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CMS NOTES de la SMC

Volume 35 No. 6 October/octobre 2003

*In this issue / Dans ce numéro*



# MESSAGE FROM THE PRESIDENT-ELECT

*Eddy H. E. A. Campbell*

This is my first report as President-Elect and I'd like to thank you, my colleagues, for your support. I am, of course, flattered and honoured to have been elected, and I will do my best for the mathematical community over the next four years. I'm very much looking forward to working with Christiane, the new executive, our staff and all of our volunteers.

My new duties require me to help with the work of the Nominations Committee and this led me to examine a number of departmental web pages. It was astonishing to see the vast number of new people who have joined the mathematical community in just a short period. Of course, it is most important that we involve these newer mathematicians in the CMS. Please consider this appeal to encourage this new generation to become involved.

I remind you of the new CMS Excellence in Teaching Award supported by Nelson & Brooks/Cole. The prize recognizes sustained and distinguished contributions at the level of post-secondary undergraduate teaching. The deadline for the first competition is November 15. More details are available at *www.cms.math.ca/MediaReleases/2003/teaching_award.html.*

Don't forget to register for our Winter Meeting in Vancouver: more details, including the appropriate forms, are available at: *www.cms.math.ca/Events/winter03/index*. There are three meetings in 2004: the Summer Meeting is at Dalhousie University, June 12-14, and the Winter Meeting is December 11-13 at McGill; there is also the first Canada-France joint mathematical meeting in Toulouse, July 12-15.

Christiane, Arthur Sherk and I visited our executive staff in Ottawa in August in connection with the Task Force on the future of the CMS and its impact on the office. Part of the rationale for the Task Force was published last month. In summary, we have enjoyed considerable success over the past two decades. As a result, no doubt, there are a considerable number of new initiatives either being actively pursued or under consideration. There are two key questions we wish to put to the community. They are:

1. If you are in favour of an increase of the level of activities of CMS, we are particularly interested to know in which direction you wish an increase of the activities.
2. If you prefer that we stay with the same level of activities, then even this could imply a choice. Are you satisfied with the present activities of CMS or would you prefer that we withdraw from some old activities to concentrate on new ones?

You may wish to review the September notes or open a correspondence with Christiane, Arthur or myself before replying.

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*CMS NOTES*
*NOTES DE LA SMC*

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# EDITORIAL

*S. Swaminathan*

A million dollars! Who wouldn't like to win a prize of a million dollars? No, I am not referring to a lottery prize. For mathematicians there is another way: solving one of the problems listed by the Clay Institute.

Mention this to a non-mathematician at a party and there is a possibility that he or she will miss the point. Is this just the "mathematical skill testing question'' required to make some obscure lottery legal? Who can enter? How is it judged? Have you ever won one of those prizes? (Quick glance at a mathematician's clothing and jewellery - no, guess not...) And why would anybody offer a prize like that for some crazy math question anyhow? (And not for what *I* do...) The last of these, at least, is not an easy questions to answer.

One of the problems on the Clay Institute's list is the famous Riemann Hypothesis. It was included by David Hilbert in his 1900 list of 23 problems. It is notoriously difficult to explain this problem even to an undergraduate who feels comfortable with mathematical ideas. Three books have appeared recently which attempt to enlighten the public about prime numbers and Riemann's Hypothesis. One of them is *Prime Obsession* written by the mathematically trained novelist John Derbyshire. This book, published by Joseph Henry Press, presents the necessary ideas underlying Riemann's Hypothesis about the zeros of the zeta function in clear exposition accessible to a general reader. The other two books are: *The Music of the Primes: Searching to Solve the Greatest Mystery in Mathematics* by Marcus du Sautoy, (Harper Collins, New York) and *The Riemann Hypothesis: the Greatest Unsolved Problem in Mathematics* by Karl Sabbagh (Farrar, Strauss and Giroux, New York). *The Music of Primes* uses rich musical analogies to explain the work of Riemann.

Apart from the Riemann Hypothesis, popular accounts of abstract ideas of mathematics suitable for a general reader are also being published frequently. These are written in readable English prose with minimal use of symbols and equations.

*777 Mathematical Conversation Starters* by De Phillis, published by the Mathematical Association of America, is an interesting work in which many mathematical topics are introduced with quotes and cartoons. For example, under the heading Progress appears the following quote:

> "The more "Progress" physical sciences make, the more they tend to enter the domain of mathematics, which is a kind of centre to which they all converge. We may even judge of the degree of perfection to which a science has arrived by the facility with which it may be submitted to calculation."

by Adolphe Quetelet, a nineteenth century Belgian mathematician and pioneer of statistics. (He also invented the Body Mass Index familiar to weight-watchers.) A glance at the books and journal papers published in the physical sciences today suggests that Quetelet's claim is still valid. While much current research is not easily

## EDITORIAL *continued*

accessible to nonspecialists, it is gratifying to note that some new textbooks do incorporate recent research results. For instance, *Introduction to Dynamical Systems*" by Michael Bain and Garrett Stuck, published recently by Cambridge University Press, contains a section describing a surprising application of ergodic theory to the problem of searching the Internet. It describes how the search engine Google uses Markov chains to rank web pages.

