möbius function plays an important role in the analytic theory of numbers. It is especially important in sieve theory and in the method of mollification as initiated by Selberg in his study of the zeros of the Riemann zeta function on the critical line.

By partial summation of (1), we obtain

$$\frac{1}{\zeta(s)} = s \int_1^{\infty} \frac{M(x)}{x^{s+1}} dx \tag{2}$$

valid for  $Re(s) > 1$  where

$$M(x) = \sum_{n \leq x} \mu(n) \tag{3}$$

is the summatory function of the Möbius function. The identity (2) demonstrates the direct connection between the zeta function and  $M(x)$ . Over the years, this function has been much studied and speculated about. One reason for interest in  $M(x)$  is that the Riemann hypothesis is equivalent to the bound

$$|M(x)| \ll x^{\frac{1}{2}} \exp\left(c \frac{\log x}{\log \log x}\right)$$

for an effective constant  $c$  and any  $\epsilon > 0$ . Moreover, Stieltjes and Mertens conjectured

$$|M(x)| \leq x^{\frac{1}{2}} \tag{4}$$

for all  $x > 1$ . Mertens based this conjecture on a numerical calculation of  $M(n)$  for  $n = 1 \dots 10000$ . A related conjecture, known as the weak Mertens conjecture, asserts that

$$\int_1^X \left(\frac{M(x)}{x}\right)^2 dx \ll \log X. \tag{5}$$

Each of these conjectures imply the Riemann hypothesis and the simplicity of all of the zeros of  $\zeta(s)$ . For a time, it was believed that the bounds (4),(5) were true. However, Ingham [In] dispelled the notion that (4) could be true with a conditional proof that

$$\limsup_{x \rightarrow \infty} x^{-\frac{1}{2}} M(x) = \infty, \liminf_{x \rightarrow \infty} x^{-\frac{1}{2}} M(x) = -\infty \tag{6}$$

assuming certain statistical properties of the zeros of  $\zeta(s)$ . Following Ingham’s ideas, Odlyzko and te Riele [OR] proved unconditionally in 1986 that

$$\limsup_{x \rightarrow \infty} x^{-\frac{1}{2}} M(x) > 1.06, \liminf_{x \rightarrow \infty} x^{-\frac{1}{2}} M(x) < -1.009.$$

The question we now address is what is the true behaviour of  $M(x)$ ? Odlyzko and te Riele write in their article that “No good conjectures about the rate of growth of  $M(x)$  are known.” We first present the current state of knowledge regarding  $M(x)$ . The best unconditional upper bound is

$$|M(x)| \ll x \exp(-c \log^{\frac{3}{5}} x (\log \log x)^{-\frac{1}{5}})$$

for some effective constant  $c$ . On the other hand, if the Riemann hypothesis is false, then

$$M(x) = \Omega_{\pm}(x^{\theta-\epsilon})$$

where  $\theta = \sup Re(\rho)$  with  $\rho$  ranging over the non-trivial zeros of  $\zeta(s)$  and any  $\epsilon > 0$ . Also observe that the existence of a multiple zero would drastically change the expected behaviour of  $M(x)$ . For example if  $\Theta + i\gamma$  were a multiple zero of order  $m \geq 1$  then

$$M(x) = \Omega_{\pm}(x^{\Theta} \log^{m-1} x).$$

Since we have some understanding of the behaviour of  $M(x)$  in these unlikely scenarios we assume the opposite is true.

Namely, we assume the Riemann hypothesis is true and that all zeros of the zeta function are simple. This is the most interesting case to consider and also the more difficult case. It is currently known [C] that at least  $\frac{4}{10}$  of the zeros are simple and lie on the critical line.

Our main interest in this problem originated with a comment of Heath-Brown [HB]. He writes, “It appears to be an open question whether

$$x^{-\frac{1}{2}} M(x)$$

has a distribution function. To prove this one would want to assume the Riemann hypothesis and the simplicity of the zeros, and perhaps also a growth condition on  $M(x)$ .” The key point is to construct a distribution function (probability measure) that demonstrates the properties of  $M(x)$ . Our approach to this problem is to exploit the connection between  $M(x)$  and negative discrete moments of the Riemann zeta function.

**Discrete moments of the Riemann zeta function**

Inverting equation (2) (by Perron’s formula) we have

$$M(x) = \frac{1}{2\pi i} \int_{c-i\infty}^{c+i\infty} \frac{x^s}{s\zeta(s)} ds$$

where  $c > 1$  and  $x \notin \mathbb{Z}$ . Moving the contour to the left, it follows that

$$M(x) = \sum_{|\gamma| \leq T} \frac{x^\rho}{\rho\zeta'(\rho)} + E(x, T)$$

where  $E(x, T)$  is a suitable error term. This last identity makes it clear that information concerning the sum

$$J_k(T) = \sum_{0 < \gamma < T} |\zeta'(\rho)|^{2k}$$

with  $k < 0$  would be especially useful in obtaining information concerning  $M(x)$ . In the 1980’s, these discrete moments began to attract interest. Gonek [Go1] considered Dirichlet polynomial approximations of these sums and Hejhal studied [Hej] the value distribution of  $\log \zeta'(\rho)$ . From these different points of view, Gonek and Hejhal independently conjectured that

$$J_k(T) \asymp T(\log T)^{(k+1)^2}. \tag{7}$$

Recently, [HKO] using random matrix model techniques have refined this conjecture. They conjecture that

$$J_k(T) \sim \frac{G^2(k+2)}{G(2k+3)} a_k \frac{T}{2\pi} \left( \log \frac{T}{2\pi} \right)^{(k+1)^2} \tag{8}$$

for  $k > -\frac{3}{2}$  where

$$a_k = \prod_p \left( 1 - \frac{1}{p} \right)^{k^2} \left( \sum_{m=0}^{\infty} \left( \frac{\Gamma(m+k)}{m!\Gamma(k)} \right)^2 p^{-m} \right)$$

and  $G$  is Barnes’ function defined by

$$G(z+1) = (2\pi)^{\frac{z}{2}} \exp \left( -\frac{1}{2}(z^2 + \gamma z^2 + z) \right) \prod_{n=1}^{\infty} \left( \left( 1 + \frac{z}{n} \right)^n e^{-z+z^2/2n} \right).$$

This conjecture has been proven for  $k = 0$  by Von Mangoldt and for  $k = 1$  by Gonek assuming the Riemann hypothesis. In the case  $k = 2$  the author has proven that the Riemann hypothesis implies this is the correct order of magnitude with explicit upper and lower bounds. As for the negative moments, less is known. Gonek established a conditional proof that  $J_{-1}(T) \gg T$  and also conjectured that  $J_{-1}(T) \sim \frac{3}{\pi^3} T$  which agrees with (8).

The idea of using  $J_k(T)$  to study  $M(x)$  was first realized by Gonek who makes use of these connections to study  $M(x)$  in short intervals [Go2]. In order to obtain any information about  $M(x)$ , it is necessary to understand  $J_k(T)$ . Without any knowledge of  $J_k(T)$ , no new information concerning  $M(x)$  can be gleaned.

**The limiting distribution**

The main theorem in [Ng2] is the construction of the limiting distribution of the function

$$e^{-\frac{y}{2}} M(e^y).$$

Precisely, we prove

**Theorem 1**

The Riemann hypothesis and the conjectural bound  $J_{-1}(T) \ll T$  imply that there exists a limiting distribution  $\nu$  on  $\mathbb{R}$  such that

$$\lim_{Y \rightarrow \infty} \frac{1}{Y} \int_0^Y f(e^{-\frac{y}{2}} M(e^y)) dy = \int_{\mathbb{R}} f(x) d\nu(x) \tag{9}$$

for all bounded continuous functions  $f(x)$ .

The idea of the proof is to use the construction from [RS]. In their work, they study the distribution functions associated to counting functions of primes in arithmetic progressions. The problem in extending [RS] is that there is little unconditional information concerning  $\zeta'(\rho)^{-1}$ . Thus it was necessary to assume bounds for the sum  $J_{-1}(T)$  as suggested in

equations (7),(8) . The key lemma was proven by using techniques from Cramér [Cr] in conjunction with  $J_{-1}(T) \ll T$ . (It should be noted that the trivial bound is  $J_{-1}(T) \ll T^{3+\epsilon}$  and this is not sufficient to obtain any significant results regarding  $M(x)$ .)

In a similar vein, we can prove bounds for  $M(x)$  or averages of  $M(x)$ .

**Theorem 2** The Riemann hypothesis and  $J_{-1}(T) \ll T$  imply the weak Mertens conjecture in the form

$$\int_1^X \left(\frac{M(x)}{x}\right)^2 dx \sim \left(\sum_{\gamma>0} \frac{2}{|\rho\zeta'(\rho)|^2}\right) \log X \quad (10)$$

and

$$M(x) \ll x^{\frac{1}{2}}(\log \log x)^{\frac{3}{2}} \quad (11)$$

except on a set of finite logarithmic measure. (The exponent  $\frac{3}{2}$  in (11) may be reduced to  $\frac{5}{4}$  under the additional assumption  $J_{-\frac{1}{2}}(T) \ll T(\log T)^{\frac{1}{4}}$ .)

**Speculations on the lower order**

We now illustrate how Theorem 1 is useful for studying the distribution of values of  $M(x)$ . Suppose Theorem 1 were true for the indicator function of the set  $[V, \infty)$ . Equation (9) would then read

$$\lim_{Y \rightarrow \infty} \frac{1}{Y} \text{meas}\{y \in [0, Y] \mid M(e^y)e^{-\frac{y}{2}} \geq V\} = \nu([V, \infty)) \quad (12)$$

This indicates that the distribution of values of  $M(x)$  is related to the tail of the probability measure  $\nu$ . It is noted in [RS] that identity (12) would be true if  $\nu$  is absolutely continuous. In fact, we can show that  $\nu$  is absolutely continuous if the following conjecture is true.

**Linear independence conjecture** Assume the Riemann hypothesis. If the non-trivial zeros of  $\zeta(s)$  are denoted as  $\rho = \frac{1}{2} + i\gamma$ , then the positive imaginary ordinates  $\gamma$  are linearly independent over  $\mathbb{Q}$ .

Now consider the random variable

$$X(\underline{\theta}) = \sum_{\gamma_k>0} \frac{2}{|(\frac{1}{2} + i\gamma_k)\zeta'(\frac{1}{2} + i\gamma_k)|} \sin(2\pi\theta_k)$$

where  $\underline{\theta} = (\theta_1, \theta_2, \dots)$  is an element of the infinite torus  $\mathbb{T}^\infty$ . We note that if  $P$  is the canonical probability measure on  $\mathbb{T}^\infty$  then the linear independence conjecture implies

$$\nu(B) = P(X^{-1}(B))$$

where  $B$  is any Borel set in  $\mathbb{R}$ . Consequently,  $\nu$  may be studied via  $X$ . Moreover, by assuming the linear independence conjecture and the assumptions of Theorem 1, we may compute the Fourier transform of  $\nu$  exactly. It equals

$$\widehat{\nu}(\xi) = \int_{-\infty}^{\infty} e^{-i\xi t} d\nu(t) = \prod_{\gamma>0} j_0\left(\frac{2\xi}{|(\frac{1}{2} + i\gamma)\zeta'(\frac{1}{2} + i\gamma)|}\right)$$

where

$$j_0(z) = \sum_{m=0}^{\infty} \frac{(-1)^m \left(\frac{z}{2}\right)^{2m}}{(m!)^2}$$

is a Bessel function of order zero. Furthermore, by pursuing ideas of Montgomery [M] concerning sums of independent random variables we can show that for large  $V$

$$\begin{aligned} \exp(-c_1 V^{c_2} \exp(c_3 V^{\frac{4}{5}})) &\ll \nu([V, \infty)) \\ &\ll \exp(-c_4 V^{c_5} \exp(c_6 V^{\frac{4}{5}})) \end{aligned}$$

for effective constants  $c_i > 0$  for  $i = 1 \dots 6$ . These arguments assume the Riemann hypothesis, the linear independence conjecture and bounds for both  $J_{-\frac{1}{2}}(T)$  and  $J_{-1}(T)$ . An analysis of these bounds suggest the following conjecture:

**Conjecture** There exists a number  $B > 0$  such that

$$\overline{\lim}_{x \rightarrow \infty} \frac{M(x)}{\sqrt{x}(\log \log \log x)^{\frac{5}{4}}} = \pm B \quad (14)$$

After the completion of this work, I learned from Gonek that he had an argument to suggest this lower bound 20 years ago. Apparently the heuristic argument in [Ng2] of the lower bound (14) is similar to Gonek's, however it was discovered independently.

We note that in the prime number case, where  $M(x)$  is replaced by  $\psi(x) - x$ , Montgomery [M] conjectures that the corresponding  $B$  equals  $\frac{1}{2\pi}$ . In this case, the value of  $B$  is not so clear and remains an open problem. We remark that years earlier Good and Churchhouse [GC] had conjectured that

$$\overline{\lim}_{x \rightarrow \infty} \frac{M(x)}{\sqrt{x}(\log \log x)^{\frac{1}{2}}} = \pm \frac{\sqrt{12}}{\pi}.$$

This was based on modelling  $\mu(n)$  as a random sequence supported on the squarefree integers and by ‘‘applying’’ the law of the iterated logarithm. Although Good and Churchhouse's argument seems promising it relies on the assumption that  $\mu(n)$  behaves randomly. However, the Möbius function is not a random sequence as it is connected directly to  $\zeta(s)^{-1}$ . Thus  $M(x)$  is determined by the zeros of  $\zeta(s)$  or more precisely by the discrete moments  $J_{-\frac{1}{2}}(T), J_{-1}(T)$ .

Consequently, it is these negative moments that should determine the behaviour of  $M(x)$ .

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## Best Practices in Electronic Scholarly Publishing

The Executive of the International Mathematical Union has endorsed a broad ranging set of recommendations on Electronic Information Communication.

These recommendations, written by its Committee on Electronic Information and Communication (CEIC, [www.ceic.math.ca](http://www.ceic.math.ca)), suggest ways in which mathematicians, librarians, and publishers can help shape the future of scholarly communication. The common principle used to formulate recommendations is that those who write, disseminate, and store mathematical literature should act in ways that serve the interests of mathematics, first and foremost.

The 15 “best practices” touch on almost every area of scholarly electronic publication, and include such things as:

- Suggestions to authors to version their electronic preprints, to post them on publicly available servers, and to become knowledgeable about copyright
- Advice to librarians to make decisions based on journal price and policy, to be alert to the distinction between posted and refereed papers, and to use web statistics with care
- Encouragement to publishers to provide key journal information (abstracts and reference lists) without subscription, to make entire articles similarly available after a suitable period of

time, and to archive material in formats that have open standards.

While the recommendations are aimed at the mathematical community, almost all apply to other scholarly disciplines as well.

The advice is meant to ease the transition in scholarly communication both for present scholars and for future generations.

The 15 specific recommendations will be updated in the future, and more detailed information will be added for each. The full text is available at [www.ceic.math.ca/Best-Practices.pdf](http://www.ceic.math.ca/Best-Practices.pdf) or [www.cms.math.ca/bulletins/Best-Practices.pdf](http://www.cms.math.ca/bulletins/Best-Practices.pdf)



## EDUCATION NOTES

Ed Barbeau and Harry White, Column Editors

### A new academic year

The *Education Notes* are a regular feature of this news magazine, and is intended to be a clearing house for information about primary, secondary and tertiary education that is of interest to members of the Society. Accordingly, we hope that you will send us news about developments in your part of the country. In particular, is there innovative work in education going on in your department? Are there reports that should be given national attention? Have you or any of your colleagues received a teaching award? Do you have opinions on any matters raised in the *Notes*? Please send your contributions to E.J. Barbeau, Department of Mathematics, University of Toronto, Toronto, ON M5S 3G3 or by email to [barbeau@math.utoronto.ca](mailto:barbeau@math.utoronto.ca).

### Fractals and Education

*Book review*

#### Fractals, Graphics & Mathematics Education

Benoit Mandelbrot & Michael Frame (editors)

Mathematical Association of America

204 pp.; paperbound, 2002

ISBN 0-888385-169-5 (US\$ 39.95)

With respect to how we look at our discipline, one of the most important developments of the last half century is the blossoming of the areas of fractals and dynamical systems. Although their roots go back to the nineteenth century, their recent growth depends on two factors, one technical and the other ideological. The advent of the modern computer gave us the power to make explorations hitherto thought impossible, but we also had to be willing to seriously engage roughness as well as smoothness and the notion that complexity and unpredictability could result from simple inputs, as well as ascribe to experimentation a respectable place in mathematical practice.

This striking new mathematics occurs at a time when the teaching of mathematics in our schools, colleges and universities is ripe for a revolution. Traditional instruction has mathematics as a sequential body of material owned (at best) by the teacher to be parcelled out to the students. To avoid having the curriculum sink under the dead weight of the past, it will be necessary for teachers to bring in their pupils as active participants in the enterprise, to equip them to discharge the responsibility of attending to their own learning, and to selectively ensure that they are provided with the core knowledge and techniques to attain facility.

This volume, number 58 in the series of *MAA Notes*

which, since 1982, has addressed topics and themes of interest in undergraduate mathematics, opens with four introductory essays written by Benoit Mandelbrot (the first in company with Michael Frame) that argue for the historical significance of fractals and dynamical systems and their importance in achieving worthwhile goals of modern education and avoiding the abuses of the past.

In twenty years, the topics discussed in this volume have proved to be more than a flash in the pan. They not only excite the wonder and imagination of pupils, but are surprisingly accessible. Their newness allows novices to make discoveries of their own, although this area certainly generates its share of intractable problems. In the third essay, Mandelbrot decries the cleavage between science and the arts, and hopes that fractals may be one tool to help resuscitate the liberal ideal of citizens conversant and appreciative of science. He has harsh words, not only for traditional mathematics education rooted in the past, but for the New Maths of the 1960s. He deplores the pegging of mathematical and scientific needs to purely utilitarian goals, and foresees the failure of this approach to either be politically effective or share the beauty and creativeness of mathematics. In the fourth essay, treating mathematics and society in the twentieth century, Mandelbrot discusses the special historical and social factors responsible for accentuating certain mathematical trends and suppressing others, but sees current mathematics as enjoying the health of diversity and constructive turmoil.

A dozen essays provide testimonials and descriptions of how fractals and dynamical systems have transformed teaching from the senior elementary to undergraduate levels. The reader is provided with mathematical examples as well as descriptions of activities, assignments and projects.

An article by Ron Lewis of Sudbury is of particular interest to Canadians. Inspired by a 1987 pilot project for high school students conducted by Brian Kaye of Laurentian University, Lewis created an advanced level Grade 12 credit course. I was aware of this course when I established a course in dynamical systems at the University of Toronto a dozen years ago. While my course made more use of algebraic tools, that of Lewis explored the concept of dimension through observations, experiments and simulations (using giant pumpkins, crumpled paper, electrolytic deposits, diffusion, pancakes on a griddle).

A useful article by Kenneth Monks describes how courses on fractals and chaos can be designed for many different audiences and offers advice on textbooks, websites, software and hardware. Other essays discuss how the essence

of these areas can be conveyed to non-science students and those taking introductory courses; art has a useful role to play.

There are two appendices. The first introduces a “panorama”, which is a kind of index to the diverse uses of fractals. Only two examples are provided in the text; for the others, the reader has to visit the website [//www.maa.org/Fractals/Panorama/Welcome.html](http://www.maa.org/Fractals/Panorama/Welcome.html). [I was unable to reach this; however, I found a Yale University site through a Google search on Fractals/Panorama.] The second index includes reports of activities that high school and college teachers, who attended summer workshops, did with their classes. This is a fine initial handbook for those who wish to teach courses in this vital and fast-developing area.

The publication may be obtained from The Mathematical Association of America, PO Box 91112, Washington, DC 20090-1112 ( [www.maa.org](http://www.maa.org)). The catalogue number is NTE-58.

### RAND Mathematics Project

The RAND Corporation has set up a study panel to harness the expertise of a variety of professionals to bring about an improvement in the general mathematical proficiency of the citizenry. This panel, chaired by Deborah Loewenberg Ball, has posted a draft (dated March, 2002) of its report *Mathematical Proficiency for All Students: towards a strategic research development program in mathematics education*. This can be found on the site [www.rand.org/multi/achievementforall/math/index.html](http://www.rand.org/multi/achievementforall/math/index.html). Would anyone be interested in reviewing this for the *CMS Notes*?

### Websites for matriculants

While educationists wrangle over what can and should be done in the high school curriculum, thanks to the net, it is possible for any student serious about taking a mathematics-related program at college or university to take matters into her own hands. There are many universities posting sample problems that high school students can try to see if they

are prepared for the demands of a first year undergraduate course. Here are a few Canadian ones:

[www.math.unb.ca/#stud](http://www.math.unb.ca/#stud)  
[conway.math.unb.ca/Placement/test](http://conway.math.unb.ca/Placement/test)  
[math.usask.ca/readin/menu.html](http://math.usask.ca/readin/menu.html)  
[www.mast.queensu.ca/diagnostic.html](http://www.mast.queensu.ca/diagnostic.html)

As part of an Australian Mathematical Methods Computer Algebra Systems (CAS) pilot study, there is quite a nice collection of problems on graphing. Consult the site: [www.vcaa.vic.edu.au/vce/studies/MATHS/caspilot.htm](http://www.vcaa.vic.edu.au/vce/studies/MATHS/caspilot.htm)

[If your search software is persnickety, try [www.edfac.unimelb.edu.au/DSME/CAS-CAT/proj.html](http://www.edfac.unimelb.edu.au/DSME/CAS-CAT/proj.html) or enter via a Google search on caspilot. Look for the section entitled *Sample examination papers*.] My own experience suggests that if students are fluent in handling inequalities and sketching graphs, then they are probably in pretty good shape to handle the technical demands of a first calculus course.

### Teaching Award at RMC

On May 17, 2002, at Convocation of the Royal Military College in Kingston, Minister of National Defence, Art Eggleton, congratulated the recipient of the *Class of 1965 Excellence in Teaching Award*, David Wehlau of the mathematics department. He was selected from a number of student nominations by a Class of 1965 representative in consultation with nominators, department heads and deans. Along with a cash prize of \$5000, the recipient receives a certificate and a plaque and is invited to give a public lecture.

The award will be actually presented in the fall, when Dr. Wehlau lectures to the public on the history and significance of cryptography. Students praised his enthusiasm, sense of humour, accessibility and clarity of explanation. In addition to teaching his regular classes, he has supervised 18 undergraduate projects during the last decade. He received his undergraduate degree from the University of Western Ontario in 1983 and his doctorate from Brandeis University in 1989. He is currently a full professor, and cross-appointed to the mathematics and statistics department of Queen’s University.

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## LAURENT SCHWARTZ 1915-2002

The mathematical community is deeply saddened at the news of the death of the world renowned French mathematician Laurent Schwartz, which occurred on July 4th, 2002. He was a brilliant student at Ecole Normale Supérieure (rue d’Ulm). During World War II, he was in Clermont-Ferrand with other future founding members of the Bourbaki group, before joining the University of Nancy. His discovery of the theory of distributions is fully recognized by his being awarded the Fields Medal in 1950. His teaching in Ecole Polytechnique has left memorable traces for thousands of students, for whom the human qualities of Laurent Schwartz cannot be separated from his mathematics. Laurent Schwartz used to emphasize that his life held on three pillars: mathematics, political engagement and butterflies, as his autobiography (Un mathématicien aux prises avec le siècle, Odile Jacob, 1997) amply demonstrates.

## AWARDS / PRIX

### Moody Wins Killam Prize



Five prominent Canadian scholars in the fields of law, philosophy, information technology, mathematics and genetics have been honoured with the 2002 Killam Prizes, Canada's most distinguished annual awards for outstanding career achievement in social sciences, humanities, engineering, natural sciences and health sciences. The awards to Harry W. Arthurs, Ian Hacking, Nicolas D. Georganas, Robert V. Moody and Lap-Chee Tsui were announced by the Canada Council for the Arts, which administers the Killam program.

Robert Moody's research has been described as "a classic example of the fruitful interplay between mathematics and physics that has been at the heart of major scientific advances since the time of Newton." Born in England in 1941, Dr. Moody is currently a Professor in the Department of Mathematical and Statistical Sciences at the University of Alberta in Edmonton. He has recently been appointed as the first Scientific Director of the newly-founded Banff International Research Station for Mathematical Innovation and Discovery (BIRS).

After spending his high school years in Ottawa, Dr. Moody completed his B.A. at the University of Saskatchewan in 1962 and received his M.A. (1964) and Ph.D. (1966) from the University of Toronto. His dissertation contained the basis for what is considered one of his greatest achievements, the Kac-Moody algebras, which he discovered independently from and simultaneously with Russian mathematician Victor G. Kac. The Kac-Moody algebras have given rise to numerous applications in various fields of mathematics and mathematical physics. By the mid-1980s, the Kac-Moody algebras and their offspring, Virasoro algebras, had emerged as the basic mathematical structure underlying superstring theory. The Kac-Moody algebras won him and Kac the 1994-95 Eugene Wigner Medal.

Moody took up his first academic position at the University of Saskatchewan in 1966 and joined the Department of Mathematical and Statistical Sciences at the University of Alberta in 1989. He has published 68 research papers and six books.

The Canadian Mathematical Society has twice bestowed honours on Dr. Moody. He received the inaugural Coxeter-James Prize in 1978, given annually to the most outstanding Canadian mathematician within 10 years of his or her degree. In 1995, he was given the highest honour awarded by the Society, the Jeffery-Williams Prize, for his outstanding contribution to mathematical research. Other awards and distinctions include the 1995 Gordin Kaplan Award for Excellence in Research, the highest research prize awarded by the University of Alberta; the 1966 Province of Alberta Science and Technology Award for Outstanding Research; and the 1998 Centre de Recherches de Mathématique/Fields Institute Prize. In 2000, he was granted the title Docteur honoris causa at the Université de Montréal; he is a Fellow of the Royal Society of Canada and an Officer of the Order of Canada.

### Fields Institute Fellows

The Fields Institute Director, Kenneth R. Davidson, has announced the names of the first Fields Institute Fellows. The names were approved at the Annual General Meeting in June. This is an honorary title which is conferred on certain individuals who have made outstanding contributions to the Fields Institute, its programs, and to the Canadian mathematical community. It is a lifetime appointment.

J. Arthur	M. Goresky	E. Muller
E. Bierstone	S. Halperin	P. Nicholson
D. Brillinger	V. Jones	J. Paldus
A. Carty	R. Kane	N. Pippenger
J. Chadam	M. Kolster	C. Riehm
S. Cook	F. Lalonde	T. Salisbury
D. Coxeter	P. Lancaster	L. Seco
G. Elliott	W. Langford	W. Shadwick
P. Fillmore	J. Marsden	M. Sigal
J. Friedlander	M. Milevsky	V. Snaith
A. George	R. Moody	J. Stewart

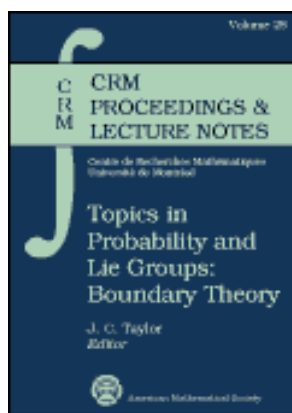
In future years, there will be a call for nominations to appoint a few new Fields Institute Fellows each year at the discretion of the Board. The new recipients of this honour will be announced at the Annual General Meeting each year.

## Behavior at Infinity Via Probability and Potential Theory

Book Review by Patrice Sawyer, Laurentian University

### Topics in Probability and Lie Groups: Boundary Theory

edited by J. C. Taylor  
CRM Proceedings Vol. 28  
AMS, 2001  
202 pp



In the Preface, J. C. Taylor explains that while the book was initially intended as a loose proceedings for a seminar he organized in 1992, it evolved into something quite different. As a result, several of the papers in the book under review contain results and approaches which are more recent. In particular, three of the papers are related, to various degrees, to the monograph [8] that Taylor published in 1998 with Yves Guivarc'h and Lizhen Ji. These are the papers by Anker and Ji, by Guivarc'h and by Taylor himself.

The papers by presenters Steve Evans and François Ledrappier are closest to being in tune with the initial intent of this book along with the article by Alessandro Figa-Talamanca who was a participant of the workshop but did not present.

The reviewer found the papers by these 3 authors to be particularly accessible for non-experts (a category he admits belonging to), this being particularly true of the expositions of Evans and Figa-Talamanca.

There is a phrase by Ledrappier which is particularly illuminating (not only about his contribution but about the whole book). “These notes illustrate a theme of this workshop, namely that potential theoretic and probabilistic objects are useful to describe the behaviors at infinity of hyperbolic and semi-hyperbolic spaces.” (and, this reviewer adds, other geometric structures).

The preface by Taylor provides an informative introduction to each of the contributions. For this reason, the reviewer will only present his general impression of each article.

The first of the articles in the book under review is by Jean-Philippe Anker and Lizhen Ji (*Heat kernel and Green function estimates on noncompact symmetric spaces. II*). It is particularly close to the reviewer's heart. The authors nicely tie in the various questions associated with estimating the growth of the heat kernel on a symmetric space. While keeping an expository flavor and being a nice introduction to their work ([1]), a new, and simpler, approach is explained. In the words of the authors: “The basic point of this note is that the analysis of spherical functions near the walls is very subtle, but the heat kernel behaves nicely because it satisfies the parabolic Harnack inequality.” The relationship of this paper to [8] comes from the application of their results in the book.

Next follows a survey by Steven N. Evans (*Local fields, Gaussian measures, and Brownian motion*) on his ground breaking work on Brownian motion in the context of local fields (see in particular [4, 5, 6]). The author asks the very natural question “What is the right way to generalize such notions as Gaussian measures and Brownian motion in this setup?” The paper is a solid introduction to the subject not only because of the examples, but also because of the justification the

author gives to the definitions. A graduate student with a good background in probability and Banach spaces, or a researcher wanting to learn about this subject would do well by reading this paper. It is easy to visualize this paper as the basis of a “teaching seminar” on that topic. The reviewer found the definition of Brownian Motion in that setup to be intriguing but well justified.

Alessandro Figa-Talamanca (*An application of Gelfand pairs to a problem of diffusion in compact ultrametric space*) acknowledges 2 particularly important sources [2, 7]. His paper is concerned with the use of Gelfand pairs in connection with finite trees to compute spherical functions. This leads to the computation of the probability associated with a natural random walk on finite trees under appropriate conditions. Although the reviewer is more used to Gelfand pairs in the context of symmetric spaces, he found this paper particularly accessible and illuminating.

The contribution of Yves Guivarc'h (*Compactifications of symmetric spaces and positive eigenfunctions of the Laplacian*) is based on joint work with Ji and Taylor. This is a solid paper which is less expository in nature than those of Evans, Figa-Talamanca or Ledrappier; in fact, a conjecture by E. B. Dynkin (see [3]) is verified in the paper. It might even be a good idea to start by reading the more accessible contribution by Taylor. The list of references given is rather comprehensive.

François Ledrappier (*Some asymptotic properties of random walks on free groups*) investigates random walks of free groups  $F$  with a finite set of generators with a view of describing properties of the harmonic measure at infinity. In the section “Notes and Reference”, the notion of homogeneous tree is put in context. The paper is very well structured and self-contained. It

is also a solid excursion and a walking stick is recommended. A comprehensive list of references is given at the end.

J. C. Taylor (*The Martin compactification associated with a second order strictly elliptic partial differential operator on a manifold  $M$* ) develops a self-contained proof of the Martin integral representation theorem for general elliptic operators on Riemannian manifolds. The approach is based on PDE techniques rather than on axiomatic potential theory. The paper also doubles as a fairly gentle introduction to Martin boundaries and to some of the material presented in [8].

To summarize, these papers present a good mixture of expository papers and more advanced articles.

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## MATH-NET LAUNCHED

The International Mathematical Union (IMU) has just released Math-Net, a worldwide electronic information and communication system for mathematics; see <http://www.math-net.org>.

Why is Math-Net needed? Today, almost every mathematics department or research institute offers information on the World Wide Web. But the content, structure, and presentation of these pages vary widely, making it difficult for users to navigate and find information. Math-Net is an alternative way for academic departments and research institutes to present information about themselves and their programs consistently. Math-Net has been designed to facilitate access to high quality mathematical information worldwide, both by human users and search engines.

A special feature of Math-Net is the Math-Net Page, a web portal for mathematics departments and institutes that presents information in a standardized, well-structured, and easy-to-use format.

The Math-Net Page is an additional entry point to institutional information, immediately accessible from the department's homepage, and not meant to replace it. Using this secondary homepage, mathematicians, scientists, students, and the news media can easily find relevant data, such as staff, student programs, colloquia, seminars, and publications.

The Math-Net Page is an enhanced version of a web page that originated in a project in Germany, targeted at establishing a nation-wide information and communication system for mathematics departments. A tool for generating Math-Net Pages as well as assistance is available at no charge at [http://www.math-net.org/Math-Net\\_Page\\_Help.html](http://www.math-net.org/Math-Net_Page_Help.html). Mathematics departments around the world are currently setting up Math-Net Pages.

The Math-Net Pages are collected by the Math-Net service NAVIGATOR, see <http://www.math-net.org/navigator>, that gathers the local information and makes it globally available. Other services of this type are MPRESS, see <http://mathnet.preprints.org>, collecting information about mathematical preprints, and PERSONA MATHEMATICA, a search engine for mathematical researchers, see [http://www.mi.uni-koeln.de/Math-Net/persona\\_mathematica](http://www.mi.uni-koeln.de/Math-Net/persona_mathematica).

Math-Net paves the way towards open and free exchange of information within and for the international mathematics community. In May 2000, the IMU adopted the Math-Net Charter, see <http://www.math-net.org/Charter/>. The IMU's Committee on Electronic Information and Communication (CEIC) has issued a recommendation that universities and institutes worldwide install a Math-Net Page.

## Bäcklund and Darboux transformations and the geometry of solitons

Book Review by Niky Kamran, McGill University

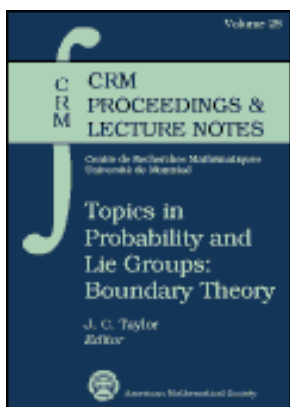
### Bäcklund and Darboux transformations, the geometry of solitons

edited by A. Coley, D. Levi, R. Milson, C. Rogers and P.  
Winternitz

CRM Proceedings Vol. 29

AMS, 2001 year

436 pp



The book under review is the proceedings of an AARMS-CRM Workshop on Bäcklund and Darboux transformations and the geometry of solitons, which was held in Halifax, Nova Scotia, from June 4 to 9, 1999. These proceedings comprise four sets of introductory lectures, and some thirty five papers of a more specialized nature. The introductory lectures are well written, and cover much of the foundational material at a level which will be accessible to non-experts. The specialized articles deal with a number of interesting current trends in the geometrical and analytical study of certain special classes of differential equations by means of Bäcklund and Darboux transformations. Nearly all these articles have been written with great care and attention to detail. Unlike many conference proceedings, this volume will likely become a useful reference in an active area of mathematics which involves a rich mixture of classical differential geometry, complex analysis, scattering theory, and Lie groups.

A review of the detailed contents of this book would be nearly impossible given the breadth of the topics that it covers. We have chosen instead to illustrate a number of the main themes of the book on a classical example which carries at an elementary level many of the features of the general situation.

The transformations that are nowadays referred to as Bäcklund transformations have their origin in the classical investigations of Lie, Bäcklund and Bianchi on transformations

of surfaces induced by line congruences. The most famous of these geometric transformations is the classical Bäcklund transformation of pseudo-spherical surfaces, that is surfaces of constant negative Gaussian curvature. Consider a piece of a surface  $S$  in  $R^3$  of negative Gaussian curvature, given as the image of an immersion  $\mathbf{X} : U \subset R^2 \rightarrow R^3 : (u, v) \mapsto \mathbf{X}(u, v)$ . If the coordinates  $(u, v)$  are chosen as the arc length parameters along the asymptotic lines of  $S$ , then the necessary and sufficient condition for  $S$  to be of constant negative Gaussian curvature  $K = -\frac{1}{c^2}$  is given by the celebrated *sine-Gordon* equation

$$\theta_{uv} = \frac{1}{c^2} \sin \theta, \tag{1}$$

where  $\theta(u, v)$  denotes the angle between the asymptotic lines at the point  $\mathbf{X}(u, v)$  of  $S$ . The first and second fundamental forms of  $S$  are thus given by

$$I = du^2 + 2 \cos \theta du dv + dv^2, \tag{2}$$

$$II = \frac{2}{c} \sin \theta du dv. \tag{3}$$

Suppose that we are given a non-zero solution  $\theta(u, v)$  of the sine-Gordon equation (1) and consider the over-determined system of first-order partial differential equations for an unknown function  $\theta'(u, v)$ , given by

$$(\theta' - \theta)_u = \frac{2\beta}{c} \sin\left(\frac{\theta + \theta'}{2}\right), \quad (\theta' + \theta)_v = \frac{2}{\beta c} \sin\left(\frac{\theta' - \theta}{2}\right). \tag{4}$$

This over-determined system, which is known as the *Bäcklund transformation* of the sine-Gordon equation, is locally solvable since the Frobenius integrability conditions are satisfied by virtue of the sine-Gordon equation (1). Bäcklund's theorem asserts that given a solution  $\theta'(u, v)$  of the Bäcklund transformation (4), the map  $\mathbf{X}' : U' \subset R^2 \rightarrow R^3 : (u, v) \mapsto \mathbf{X}'(u, v)$  defined by

$$\mathbf{X}' = \mathbf{X} + \frac{L}{\sin \theta} \left[ \sin\left(\frac{\theta - \theta'}{2}\right) \mathbf{X}_u + \sin\left(\frac{\theta + \theta'}{2}\right) \mathbf{X}_v \right], \tag{5}$$

where

$$L = c \sin \zeta, \quad \beta = \tan \frac{\zeta}{2}, \tag{6}$$

gives rise to a pseudo-spherical surface  $S'$  of constant negative Gaussian curvature  $K' = K = -\frac{1}{c^2}$ . The tangent planes at the corresponding points  $\mathbf{X}(u, v)$  and  $\mathbf{X}'(u, v)$  make a constant angle  $\zeta$ . The Bäcklund transformation (4) can thus be thought of as a technique for generating new solutions of the sine-Gordon equation from known ones by the integration of a compatible first-order quasi-linear system. One particularly nice feature of the Bäcklund transformations (4) is that

their composition is commutative with respect to the parameter  $\beta$ . This is known as the *Bianchi Permutability Theorem*.

The sine-Gordon equation (1) is a non-linear hyperbolic equation, and it is quite remarkable that it admits closed-form solutions which describe the interaction of solitary waves. These solutions are called *soliton* solutions. For example the solution given by

$$\theta = 4 \arctan \left[ \exp\left(\frac{1}{2c}(\beta + \beta^{-1})x + \frac{1}{2\beta c}(\beta - \beta^{-1})y\right) \right], \quad (7)$$

where

$$x = u + v, \quad y = u - v, \quad (8)$$

is the 1-soliton solution of the sine-Gordon equation. The corresponding pseudo-spherical surface is known as a *Dini surface*, and is parametrized by  $X(x,y)$ , given by

$$\left[ c \frac{\sin \zeta}{\cosh \chi} \cos\left(\frac{y}{c}\right), c \frac{\sin \zeta}{\cosh \chi} \sin\left(\frac{y}{c}\right), x - c \sin \zeta \tanh \chi \right] \quad (9)$$

where

$$\chi := \frac{x - y \cos \zeta}{c \sin \zeta}. \quad (10)$$

The  $N$ -soliton solutions of the sine-Gordon equation are obtained by applying the Bäcklund transformation (4) to the 1-soliton solution and exploiting the Bianchi Permutability Theorem. These multi-soliton solutions describe the non-linear interaction of traveling waves, which retain their velocity and shape after their interaction, but with a phase shift. The parameter  $\beta$  which appears in the Bäcklund transformation plays the role of the spectral parameter in the solution of the sine-Gordon equation by the method of inverse scattering, through a Lax pair formulation.