Un million de dollars! Qui n'aimerait pas gagner pareil gros lot? Mais non, je ne parle pas d'une loterie. Les mathématiciens ont toutefois un autre moyen de remporter un tel magot : en résolvant l'un des problèmes qui figurent sur la liste de l'Institut Clay.

Mentionnez cette liste à un profane lors d'une soirée. Il risque fort de ne pas savoir du tout de quoi vous parlez. « Serait-ce la fameuse "question d'habileté mathématique" qui rend légale n'importe quelle loterie?, demandera-t-il. Qui peut participer? Qui sont les juges? Avez-vous déjà remporté un de ces prix? (Un simple regard à l'habillement et aux bijoux du mathématicien suffira - J'imagine que non…) Et pourquoi de toute façon voudrait-on offrir un tel prix pour connaître la réponse à une question mathématique impossible? (Et pourquoi pas pour mon travail à MOI?) » Pas si simple de répondre à ces questions…

L'un de ces problèmes de l'Institut Clay est la fameuse hypothèse de Riemann. C'est David Hilbert qui l'a ajouté en 1900 à sa liste de 23 problèmes. Ce problème, il est reconnu, est extrêmement difficile à expliquer même à des étudiants de premier cycle universitaire à l'aise avec les concepts mathématiques. Trois livres publiés dernièrement tentent de faire la lumière sur les nombres premiers et l'hypothèse de Riemann. Le premier, intitulé *Prime Obsession*, est paru sous la plume d'un romancier de formation mathématique, John Derbyshire. Publié chez Joseph Henry Press, il présente les concepts à la base de l'hypothèse de Riemann sur les zéros de la fonction zeta de manière claire et accessible au grand public. Les deux autres ouvrages sont *The Music of the Primes: Searching to Solve the Greatest Mystery in Mathematics*, de Marcus du Sautoy (Harper Collins, New York) et *The Riemann Hypothesis: the Greatest Unsolved Problem in Mathematics*, de Karl Sabbagh (Farrar, Strauss and Giroux, New York). Dans *The Music of Primes*, l'auteur se sert de riches analogies musicales pour expliquer l'œuvre de Riemann.

Outre les livres sur l'hypothèse de Riemann, il se publie fréquemment, pour le grand public, des ouvrages de vulgarisation de concepts mathématiques rédigés en anglais « lisible » et contenant le moins de symboles et d'équations possible.

Publié par la Mathematical Association of America, *777 Mathematical Conversation Starters*, par De Phillis est un ouvrage intéressant où l'auteur présente de nombreux sujets mathématiques à l'aide de citations et de bandes dessinées. Par exemple, sous le titre « Progress » figure la version anglaise de la citation suivante :

> « Plus les sciences se développent, plus elles ont tendance à entrer dans le domaine des mathématiques qui sont en quelque sorte le centre vers lequel elles convergent. Nous pouvons juger de la perfection d'une science selon la facilité plus ou moins grande avec laquelle elle peut être approchée par le calcul. »

C'est une citation d'Adolphe Quetelet, mathématicien belge du IXe siècle et pionnier de la statistique (on lui doit également l'Indice de masse corporelle, bien connu de quiconque a déjà suivi un régime). Un coup d'œil aux livres et aux articles de revues publiés en physique aujourd'hui nous porte à croire que l'assertion de Quetelet tient encore la route.

Si une grande partie des recherches actuelles n'est pas facile d'accès pour les non-spécialistes, il est réconfortant de voir que de nouveaux manuels incorporent des résultats de recherches récentes. Dans *Introduction to Dynamical Systems*, par exemple, publié récemment chez Cambridge University Press, Michael Bain et Garrett Stuck décrivent une application surprenante de la théorie ergodique à la recherche dans Internet. Ils expliquent notamment comment le moteur de recherche Google utilise les chaînes de Markov pour classer les pages Web par ordre de pertinence.

# MESSAGE DU PRÉSIDENT-ÉLU

*H. E. A. Eddy Campbell*

Je profite de mon premier rapport en tant que président élu pour vous remercier, chers collègues, de votre appui. Je suis évidemment flatté et honoré d'avoir été élu, et je promets de faire de mon mieux pour la communauté mathématique au cours des quatre prochaines années. C'est avec plaisir que je travaillerai avec Christiane, le nouveau Comité exécutif, notre personnel ainsi que tous nos bénévoles.

Appelé dans le cadre de mes nouvelles fonctions à participer aux activités du Comité des mises en candidature, j'ai consulté dernièrement les pages Web de nombreux départements. J'ai été fort étonné de voir combien de personnes se sont jointes à la communauté mathématique en si peu de temps. Il sera bien sûr très important d'amener ces jeunes recrues à jouer un rôle actif au sein de la SMC. Pourquoi ne pas profiter de l'occasion pour les encourager à se joindre à nous?