The sine-Gordon equation is related in a very interesting way to a certain ordinary differential equation of Painlevé type. Recall that a second-order ordinary differential equations in the complex domain

$$w'' = F(z, w, w'), \quad (11)$$

is said to be of Painlevé type if its solutions have no singularities depending on the initial conditions other than poles. Painlevé showed that up to a natural group of transformations, there are fifty parametrized families of differential equations whose solutions enjoy this property. Six of these families are such that for generic values of their parameters, the corresponding solutions define new transcendental functions, called the *Painlevé transcendents*. The third of these Painlevé transcendents arises when one seeks solutions

which exploit the invariance of the sine-Gordon equation under Lorentz transformations of the  $(u, v)$ -plane viewed as the Minkowski plane in null coordinates,

$$ds^2 = du dv. \quad (12)$$

In these variables, the identity component of the Lorentz group acts on the Minkowski plane by scaling,

$$(u, v) \mapsto \left( au, \frac{v}{a} \right), \quad a \neq 0, \quad (13)$$

and one may seek Lorentz-invariant solutions in the form

$$\theta(u, v) = g(z), \quad z := uv. \quad (14)$$

After substituting the above in the sine-Gordon equation and letting

$$w(z) = \exp(ig), \quad (15)$$

we see that the Lorentz-invariant solutions are governed by the ordinary differential equation

$$w'' = \frac{(w')^2}{w} + \frac{2w' - w + 1}{2z}. \quad (16)$$

This is a special case of the equation defining the third of the six Painlevé transcendents.

The last important property of the sine-Gordon equation that we will briefly mention here is the existence of an infinite family of conservation laws of arbitrary differential order, giving rise to functionals which are commuting with respect to a natural Poisson bracket. This fact bears a strong analogy to the defining of completely integrable finite-dimensional Hamiltonian systems.

The existence of multi-soliton solutions, of a Bäcklund transformation involving a spectral parameter, of symmetry reductions to ordinary differential equations of Painlevé type and of an infinite hierarchy of commuting flows is often viewed as a meta-definition of the class of "completely integrable" non-linear partial differential equations. The sine-Gordon is only one of a large number of equations which are completely integrable in this sense. Completely integrable equations are nevertheless very special, and the volume under review does a wonderful job of revealing their phenomenology, particularly through the prism of classical differential geometry. Still, one of the main open challenges in this subject is to fully understand why there are so few genuine examples known of "completely integrable" non-linear partial differential equations when the number of independent variables is higher than two.

## NEWS FROM THE INSTITUTES



### 10th Anniversary of the Fields Institute

Justifiable pride was on display at the Fields Institute in June, when its 10th anniversary was marked with a two-day event that included lectures, a banquet and archival displays. There was also a beautifully-produced 24 page booklet with brief articles on many aspects of the Institute's history and operations. In addition the honorary title of "Fields Institute Fellow" was created and conferred on 33 individuals for "outstanding contributions to the Institute, its programs, and to the Canadian mathematical community" (see page 11 for more information about this).

The speakers, all of whom were involved in past events at the Institute, were led off by Martin Golubitsky (Houston), who described his work on modelling animal gaits. He recalled Leland Stanford's early question: is there a point at which all four of a galloping horse's feet are off the ground? This led to the collection of data on an astonishing number of gaits: walk, trot, pace, canter, gallop (transverse and rotary), and prong. Fascinating bits of biology were mentioned, for example that dogs trot but cannot be made to pace. A simple neurological model was described that can produce most of these gaits by appropriate patterns of neuron firing.

Persi Diaconis (Stanford) gave a masterful talk on patterns in eigenvalues, typically via Haar measure on the unitary group. The importance of this first came to light in statistics (data mining, Google), then physics (scattering, dynamical systems) and combinatorics (Ulam's problem). He described in some detail a connection with the distribution of the zeros of the zeta function, and mentioned further appli-

cations in numerical analysis, complex analysis and operator algebras. Summarizing, he said "this list shows that anyone who thinks he can work in one small corner is missing something—we're all part of the same enterprise".

Other speakers were Angus Macintyre (Edinburgh), on Frobenius maps in model theory; Chris Rogers (Bath), Monte Carlo valuation of American options; Stephen Cook (Toronto), Propositional proofs of combinatorial principles; Vaughan Jones (Berkeley), Hilbert space representations of Temperley-Lieb algebras; and Karl Rubin (Stanford), Ranks of elliptic curves.

At the banquet we were entertained by William Pulleyblank, formerly of Waterloo and now directing IBM's Computing Institute. His subject was the computer simulation of protein folding. He explained that a protein is simply a chain of amino acids; there are only 20 of these acids and the chains can have up to 300 links. In water these chains assume complicated three-dimensional shapes, and the function depends on the configuration. The goal ("protein folding") is a systematic survey of the possibilities, with a view to designing proteins for specific tasks. For this one needs 1 petaflop per year of computing power; at present the 500 largest machines together can do only one-tenth of this. IBM is building a one-third petaflop parallel machine with 64,000 processors, due in 2004. He concluded by pointing out the rapid emergence of the computer as a mathematical science tool, and with a prediction that "designer drugs", taking into account individual genetic characteristics, will be here in four years.

For this reporter, who was involved over the past 15 years in several aspects of the the Institute's birth and operation, this was a wonderful event: the beautiful building, the great people, and above all the stimulating mathematics, combined memorably. Ken Davidson and his staff are to be congratulated.

—Peter Fillmore

### NZ Institute Of Mathematics And Its Applications

On 6 March 2002 the New Zealand government announced the formation of the New Zealand Institute of Mathematics and its Applications (NZIMA) as a Centre of Research Excellence. Another new Center, the Allan Wilson Centre for Molecular Ecology and Evolution, has a major biomathematics component. The establishment of these two research centres amounts to a revolution in mathematics research funding in New Zealand.

The NZIMA is based at the University of Auckland and headed by Fields Medallist Vaughan Jones DSc FRS FRSNZ (Berkeley) and Professor Marston Conder (Auckland). It will be modelled on similar well-funded mathematical research institutes, notably the Fields Institute (Canada), IMPA (Brazil), MSRI (Berkeley), and the Newton Institute (UK).



In particular, it will place considerable emphasis on world-class research and the use of high-level mathematical techniques in modern application areas such as bioengineering, bioinformatics, medical statistics, operations research, and risk assessment.

Its activities will include:

- the organization of two 6-month programmes each year, on themes drawn from a range of fields of significant interest
- an associated workshop held at various locations around New Zealand, like the New Zealand Mathematics Research Institute Workshops held annually since 1995.
- establishment of annual Maclaurin Fellowships, to enable mathematical scientists from NZ or worldwide to take time out from their usual occupations and undertake full-time research in New Zealand (or partly overseas if based in New Zealand).

It is expected that NZIMA will open for business later this year.

The Allan Wilson Centre for Molecular Ecology and Evolution will be located at Massey University and directed by Professors David Penny (biology) and Michael Hendy (mathematics). It will undertake studies of the ecology and evolution of New Zealand plants, animals and micro-organisms. Recent research, using new techniques such as sequencing of whole genomes and the study of ancient DNA, has revolutionized our understanding of New Zealand's biodiversity. The simplistic view that New Zealand is a 'Moa's Ark' of relic species undergoing 'ancient and slow' changes over long periods of time has been overturned by the infor-

mation obtained with these new techniques. The Centre's vision is to utilise the network of outstanding New Zealand biologists and mathematicians, who have made significant contributions to developing new analytical methods and techniques in this area, to address some of the fundamental questions about New Zealand's plant and animal life.

–*Rod Downey, President of the NZ Mathematical Society*

### **BIRS Proposals for 2004**

The Banff International Research Station for Mathematical Innovation and Discovery (BIRS) is now accepting proposals for 2004. Full information, guidelines, and online forms are available at the website

<http://pims.math.ca/birs>

BIRS will be operating for 40 weeks in 2004 and will be running either a full workshop (40 people for 5 days) or two half-workshops (20 people for 5 days) each week. As usual, BIRS provides full meals, accommodation, and research facilities at no cost to the organizers and to the invited participants.

In addition BIRS will operate its Research in Teams and Focused Research Groups programs, which allow smaller groups of researchers to get together for several weeks of uninterrupted work in a setting conducive to research and collaboration.

The deadline for BIRS workshop proposals is October 15, 2002.

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## **CARLETON UNIVERSITY– OTTAWA, ONTARIO SCHOOL OF MATHEMATICS AND STATISTICS**

### **Position in Mathematics and Statistics**

The School of Mathematics and Statistics invites applications for one or more tenure track positions at the rank of Assistant Professor and possibly higher starting July 1, 2003. Applicants should have a Ph.D. (by the time of appointment) in Mathematics, Statistics, or related areas, a demonstrated potential for research and a strong commitment to excellence in teaching. The School is particularly interested in candidates who are actively engaged in research in applied areas of mathematics or statistics; however outstanding candidates in all areas of mathematics or statistics will be considered. More information about the School can be found at [www.math.carleton.ca](http://www.math.carleton.ca). These positions are subject to budgetary approval. Applications including a curriculum vitae and three letters of reference, should be sent to:

**Dr. C.W.L. Garner,  
Director School of Mathematics and Statistics  
Carleton University  
1125 Colonel By Drive Ottawa, Ontario, K1S 5B6**

Deadline for applications is **October 1, 2002** but applications received after this date may be considered.

All qualified candidates are encouraged to apply. The applications of Canadians and Permanent Residents will be given priority. Carleton University is committed to equality of employment for women, aboriginal peoples, visible minorities, and persons with disabilities. Persons from these groups are encouraged to apply.

## A Grad Student at the Laval Meeting

by Tara Taylor, Dalhousie University

The annual CMS summer meeting was held this past June 15-17 in Québec City, at Laval University. I am currently a doctoral student at Dalhousie University, and this was my first time as a participant at a CMS meeting. I was in Québec only on Saturday and Sunday, so I was unable to participate in the entire meeting. It was all a bit overwhelming, there were so many interesting things going on. I found that the meeting was extremely well-organized, and there were many enthusiastic people around to answer all sorts of queries.

My experience began Saturday afternoon. I had been attending another mathematics conference in Michigan, and unfortunately I was delayed and had to miss the delegate's luncheon. I did get to fly on a small propeller plane, which was quite a thrill. I must say that I was happy to be back in Canada. I have only been to Québec once before, so I was very excited to be there. I was not able to explore the city as I was too busy at the meeting, and the weather was not very agreeable anyways. Many people told me that Friday had been a glorious day and they were able to enjoy the city. Oh well, à la prochaine. So, with Dunkin' Donuts for sustenance, I attended talks from a few different sessions. As a graduate student, I am just starting to focus on a specific topic. However, there are so many different areas of mathematics that interest me, and so I often found it rather difficult to choose one talk to attend over many other equally appealing ones. I am learning that it is okay to not understand everything in a talk. I can always glean something new, and it is always nice to meet other mathematicians from across the country.

Saturday evening I went to the Graduate Student Social at Le Tapis Vert, and it was quite pleasant. One of the highlights of the meeting was being able to hear and speak French. It had been quite a long time since I had had the opportunity. You know that you are not speaking French too well when

someone answers you back in English. So at the end of the evening, when I called for a taxi, I was thrilled to be answered in French.

Sunday began with a talk by Isadore Singer, "Forty Years Of Index Theory". This was another talk where the mathematics went over my head, but I felt reassured when the speaker described how a talk should be broken down. The first five minutes should be understandable to your landlord, and the next five minutes to an undergraduate math student, and so on with increasing complexity until the last five minutes, which shouldn't be understandable even to the speaker himself. Then I participated in the "Experiencing Geometry Workshop" by David Henderson and Daina Taimina, that was part of the Math Education session. I found this workshop extremely enlightening and fun. We endeavoured to define "What is a straight line?" first on a plane, then on a sphere, a cone and finally on a hyperbolic plane. This was definitely a hands-on experience. Following the workshop, I attended a talk where the slides were in English and the speaker (Dominic Rochon) spoke French. I think this was an innovative way to bring both worlds together. Throughout the meeting it was truly wonderful to witness mathematics in both languages. I attended various sessions throughout the afternoon, leaving my mind buzzing.

The Banquet took place Sunday evening at le Musée du Québec. This was certainly another highlight of the meeting. There were a few speeches, and I wasn't quite able to understand everything, but I believe they were quite humorous. I find that being a mathematician can often make one feel isolated, but at the banquet, and indeed throughout the meeting, the opposite was true. It was a joy to be part of a community. I look forward to attending many more CMS meetings in the years to come.

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### Letters to the Editors/Lettres aux Rédacteurs

The Editors of the *Notes* welcome letters in English or French on any subject of mathematical interest but reserve the right to condense them. Those accepted for publication will appear in the language of submission. Readers may reach us at [notes-letters@cms.math.ca](mailto:notes-letters@cms.math.ca) or at the CMS Executive Office.

Les rédacteurs des *Notes* acceptent les lettres en français ou en anglais portant sur un sujet d'intérêt mathématique, mais ils se réservent le droit de les compresser. Les lettres acceptées paraîtront dans la langue dans laquelle elles nous sont parvenues. Les lecteurs pourront nous joindre au bureau administratif de la SMC ou à l'adresse suivante: [notes-lettres@smc.math.ca](mailto:notes-lettres@smc.math.ca).

**CMS Winter Meeting 2002**  
**Ottawa Marriott Hotel**  
**Ottawa, Ontario**  
**December 8-10, 2002**

**First Announcement**

On behalf of the University of Ottawa, the Department of Mathematics and Statistics invites all researchers, educators and students to the Winter 2002 Meeting of the Canadian Mathematical Society (CMS).

The Department is pleased to once again welcome colleagues back to the Nation's Capital. Following the usual format, the meeting will include twelve symposia, contributed papers, four plenary speakers, as well as the Coxeter-James and Doctoral Prize lecturers and the awarding of the 2002 Adrien Pouliot Prize. There will also be a Public Lecture delivered by Robert Zuccherato of Entrust.

All pre-meeting activities and scientific talks will be held at Ottawa Marriott Hotel, 100 Kent Street, steps away from Parliament Hill and Ottawa's downtown core.

The most up-to-date information concerning the programmes, including detailed schedules, will be made available at the following web site:

<http://www.cms.math.ca/Events/winter02>

Meeting registration forms and hotel accommodation forms are published in the September 2002 issue of the *CMS Notes* and are also available on the web site, along with on-line forms for registration and submission of abstracts.

**Public Lecture**

**Robert Zuccherato** (Entrust)

**Plenary Speakers**

**James Arthur** (University of Toronto)

**Rene Carmona** (Princeton University)

**Victor Guillemin** (MIT)

**Maciej Zworski** (Berkeley University)

**Prizes and Awards**

The **CMS Coxeter-James Lecture** will be given by **Lisa Jeffrey**, University of Toronto.

The **Doctoral Prize** and the **Adrien Pouliot Prize** will also be awarded during this meeting.

**Symposia**

By invitation of the Meeting Committee, there will be symposia in the following areas. Here is the preliminary list of speakers. If you are interested in being an invited speaker in one of the symposia, it may be possible to do so by contacting one of the organizers of that symposium.

*Financial Mathematics*

(Org: **Luis Seco**, University of Toronto)

Robert Almgren (Toronto), Abel Cadenillas (Alberta), Tahir Choulli (Alberta), Matt Davison (UWO), Tom Hurd (McMaster), Ali Lavassani (Calgary), Eric Renault (Montréal), Tom Salisbury (York), Dave Saunders (Pittsburgh), Agnes Tourin (McMaster). Tony Ware (Calgary).

*Finite Elements*

(Org: **Roger Pierre**, Laval University)

Francois Bertrand (École Polytechnique de Montréal), Yves Bourgault (Ottawa), Alain Charbonneau (UQAH), Kokou Dossou (ICIP, Hull), Mohammed Farhloul (Moncton), Peter A. Forsyth (Waterloo), André Fortin (GIREF, Laval), Robert Guenette (GIREF, Laval), P.D. Minev (Alberta), Dominique Pelletier (École Polytechnique de Montréal), Leila Slimane (GIREF, Laval), Azzedine Soulaïmani (École de technologie supérieure).

*History of Mathematics*

(Org: **Richard O'Lander** and **Ronald Sklar**,  
St. Johns University N.Y.)

Michael Barr (McGill), Jonathan Borwein (Simon Fraser), Florin Diacu (Victoria), Hardy Grant (Carleton), Francois Major (Montreal), Michael Makkai (McGill), John McKay (Concordia), Angelo Mingarelli (Carleton), Gregory Moore (McMaster), Christiane Rousseau (Montréal), Luis Seco (Toronto), Walter Whiteley (York), Peter Zvengrowski (Calgary).

*Lie Algebras and Moonshine*

(Org: **Abdellah Sebbar** and **Erhard Neher**,  
University of Ottawa)

Bruce Allison (Alberta), Yuri Bahturin (Memorial), Georgia Benkart (Wisconsin-Madison), Nantel Bergeron (York), Stephen Berman (Saskatchewan), Yuly Billig (Carleton), Chris Cummins (Concordia), Drajomir Djokovic (Waterloo), Chongying Dong (California-Santa Cruz) Terry Gannon (Alberta), Yun Gao (York), Haisheng Li (Rutgers), John McKay (Concordia), Adrian Ocneanu (Pennsylvania State), Arturo Pianzola (Alberta), Yoji Yoshii (Wisconsin-Madison), Noriko Yui (Queen's).

*Mathematical Education : Now I See !!!!*

*Dynamic Visualisations in  
Canadian Mathematics Education*  
(Org: **Thomas Steinke**, OCCDSB)

Keynote Speaker: Walter Whiteley (York).

*Number Theory*

(Org: **Damien Roy**, University of Ottawa,  
and **Kenneth Williams**, Carleton University)

Peter Borwein (Simon Fraser), Douglas C. Bowman (Illinois - Urbana-Champaign), Kwok-Kwong Stephen Choi (Simon Fraser), Henri Darmon (McGill), Chantal David (Concordia), John Friedlander (Toronto), Eyal Goren (McGill), Manfred Kolster (McMaster), Greg Martin (British Columbia), David McKinnon (Waterloo), Yiannis Petridis (City Univ. of New-York), Cameron L. Stewart (Waterloo), Jeffrey Lin Thunder (Northern Illinois), Michel Waldschmidt (Paris VI).

*Operator Algebras*

(Org: **Thierry Giordano**, and **David Handelman**,  
University of Ottawa)

Berndt Brenken (Calgary), Ken Davidson (Fields/Toronto), Man Duen Choi (Toronto), George Elliott (Toronto), Nigel Higson (Penn State), Mahmood Khoshkam (Saskatchewan), Claus Koestler (Queen's), Dan Kucerovsky (UNB), Marcelo Laca (Victoria), Jamie Mingo (Queen's), Vladimir Pestov (Ottawa), John Phillips (Victoria), Ian Putnam (Victoria), Roland Speicher (Queen's).

*Partial Differential Equations*

(Org: **Victor Ivrii** and **John Toth**, University of Toronto)

Richard Beals (Yale), Jim Colliander (Toronto), Andrew Comech (North Carolina-Chapel Hill), Walter Craig (McMaster), Alan Greenleaf (Rochester), Peter Greiner (Toronto), Victor Guillemin (MIT), Victor Ivrii (Toronto), Vojkan Jakšić (McGill), Kate Okikiolu (California-SanDiego), Chris Sogge (John's Hopkins), Catherine Sulem (Toronto), John Toth (McGill), Guenter Uhlmann (Washington), Andras Vasy (MIT), Jared Wunsch (SUNY-Stony Brook), Steve Zelditch (John's Hopkins), Maciej Zworski (Berkeley).

*"Real-World" Problems in Search of Solutions*

(Org: **André Dabrowski**, University of Ottawa)

Xiaoyi Bao (Ottawa), Mary Hefford (Health Canada), Donal Hickey (Ottawa), André Longtin (Ottawa), Rejean Munger (Ottawa Hospital Research Institute - Eye institute), Michael Rudnicki (Ottawa Hospital Research Institute).

*Representation Theory of Real and  $p$ -adic Groups*

(Org: **Jason Levy** and **Monica Nevins**,  
University of Ottawa)

Heather Betel (Toronto), Clifton Cunningham (Calgary), Stephen DeBacker (Harvard), Julee Kim (Institute for Advanced Study), Jason Levy (Ottawa), Fiona Mur-naghan (Toronto), Monica Nevins (Ottawa), Alfred Noël (Massachusetts-Boston), Eric Sommers (Massachusetts-Amherst), Yuanli Zhang (Montréal).

*Symplectic Geometry*

(Org: **Lisa Jeffrey** and **Eckard Meinrenken**,  
University of Toronto)

Anton Alekseev (Geneva), Henrique Bursztyn (Toronto), Rebecca Goldin (George Mason), Megumi Harada (California-Berkeley), Tara Holm (MIT), Yael Karshon (Toronto), Ely Kerman (Toronto), Askold Khovanskii (Toronto), Misha Kogan (Northeastern), Francois Lalonde (Québec-Montréal), Eugene Lerman (Illinois-Urbana-Champaign), David Metzler (Florida), Jonathan Weitsman (California-Santa Cruz), Siye Wu (Colorado-Boulder), Ping Xu (Pennsylvania State), Carmen Young (Fields Institute), Catalin Zara (Yale).

*Theory and Applications of Point Processes*

(Org: **Gail Ivanoff** and **David McDonald**,  
University of Ottawa)

Francois Baccelli (École Normale Supérieure), Raluca Balan (Sherbrooke), Gail Ivanoff (Ottawa), Reg Kulperger (Western Ontario), David McDonald (Ottawa), Richard Serfozo (Georgia Institute of Technology), Yiqiang Q. Zhao (Carleton).

*Contributed Papers Session*

(Org: **to be announced**)

Contributed papers of 15 minutes duration are invited. Abstracts for CMS contributed papers should be prepared as specified below. To better assist organizers, please include the Primary (2000) AMS Classification.

For an abstract to be eligible, the abstract must be received before **October 15, 2002**. The abstract must be accompanied by its contributor's registration form and payment of the appropriate fees.

**Travel Grants for Graduate Students**

Limited funds are available to partially fund the travel and accommodation costs for graduate students. For more information, please contact the Meeting Committee at gradtravel-w02@cms.math.ca.

Applicants must be bona fide graduate students, at a Canadian or other University. To apply for this funding, please have a letter written by your Supervisor or departmental Graduate Advisor, briefly answering the following: Name of Student, Area of study and level, How will the student benefit from the meeting? Will the student be speaking? What support is available from local sources or grants, for this student?

Please have this sent before **November 1, 2002**. This letter may be emailed to gradtravel-w02@cms.math.ca. **Applicants will be notified early in November** of the funding decision.

If successful, the student will receive a cheque for reimbursement of expenses upon completion and submission of the standard Travel Expense Claim Form, along with appropriate original receipts.

## Social Events

A **welcoming reception** will be held Saturday, December 7, from 7:00 to 9:00 p.m. in the Victoria North Ballroom of the Ottawa Marriott Hotel.

A **Public Lecture Reception** will be held in connection with the talk by Robert Zuccherato (Entrust). More details will be posted on our web site as they become available.

The **Delegates' Luncheon** will be held on Sunday, December 8, from 12:30 to 2:00 p.m. in the Victoria North/South Ballrooms of the Ottawa Marriott Hotel. A ticket to this luncheon is included in all registration fee categories.

A **banquet** will be held on Sunday, December 8, from 7:30 p.m. in the Victoria North/South Ballrooms of the Ottawa Marriott Hotel, preceded by a cash bar at 6:30 p.m. Tickets to this event are available at \$50.00 each.

Coffee and juice will be available during the **scheduled breaks**.

A detailed schedule of all social and other events is available from the schedule page of the meeting web site.

## Business Meetings

The CMS will be holding business meetings during the course of the meeting.

The **CMS Executive Committee Meeting** will meet on Friday, December 6, from 6:00 to 10:00 p.m. in the Sussex Salon of the Ottawa Marriott Hotel.

The **CMS Development Group Luncheon** will be held from 11:00 a.m. to 1:00 p.m. on Saturday, December 7 in the Sussex Salon of the Ottawa Marriott Hotel.

The **CMS Board of Directors Meeting** will be held from 1:30 to 6:30 p.m. on Saturday, December 7 in the Wellington Salon of the Ottawa Marriott Hotel.

A detailed schedule of business meetings and other events is available from the schedule page of the meeting web site.

## Exhibits

Exhibits will be held in the Victoria Gallery of the Ottawa Marriott Hotel during specified hours during the conference.

## Submission of Abstracts

Abstracts for all talks will be published in the meeting programme and will also be available at <http://cms.math.ca/Events/winter02/abs/>.

Abstracts may be sent electronically, following instructions given below. Electronic submission of abstracts is preferred. If this is not possible, abstracts may also be prepared on the standard form available from the CMS Executive Office, 577 King Edward, Suite 109, Ottawa, Ontario CANADA K1N 6N5.

Speakers are asked to submit their abstracts as soon as possible. The deadline for submission of abstracts has been set at **October 15, 2002**. The organizers appreciate the cooperation of all the speakers in observing this important deadline.

**Electronic submission of abstracts:** To submit your abstract, please go to the forms section of the meeting web site: <http://cms.math.ca/Events/winter02/forms.html>.

Alternatively, files including the session, speaker's name, affiliation, complete address, title of talk, and abstracts may be sent to [abstracts-w02@cms.math.ca](mailto:abstracts-w02@cms.math.ca) (speakers), or [cp-abstracts-w02@cms.math.ca](mailto:cp-abstracts-w02@cms.math.ca) (contributed papers).

Please make sure to include the session name in your subject line. For contributed papers, to better assist organizers, please include the 2000 AMS Subject Classification.

**Important deadline for submission of all abstracts:  
October 15, 2002**

## Registration

The registration form will appear in the **September 2002** issue of the *CMS Notes* and are also available from:

CMS Executive Office  
577 King Edward, Suite 109, P.O. Box 450, Station A  
Ottawa, Ontario CANADA K1N 6N5  
Tel: 613-562-5702 FAX: 613-565-1539  
Email: [meetings@cms.math.ca](mailto:meetings@cms.math.ca)

**Electronic pre-registration** is available at <http://www.cms.math.ca/Events/winter02/forms.html>

Payment for preregistration may be made by cheque, or by VISA or MasterCard. Although registration fees are given in Canadian dollars, delegates may send cheques in US dollars by contacting their financial institution for the current exchange rate.

Please note that **payment must be RECEIVED IN OTTAWA on or before November 1 in order to qualify for reduced rates**. In order for your payment to be processed before the meeting, it should be received by November 30.

	Before Nov 1	After Nov 1
Delegate's Luncheon included		
Plenary speakers/prize lecturers	\$ 0	\$ 0
Session speakers	215	215
Organizers	145	145
Non-members	430	560
CMS/AMS/MAA members with grants	290	375
CMS/AMS/MAA members without grants	145	190
One-day fee	195	255
Postdocs, retired	110	145
Teachers (K-12, CEGEP), students, unemployed	55	70
Banquet (free for plenary/prize speakers)	50	50

CMS = Canadian Mathematical Society  
AMS = American Mathematical Society  
MAA = Mathematical Association of America

## Why Preregister?

Wondering whether to pre-register or wait until you arrive? Here are some advantages to pre-registering.

- many can take advantage of reduced fees until the early registration deadline (see above)
- your name would appear on the list of participants on our web site
- your Meeting Kit will be waiting for you at the reception on Saturday evening
- no waiting in line early Sunday morning to process your registration !
- banquet tickets are available now but may no longer be available on site

For all these reasons, we encourage you to preregister, whether it be before or after the early registration deadline. If you'd like to preregister and enjoy the above benefits, please visit our web site to use our online forms.

## Refund Policy

Delegates wishing to cancel their registration must notify the CMS Executive Office **in writing before November 30** to receive a refund less a \$40 processing fee. Those whose contributed paper has not been accepted will upon request be fully refunded.

## Do you qualify for free CMS membership?

An AMS or a MAA member who registers at a semi-annual meeting of the CMS and who is not a member of the CMS, is eligible for a one-time only, one-year free membership in the CMS.

If you qualify, please visit the CMS booth to complete a membership application form. Please provide proof of current AMS or MAA membership. This offer applies to new members only.

## Accommodation

It is recommended that those attending the conference book early to avoid disappointment. Blocks of rooms have been

reserved at the locations given below and will be held until the deadlines specified. Reservations not made by that date will be on a space available basis. Rates are per room, per night and are quoted in Canadian dollars.

### Ottawa Marriott Hotel

100 Kent Street, Ottawa (Ontario) Canada K1P 5R7

Check-in: 3:00 p.m.; Check-out: 1:00 p.m.

Applicable taxes: GST (7%), Hotel tax (5%)

**Deadline: November 6, 2002**

**Group Code: CMS Winter Meeting 2002**

Phone: 613-238-1122 toll-free: 800-853-8463

FAX: 613-783-4238

email: genevieve.harding@ottawamarriott.com

parking: \$15.00 daily (self-parking), \$20.00 daily (valet parking)

Rates: \$128, single/double occupancy

(Children 19 yrs old and under sharing parents' accommodation are complimentary.)

### Travelodge Hotel by Parliament Hill

402 Queen Street, Ottawa (Ontario) Canada K1R 5A7

Check-in: 3:00 p.m.; Check-out: 12:00 noon

Applicable taxes: GST (7%), Hotel tax (5%)

**Deadline: November 6, 2002**

**Group Code: Cdn Mathematical Society**

Phone: 613-236-1133 Toll-free: 1-800-578-7878

FAX: 613-236-2317

email: salestlph@whgca.com parking: \$9.00 daily (self-parking) plus taxes (in and out privileges)

Rates: \$89, Standard Room, single/double occupancy

\$105, Deluxe Rooms, single/double occupancy

\$15 additional where a cot may be required

(Children 17 yrs old and under sharing parents' accommodation are complimentary.)

In all cases, delegates must make their own reservations. The conference rate is extended up to two days pre- and post-convention. Where applicable, and in order for your room to be applied against our block, please quote the group code.

**Accommodation reservations and cancellations:** For the **Ottawa Marriott Hotel**, all reservations must be guaranteed by a first night deposit, or major credit card guarantee. Deposit is refundable without penalty if an individual guest cancels a room reservation by 6:00 p.m. on the day of arrival. In the case of a "no show" or if the guaranteed reservation not be cancelled by 6:00 p.m. on the day of arrival, the cost of the room for the first night will be charged to the guarantor.

For the **Travelodge Hotel by Parliament Hill**, reservations will be held until 6:00 p.m. on the day of arrival unless guaranteed by a first night deposit, or major credit card guarantee. Should a guaranteed reservation not be cancelled by 6:00 p.m. on the day of arrival, the cost of the room for the first night will be charged to the guarantor.

## Child Care

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

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

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

Updates will be posted to the meeting web site as they become available.

## Travel

**The City of Ottawa:** The Nation’s Capital has much to explore during winter or summer. The festival of lights on Parliament Hill is a must-see for anyone visiting in December. We hope you’ll take the opportunity to bring your family, explore the city and take in some great attractions and shopping.

Detailed information regarding the University of Ottawa and the city of Ottawa, including tourism information, local weather and climate, car rental information, site and street maps, and suggested One Day Itineraries for self-guided tours, are available at the following web sites:

<http://www.uottawa.ca/>

<http://www.ottawa-conventions.com/>

[http://weatheroffice.ec.gc.ca/canada\\_e.html](http://weatheroffice.ec.gc.ca/canada_e.html)

**Parking:** Guests at the Ottawa Marriott Hotel may park for a daily fee of \$15.00 for self-parking or \$20.00 for valet parking, both including full in-and-out privileges.

Guests at the Travelodge Hotel by Parliament Hill may park for a daily fee of \$9.00, including full in-and-out privileges.

## Acknowledgements

Support from the following is gratefully acknowledged:

- University of Ottawa, Department of Mathematics and Statistics

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

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

## Meeting Committee

### Programme

*Meeting Director:* Daniel Daigle (Ottawa)  
 André Dabrowski (Ottawa), Thierry Giordano (Ottawa), David Handelman (Ottawa), Gail Ivanoff (Ottawa), Victor Ivrii (Toronto), Lisa Jeffrey (Toronto), Jason Levy (Ottawa), David McDonald (Ottawa), Eckard Meinrenken (Toronto), Erhard Neher (Ottawa), Monica Nevins (Ottawa), Richard O’Lander (St. Johns N.Y.), Roger Pierre (Laval), Damien Roy (Ottawa), Abdellah Sebbar (Ottawa), Luis Seco (Toronto), Ronald Sklar (St. Johns N.Y.), Thomas Steinke (OCCDSB), John Toth (Toronto), Kenneth Williams (Carleton), Graham Wright (CMS ex-officio).

### Local Arrangements

*Chairs:* Walter D. Burgess (Ottawa) and André Dabrowski (Ottawa)

Monique Bouchard (CMS ex-officio).

## CMS MEMBERSHIP

The 2003 Membership Notices have been mailed. Please renew your membership now. To renew electronically, please visit our website at [www.cms.math.ca](http://www.cms.math.ca)

## ADHÉSION À LA SMC

Les avis d’adhésion 2003 ont été postés. Veuillez renouveler votre adhésion maintenant. Vous pouvez aussi renouveler au site web [www.smc.math.ca](http://www.smc.math.ca)

## Réunion d'hiver de la SMC

### Hôtel Marriott Ottawa

### Ottawa (Ontario)

### 8-10 décembre 2002

#### Première annonce

Au nom de l'Université d'Ottawa, le Département de mathématiques et de statistique souhaite cordialement la bienvenue à tous les participants à la Réunion d'hiver 2002 de la Société mathématique du Canada (SMC).

Les membres du département sont heureux de recevoir encore une fois les participants dans la capitale nationale. Conformément au format habituel, la Réunion comprendra douze symposiums, des communications libres, quatre conférences principales ainsi que les conférences des lauréats des prix Coxeter-James et de Doctorat. De plus, le prix Adrien-Pouliot sera décerné pendant la réunion et une conférence populaire sera donnée par Robert Zuccherato de Entrust.

Toutes les activités au programme et celles qui précèdent la Réunion se dérouleront à l'Hôtel Marriott Ottawa (100, rue Kent) situé au centre-ville à quelques pas de la Colline du Parlement.

Vous trouverez l'information la plus récente sur les programmes, y compris les horaires, à l'adresse Web suivante :

<http://www.smc.math.ca/Reunions/hiver02/>

Vous trouverez les formulaires d'inscription et de réservation d'hôtel dans le numéro de septembre 2002 des *Notes de la SMC*. Ils seront aussi publiés sur notre site Web, tout comme les formulaires électroniques d'inscription et de présentation des résumés.

### Conférence populaire

**Robert Zuccherato** (Entrust)

### Conférenciers principaux

**James Arthur** (Université de Toronto)

**Rene Carmona** (Université Princeton)

**Victor Guillemin** (MIT)

**Maciej Zworski** (Université Berkeley)

### Prix

La **conférence Coxeter-James de la SMC** sera donnée par **Lisa Jeffrey**, de l'Université de Toronto.

De plus, le **Prix de Doctorat** et le **Prix Adrien-Pouliot** seront décernés à la Réunion.

## Symposiums

Le Comité de coordination a organisé des symposiums sur les thèmes qui suivent. Voici la liste préliminaire des conférenciers. Si on est intéressé à faire un exposé comme conférencier invité dans l'un des symposiums, on peut en faire la demande auprès des organisateurs de ce symposium.

### *Mathématiques financières*

(Org: **Luis Seco**, Université de Toronto)

Robert Almgren (Toronto), Abel Cadenillas (Alberta), Tahir Choulli (Alberta), Matt Davison (UWO), Tom Hurd (McMaster), Ali Lavassani (Calgary), Eric Renault (Montréal), Tom Salisbury (York), Dave Saunders (Pittsburgh), Agnes Tourin (McMaster). Tony Ware (Calgary).

### *Éléments finis*

(Org: **Roger Pierre**, Université Laval)

Francois Bertrand (École Polytechnique de Montréal), Yves Bourgault (Ottawa), Alain Charbonneau (UQAH), Kokou Dossou (ICIP, Hull), Mohammed Farhloul (Moncton), Peter A. Forsyth (Waterloo), André Fortin (GIREF, Laval), Robert Guenette (GIREF, Laval), P.D. Minev (Alberta), Dominique Pelletier (École Polytechnique de Montréal), Leila Slimane (GIREF, Laval), Azzedine Soulaïmani (École de technologie supérieure).

### *Histoire des mathématiques*

(Org: **Richard O'Lander** et **Ronald Sklar**, Université St. Johns N.Y.)

Michael Barr (McGill), Jonathan Borwein (Simon Fraser), Florin Diacu (Victoria), Hardy Grant (Carleton), Francois Major (Montreal), Michael Makkai (McGill), John McKay (Concordia), Angelo Mingarelli (Carleton), Gregory Moore (McMaster), Christiane Rousseau (Montréal), Luis Seco (Toronto), Walter Whiteley (York), Peter Zvengrowski (Calgary).

### *Algèbres de Lie et Moonshine*

(Org: **Abdellah Sebbar** et **Erhard Neher**, Université d'Ottawa)

Bruce Allison (Alberta), Yuri Bahturin (Memorial), Georgia Benkart (Wisconsin-Madison), Nantel Bergeron (York), Stephen Berman (Saskatchewan), Yuly Billig (Carleton), Chris Cummins (Concordia), Drjomir Djokovic (Waterloo), Chongying Dong (California-Santa Cruz) Terry Gannon (Alberta), Yun Gao (York), Haisheng Li (Rutgers), John McKay (Concordia), Adrian Ocneanu (Pennsylvania State), Arturo Pianzola (Alberta), Yoji Yoshii (Wisconsin-Madison), Noriko Yui (Queen's).



*Enseignement des mathématiques:**Maintenant je vois !!!!**Visualisations dynamiques dans l'enseignement des mathématiques au Canada*(Org: **Thomas Steinke**, OCCDSB)

Orateur principal: Walter Whiteley (York).

*Théorie des nombres*(Org: **Damien Roy**, Université d'Ottawa, et **Kenneth Williams**, Université Carleton)

Peter Borwein (Simon Fraser), Douglas C. Bowman (Illinois-Urbana-Champaign), Kwok-Kwong Stephen Choi (Simon Fraser), Henri Darmon (McGill), Chantal David (Concordia), John Friedlander (Toronto), Eyal Goren (McGill), Manfred Kolster (McMaster), Greg Martin (British Columbia), David McKinnon (Waterloo), Yiannis Petridis (City Univ. of New York), Cameron L. Stewart (Waterloo), Jeffrey Lin Thunder (Northern Illinois), Michel Waldschmidt (Paris VI).

*Algèbres des opérateurs*(Org: **Thierry Giordano**, et **David Handelman**, Université d'Ottawa)

Berndt Brenken (Calgary), Ken Davidson (Fields/Toronto), Man Duen Choi (Toronto), George Elliott (Toronto), Nigel Higson (Penn State), Mahmood Khoshkam (Saskatchewan), Claus Koestler (Queen's), Dan Kucerovsky (UNB), Marcelo Laca (Victoria), Jamie Mingo (Queen's), Vladimir Pestov (Ottawa), John Phillips (Victoria), Ian Putnam (Victoria), Roland Speicher (Queen's).