Je vous rappelle en outre la création du Prix d'excellence en enseignement de la SMC, parrainé par Nelson & Brooks/Cole. Ce prix rend hommage à une personne ayant fait une contribution exceptionnelle et soutenue à l'enseignement des mathématiques au premier cycle universitaire. La date limite du premier concours est le 15 novembre. Pour plus de détails, passez au *www.smc.math.ca/Communiques/2003/teaching_award*.

N'oubliez pas non plus de vous inscrire à notre prochaine Réunion d'hiver, qui se tiendra à Vancouver. Tous les détails et formulaires au *www.smc.math.ca/Reunions/hiver03/*. À noter que trois congrès auront lieu en 2004 : la Réunion d'été à Dalhousie (12-14 juin), la Réunion d'hiver à McGill (11-13 décembre) et le premier congrès mathématique conjoint Canada-France à Toulouse (12-15 juillet).

Christiane, Arthur Sherk et moi avons rencontré le personnel du bureau administratif à Ottawa en août pour discuter du Groupe de travail sur l'avenir de la SMC et ses effets sur les activités du bureau. Nous avons publié le mandat de ce groupe de travail le mois dernier. Disons en bref que la réussite de nos activités des vingt dernières années nous a amenés à entreprendre ou à étudier un grand nombre de nouvelles initiatives. Voici les deux grandes questions que nous aimerions vous poser :

1. Si vous êtes en faveur d'une intensification des activités de la SMC, dans quel secteur d'activité souhaiteriez-vous voir cette intensification?

2. Si vous ne souhaitez pas une intensification de nos activités (ce qui pourrait tout de même entraîner des choix), êtes-vous satisfait des activités actuelles de la SMC ou souhaiteriez-vous plutôt que nous en laissions tomber certaines afin de nous concentrer sur des nouvelles?

Vous souhaiterez peut-être consulter les Notes de septembre ou discuter avec Christiane, Arthur ou moi avant de répondre à ces questions.

## CMS MEETINGS

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

*http://www.cms.math.ca/Events/winter03*

Meeting registration forms and hotel accommodation forms are also available on the web site, along with online forms for registration and submission of abstracts.

## RÉUNIONS DE LA SMC

Vous trouverez l'information la plus récente sur les programmes, y compris les horaires, sur le site Web suivant:

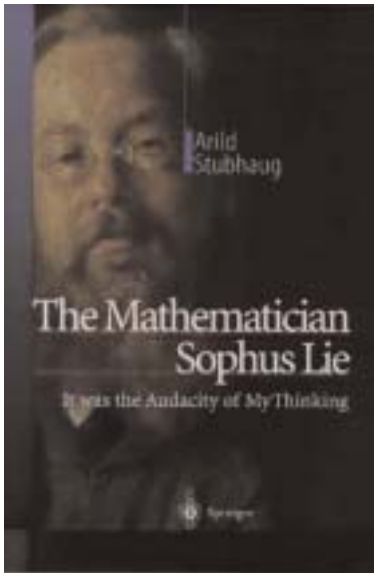
*http://www.cms.math.ca/Reunions/hiver03*

Vous trouverez les formulaires d'inscription et de réservation d'hôtel sur notre site Web, tout comme les formulaires électroniques d'inscription et de présentation de résumé.

# A BOOK FOR MATHEMATICIANS - AND THEIR SPOUSES!

Book review by John Coleman, Queen's University

**The Mathematician Sophus Lie**
*by Arild Stubhaug*
xi 555 pages
Springer 2002




This is a remarkable biography of a remarkable mathematician, which should be read by anyone who pretends to the title "mathematician".

Sophus Lie (1842 - 1899) met, admired, or attacked nearly every significant mathematician in the nineteenth century of whose name I ever heard! He created many ideas that are basic to the mathematics we now research or practice. In my article in vol. 11, No. 3 of the Mathematical Intelligencer (on Killing) I bemoaned the current apparent lack of interest in, or knowledge of, the history of mathematics among young mathematicians - which leads to loss of perspective and therefore of meaning and richness of satisfaction in their work. Reading this book would alleviate this lack in large measure.

My wife, who is a math-physics illiterate (according to herself), found Stubhaug's book fascinating and wished she had read it before we were married! She therefore recommends it to anyone entering a permanent relationship with a research mathematician. She was led to this not only by enduring her husband's absorption in his work but through her experience in counselling the wives of my young colleagues during the 20 years I was Head of the Department.

Sophus was a complex personality with strong and turbulent emotions. I found some of the quotations from his many letters to Anna before and after their marriage deeply touching, even exaggerated, yet he would leave her alone with children while indulging in long strenuous walks in his beloved mountains. In his latter life, especially during a period of mental illness, he became almost paranoid over issues of priority, feeling that others were stealing his ideas or not crediting them to him. This resulted in a break-up between himself and Felix Klein (1849 - 1925) with whom he had been in close friendship when they were young and for years thereafter.