*Équations aux dérivées partielles*(Org: **Victor Ivrii** et **John Toth**, Université de Toronto)

Richard Beals (Yale), Jim Colliander (Toronto), Andrew Comech (North Carolina-Chapel Hill), Walter Craig (McMaster), Alan Greenleaf (Rochester), Peter Greiner (Toronto), Victor Guillemin (MIT), Victor Ivrii (Toronto), Vojkan Jakšić (McGill), Kate Okikiolu (California-SanDiego), Chris Sogge (John's Hopkins), Catherine Sulem (Toronto), John Toth (McGill), Guenter Uhlmann (Washington), Andras Vasy (MIT), Jared Wunsch (SUNY-Stony Brook), Steve Zelditch (John's Hopkins), Maciej Zworski (Berkeley).

*Problèmes mathématiques provenant du monde industriel*(Org: **André Dabrowski**, Université d'Ottawa)

Xiaoyi Bao (Ottawa), Mary Hefford (Santé Canada), Donal Hickey (Ottawa), André Longtin (Ottawa), Rejean Munger (Institut de recherche de l'Hôpital Ottawa - Institut de l'oeil), Michael Rudnicki (Institut de recherche de l'Hôpital Ottawa).

*Théorie des représentations des groupes réels et p-adiques*(Org: **Jason Levy** et **Monica Nevins**, Université d'Ottawa)

Heather Betel (Toronto), Clifton Cunningham (Calgary), Stephen DeBacker (Harvard), Julee Kim (Institute for Advanced Study), Jason Levy (Ottawa), Fiona Mur-naghan (Toronto), Monica Nevins (Ottawa), Alfred Noël (Massachusetts-Boston), Eric Sommers (Massachusetts-Amherst), Yuanli Zhang (Montréal).

*Géométrie symplectique*(Org: **Lisa Jeffrey** et **Eckard Meinrenken**, Université de Toronto)

Anton Alekseev (Geneva), Henrique Bursztyn (Toronto), Rebecca Goldin (George Mason), Megumi Harada (California-Berkeley), Tara Holm (MIT), Yael Karshon (Toronto), Ely Kerman (Toronto), Askold Khovanskii (Toronto), Misha Kogan (Northeastern), Francois Lalonde (Québec-Montréal), Eugene Lerman (Illinois-Urbana-Champaign), David Metzler (Florida), Jonathan Weitsman (California-Santa Cruz), Siye Wu (Colorado-Boulder), Ping Xu (Pennsylvania State), Carmen Young (Fields Institute), Catalin Zara (Yale).

*Théorie et applications des processus ponctuels*(Org: **Gail Ivanoff** et **David McDonald**, Université d'Ottawa)

Francois Baccelli (École Normale Supérieure), Raluca Balan (Sherbrooke), Gail Ivanoff (Ottawa), Reg Kulperger (Western Ontario), David McDonald (Ottawa), Richard Serfozo (Georgia Institute of Technology), Yiqiang Q. Zhao (Carleton).

*Communications libres*(Org. : **à confirmer**)

Nous lançons un appel de communications libres de 15 minutes chacune. Les résumés devront respecter les critères précisés ci-dessous et nous parvenir **au plus tard le 15 octobre 2002**. Nous demandons à chacun de joindre au résumé le formulaire d'inscription et le règlement des frais pertinents. Pour les communications libres, veuillez indiquer la classification de sujet AMS 2000.

## Subventions pour étudiants diplômés

Les étudiants diplômés ont accès à un fonds limité pour financer une partie de leurs frais de déplacement et de séjour. Pour de plus amples renseignements, veuillez communiquer avec le Comité de coordination à l'adresse suivante : [subventions-h02@smc.math.ca](mailto:subventions-h02@smc.math.ca).

Les demandeurs doivent être des étudiants de deuxième ou de troisième cycle inscrits dans une université canadienne ou étrangère. Toute demande de financement doit être accompagnée d'une lettre du superviseur de l'étudiant ou de la personne responsable des études supérieures de son département, dans laquelle il ou elle indiquera le nom de l'étudiant, son domaine et son niveau d'études, en quoi la Réunion sera profitable à l'étudiant, si l'étudiant présentera une communication et si l'étudiant a accès à d'autres sources de financement de son université (bourses, subventions, etc.).

Cette lettre doit parvenir à la SMC avant le **1<sup>er</sup> novembre 2002** et peut être envoyée par courriel ([subventions-h02@smc.math.ca](mailto:subventions-h02@smc.math.ca)). **Les décisions seront annoncées au début de novembre.**

Si une subvention est accordée à l'étudiant, ce dernier se verra rembourser ses dépenses sur présentation du formulaire de remboursement approprié accompagné des reçus originaux.

## Activités sociales

Une **réception** aura lieu le samedi 7 décembre, de 19 h à 21 h, à la salle de bal Victoria Nord de l'Hôtel Marriott Ottawa.

Une **réception pour la conférence populaire** aura lieu avant la conférence de Robert Zuccherato (Entrust). Nous publierons tout nouveau renseignement sur le site Web dès que nous le recevrons.

Le **lunch des participants** se tiendra le dimanche 8 décembre, de 12 h 30 à 14 h, à la salle de bal Victoria Nord/Sud de l'Hôtel Marriott Ottawa. Ce repas est compris dans toutes les catégories d'inscription.

Un **banquet** aura lieu le dimanche 8 décembre, à compter de 19 h 30, à la salle de bal Victoria Nord/Sud de l'Hôtel Marriott Ottawa. Il y aura un service de bar payant à partir de 18 h 30. On peut se procurer des billets pour cette activité au coût de 50 \$ chacun.

Du café et des jus seront servis pendant les pauses.

Un horaire détaillé de toutes les activités sociales et des autres événements est disponible à la page des horaires du site Web.

## Séances de travail

La SMC organisera des séances de travail à l'occasion de cette Réunion.

Le **Comité exécutif de la SMC** tiendra une réunion le vendredi 6 décembre de 18 h à 22 h au Salon Sussex de l'Hôtel Marriott Ottawa.

Le lunch du **Groupe de développement de la SMC** aura lieu de 11 h à 13 h le samedi 7 décembre au Salon Sussex de l'Hôtel Marriott Ottawa.

La réunion du **Conseil d'administration de la SMC** aura lieu de 13 h 30 à 18 h 30 le samedi 7 décembre au Salon Wellington de l'Hôtel Marriott Ottawa.

Un horaire détaillé des séances de travail et des autres événements est disponible à la page des horaires du site Web.

## Exposition

Les kiosques d'exposition seront ouverts dans la Galerie Victoria de l'Hôtel Marriott Ottawa aux heures indiquées.

## Envoi des résumés

Tous les résumés paraîtront dans le programme de la Réunion et seront accessibles sur le site Web : <http://smc.math.ca/Reunions/hiver02/res/>

Les participants peuvent envoyer leur résumé sous forme électronique en suivant les instructions ci-dessous. Il est préférable de remettre les résumés par voie électronique, mais si ce n'est pas possible, vous pouvez utiliser le formulaire standard que vous pourrez vous procurer au Bureau administratif de la SMC, 577, avenue King-Edward, bureau 109, Ottawa (Ontario) Canada K1N 6N5.

Les conférenciers sont priés de remettre leur résumé le plus tôt possible. La date limite est fixée au **15 octobre 2002**. Les organisateurs remercient les conférenciers de bien vouloir respecter cette importante échéance.

**Envoi électronique des résumés :** Pour envoyer votre résumé, rendez-vous à la section des formulaires du site Web de la Réunion : <http://smc.math.ca/Reunions/hiver02/forms.html>

Vous pouvez aussi nous faire parvenir par courriel un fichier comprenant le nom de la séance, le nom du conférencier, son affiliation, son adresse complète, le titre de la conférence et le résumé à l'une des adresses suivantes : [resumes-h02@smc.math.ca](mailto:resumes-h02@smc.math.ca) (conférenciers invités), ou [cl-resumes-h02@smc.math.ca](mailto:cl-resumes-h02@smc.math.ca) (communications libres).

N'oubliez pas de préciser le nom de la séance dans le sujet de votre message. Pour les communications libres, veuillez indiquer la classification de sujet AMS 2000.

**Important – Date limite de remise des résumés : 15 octobre 2002.**

## Inscription

Un formulaire d'inscription paraîtra dans le numéro de **septembre 2002** des *Notes de la SMC*. On peut également se le procurer auprès de la SMC :

Bureau administratif de la SMC, 577, av. King-Edward, bureau 109  
C.P. 450, Succursale A, Ottawa (Ontario) CANADA K1N 6N5  
Téléphone : 613-562-5702, Télécopieur : 613-565-1539  
Courriel : reunions@smc.math.ca

**Vous pouvez aussi vous inscrire sur le Web** au :  
<http://smc.math.ca/Reunions/hiver02/forms.html>

Les frais (en devises canadiennes) sont payables par chèque, VISA ou MasterCard. Les paiements en devises américaines seront acceptés, mais nous vous demandons de contacter votre institution financière pour prendre connaissance du taux de change en vigueur.

**Le paiement doit nous PARVENIR À OTTAWA au plus tard le 1<sup>er</sup> novembre pour que vous ayez droit aux tarifs réduits.** Pour que votre inscription soit traitée avant la Réunion, votre paiement doit nous parvenir au plus tard le 30 novembre.

	Avant le 1 <sup>er</sup> nov	Après le 1 <sup>er</sup> nov
Lunch des participants inclus		
Conférenciers principaux ou primés	\$ 0	\$ 0
Conférenciers	215	215
Organisateurs	145	145
Non-membres	430	560
Membres SMC/AMS/MAA avec subvention	290	375
Membres SMC/AMS/MAA sans subvention	145	190
Frais d'une journée	195	255
Postdocs, retraités	110	145
Enseignant(e)s (élém., second., CÉGEP), étudiant(e)s, sans-emploi	55	70
Banquet (gratuits pour principaux/primés)	50	50

SMC = Société mathématique du Canada  
AMS = American Mathematical Society  
MAA = Mathematical Association of America

## À quoi sert de s'inscrire à l'avance?

Vous vous demandez si vous devriez vous inscrire à l'avance ou le faire sur place? Voici quelques-uns des avantages de la préinscription :

- plusieurs personnes ont droit à une réduction en s'inscrivant avant la date limite pour tarifs réduits (voir section ci-dessus)
- votre nom figure dans la liste Web des participants sur le site Web
- votre trousse d'inscription sera déjà prête à votre arrivée le samedi soir
- vous n'aurez pas besoin de faire la file pour vous inscrire à la première heure dimanche matin
- les billets pour le banquet sont en vente maintenant, mais il pourrait ne plus en rester sur place

Pour ces raisons, nous vous encourageons à vous inscrire à l'avance, soit avant ou après la date limite pour tarifs réduits. Pour vous inscrire à l'avance et profiter des avantages ci-dessus, rendez-vous sur notre site Web et remplissez les formulaires appropriés .

## Politique de remboursement

Les participants qui désirent annuler leur inscription doivent en aviser le bureau administratif de la SMC **par écrit avant le 30 novembre** pour se voir rembourser leurs frais d'inscription (moins 40 \$). Les participants dont les communications libres n'auront pas été acceptées seront remboursés intégralement sur demande.

## Êtes-vous admissible à une adhésion gratuite à la SMC?

Les membres de l'AMS et de la MAA qui s'inscrivent à une Réunion semestrielle de la SMC et qui ne sont pas membres de la SMC sont admissibles à une année d'adhésion gratuite à la SMC (offre unique).

Si vous êtes admissible, présentez-vous au kiosque de la SMC pour remplir une demande d'adhésion. Veuillez fournir une preuve d'adhésion à l'AMS ou à la MAA. Cette offre est destinée aux nouveaux membres seulement.

## Hébergement

Il est fortement recommandé aux participants de réserver à l'avance. Des chambres ont été retenues aux endroits ci-dessous jusqu'aux dates précisées. Après ces dates, les hôtels ne prendront vos réservations que s'il reste des chambres. Les tarifs sont par nuit, par personne, et sont indiqués en devises canadiennes.

### Hôtel Marriott Ottawa

100, rue Kent, Ottawa (Ontario) Canada K1P 5R7

Arrivée : 15 h; départ : 13 h

Taxes applicables : TPS (7 %), taxe d'hôtel (5 %)

**Réserver au plus tard le 6 novembre 2002**

**Code de groupe : CMS Winter Meeting 2002**

Téléphone : 613-238-1122 sans frais : 800-853-8463

Télécopieur : 613-783-4238

courriel : [genevieve.harding@ottawa.marriott.com](mailto:genevieve.harding@ottawa.marriott.com)

stationnement : 15 \$ la nuit, 20 \$ avec service voiturier (entrées et sorties illimitées)

Tarifs : 128 \$, 1 ou 2 personnes

(Gratuit pour les enfants de moins de 20 ans

qui partagent la chambre de leurs parents.)

### Travelodge Hotel by Parliament Hill

402, rue Queen, Ottawa (Ontario) Canada K1R 5A7

Arrivée : 15 h; départ : 12 h

Taxes applicables : TPS (7 %), taxe d'hôtel (5 %)

**Réserver au plus tard le 6 novembre 2002**

**Code de groupe : Cdn Mathematical Society**

Téléphone : 613-236-1133 sans frais : 800-578-7878

Télécopieur : 613-236-2317 courriel : [salestlph@whgca.com](mailto:salestlph@whgca.com)

Stationnement: 9 \$ la nuit + taxes (entrées et sorties illimitées)

Tarifs : 89 \$, standard, 1 ou 2 personnes

105 \$, deluxe, 1 ou 2 personnes

15 \$ additionnels si un lit pliant est requis

(gratuit pour les enfants de moins de 18 ans qui partagent la chambre de leurs parents)

Vous êtes priés de faire vos propres réservations. Les tarifs préférentiels s'appliquent aussi aux deux jours qui précèdent et qui suivent la Réunion. S'il y a lieu et pour que votre chambre soit prise dans le groupe de chambres réservées, veuillez donner le code de groupe.

**Réservations et annulations :** À l'Hôtel Marriott Ottawa, pour chaque réservation, l'hôtel doit recevoir un dépôt équivalant à la première nuit payé par chèque, une carte de crédit reconnue ou une lettre de garantie acceptable. Tout dépôt est remboursable sans pénalité si une personne annule sa réservation avant 18 h la date d'arrivée. Autrement, le dépôt en entier ne sera pas remboursé. Si une personne ne se présente pas à l'hôtel, on lui facturera la première nuit de sa réservation.

Au **Travelodge by Parliament Hill**, les chambres sont réservées jusqu'à 18 h le jour de l'arrivée, à moins que la réservation ne soit garantie par le paiement d'une nuit ou par une carte de crédit reconnue. Si une réservation garantie n'est pas annulée avant 18 h la date d'arrivée prévue, on facturera au client la première nuit.

## Services de garde

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

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

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

Nous publierons tout nouveau renseignement sur le site Web dès que nous le recevrons.

## Déplacements

**Ville d'Ottawa :** La capitale nationale a beaucoup à offrir en hiver comme en été. Le festival des lumières sur la Colline du Parlement est au nombre des événements de décembre à ne pas manquer. Nous espérons que vous en profiterez pour amener votre famille, découvrir la ville, magasiner et visiter quelques-uns des plus beaux attraits de la capitale.

Vous trouverez des renseignements détaillés sur l'Université d'Ottawa et la ville d'Ottawa (renseignements

touristiques, température et climat locaux, cartes de la ville et des attractions touristiques, etc.) sur les sites Web suivants :

<http://www.uottawa.ca/>

<http://www.ottawa-conventions.com/>

[http://weatheroffice.ec.gc.ca/canada\\_f.html](http://weatheroffice.ec.gc.ca/canada_f.html)

**Stationnement :** Le stationnement à l'Hôtel Marriott Ottawa est disponible pour 15 \$ la nuit, 20 \$ avec service voiturier (entrées et sorties illimitées).

Au Travelodge by Parliament Hill, vous pouvez stationner pour 9 \$ la nuit (entrées et sorties illimitées).

## Remerciements

Nous remercions les organismes suivants de leur soutien financier :

- le Département de mathématiques et de statistique de l'Université d'Ottawa
- le Comité du programme national (programme conjoint du Centre de recherches mathématique, de l'Institut Fields et de l'Institut Pacific)

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

## Comité de coordination

### Programme

*Président et coordonnateur :* Daniel Daigle (Ottawa)

André Dabrowski (Ottawa), Thierry Giordano (Ottawa), David Handelman (Ottawa), Gail Ivanoff (Ottawa), Victor Ivrii (Toronto), Lisa Jeffrey (Toronto), Jason Levy (Ottawa), David McDonald (Ottawa), Eckard Meinrenken (Toronto), Erhard Neher (Ottawa), Monica Nevins (Ottawa), Richard O'Lander (St. Johns N.Y.), Roger Pierre (Laval), Damien Roy (Ottawa), Abdellah Sebbar (Ottawa), Luis Seco (Toronto), Ronald Sklar (St. Johns N.Y.), Thomas Steinke (OCCDSB), John Toth (Toronto), Kenneth Williams (Carleton), Graham Wright (SMC, d'office).

### Logistique

*Présidents du comité local :*

Walter D. Burgess (Ottawa) et André Dabrowski (Ottawa)

Monique Bouchard (SMC, d'office).

**CANADIAN MATHEMATICAL SOCIETY  
REGISTRATION FORM - CMS WINTER MEETING 2002**  
December 8-10, 2002 - Ottawa Marriott Hotel, 100 Kent Street, Ottawa, Ontario  
To register electronically, go to <http://www.cms.math.ca/Events/winter02/forms.html>

**Deadlines:** Pre-registration for reduced rates payment by November 1  
Arrival of payments to be processed before the meeting November 30  
Cancellation (refund less \$40 penalty) November 30

LASTNAME:	FIRSTNAME:	CMS ID #
Institution (for badge):		
Mailing Address:		Voluntary Information:
<input type="checkbox"/> home OR		<input type="checkbox"/> Male
<input type="checkbox"/> office		<input type="checkbox"/> Female
Telephone:		Email:
Arrival date:		Departure date:
PLEASE MAKE YOUR HOTEL RESERVATIONS. DEADLINE : November 6		
Where will you be staying? <input type="checkbox"/> Ottawa Marriott <input type="checkbox"/> Travelodge <input type="checkbox"/> Other hotel <input type="checkbox"/> No housing required		
Special diets : <input type="checkbox"/> Kosher <input type="checkbox"/> Vegetarian <input type="checkbox"/> Diabetic <input type="checkbox"/> Low fat <input type="checkbox"/> Milk allergy <input type="checkbox"/> Nut allergy <input type="checkbox"/> Other:		
I am : <input type="checkbox"/> a Plenary Speaker <input type="checkbox"/> a Prize Recipient <input type="checkbox"/> a Session Speaker <input type="checkbox"/> an Organizer <input type="checkbox"/> a delegate		
SESSION:		ABSTRACT DEADLINE : OCT 15
<input type="checkbox"/> I would like to deliver a contributed paper.		
CONTRIBUTED PAPER DEADLINE (ABSTRACT & REGISTRATION) : OCT 15		
Please remember, we cannot consider the contributed paper abstracts until registration fees are received.		
TO SUBMIT YOUR ABSTRACT, GO TO <a href="http://www.cms.math.ca/Events/winter02/forms.html">http://www.cms.math.ca/Events/winter02/forms.html</a>		
Memberships: <input type="checkbox"/> CMS <input type="checkbox"/> CAIMS <input type="checkbox"/> CORS <input type="checkbox"/> CSHPM <input type="checkbox"/> SSC <input type="checkbox"/> AMS <input type="checkbox"/> MAA <input type="checkbox"/> SIAM <input type="checkbox"/> AWM		
(check all that apply) <input type="checkbox"/> University professor <input type="checkbox"/> Elementary teacher <input type="checkbox"/> High school teacher <input type="checkbox"/> College teacher		
<input type="checkbox"/> CEPEG teacher <input type="checkbox"/> Student <input type="checkbox"/> Postdoctoral fellow <input type="checkbox"/> Retired <input type="checkbox"/> Unemployed		
PLEASE INDICATE WHICH SPECIAL OR RELATED EVENT(S) YOU MIGHT BE ATTENDING		
<input type="checkbox"/> Public Lecture		
PLEASE INDICATE WHICH SESSION(S) YOU MIGHT BE ATTENDING		
<input type="checkbox"/> Financial Mathematics	<input type="checkbox"/> Finite Elements	<input type="checkbox"/> History of Mathematics
<input type="checkbox"/> Lie Algebras/Moonshine	<input type="checkbox"/> Mathematical Education	<input type="checkbox"/> Number Theory
<input type="checkbox"/> Operator Algebras	<input type="checkbox"/> Partial Diff. Equations	<input type="checkbox"/> Real-World Problems
<input type="checkbox"/> Representation Theory	<input type="checkbox"/> Symplectic Geometry	<input type="checkbox"/> Point Processes
<input type="checkbox"/> Contributed Papers	<input type="checkbox"/> Other :	

Don't forget to purchase your ticket for the banquet !!  
All categories include a ticket to the Delegates' Luncheon.

Please circle one of the registration categories in the chart below	Before Nov 1	After Nov 1
Plenary Speaker / Prize Lecturer	\$ 0	\$ 0
Session Speakers (choose this or other category, whichever is less)	215	215
Organizers (choose this or other category, whichever is less)	145	145
Non-members	430	560
CMS/AMS/MAA members with grants	290	375
CMS/AMS/MAA members without grants	145	190
One-day fee	195	255
Postdocs, retired	110	145
Teachers (K-12, CEGEP), students, unemployed	55	70
Banquet, Sunday, December 8 (free for plenary/prize speakers)	50	50

Registration: \$	#	Banquet = \$	TOTAL \$
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Payment method:  Cheque (payable to CMS)  VISA  Master Card  Purchase Order (attached)

Credit Card #	Expiry:
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If this is your credit card, please print your name as it appears on the card and sign your name. If this is not your card, please print holder's name as it appears on the credit card and have the card holder sign.

Print:	Signature:
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Send completed form with payment to:  
CMS Executive Office, 577 King Edward, POB 450, Station A, Ottawa, ON CANADA K1N 6N5  
Phone: 613-562-5702 FAX 613-565-1539 (Please use the FAX # for credit card payments only.)

**Don't forget to allow ample time for your registration to reach us before the deadline date.**

**SOCIÉTÉ MATHÉMATIQUE DU CANADA  
FORMULAIRE D'INSCRIPTION - HIVER 2002**

8-10 décembre 2002 - Hotel Marriott Ottawa, 100, rue Kent, Ottawa (Ontario)

Vous pouvez aussi vous inscrire sur le Web au <http://www.smc.math.ca/Reunions/hiver02/forms.html>

**Dates importantes:** Pré-inscription à prix réduit paiement avant le 1<sup>er</sup> nov.  
Arrivée de paiement pour traiter l'inscription avant la Réunion 30 nov.  
Annulation - Pré-inscription (remboursement moins 40 \$) 30 nov.

NOM:	PRENOM:	No. SMC
Établissement (pour le "badge"):		
Adresse postale:	Information optionnelle:	
<input type="checkbox"/> domicile OU	<input type="checkbox"/> Homme	
<input type="checkbox"/> travail	<input type="checkbox"/> Femme	
Téléphone:	Courriel:	
Date d'arrivée:	Date de départ:	
VOUS ÊTES PRIÉS DE FAIRE VOS PROPRES RÉSERVATIONS D'HÔTEL. DATE LIMITE : 6 novembre		
Votre choix d'hôtel? <input type="checkbox"/> Marriott Ottawa <input type="checkbox"/> Travelodge <input type="checkbox"/> Autre hôtel <input type="checkbox"/> Aucune réservation nécessaire		
<input type="checkbox"/> Kosher <input type="checkbox"/> Végétarien <input type="checkbox"/> Diabétique <input type="checkbox"/> Pauvre en mat. grasses <input type="checkbox"/> Allergie-lait <input type="checkbox"/> Allergie-noix <input type="checkbox"/> Autre:		
Je suis un: <input type="checkbox"/> organisateur <input type="checkbox"/> conférencier primé <input type="checkbox"/> conf. principal <input type="checkbox"/> conf. de séance <input type="checkbox"/> participant		
<b>DATE LIMITE - CONFÉRENCIER PRIMÉ/PRINCIPAL/DE SÉANCE (RÉSUMÉ) : 15 OCT.</b>		
<input type="checkbox"/> J'aimerais présenter une communication courte.		
<b>DATE LIMITE - COMMUNICATIONS COURTES (RÉSUMÉ ET INSCRIPTION) : 15 OCT.</b>		
Le résumé sera évalué une fois que les frais d'inscription seront reçus.		
<b>PAGE WEB POUR ENVOI DE RÉSUMÉS: <a href="http://www.smc.math.ca/Reunions/hiver02/forms.html">http://www.smc.math.ca/Reunions/hiver02/forms.html</a></b>		
Adhésions: <input type="checkbox"/> SMC <input type="checkbox"/> SCMAI <input type="checkbox"/> SCRO <input type="checkbox"/> SCHPM <input type="checkbox"/> SSC <input type="checkbox"/> AMS <input type="checkbox"/> MAA <input type="checkbox"/> SIAM <input type="checkbox"/> AWM		
Cochez <input type="checkbox"/> Professeur d'université <input type="checkbox"/> Enseignant - élém. <input type="checkbox"/> Enseignant - secondaire <input type="checkbox"/> Enseignant - collège s.v.p. <input type="checkbox"/> Enseignant - Cégep <input type="checkbox"/> Étudiant <input type="checkbox"/> Postdoc <input type="checkbox"/> À la retraite <input type="checkbox"/> Sans-emploi		
<b>VEUILLEZ INDIQUER À QUEL(S) ÉVÈNEMENT(S) VOUS PARTICIPEREZ</b>		
<input type="checkbox"/> Conférence populaire		
<b>VEUILLEZ INDIQUER À QUELLE(S) SÉANCE(S) VOUS PARTICIPEREZ</b>		
<input type="checkbox"/> Mathématiques financières <input type="checkbox"/> Éléments finis <input type="checkbox"/> Histoire des mathématiques		
<input type="checkbox"/> Algèbres de Lie/Moonshine <input type="checkbox"/> Enseignement des maths <input type="checkbox"/> Théorie des nombres		
<input type="checkbox"/> Algèbres des opérateurs <input type="checkbox"/> Équations aux dérivées partielles <input type="checkbox"/> Problèmes mathématiques		
<input type="checkbox"/> Théorie des représentations <input type="checkbox"/> Géométrie symplectique <input type="checkbox"/> Processus ponctuels		
<input type="checkbox"/> Communications libres <input type="checkbox"/> Autre :		

N'oubliez pas d'acheter votre billet pour le banquet !!

Un billet pour le lunch des délégués est inclus dans toutes les catégories d'inscription.

Veillez encercler la catégorie d'inscription choisie	Avant le 1 <sup>er</sup> nov	Après le 1 <sup>er</sup> nov
Conférenciers principaux / conférenciers primés	0 \$	0 \$
Conférenciers (choisissez cette catégorie ou une autre : montant moins élevé)	215	215
Organisateurs(choisissez cette catégorie ou une autre : montant moins élevé)	145	145
Non-membres	430	560
Membres SMC/AMS/MAA avec subvention	290	375
Membres SMC/AMS/MAA sans subvention	145	190
Frais d'une journée	195	255
Postdocs, retraités	110	145
Enseignant (élém., second., Cégep), étudiants, sans-emploi	55	70
Banquet, dimanche 8 décembre (gratuit pour conférenciers principaux / primés)	50	50

Inscription:	\$   #	Banquet =	\$   TOTAL	\$
Mode de paiement:	<input type="checkbox"/> Chèque (au nom de la SMC) <input type="checkbox"/> VISA <input type="checkbox"/> Master Card <input type="checkbox"/> Bon de commande			
Carte de crédit #:	Date d'expiration:			
Veillez inscrire votre nom (tel qu'il apparaît sur votre carte) en lettres moulées et signer.				
Si vous utilisez la carte d'une autre personne, veuillez inscrire le nom du détenteur et le faire signer.)				
Lettres moulées:				Signature:

Veillez envoyer ce formulaire et votre paiement à :

Bureau de la SMC, 577, av. King-Édward, C.P. 450, Succursale A, Ottawa (Ontario) CANADA K1N 6N5

Téléphone: (613) 562-5702 Télécopieur: (613) 565-1539 (A utiliser pour paiements par carte de crédit seulement.)

**N'oubliez pas d'envoyer votre inscription assez longtemps à l'avance pour qu'elle nous parvienne avant la date limite!**

CMS Winter Meeting 2002 - Réunion d'hiver 2002 de la SMC Ottawa Marriott Hotel, Ottawa (Ontario)					
Time	Friday / vendredi December 6 décembre	Saturday / samedi December 7 décembre	Sunday / dimanche December 8 décembre	Monday / lundi December 9 décembre	Tuesday / mardi December 10 décembre
8:00			8 am - 5 pm Exhibits / Expositions Registration / Inscription	8 am - 5 pm Exhibits / Expositions Registration / Inscription	8 am - 5 pm Registration / Inscription
8:30			Opening / Ouverture		
9:00			9:00 - 10:00 PLENARY	9:00 - 10:00 PLENARY	9:00 - 10:00 DOCTORAL PRIZE
10:00			<i>Coffee / café</i>		
10:30					
11:00		11:00 - 1:00 CMS Development Group Luncheon / Lunch du Groupe de développement de la SMC (Sussex Salon)	10:30 - 12:30 SESSIONS	10:30 - 12:30 SESSIONS	10:30 - 12:30 SESSIONS
12:30			12:30 - 2:00 Delegates' Luncheon Lunch des participants	12:30 - 2:00 LUNCH	12:30 - 2:00 LUNCH
1:30					
2:00				2:00 - 3:00 LISA JEFFREY COXETER-JAMES LECTURE	2:00 - 3:00 PLENARY
2:30		1:30 - 6:30 CMS Board of Directors Meeting / Réunion du Conseil d'administration de la SMC (Wellington Salon)	2:00 - 3:30 SESSIONS	<i>Coffee / café</i>	<i>Coffee / café</i>
3:00			<i>Coffee / café</i>		
3:30			4:00 - 5:00 PLENARY	3:30 - 6:00 SESSIONS	3:30 - 6:00 SESSIONS
4:00			5:00 - 6:00 SESSIONS		
4:30					
5:00					
5:30					
6:00					
6:30					
7:00	6:00-10:00 CMS Executive Committee Meeting Réunion du Comité exécutif de la SMC (Sussex Salon)	7:00 - 9:00 RECEPTION Meeting Registration Inscription pour la réunion (Victoria North Ballroom)	6:30 - 7:30 CASH-BAR RECEPTION BAR-PAYANT	7:00 - 7:30 PUBLIC LECTURE RECEPTION	BON VOYAGE HAVE A SAFE JOURNEY
7:30			7:30 - 10:00 BANQUET (Victoria North/South Ballrooms)	7:30 - 8:30 ROBERT ZUCCHERATO PUBLIC LECTURE	

## From the President's Desk

by Christiane Rousseau

This is my first message to you as the President of the Canadian Mathematical Society. Over the past 57 years, thanks to the effort and commitment of hundreds of members of the Canadian mathematics community, the CMS has grown to become a major organization. What's more, our discipline is in better health than it was just a few years ago. With three institutes and BIRS, our research infrastructure is now very well developed, and the scientific programs of these institutions cover a broad spectrum of mathematical science. We have strengthened our ties with industry and defended the role of mathematics in all areas of strategic innovation, and we are now beginning to see our efforts bear fruit. Promoting our discipline to grant organizations is now easier than before. The activities that we have offered to the general public in recent years—particularly during World Mathematical Year 2000—have helped to burnish mathematics' image in the eyes of the media and the public. We have forged new links with educational institutions and we look forward to playing a leadership role in mathematics education in this country.

We must remain vigilant, however, because there are still clouds on the horizon. One concern is what is happening in scientific publications. Our publications revenues fund many of our other activities. If the publications market collapses, we will have to cut budgets for educational programs, electronic services and research activities. Another concern is the number of members of our community who will soon be retiring; we must recruit young people at Canadian universities as new CMS members and convince them to work with us. Over the next few years, the CMS will continue to serve the Canadian mathematics community and to promote our discipline at every opportunity and venue. The remarkable work accomplished by the staff of the CMS has benefited the entire Canadian mathematics community. By building on our strengths, we hope to keep the CMS the same useful tool that has served us so well over the past 57 years.

On behalf of all congress participants, I would like to thank Laval University, which hosted the CMS Summer Meeting, Claude Lévesque, the meeting's scientific chair, Jean-Pierre Carmichael, president of the local organizing committee, and all their teams, as well as the CMS staff. With 400 participants, this was the largest meeting ever held by the CMS, except for the MATH 2000 summer meeting at McMaster, which was organized jointly with several other societies. The meeting featured 14 symposia and culminated in the presentation of an honorary doctorate to Robert Langlands. This ceremony was held at the Museum of Quebec and was followed by a banquet. We also had the pleasure of recognizing the accomplishments of Priscilla Greenwood,

recipient of the Krieger-Nelson Prize, and Edwin Perkins, recipient of the CMS Jeffery-Williams Prize. Quebec City's French flavour permeated the congress, and some of us discovered the pleasure of talking in French with our colleagues from other provinces. In terms of plenary activities, two presentations were given in French, the public lecture by Jean-Marie de Koninck and the plenary address by Robert Langlands. At the banquet, Bernard Hodgson kept the audience laughing in both English and French. A number of students attended the congress and presented papers.

Jonathan Borwein has now completed his term as President of the CMS. On behalf of the Canadian Mathematical Society, it gives me great pleasure to thank him for the wonderful things he has accomplished for the CMS, and for all the work he did for the Canadian mathematics community for so many years, particularly during his term as President. Jonathan Borwein has made his mark in all areas of the CMS's activities: publications, electronic services, education, research, and international affairs. Besides his outstanding work in all these areas, Jonathan Borwein has also worked behind the scenes to make the CMS a better organization: administrative management, office location problems, fundraising to balance budgets, etc. In all these areas, the CMS has profited from his broad perspective on problems and his unstinting efforts to solve them.

Now we are starting a new year. Here are some of our upcoming activities. This will be the first year for the "NSERC-CMS Math in Moscow" program. On May 16-18, 2003 the National Educational Forum will be held at UQAM in Montreal. The Winter Meeting 2002 will take place in Ottawa and the Summer Meeting 2003 at the University of Alberta in Edmonton. We just learnt the results of the Reallocations exercise at NSERC. In this operation each GSC and program contributed 10% of its budget to a common pot. The money was then reallocated between the different programs and GSCs. The GSCs 336 and 337 have contributed \$979,000 and have received \$1,075,000, i.e. about 9.5% more than what they have contributed. The three Institutes nearly got the parity and the money contributed to the Institutes increased significantly. These results show the vitality of our discipline. It also shows our success in making its importance recognized: indeed more than half the GSCs lost money in the Exercise. We are very thankful to our colleagues who prepared the application of the mathematical community in the Reallocations exercise.

I look forward to working over the next two years with you, the members of the Canadian mathematics community and the staff of the CMS, as we strive to promote the advancement of mathematical sciences.



## Math in Moscow Scholarships Update

NSERC and the CMS are pleased to announce a new joint scholarship programme. Beginning this fall, three scholarships of \$10,000 each will be awarded annually to support three Canadian students registered in a mathematics or computer science program to attend a semester at the Math in Moscow program (undergraduate or beginning master's level).

One scholarship will be awarded in the fall competition (application deadline September 30) and two scholarships in the spring competition (deadline April 15). Details can be found at [www.smc.math.ca/bulletins/Moscow\\_web.html](http://www.smc.math.ca/bulletins/Moscow_web.html)

The Independent University of Moscow (IUM) is a small, elite institution of higher learning focusing primarily on mathematics. It was founded in 1991 at the initiative of a group of well known Russian research mathematicians, who now comprise the Academic Council of the University. Professors Pierre Deligne and Robert McPherson, both permanent members of the Institute for Advanced Study in Princeton, also played crucial roles in founding the Independent University. The American Mathematical Society has had a special (although not official) relationship with the institution as well, arranging for help in obtaining publications and helping financially during one especially difficult period.

Recently, the Independent University of Moscow created a new program, MATH in MOSCOW, offering foreign students (undergraduate or beginning graduate students specializing in mathematics and/or computer science) the chance to spend a semester in Moscow studying within its MATH in MOSCOW program ([www.mccme.ru/mathinmoscow](http://www.mccme.ru/mathinmoscow)). The courses are taught in English. Besides mathematics courses, a Russian language course and a course in the history of Moscow (in English) will be proposed. For those who know enough Russian, courses in Russian literature and history (in Russian) will also be available. The list of math courses mentioned above includes two courses in theoretical computer science.

The MATH in MOSCOW program provides a fifteen-week-long research experience for students, not only with other mathematically talented and highly motivated undergraduates but also with some of the world's leading mathematicians. Students will be learning mathematics in an environment similar in spirit to that of an NSERC summer scholarship, but with much broader representation from a world-class international community. There are few better ways to prepare our most talented undergraduates for further work in mathematics.

*(PRESIDENT—continued from page 1)*

Pendant les prochaines années la Société mathématique du Canada va continuer à se mettre au service de la communauté mathématique canadienne et à promouvoir notre discipline dans tous les milieux et forums. Le personnel de la Société mathématique du Canada fait un travail remarquable qui profite à toute la communauté mathématique canadienne. En construisant sur nos forces nous pouvons espérer maintenir en la Société mathématique du Canada l'outil qui nous a si bien servis depuis 57 ans.

Au nom de tous les congressistes il me fait plaisir de remercier l'Université Laval qui a accueilli la réunion d'été de la SMC, Claude Lévesque, président scientifique de la réunion, Jean-Pierre Carmichael, président du comité local d'organisation et leurs équipes ainsi que le personnel de la SMC. Avec 400 participants cette réunion est la plus nombreuse que la société ait organisée si l'on exclut la réunion d'été MATH 2000 à McMaster que nous avons organisée en partenariat avec d'autres sociétés. La réunion a compté 14 sessions spéciales et a culminé avec la remise d'un doctorat honoris causa à Robert Langlands: la cérémonie a eu lieu au musée du Québec et a été suivie du banquet. Nous avons eu le plaisir d'honorer Priscilla Greenwood, récipiendaire du Prix Krieger-Nelson et Edwin Perkins, récipiendaire du Prix Jeffery-Williams de la Société. Le caractère français de la ville de Québec a déteint sur le congrès si bien que plusieurs

d'entre nous ont découvert le plaisir de tenir une conversation en français avec nos collègues des autres provinces. Au niveau des activités plénières deux conférences ont eu lieu en français, soit la conférence publique de Jean-Marie de Koninck et la conférence plénière de Robert Langlands. Au banquet nous avons pu apprécier que Bernard Hodgson maniait l'humour aussi bien en anglais qu'en français. Plusieurs étudiants sont venus au congrès et ont présenté des communications. Jonathan Borwein vient de terminer son mandat à la présidence de la SMC. Au nom de la Société mathématique du Canada il me fait plaisir de le remercier pour le travail remarquable qu'il a accompli pour la SMC et la communauté mathématique canadienne depuis de nombreuses années et plus spécialement pendant sa présidence.

Jonathan Borwein s'est investi dans tous les dossiers de la SMC: publications, services électroniques, éducation, recherche, affaires internationales. Outre son action remarquable dans ces dossiers Jonathan Borwein a travaillé dans l'ombre à la santé de la SMC: gestion du personnel administratif, problèmes de locaux pour la SMC, levée de fonds pour équilibrer les budgets, etc. Dans chaque cas la SMC a pu profiter de sa vision globale des problèmes et de son travail acharné pour les résoudre.

Nous commençons une nouvelle année. Voici quelques-uns de nos activités spéciales. Ce sera la première année du programme "CRSNG-SMC Math à Moscou". Les 16-

18 mai 2003 se tiendra à l'UQAM le Forum national sur l'enseignement mathématique. La réunion d'hiver 2002 se tiendra à Ottawa et la réunion d'été 2003 à l'Université d'Alberta à Edmonton.