Indeed, they met in Berlin in 1869 and in 1870 they were together in Paris, meeting the leading mathematicians such as Camille Jordan and Gaston Darboux. However, with the advent of the Franco-Prussian War, Klein was called back to Berlin for military duty. Lie decided to walk to Italy in hope of meeting Italian mathematicians, such as Cremona, whose works he had studied. He was arrested as a German spy and imprisoned in Fontainebleau for a month. At one point he casually asked a guard what they usually do with prisoners. "Normally, they are shot at six a.m."! At home, headlines screamed, "Norwegian mathematician arrested by French as German spy." From then on, Lie's name was a household word in Norway.

Released through the intervention of Darboux, Lie proceeded by train to Italy and then returned to Norway via Berlin, where he again had exciting talks with Klein. At an early stage in their friendship they conceived the idea of using the symmetry group of a mathematical object to study its properties and agreed that Lie would pursue "infinitesimal groups" and Klein, discrete groups. This proved an extraordinarily fruitful decision! For Klein it resulted in the "Erlangen Program" with its manifold consequences. For Lie, it guided his life work beginning with his method of solving ordinary first order differential equations culminating in his major work, the huge 3 volume (1888, 1891, 1893) - 2000 pages - *Theorie der Transformationsgruppen*, written with essential help from Friedrich Engel (1861-1941).

Lie was granted the Doctor's degree in 1871 for defense of a thesis "Concerning a Class of Geometrical Transformations" which, according to his early biographer "not one mother's son among his examiners understood"! However, it was hailed by the famous professors in Paris as superb. He was offered a good job at Lund in Sweden. But

the "radical" Party, that is those who were attempting to free Norway from domination by Sweden, could not tolerate the idea of losing their best mathematician and propsed that a Parliamentary Professorship be created for him. This was passed in 1872 by 85 to 16!

Lie became the first such and continued in Christiania, as Oslo was then called, until 1886 when he moved to Leipzig to fill the chair which had been held by Klein. During those years when he worked on differential invariants and differential equations and his work was becoming increasingly recognized, Engel visited him for nine months, beginning an association that assured the publication of his enormous contributions to the theory of "transformation groups" — the name under which the subject was developed until about 1930. Indeed, it was not until the mid-thirties that Weyl (1885 -1955), during his Seminar at Princeton, was persuaded to employ the terms "Lie algebra" or "Lie group". Our Lie algebra had been the "group of infinitesimal transformations" of Elie Cartan (1869-1951) and Hermann Weyl.

Except for a year during which he spent seven months in a mental clinic, the period in Leipzig, from 1886 until 1898 when he returned to Norway, was the most frenetic of Lie's life. He was now famous and had students flocking from Europe and abroad seeking to work with him. He was writing papers at a mad rate, working with Engel on his volumes on transformation groups and with Georg Scheffers (1866-1945) on what finally became the Collected Works — seven volumes containing all the papers published by Lie, exclusive of several large volumes prepared for publication by Engel or Scheffers; and he was attacking the German mathematical establishment.

This last activity was epitomized in a short preface to the third volume of those prepared by Engel. In this he went to the absurd length of stating "I am no pupil of Klein nor is the opposite the case, though perhaps this would be nearer the truth". Not surprisingly this caused much furore. Unhappily, Lie developed pernicious anaemia and died a few months after his return. A somewhat pathetic demise of a remarkable scientist!

I regret that there is not enough space to extol as I should the virtues of Stubhaug's great work. He had previously written a widely praised biography of Abel, the most famous other Norwegian mathematician. One senses that both were works of love completed with infinite patience. He combines the details of Lie's life, the family background that shaped him, and a careful exposition of the subject matter of Lie's research with a fascinating account of the social and political characteristics of 19th Century Norway (and to a lesser extent of Europe) in a lively skillful manner. Reading it, no mathematician today can fail to be struck by the extraordinary change in our mathematical profession as well as the public recognition of the value of mathematics. Even though mathematics has much more obvious effect on everyday life than was the case in Lie's times, can you imagine Parliament debating whether it should institute a Parliamentary Professorship for a mathematician? Just figure!

As a final remark, I note that the superb *Emergence of the Theory of Lie Groups* by Thomas Hawkins (Springer 2000) puts Lie's theory in the context of work by Killing, Cartan and Weyl as they interplay with geometry, algebra, analysis, physics and topology. It is therefore a timely complement to Stubhaug's book.

## 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* or at the Executive Office.**

**Les rédacteurs des *Notes* acceptent les lettres en français ou anglais portant sur un sujet d'intérêt mathématique, mais ils se réservent le droit de les comprimer. Les lettres acceptées paraîtront dans la langue soumise. Les lecteurs peuvent nous joindre au bureau administratif de la SMC ou a l'addresse suivante: *notes-lettres@smc.math.ca.***

# DISTINGUISHED SERVICE AWARD 2003 - WILLIAM MOSER

*William Moser*

The CMS Distinguished Service Award was created in 1995 to recognize individuals who have made sustained and significant contributions to the Canadian mathematical community and, in particular, to the Canadian Mathematical Society.