Au moment de mettre sous presse nous venons d'apprendre les résultats et programme de l'exercice de réallocation au CRSNG. Dans cet exercice chaque comité contribuait 10% de son enveloppe. La somme ainsi collectée était ensuite redistribuée entre les différents comités. Les comités 336 et 337 ont ainsi contribué 979,000\$ et se sont vus attribués 1,075,000\$, soit environ 9.5% de plus que ce qu'ils ont contribué. Les trois Instituts ont obtenu la quasi-

parité. De plus leur enveloppe globale a connu une très forte hausse. Ces résultats témoignent, non seulement de la vitalité de notre discipline mais de notre capacité comme communauté à faire reconnaître son importance: en effet plus de la moitié des comités ont vu leur enveloppe baisser. Nous sommes reconnaissants à nos collègues qui ont préparé le dossier de défense des mathématiques dans l'opération de réallocation.

Je me réjouis de travailler pendant les deux prochaines années avec vous, membres de la communauté mathématique canadienne et membres du personnel de la SMC, à l'avancement des sciences mathématiques.

## CALL FOR NOMINATIONS / APPEL DE CANDIDATURES

Various committees of the CMS have been served throughout the years by many members of the Canadian mathematical community on a voluntary basis. The Society is grateful to all its members for their time and generous support.

For the year 2003, we will have vacancies on the following committees:

- Advancement of Mathematics Committee
- Education Committee
- Electronic Services Committee
- Endowment Grants Committee
- Finance Committee
- International Affairs Committee
- Mathematical Competitions Committee
- Publications Committee
- Research Committee
- Student Committee
- Committee On Women in Mathematics

We warmly invite nominations for memberships on these committees by members of the Canadian mathematical community. Nominations should include full addresses, e-mail addresses and a brief rationale and be submitted to the address below **by October 1, 2002**.

Descriptions of roles of the above committees may be found in <http://www.cms.math.ca/Docs/Terms/TofRef/>.

Chair of Nominating Committee  
Canadian Mathematical Society  
577 King Edward, Suite 108  
POB 450, Station A  
Ottawa, Ontario CANADA K1N 6N5  
[chair-nomc@cms.math.ca](mailto:chair-nomc@cms.math.ca)

Un grand nombre de membres de la Société mathématique du Canada ont siégé, à titre bénévole, aux divers comités de la Société au fil des ans. La Société remercie toutes ces personnes de leur temps et de leur générosité.

Pour l'année 2003, nous aurons des postes vacants au sein des comités suivants :

- Comité pour l'avancement des mathématiques
- Comité d'éducation
- Comité des services électroniques
- Comité d'attribution des bourses du fonds de dotation
- Comité des finances
- Comité des affaires internationales
- Comité des concours mathématiques
- Comité des publications
- Comité de recherche
- Comité des étudiants
- Comité des femmes en mathématiques

Nous encourageons fortement les membres de la communauté mathématique canadienne à proposer des candidats aux comités ci-dessus. Les mises en candidature doivent comporter l'adresse postale complète du candidat et son adresse de courriel, ainsi qu'une brève justification de la mise en candidature, et parvenir à l'adresse ci-dessous au plus tard le **1er octobre 2002**.

Vous trouverez la description des rôles des comités susmentionnés au <http://www.cms.math.ca/Docs/Terms/TofRef/> (anglais seulement).

Président du Comité des mises en candidature  
Société mathématique du Canada  
577 King Edward, Suite 108  
CP 450, Succursale A  
Ottawa (Ontario) CANADA K1N 6N5  
[pres-nomc@smc.math.ca](mailto:pres-nomc@smc.math.ca)

## REALLOCATION AND MATHEMATICS

by Richard Kane, Chair, Mathematics Steering Committee

### (I) Leadership Support Supplements

This refers to Proposal A, intended to provide “additional funds to promote structured initiatives by recognized leaders”. This money will be awarded selectively to augment the Research Grants of selected individuals.

Implementation of this supplement program is complicated by the fact that the amount awarded is considerably less than the amount requested (\$1M) in the proposal submitted to NSERC. The available funding will only support a much more limited program than was envisaged. The question of implementation is already being discussed by NSERC and the chairs of the Mathematics GSC’s. (e.g. average amount to be awarded? one time competition covering grantees from all four years of the grant cycle?) Since this funding covers the next four funding competitions, decisions will have to be made quickly and then communicated, so that those applying for renewal in the fall will know the rules.

### (II) Guide to Reallocation Information

The NSERC website contains comprehensive information about the Exercise and its outcome. This information can be accessed via the NSERC main page [www.nserc.ca/index.htm](http://www.nserc.ca/index.htm). The actual site for obtaining information is

[www.nserc.ca/programs/real2000-e.htm](http://www.nserc.ca/programs/real2000-e.htm)

The following items are particularly relevant.

(1) For the overall NSERC Report on the 2002 Reallocation Exercise go to website

[www.nserc.ca/programs/real2000/report\\_final\\_e.htm](http://www.nserc.ca/programs/real2000/report_final_e.htm)

(2) For a clear table listing all the results of Reallocation go to website

[www.nserc.ca/programs/real2000/annex\\_a\\_e.htm](http://www.nserc.ca/programs/real2000/annex_a_e.htm).

(3) For a summary of the funding proposals submitted by the various disciplines go to website

[www.nserc.ca/programs/real2000/annex\\_b\\_e.htm](http://www.nserc.ca/programs/real2000/annex_b_e.htm)

(4) For the complete submissions of the various disciplines go to website

[www.nserc.ca/programs/real2000/subs\\_e.htm](http://www.nserc.ca/programs/real2000/subs_e.htm)

(5) For the comments of the Reallocation Committee on the discipline submissions go to website

[www.nserc.ca/programs/real2000/feedback\\_e.htm](http://www.nserc.ca/programs/real2000/feedback_e.htm)

### (III) The Mathematics Submission

The following is a brief summary of the outcome of Reallocation from the vantagepoint of Mathematics. This is the third such Reallocation process. All NSERC Grants Selection Committees, as well as the institutes funded by the Research Grants program, (CITA, CRM, Fields Institute, PIMS) contributed 10% of their NSERC budgets to a pot for redistribution. The money was awarded by the Reallocation Committee on the basis of funding proposals submitted by the various disciplines. In a number of cases, two GSC’s combined

to make a common submission. This was the case for the two Mathematics GSC’s. The Mathematics Steering Committee has a website [www.math.ualberta.ca/nserc/](http://www.math.ualberta.ca/nserc/)

Each discipline submission was expected to satisfy the following format. (1.) A vision for the discipline in Canada, presented in an international context. (2.) Strategy for the future development of the discipline. (3.) Specific practical proposals to implement the strategy over the four year period 2003-2006. (4.) Consequences of no reallocated funds. (5.) Implementation of the last exercise.

It is clear from the comments of the Reallocation Committee on the various submissions that one ignored this format at one’s own peril. It was crucial to present a clear “vision” and to develop a strategy with funding proposals strongly connected to the vision.

The three Mathematics Institutes each made their own independent submissions. However, the three Institute Directors were also members of the Mathematics Steering committee and helped prepare that document as well.

The Mathematics submission contained three (ranked) funding proposals. The proposals were:

**PROPOSAL A:** Additional funds to promote structured initiatives by recognized leaders in the community during the period 2003-2007; this requires \$50K for each of 20 leaders, amounting to \$1M per year.

**PROPOSAL B:** Additional funds to enhance the research and training capabilities of emerging leaders during the period 2003-2007; this requires \$10K for each of 60 younger researchers, amounting to \$600K.

**PROPOSAL C:** Additional funds for 100 projected new grantees and 40 senior news during the period 2003-2007. This requires \$16.5K for each of 100 new applicants and \$33K for each of 40 senior news, amounting to a total of \$2.97M per year.

### (IV) Reallocation Results

Of the 19 GSC submissions to Reallocation only 6 resulted in increased funding for the disciplines involved. The chart mentioned in Part II above presents a clear picture. With the exception of Electrical Engineering these submissions came from the the Mathematical and Physical Sciences. Mathematics was one of them. The Mathematics GSC’s contributed \$979K to the Reallocation pot and received \$1075 back. The funding was awarded as follows:

Proposal A \$270

Proposal B \$0

Proposal C: \$805

Proposal A was the most difficult one for the Steering Committee to come to grips with. The Reallocation Committee described it as “innovative” and “well received”. One

rationale provided for rejecting Proposal B was that it significantly overlapped Proposal C.

The three Mathematical Institutes were highly praised by the Reallocation Committee, and their combined NSERC funding was increased significantly. They contributed \$247K

to the Reallocation pot and received \$674K in return. All three institutes are now equally funded by NSERC with each receiving \$970K per year. As well, a joint project of the three Institutes with the Statistics community will be funded at \$172K per year.

## 34th CANADIAN MATHEMATICAL OLYMPIAD WINNERS

A total of 81 students from 47 Canadian schools were invited to write the 2002 CMO based upon their performance in the 2001 Canadian Open Mathematics Challenge, the CMS Correspondence Training Programme and other mathematics competitions. Students had to solve five difficult questions during the three hour 2002 CMO examination held on March 27, 2002.

“To be an olympiad winner is a remarkable achievement” said Dr. Daryl Tingley, University of New Brunswick at Fredericton, and Chair of the CMS Mathematical Competitions Committee. “A real benefit of contests like the CMO is the motivation it gives students to explore problems not encountered in a standard school curriculum. It also helps students gain a greater understanding and appreciation of the role of Mathematics in the workplace.”

First Prize and the Sun Life Financial Cup went to Tianyi Han, Woburn Collegiate Institute, Toronto, Ontario. Second Prize went to Roger Mong, Don Mills Collegiate Institute Toronto, Ontario. Third Prize went to Paul Cheng, West Vancouver Secondary School, West Vancouver, British Columbia. Honourable Mentions were awarded to Robert Barrington Leigh, Old Scona Academic High School, Edmonton, Alberta; Olena Bormashenko, Don Mills Collegiate Institute, Toronto, Ontario; Xiaoxuan Jin, Vincent Massey Secondary School, Windsor, Ontario; Timothy Kusa-

lik, Queen Elizabeth High School, Halifax, Nova Scotia; Cornwall Lau, David Thompson Secondary School, Vancouver, British Columbia; Tian Feng, Vincent Massey Secondary School, Windsor, Ontario; Yang Yang, Don Mills Collegiate Institute, Toronto, Ontario.

More than 4,000 students wrote the 2001 Canadian Open Mathematics Challenge and the winners of the 2001 Open and the 2002 CMO were honoured at a CMS Awards Banquet held at the University of Waterloo in June.

The Society receives major support from Sun Life Financial. Other sponsors include: the Ministry of Education, Ontario; the Ministry of Education, Quebec; Alberta Learning; Department of Education, New Brunswick; Department of Education, Newfoundland and Labrador; Department of Education, Northwest Territories; Department of Education Saskatchewan; the Department of Mathematics and Statistics, University of New Brunswick at Fredericton; the Centre for Education in Mathematics and Computing, University of Waterloo; the Department of Mathematics and Statistics, University of Ottawa; the Department of Mathematics, University of Toronto; Nelson Thomson Learning and John Wiley and Sons Canada Ltd..

Problems, solutions and other contest information can be found at: [www.cms.math.ca/Competitions/CMO/](http://www.cms.math.ca/Competitions/CMO/)



Left to right

Mark Heritage, (Head of Mathematics, Woburn Collegiate Institute), Ed Barbeau, (University of Toronto), Stewart Martin, (Sun Life Financial), and Tianyi (David) Han.

*(Steering Committee Report—continued from page 4)*

(ii) the 1998 mathematics submission provided a list of "31 younger researchers at the forefront of exciting emerging fields."

In the past 4 years, the total value of the grants of these young researchers rose more than 50% from \$503K to \$777K; and (iii) providing more money for the support of postdoctoral fellows (PDFs) was an implicit goal of the 1998 funding requests. There has been a striking increase (over 50%) in research grant expenditures on PDFs over the past 3 years (HQP, Table 16), reflecting the additional funding provided for key researchers. Moreover, these expenditures have been leveraged by at least 100% - almost all mathematics PDFs are financed by partnering research funds with other sources.

### **Discipline Dynamics**

Several dynamics in Canadian mathematics have shaped our perception of the precise funding proposals to be pursued. These discipline dynamics are detailed here.

(a) Larger Scale Research and Training: The existence of groups directed towards targeted, very often interdisciplinary, areas of research is familiar to the experimental sciences, but is a new and rapidly expanding phenomenon in mathematics. There are many forces encouraging and shaping such groups, such as:

- the active support of the mathematical institutes or MITACS;
- the growing emphasis on interdisciplinary activity. There is an increasing complexity to research projects having a well-defined mathematical component, resulting in an expanded need for professional expertise and PDF support;
- the surge in university-based labs targeting the private sector; and
- the drive within Canadian universities to define research and training priorities and to establish long-term hiring plans that reflect those priorities.

This phenomenon has had a substantial cumulative effect. Typically, this research format is built around a leader and involves a combination of PDFs, programming and technical assistants, graduate students, university researchers, and visitors. Such groups provide wonderfully stimulating training grounds (and magnets!) for these graduate students and PDFs. This model for the mathematics community is creating a need to finance such leaders at a level beyond that previously available for single individuals.

(b) Demographic Pressures: The current turnover in university faculty is producing a rapid increase in the fraction of university mathematicians who are strong active researchers

and therefore potential NSERC grantees. This rapidly growing strength of the discipline is reflected in the 10% rise in the number of grantees in GSC 336/337 in the past two years (DD, Table 1). The number of new applicants for the past 3 grant competitions (including the present one) are 47, 47, and 52, respectively; these totals include 12, 13, and 23 senior news, respectively. This demographic surge will continue. For example, 42 tenure track positions for mathematicians are advertised for the coming year; 14 of these are at the level of associate professor or higher. The Canada Research Chairs (CRC) program will also have considerable impact on mathematics departments, and hence on GSCs 336/337, in the next few years. A survey of Canadian mathematics departments yields commitments for 31 CRCs over the next 5 years, evenly spread between Tier I and II; 10 CRC positions are presently being advertised. The current 9 CRCs funded through GSC 336/337 have an average grant of over \$41K.

These demographics are wonderful news for Canadian mathematics and its future, but a mixed blessing for GSCs 336/337. An influx of new talent raises serious concern about the ability of these GSCs to provide adequate grants for all of these deserving new applicants over the next few years without seriously under-funding many strong researchers currently receiving grants. The scale of this concern has led us to submit a separate funding proposal for new applicants.

(c) Increased Funding Needs: The funding needs of mathematicians are intensifying. As increasing numbers of mathematicians become involved in larger scale research (e.g., leading an active group or directing an expensive project), there is an urgent need for significantly more funding. There is also a collective need for more funds. As already noted, a large number of young talented researchers are entering the system; however, it will be shown (see Part 7) that many excellent researchers currently in the system will not be leaving. Funding an increasing number of active researchers requires more money. In addition, current funding levels in mathematics are too low to adequately support the necessary numbers of HQP. The current average grant of \$16,580 (only \$2,250 above what it was a decade ago) (DD, Table 3) supports at most one Masters student per year. Even larger grants in mathematics cannot support a full PDF; the importance of PDFs in mathematical research programs will be emphasized in Part 6. For the information of our referees, we point out that university support of HQP in Canada is typically limited to salary provided by sessional teaching and TA duties. Research grants are a necessary and major component of HQP support.

### **Three Funding Proposals**

We have developed 3 funding proposals based on these current impacts and on future trends in Canadian mathematics. For each, we give the rationale followed by the funding request.

(a) **Leadership Support:** There is a new discipline dynamics in mathematics—group-based research is being carried out on a larger scale than ever before. There are now both very effective established groups and a number of emerging groups, each centered around key individuals. Examples of such groups and their activities are to be provided in Part 3. Added resources are required for existing groups to realize their full potential and for fledging groups to evolve to a more structured level. The local presence of adequate funding is a primary reason for the existence of the existing groups where they have emerged. Notably, the evolution of group activity is more pronounced in Quebec and western Canada.

It is essential for Canadian mathematics that we support and encourage this new type of dynamic and the leaders who are driving it. To do so, GSCs 336/337 must provide targeted funding to recognized researchers who are assuming, or have assumed, a leadership role involving an active group, typically focused on training or a major research project. Such funds would provide resources to allow researchers to carry out a structured initiative. To have a real impact, at least 20 leaders require targeted funds with an average value of \$50K per year, normally awarded for a 4 year period. Important criteria would be demonstrated need and a credible plan for pursuing alternative funding in the case of longer-term activity. Awards could either be part of the normal grant cycle or be dispersed in a special competition.

**Proposal A:** Additional funds to promote structured initiatives by recognized leaders in the community during the period 2003-2007; this requires \$50K for each of 20 leaders, amounting to \$1M per year.

(b) **Emerging Leaders:** There is an impressive number of junior researchers in both traditional and emerging areas with high impact and visibility, and who must be funded in proportion to their activity. These rising stars can be identified as grantees seeking their first or second renewal who have a distinguished research record of at least 6-10 years duration. At that stage, a better assessment of quality and financial needs can be made. These emerging leaders also have growing financial needs, particularly with respect to training of HQP.

**Proposal B:** Additional funds to enhance the research and training capabilities of emerging leaders during the period 2003-2007; this requires \$10K for each of 60 younger researchers, amounting to \$600K.

(c) **New Applicants:** The demographic statistics presented above strongly suggest that the number of grantees in GSCs 336/337 will increase sharply over the next 4 years and that, on a yearly basis, GSCs 336/337 will need to award 35-40 new grants, including at least 10 to senior new applicants.

The current average grant in mathematics for junior new applicants is \$11K. This is a minimal entry grant whose level is ultimately explained by the current low value of mathematics grants. The target should be to award junior newcomers the current average grant in mathematics, namely \$16.5K. The activity level of new grantees easily warrants such entry grants. As a comparison, this is almost exactly the average entry grant over the past 4 years in Computing Science (DD, Table 15), which is a group of beginning researchers with similar funding needs. The funding needs of senior new applicants, because of their consistently high level of activity, will average twice (e.g., \$33K) that of junior new applicants.

We have also used NSERC's own data to analyze the situation regarding new applicants for GSCs 336/337 (see Part 7). The analysis leads to two conclusions:

(1) About 25 new grantees per year will apply to GSC 336/337. This definitely contrasts with the GSC reality of 47, 47, and 52 new applicants in the last 3 competitions. Moreover, NSERC data does not take into account senior new applicants.

(2) The money to become available for redistribution via attrition in GSCs 336/337 will essentially equal the contribution of 10% of GSCs 336/337 budget to the Reallocation Exercise. Without funding provided by Reallocation, GSCs 336/337 will have no funds to finance grants for new applicants, unless funding levels of renewal grantees is significantly reduced.

Taking into account the major divergence between actual empirical data and the estimate arrived at from NSERC data, we are projecting 35 new grantees per year, including 10 senior grantees.

**Proposal C:** Additional funds for 100 projected new grantees and 40 senior news during the period 2003-2007. This requires \$16.5K for each of 100 new applicants and \$33K for each of 40 senior news, amounting to a total of \$2.97M per year.

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## ICM 2002 Medallists

At the opening ceremony of ICM 2002 on August 20th, Chinese President Jiang Zemin and Jacob Palis, President of the International Mathematical Union, awarded Fields Medals to France's **Laurent Lafforgue** and **Vladimir Voevodsky** from Russia. **Madhu Sudan** from the Massachusetts Institute of Technology won the Nevanlinna Prize.

Laurent Lafforgue, of the IHES, Bures-sur-Yvette, was honoured for making major advances in the Langlands Program, which conjectures certain deep connections among number theory, analysis and group representations. Vladimir Voevodsky, IAS Princeton, was cited for developing a new cohomology theory for algebraic varieties. The Nevanlinna Prize recognizes exceptional work in theoretical computer science.

## OBITUARY / AVIS DE DÉCÈS

**Richard Brown 1941-2002**



Colleagues in the Department of Mathematics and Statistics at York University mourn the recent death of well-loved colleague Richard Brown.