William Moser is awarded the Canadian Mathematical Society 2003 Distinguished Service Award.

William Oscar Jules Moser was born in Winnipeg in 1927, one of the twin younger brothers of Leo Moser. His involvement in mathematics was, in some way, affected by that of his late brother Leo, a fine mathematician with similar mathematical interests, whom he has always idolized. He obtained his B.Sc. Hons. from the University of Manitoba and an MA from the University of Minnesota in 1951. He obtained his Ph.D. from the University of Toronto under the supervision of Donald Coxeter in 1957. William Moser's relations with Donald Coxeter were beyond those of a former student: during his whole life he spent many respectful hours visiting Coxeter, particularly later in Coxeter's life. Some of his trips to Toronto have been only to visit Coxeter.

His first academic position — four years at the University of Saskatchewan — was followed by five years at the University of Manitoba. He spent the rest of his career at McGill University where he was Associate professor in 1964 and became Professor in 1966. He retired from McGill University and became Professor Emeritus in 1997.

During his career William Moser published over 45 papers, mostly in classical combinatorics and also in combinatorial group theory. His first publication, in 1957, a joint book with Donald Coxeter, "Generators and Relations for Discrete Groups", has been published in an unprecedented number of four editions in the distinguished series *Ergebnisse der Mathematik und ihrer Grenzgebiete* of Springer-Verlag. The book was translated into Russian in 1980. Today, 46 years after the first edition appeared, its usefulness as the definitive handbook in the area remains undiminished. William Moser also became famous for his 1958 paper "On the number of ordinary lines determined by $n$ points in the plane" with L.M. Kelly. Indeed the celebrated Sylvester-Gallai theorem states that given $n$ points in the plane, not all on a line, they always determine a "simple" line, i.e., one that passes through precisely two of the points. According to Dirac's famous conjecture, there are at least $n/2$ such simple lines, provided that $n$ is sufficiently large. The paper of Kelly and Moser was a breakthrough in the subject by showing that the number of simple lines is at least $(3/7)n$, which is sharp for $n=7$. Moreover, their argument holds in the projective plane without using any metric properties of the plane, which opened a completely new line of research. Willy Moser's famous problem collection RPDG (Research Problems in Discrete Geometry) grew out of a list of "Poorly formulated unsolved problems in combinatorial geometry", circulated by his brother Leo at a 1963 conference in Boulder. It had an enormous effect on the field by popularizing many of its most notorious questions. Its later editions co-authored by Janos Pach reached virtually everybody interested in the subject, and is widely referenced. William Moser also has done extensive reviewing: MR, Zbl and other locations.

William Moser has an admirable record of Service to the Canadian Mathematical Society in many areas: publications, Olympiads, administration. In particular he was president of CMS from 1973 to 1975. He was Editor-in-Chief of the Canadian Mathematical Bulletin from 1961 to 1970, Chairman of the Publications Committee from 1970 to 1974 and an Associate Editor of the Canadian Journal of Mathematics from 1981 to 1985.

Since the beginning of his career in 1955, William Moser has been involved with high school/college mathematics in a variety of ways, particularly serving on committees arranging provincial mathematics competitions in Saskatchewan, Manitoba and Quebec. He was a member of the CMS Education Committee when, under the chairmanship of Lloyd Dulmage, it instituted the Canadian Mathematical Olympiad. He edited (some with Ed Barbeau) the booklets containing the problems, solutions and results of the Canadian mathematical Olympiads from 1969 to 1978. During the years 1975-1985, he, E. Barbeau and M. S. Klamkin edited five collections of problems (500 problems altogether) that the CMS printed and distributed widely. The full collection, corrected and improved, has

been published by Mathematics Magazine in its spectrum series as "500 Mathematical Challenges" in 1995. He has also taught NSF. Summer Institutes for High School Teachers (1959--62) and participated in the College Geometry Project (1964--68) at the University of Minnesota, making beautiful films, one about Coxeter.

*Donald Coxeter and William Moser*

*The Canadian Mathematical Society, formerly the Canadian Mathematical Congress, was founded in 1945. I participated for the first time in the summer seminars and general meeting in 1949. There I met the founders of the Congress and established a lasting friendship with them and others. I well remember Lloyd Williams, who raised tens of thousands of dollars from private corporations to support the work of the Congress. Also, Ralph Jeffery who started, and guided, the Summer Research Institutes in Kingston where I spent three great summers. I also started a friendship with Father O'Connor who worked tirelessly for the benefit of others.*

*I met Donald Coxeter who played such an important role in my life. Later on, I worked closely with John McNamee who left a secure position at University of Alberta to take on the role of Executive Director of the CMS because he wanted to work for the benefit of others.*

*These mathematicians, Williams, Jeffery, O'Connor, McNamee, Coxeter and many others showed a generosity, a desire to devote time, and energy working for the benefit of others. We have today a vibrant, active society and it all started with the dedicated, selfless work of these fine men.*

*I hope that all of you young mathematicians, professors and students, take them as models. Be generous and patient as teachers, be active in projects which benefit the mathematical community and, above all, have as long and as happy a mathematical life as I have had, and am still having.*

*Finally, I thank the Society for this award. I am honored, for I have joined a group of mathematicians, the earlier recipients of this award, for whom I have great admiration.*

*William Moser*

*William Moser and Christiane Rousseau*

# EDUCATION NOTES

Ed Barbeau

## Why study school mathematics?

Many students are encouraged to stick to their mathematical studies on the promise of some future benefit. Those not planning a scientific or technical career may be skeptical and so their interest will flag. Accordingly, the recalcitrance of certain adolescents will suggest a shortening of the compulsory school curriculum to the mathematics required of every citizen. The quadratic equation has come to symbolize the redundant mathematics that should be dropped.

To be sure, the incentive to disdain the study of algebra and geometry is real enough. One would not expect a teacher of music or literature to sustain the interest of a class without the promise of some product at the end, a piece analyzed, created or performed or a selection of prose and poetry assimilated. But how often does school mathematics reduce to a recital of isolated topics hastily covered in a "crowded" syllabus? Rather than abandon the notion of mathematics for the masses, we need to inform it better so that at the very time students take it, they can apprehend something of its power, structure and capacity to engross and amaze.

Recently published are two books that can serve as a useful resource for secondary and tertiary teachers. Together, they suggest topics for useful and recreational mathematics.

The first is a collection of essays on one of the most pressing issues of our era, one that deserves a place in every student's educational experience; it can be ordered from the Mathematical Association of America by mail (PO Box 91112, Washington, DC 20090-112), fax (301-206-9789), phone (301-617-7800) or computer (*www.maa.org*).

### Environmental mathematics in the classroom

*Edited by B.A. Fusaro & P.C. Kenschaft*
*Mathematical Association of America, 2003*
*ISBN 0-88385-714-6 paperbound, viii+255 pages*
*US$49.95 (list), US$39.95 (member)*

There are fourteen essays by faculty members of various American tertiary institutions, each outlining some topic and providing suggestions for classroom treatment and exercises. An opening essay by Barry Schiller makes the point that keeping an eye on the news will alert one to many opportunities for increasing the numeracy and critical sense of students. Every day we are bombarded with numbers, both large and small, but what do they mean? Iris Fetta looks at different environmental data sets and discusses the appropriate types of functions for modelling them. Christopher Schaufele and Nancy Zumoff analyze the effect of the effluent of a coal-burning power plant on a nearby lake. I found of particular interest the long essay by Charles Hadlock that studied the direction and rate of groundwater flow. The remaining essays treated ground-level ozone (James Rauff), buffalo genetics (Julian Fleron and Donald Hoagland), the growth of the human population (Martin Walter; Mohammad Moazzam and Richard Schwartz); population dynamics for birds (William Stone); environmental economics (Ginger Holmes Rowell); oil spills (Donald Miller and Joanne Snow; Yves Nievergelt); lead poisoning of people (Robert Cole and Robert Tardiff); and weather prediction (Michael Folkoff, Donald Cathcart and Stephen Hetzler). The mathematical requirements for this book are modest. Students needs some familiarity with presentation and manipulation of data, and facility in algebra. For some of the chapters, knowledge of matrices and probability is useful. But a lot of the material can actually be used with high school students, and will deliver the message that they do not have to wait to understand that mathematics can be an effective tool in getting a grip on aspects of the world that we live in.

As an alternative to making the case that mathematics has something useful to say about practical matters, one can also push mathematics because of its sheer capacity to bring enjoyment. Some mathematics is self-contained and relies on no outside experience or background; it quickly leads to investigations that become a testing ground for the mental discipline and ingenuity of the user. There are many topics that an amateur can readily take up and even find some new results; geometry is a particularly rich area for these. So the second book I want to take up is:

### Dissections: Plane & Fancy

*Greg. N. Frederickson*
*Cambridge University Press, 1997, 2002*
*ISBN 0-521-57197-9 (hardback), 0-521-52582-9 (paperback) xi+310 pages*

This book is a comprehensive survey of various techniques for solving dissection problems. The author has combed the literature past and present for material, and brought together and systematized isolated solutions to dissection problems that might have been posed purely for recreational persons. There is much more here than any teacher could ever use, but the book could be read on different levels. Anyone who wants to take dissections seriously could use it as a training manual, but it also lends itself to dipping. It is fun to just look at the pictures; there are many illustrations that show such things as converting a seven-pointed star into two heptagons, or a dodecagon to three squares, Since areas of similar figures are

proportional to the squares of the linear dimensions, some dissections illustrate the integer solutions to quadratic diophantine equations such as $x^2 + y^2 + z^2 = w^2$. As you might imagine, much of the spade work has been done by amateurs, and one of the attractive features of the book is the provision of short biographies of the various creators. The book is not completely about polygonal dissections; some involve curves - a crescent can be transformed to a cross, a spade to a heart.