Richard Laurence Wilmott Brown, the eldest of three sons of Laurence Wilmott Brown and Vivian Eliza Brown (nee Kyle), was born in Ottawa on September 17, 1941. He was educated at Nepean High School and at Carleton University, where he received an Honours BSc degree in Mathematics in 1962. In the same year he was awarded a Woodrow Wilson Fellowship. A fellow Carleton student remembers him as brilliant and unassuming. He went to Harvard University as a graduate student and obtained his PhD under the supervision of Barry Mazur in 1969 with a thesis entitled "Cobordism, Embeddings, and Fibrations of Manifolds". While at Harvard, Richard married fellow graduate student Julia May Nowlin. Richard and Julia (also a Harvard PhD in Mathematics) became faculty members at York, in 1969 and 1970, respectively. They have been excellent colleagues whose dedication, loyalty and performance showed their commitment to the true purposes of the University.

Richard's early research work was in differential topology. The published results of his thesis were quoted and used by others including R. L. Cohen in his work on the immersion conjecture (Ann. of Math. 122 (1985), 237-328). His early work continues to be of interest and is quoted in reviews of recent articles by Y. Kuramoto, Y. Kuramoto and T. Yasui, and by I. Takata. But it would have been out of character for Richard to continue to exploit a single area. He had the knack of extracting the essence from a mathematical result or application and presenting it in a context that anyone could understand. He would illustrate some concepts in catastrophe theory with a model of wood and elastic. His article entitled "The Klein bottle as an eggbeater", Mathematics Magazine 46 (1973), 244-250 is a good example of his approach. Often he adapted his interests to those of the people around him. For example, a sabbatical leave at the University of Sussex led to a joint paper with John Maynard Smith on competition and body size. In recent years, he contributed to

the conference and periodical literature on the programming language J. This followed on a long-time interest in APL, and tied in with his teaching interests in optimization and theory of interest. During his last sabbatical at CU-Denver, Richard collaborated with three University of Colorado researchers on numerical models in population genetics. He brought the power and efficiency of J to bear on these problems, writing extremely compact and general codes that out-performed then existing ones.

In the 1970s, Richard introduced a course in game theory at the first year level. This proved to be very popular and filled a niche for a number of years at a time when York discouraged early specialization in the undergraduate program. As more applied programs became the norm, Richard quickly adapted to the new needs, making major contributions to courses in operations research, business mathematics and, in general, to computer use in our courses. Never an empire-builder, he did not seek credit for those of his ideas picked up by others, and did not cling to ideas that had fallen out of favour, choosing rather to pursue new ones.

With the increase of computer use in the 1980s, Richard was a constant source of help and advice to his colleagues. He even started a "Computer Users Newsletter" which was just what was needed at the time. He had a fondness for keeping things elegantly simple and loved to show that a clever idea could do the job of some bloated software. He served the Department well as Undergraduate Director during the years 1987-1992. Richard made an enormous contribution to both York and the Canadian Mathematical Society by serving as Chair of the York Local Arrangements Committee for the International Mathematical Olympiad in 1995. This simple title does not do justice to what was an incredibly arduous task extending over a number of years. That Richard was asked to do it was a testimony to the confidence placed in him by his colleagues. The success of this, the only IMO ever hosted by Canada, was directly attributable to his leadership skills in this huge undertaking. Richard was quiet and unpretentious. Better acquaintance revealed that he had some strong views but it was observed that rarely, if ever, did he say an unkind or critical word about anyone. It was as if he knew that life is too short for quarreling and that time should be spent in constructive ways.

In summer 2001, Richard was diagnosed with cancer. He bore his suffering patiently but not passively (he studied the literature on cancer, including current developments) until his death on March 9, 2002. He leaves his wife Julia and three children, Daniel, Amanda and Emily. May their pain be eased by the knowledge that dozens of colleagues and thousands of students cannot fail to have been influenced by his genius, helpfulness and dedication.

## NEWS FROM DEPARTMENTS

### Acadia University, Wolfville, NS

Appointments: Nancy Clarke (Assistant Professor, tenure track, Graph Theory, July 2002), Jianan Peng (Assistant Professor, tenure track, Statistics, July 2002), Holger Teismann (Assistant Professor, tenure track, Differential Equations, July 2002) Marco Pollanen (Assistant Professor, fixed term, Probability, July 2002).

Retirements: Vincent Leung (retired June 30, 2002), who taught in the department for 35 years; Jag Chawla, (June 2002) a statistician who joined the department in 1986; Michael Nutt, (June 2002), who joined Acadia in 1975.

Visitors: R. Shonkwiler, USA (Georgia Tech), Mathematical Biology, Stochastic Optimization, Parallel Processing will be a visiting Professor in the Fall term 2002; S. Kang, Canada (Toronto), Biostatistics, McGill University, Montreal.

Other News: Paul Cabilio has returned as Head.

### Dalhousie University, Halifax, NS

Award: Matiur Rahman has received an "Eminent Scientist" medal, awarded by the Wessex Institute of Technology (UK) for outstanding contributions to fluid mechanics. It was presented at the Fourth International Conference on Advances in Fluid Mechanics held at Ghent, Belgium in May.

### McGill University, Montreal, QC

Appointments: Antony Humphries (Associate Professor, numerical analysis, July 2002); Alexei Miasnikov (Professor and CRC Chair, group theory, July 2002); Ravi Ramakrishna (Associate Professor, number theory, July 2002); Russell Steele (Assistant Professor, Statistics, July 2002).

Promotions: Eyal Goren (Associate Professor with tenure, June 2002); Sherwin A. Maslowe (Emeritus Professor, September 2002).

Awards: Henri Darmon (NSERC Stacie Fellowship); Michael Makkai (Thompson award for excellence in graduate supervision and teaching).

### Memorial University of Newfoundland, St. John's, NF

Promotions: David Pike (Associate Professor, September 2002); Xiao-qiang Zhao (Associate Professor, September 2002); Xingfu Zou (Associate Professor, September 2002).

Tenure: Serpil Kocabiyik (September 2002).

Retirements: Roland Eddy (August 2002); Bruce Shawyer (August 2002); Sankatha Singh (August 2002).

Awards/Distinctions: Xingfu Zou, Young Innovators Award 2002.

### Université Laval, Québec, QC

Promotion: Michel Fortin (Emeritus Professor, June 2002).

### University College of Cape Breton, Sydney, NS

Appointment: George Chen (Lecturer, September 2001). Promotion: Edmund Rudiuk (Associate Professor, July 2001). Retirement: Tat Ngai (June 2002). Other News: Douglas Grant became Chair of the Department of Physical and

Applied Sciences (which includes Mathematics) for the period July 2001 to June 2003.

### University of British Columbia, Vancouver, BC

Appointments: Ailana Fraser (Assistant Professor, Differential Geometry, July 2002); Alexander Holroyd (Assistant Professor, Probability, July 2002); Rachel Kuske (Associate Professor, Industrial Applied Mathematics, July 2002); Vlada Limic (Associate Professor, Probability, July 2002); Jozsef Solymosi (Assistant Professor, Probability, Combinatorics, July 2002); Tai-Peng Tsai (Assistant Professor, Partial Differential Equations, July 2002); Stephanie van Willigenburg (Assistant Professor, Discrete Mathematics, July 2002). Promotions: Jim Bryan (Associate Professor with Tenure); Michael Doebeli (Associate Professor with Tenure); Izabella Laba (Tenure).

Resignations: Changfeng Gui (June 30, 2002).

Retirements: An Ton Bui (June 30, 2002).

Awards and Distinctions: Priscilla Greenwood (Professor Emeritus, 2002 Krieger-Nelson Prize); Leah Keshet (Poster awards at MITACS AGM (May 2002) and Faculty of Science Achievement Award 2002); Izabella Laba (University Faculty Award 2000-2005, Faculty of Science Achievement Award 2002); Greg Martin (Lester R. Ford Award from AMS, June 2002); Edwin Perkins (2002 Jeffery-Williams Prize Lecture, 2001-02 Science Teaching Award); Vinayak Vatsal (Alfred P. Sloan Research Fellow 2002-2004); Ailana Fraser (NSERC University Faculty Awards 2002); Stephanie van Willigenburg (NSERC University Faculty Awards 2002).

Visitors: Martial Agueh (USA, Calculus of Variations, (Sept.2002-Aug.2003); Kevin Buhr (USA, Probability, Jan.2002-Dec.2003); Temeur Chaolu (China, Symmetries of Partial Differential Equations, March 2002-March 2003); Jaydeep Chipalkatti (Canada, Algebraic Geometry, Sept.2002 - Aug.2004); Nima Geffen (Israel, Fluid dynamics, June 2002 - June 2003); Hamidani Hamideh (Iran, Probability, Aug.2002 - July 2003); Kiumars Kaveh (Canada, Algebraic Geometry, Sept.2002 - Aug.2004); Euiwoo Lee (Korea, Mathematical Biology, Aug 2002- Aug 2003); Sheng Liu (China, Partial Differential Equations, June 2002-Dec.2002); Nathaniel Newlands (Canada, Mathematical Biology, April 2002-April 2003); Michael Novak (Canada, Soil Physics, Sept.2002-Dec.2003); Changzheng Qu (China, Symmetry Groups, Sept.2002 - Aug.2003); Yanxia Ren (China, Markov Process, July 2002 - Dec.2002); Ramajayam Sahadevan (India, Nonlinear Differential and Difference Equations, Sept.2002-Dec.2002); Akira Sakai (Japan, Mathematical Physics, Sept.2000 - Dec.2002); Joern Sass (Germany, Mathematical Finance, Oct.2001 - July 2003); Alexander Schied (Germany, Financial Mathematics, July 2002-Sept.2003); Nikolaus Vonessen (USA, Algebra, June 2002-Aug. 2003);



Zhenya Yan (China, Nonlinear Partial Differential Equations, Sept.2002-Aug.2003); Zhenbu Zhang(USA, Nonlinear parabolic and elliptic equations, Sept.2002-Aug.2003).

#### **University of Western Ontario, London, ON**

Appointments(tenure stream): Graham Denham (Assistant Professor, algebraic combinatorics, January 2002); Nicole Lemire (Assistant Professor, NSERC University Faculty Award, July 2002).

Promotion: David Riley (Associate Professor, tenure, July 2002).

Postdoctoral Fellows: Kristine Bauer (Ph.D. Univ. of Illinois, homotopy theory, January 2003); Oliver Roendigs (Ph.D. Bielefeld, homotopy theory, algebraic geometry, July 2002). Andrew Richardson (Ph.D. Univ. of Illinois, commutative algebra, July 2002).

Awards/Distinctions: Dan Christensen (Government of Ontario Premier's Research Excellence Award, 2001).

Visitors: M. Fiali (Univ. of Oulu, Finland, Analysis, Aug.-Dec.2001); P. Hajac (Univ. of Munich, Germany, Non-commutative Geometry, March 2002); R. Laubenbacher (Virginia Bioinformatics Institute, USA, Homotopy Theory, Computer Science, March 2002); P. Paramonov (Moscow State University, Complex Analysis, May-June 2002); W. Raskind, Univ. of Southern California, Algebraic Geometry, April 2002); A. Sedletski, Moscow State University, Russia, Complex Analysis, May-June 2002); P. Shumyatski, Univ. of Brasilia, Brazil, Non-commutative Algebra, January 2002); R. Sigurdsson (Univ. of Iceland, Complex Analytic Geometry, Oct.-Nov.2001); B. Toen, Univ. de Nice, France, Algebraic Geometry, Homotopy Theory, April-May 2002).

Other News: Vladimir Voevodsky (IAS, Princeton) was the speaker in the Department's annual Distinguished Lecture Series, April 25-26, 2002; The University of Western Ontario became a Principal Sponsoring University for the Fields Institute in 2001, and has recently upgraded its annual contribution to Fields to accommodate an expanded level of shared activity in research and training. This activity includes the running of Fields Institute programs at UWO. The first of these will be a program entitled "Applied Homotopy Theory" to be held in the Department of Mathematics at UWO during the month of September, 2003 under the direction of Rick Jardine and Dan Christensen. This program will involve long term visits by G. Carlsson (Stanford), P. Goerss (Northwestern) J. Morava (Johns Hopkins) and F. Morel (Paris VII), and there will be a 5 day conference near the end of the month. Concordia University, Montreal, Québec

Appointments: A. Sen (Assistant Professor, Statistics,

July 2002); A. Iovita (Associate Professor, January 2003). Promotions: J. Garrido (Professor, June 2002); D. Korotkin (Associate Professor, June 2002).

#### **University of Guelph, Guelph, ON**

Appointments: Herb Kunze (Assistant Professor, applied mathematics, 2000); Gerarda Darlington (Assistant Professor, Biostatistics, 2000); Heinz Bauschke (Assistant Professor, Optimization, 2001); Gary Umphrey (Assistant Professor, Biostatistics, 2001).

Promotion: Eleanor Chu (Professor, July 2001).

Retirements: Joe Mokanski. He became a member of the department in 1963. A gifted teacher, he won the University of Guelph Faculty Association Teaching Award (1990), the Ontario Confederation of University Faculty Association Award (1992), and the Ontario Lieutenant Governor's Award for Excellence in Teaching (1992). He was Assistant Chair from 1982 to 1995, and assumed the Chair in 1995; Hosh Pesotan. He became a member of the department in 1968. His research centred around combinatorial aspects of statistical design. He enjoyed teaching a great variety of courses at all levels and consistently ranked among the highest teaching evaluations in the department; Robert G. Chapman. He joined the department in 1969. He has been a leader in research, teaching and service to the university. He has diverse research interests, from the cohomology of finite groups to statistical design. In 1989, he was awarded a University of Guelph Faculty Association Teaching Award.

Deaths: George Leibbrandt, 1938-2001, He was a valued member of the Department of Mathematics and Statistics at the University of Guelph from 1966 until his untimely death in 2001. An applied mathematician specializing in theoretical physics, he published 72 refereed papers and a 1994 research monograph on Noncovariant Gauges. He was visiting professor at many universities including Cambridge and Harvard and twice received Germany's Alexander von Humboldt Fellowship. More recently, he was a founding director of the newly established Perimeter Institute for Theoretical Physics in Waterloo.

Ernie Frejer, He was a founding member of the department, coming on board in 1965 and retiring in 1994. He was a meticulous teacher, always well-organized, clear and fair. He had the distinction of teaching the greatest variety of courses in the department, from first year algebra to fourth year tensor analysis.

Award/Distinction: Gerarda Darlington (University of Guelph Central Student Association Teaching Excellence Award, 2001).

## CALENDAR OF EVENTS / CALENDRIER DES ÉVÉNEMENTS

**SEPTEMBER 2002**

**29 Aug–3** Polynomial Identities in Algebras (Memorial University of Newfoundland, St. John's, Newfoundland)  
*http://www.math.mun.ca*

**9–20** Axiomatic, Enriched and Motivic Homotopy Theory (NATO Advanced Study Institute) (Issac Newton Institute for Mathematical Sciences, Cambridge, U. K.)  
*t.andrew@newton.cam.ac.uk,*  
*http://www.newton.cam.ac.uk/programs/NST/nstw01.html*

**15–21** 8th International Conference on General Inequalities (De La Motte Castle, Noszvaj, Hungary)  
*gi8@riesz.math.klte.hu*

**23–28** Workshop on Categorical Structures for Descent and Galois Theory, Hopf Algebras and Semiabelian Categories, (The Fields Institute for Research in Mathematical Sciences, Toronto)  
*tholen@mathstat.yorku.ca*

**29–Oct 3** 18th International CODATA Conference (Hotel Delta Centreville, Montreal, Que)  
*codata@dial.oleane.com, http://www.codata.org*

**30–Oct 4** K-theory and Arithmetic (Issac Newton Institute for Mathematical Sciences, Cambridge, U. K.)  
*t.andrew@newton.cam.ac.uk,*  
*http://www.newton.cam.ac.uk/programs/NST/nstw01.html*

**OCTOBER 2002**

**17–19** NCTM Canadian Regional Conference (Regina, Saskatchewan) Hosted by the Saskatchewan Mathematics Teachers' Society.  
*http://www.nctm.org/, http://mathcentral.uregina.ca/SMTS/*

**NOVEMBER 2002**

**2–3** PIMS Cascade Topology Conference (University of British Columbia, Vancouver, BC)

**25–28** Fifth International Conference on Monte Carlo and QuasiCarlo methods in Scientific Computing (MCQMC) (Singapore, Republic of Singapore)  
*http://www.mcqmc2002.math.nus.edu.sg*

**DECEMBER 2002**

**8–10** CMS Winter Meeting / Réunion d'hiver de la SMC (Marriott Hotel, Ottawa, Ontario)  
*http://www.cms.math.ca/Events/winter02/index.html*

**9–13** Elliptic Cohomology and Chromatic Phenomena (EuroWorkshop, Newton Institute, Cambridge, U.K.)  
*t.andrew@newton.cam.ac.uk,*  
*http://www.newton.cam.ac.uk/programs/NST/nstw04.html*

**16–20** Higher Chromatic Phenomena (EuroWorkshop, Newton Institute, Cambridge, U.K.)

**SEPTEMBRE 2002**

*t.andrew@newton.cam.ac.uk,*  
*http://www.newton.cam.ac.uk/programs/NST/nstw04.html*

**JANUARY 2003**

**Jan – Aug** Thematic Program on Automorphic Forms, (The Fields Institute for Research in Mathematical Sciences, Toronto)  
*Automorphic@fields.utoronto.ca*

**FEBRUARY 2003**

**10–15** Mathematiques Appliquees et Applications des Mathematiques (Nice, France)  
*http://www.acm.emath.fr/amam/*

**MAY 2003**

**11–16** International Conference on General Control Problems and Applications (GCP2003) : Dedicated to the 100th anniversary of A./ N./ Kolmogorov (Tambov Sate University, Tambov, Russia)  
*www.opu2003.narod.ru/*

**JUNE 2003**

**14–16** CMS Summer Meeting / Réunion d'été de la SMC (University of Alberta, Edmonton, Alberta)  
*Monique Bouchard: meetings@cms.math.ca*

**17–21** Fourth Butler Memorial Conference (University of Alberta, Edmonton, Alberta, Canada)  
*http://conley.math.ualberta.ca/butler.html*

**18–21** First Joint Meeting between AMS and Real Sociedad Matematica Espanola (Seville, Spain)  
*www.us.es/rsme/-ams/*

**JULY 2003**

**7–11** Fifth International Congress in Industrial and Applied Mathematics (Sydney, Australia)  
*www.iciam.org*

**27 - Aug. 9** Banach algebras and their applications (University of Alberta, Edmonton, AB)  
*http://www.math.ualberta.ca/ba03/*

**DECEMBER 2003**

**6–8** CMS Winter Meeting / Réunion d'hiver de la SMC (Simon Fraser University, Harbour Centre, Vancouver, British Columbia)  
*Monique Bouchard: meetings@cms.math.ca*

**SUMMER 2004**

**CMS Summer Meeting / Réunion d'été de la SMC (Dalhousie University, Halifax, Nova Scotia)**  
*Monique Bouchard: meetings@cms.math.ca*

**JANVIER 2003****FÉVRIER 2003****MAI 2003****JUIN 2003****JUILLET 2003****DÉCEMBRE 2003****ÉTÉ 2004**

**JULY 2004****JUILLET 2004**

**12–15 Toulouse 2004** Joint Meeting of between the CMS, Société Mathématique de France (SMF), Société de Mathématiques Appliquées et Industrielles (SMAI) and the Société Française de Statistiques (SFDS), (Toulouse, France)  
<http://www.cms.math.ca/Events/Toulouse2004/>

<http://www.cms.math.ca/Reunions/Toulouse2004/>

**DECEMBER 2004****DÉCEMBRE 2004**

**CMS Winter Meeting / Réunion d'hiver de la SMC**  
**(McGill University, Montréal, Québec)**  
 Monique Bouchard: [meetings@cms.math.ca](mailto:meetings@cms.math.ca)

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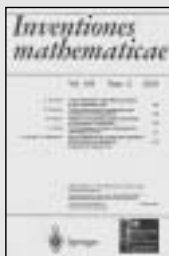
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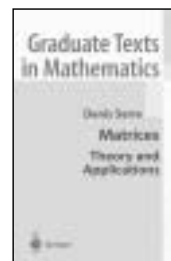
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