A famous dissection in Chapter 12 that solves the problem posed by Henry Dudeney in 1902 to dissect an equilateral triangle into pieces that can be rearranged into a square can be the occasion of a nice exercise for students in high school, and some readers might want to try it on a university class. Indeed, it was the basis for an Olymon problem (#146 in the CMS-University of Toronto Mathematics Olympiads Correspondence Programme, appearing in issue 3:4 for May, 2003). The following diagram illustrates the method.

**Take in Figure 1.** One might suppose from the diagram that the base of the triangle is dissected in such a way that the two end segments are each one quarter of the base. The pieces can indeed be folded up into a rectangle, but you might wish to find a simple argument that the rectangle is not in fact a square. How should the base be dissected in order to achieve a square?

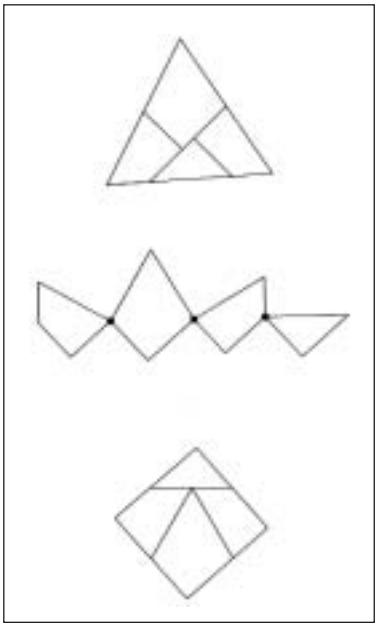


*Figure 1*

The topic of this book plays the same role for mathematics as the planetary system does for astronomy; although it might not capture the interest of most serious researchers, it provides a venue where amateurs can get in quickly and make real progress. Accordingly, it would be well worth the while of any teacher seeking a respite from the regular syllabus to acquaint her students with the topic and to make sure that the school or college library has a copy for any student who might actually get hooked.

Students who are planning to continue in science and engineering might be persuaded to accept a mathematical syllabus that is focussed and technical on the promise of eventual usefulness in their chosen fields. However, our schools are full of intelligent young people who have other careers in mind, but who under the right set of circumstances might be willing to give some time and thought to mathematics. For such students, at least some of the curriculum should be readily accessible and self-contained, and still involve some significant mathematics and illustrate the mathematical process. Each of these books in its own way suggests some possibilities.

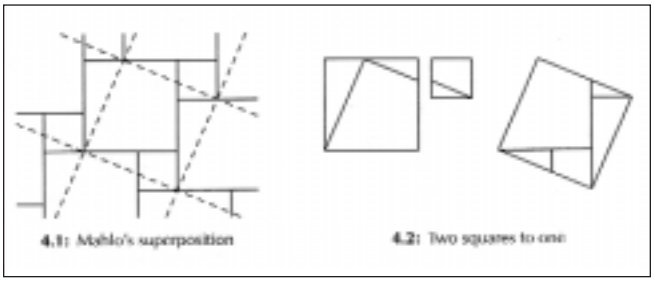


*Figure 2: Use of a tessellation to effect a dissection proof of the Pythagorean theorem (page 29).*

## A tale of two countries

The Times Educational Supplement of May 16, 2003 carried two articles about the mathematical education situation in Great Britain and France. The failure of students to take school mathematics in the United Kingdom has become a crisis. A drop of almost 19% in enrolment in A-level mathematics is echoed by a lower inake at university and a shortage of candidates for mathematics teaching. Financial inducements have eased the situation, but a more robust solution is in the wings with the opening of a National Centre for Excellence in Mathematics. This will provide continuing professional development for teachers at all stages in their careers. In particular, "it will look at how the subject is taught and lobby to shift the focus away from an assessment-based curriculum."

This initiative follows a report, "Continuing professional development for teachers of mathematics", produced by the Advisory Committee on Mathematics Education and available from the site *www.acme-uk.org*. Visit also the site *www.mathsinquiry.org.uk*.

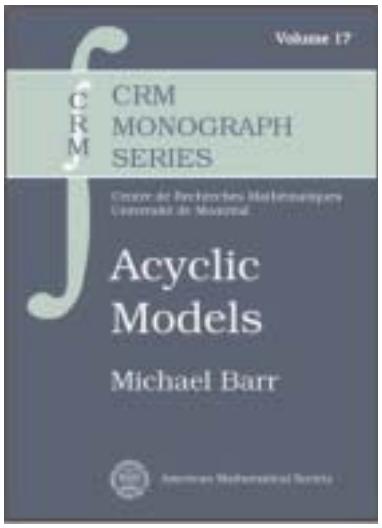
On the other hand, France has a surplus of mathematics teachers and there are compulsory mathematics courses at all levels. This, in no small measure, is due to a network of 28 IREMs (*Instituts de Recherche sur l'Enseignement des Mathématiques*) that are based in mathematics departments and collaborate with education authorities and teacher-training oprganizations. Fifteen commissions supervise different facets of the activities of IREM, which has an active research program involving pedagogy, curriculum and links to other disciplines. Short training courses each year serve about 15000 teachers, and this has led to positive results in class. Visit *www.univ-irem.fr*.

# LOVE THAT ACYCLIC MODELS THEOREM

Book review by Renzo Piccinini, University of Milan

## Acyclic Models

*by Michael Barr*
CRM Monograph 17
AMS 2002 xi + 179 pages




This is an algebraic topologist's review of a book centered around the Acyclic Models Theorem (AMT). The AMT made its first appearence in [1] and was immediately applied in both [1] and [2] (these papers were received by the editors of the American Journal of Mathematics on the same date: May 26, 1953). The AMT was used in the first of these papers to prove, for instance, the equivalence between the singular and the cubical singular homology theories and, in the second, to study the singular homology of a product of two spaces. Then it was employed in a variety of situations, proving itself to be a very useful tool in algebraic topology and homological algebra.

In this review (directed mostly to the non-expert) we present the AMT in its possibly simplest format, as one would probably describe in a beginner's course in Algebraic Topology.

In what follows $\mathbb{Z}$ stands for the set (or the additive abelian group) of the integers, and $\mathbb{Z}_{\geq}$ for the set of non-negative integers.

Let $\mathfrak{C}\mathfrak{C}_{\mathbb{Z}_{\geq}}$ be the category of augmented $\mathbb{Z}_{\geq}$-chain complexes: its objects are $\mathbb{Z}_{\geq}$-graded abelian groups $C_*=\{C_n\}$, together with homomorphisms $d_n:C_n\to C_{n-1}$, for $n \geq 1$ (called *boundary homomorphisms*), such that and an epimorphism $\alpha:C_0\to\mathbb{Z}$ (called *augmentation homomorphism*), such that $(\forall n \geq 1)\ d_{n-1}d_n = 0$ and $\alpha d_1 = 0$;

Its morphisms are graded group homomorphisms of degree 0 which commute with the boundary and augmentation homomorphisms.

The *singular chain complex* $S_*(X)$ of a topological space $X$, which we describe next, is an example. For every $n \in \mathbb{Z}_{\geq}$ let $\Delta^n$ be the convex hull of the points $e_i=(0,\ldots,1,\ldots,0)$

$\in \mathbb{R}^{n+1}$, $i=0,\ldots,n$; for a given $n \in \mathbb{Z}_{\geq}$, let $S_n(X)$ be the free abelian group generated by all the maps $f:\Delta^n\to X$. Now we define the homomorphisms $d_n:S_n(X)\to S_{n-1}(X)$ and the augmentation: firstly, take $\delta_n^i:\Delta^{n-1}\to\Delta^n$ as the linear function defined on the vertices by

$$\delta_n^i(e_j) = \begin{cases} e_j & j < i \\ e_{j+1} & j \geq i \end{cases}$$

A direct computation shows that if $0 \leq j < i \leq n$, $\delta_{n+1}^i\ \delta_n^j=\delta_{n+1}^j\ \delta_n^{i-1}$; this implies that the homomorphisms $d_n(f) = \Sigma_{i=0}^n\ f\ \delta_n^i$ have the property $d_{n-1}d_n = 0$; secondly, we define the augmentation $\alpha:S_0(X)\to\mathbb{Z}$ by sending each $f:S^0\to X$ into $1 \in \mathbb{Z}$.

Associated to the $\mathbb{Z}_{\geq}$-graded abelian group $C_*$ of a chain complex there is another $\mathbb{Z}_{\geq}$-graded abelian group called *the homology of* $C^*$: in fact, the condition $d_nd_{n+1}=0$ on the boundary homomorphisms implies that im $d_{n+1} \subset$ ker $d_n$ and hence, we define $H_*(C_*)$ by setting $H_n(C_*)$ = ker $d_n$/im $d_{n+1}$ if $n \geq 1$; for $n=0$, we set $H_0(C_*) = C_0$/im $d_1$. Clearly, a chain complex homomorphism induces a $\mathbb{Z}_{\geq}$-abelian group homomorphism at the homology level. The following question is pertinent to the subject: under what conditions do two different chain complex morphisms $\phi,\psi:C_*\to C'_*$ induce the same homomorphism from $H_*(C_*)$ to $H_*(C'_*)$? This happens, for instance, whenever there exists a $\mathbb{Z}_{\geq}$-graded group homomorphism $E:C_*\to C'_*$ of degree +1 such that $Ed+d'E=\phi-\psi$, in this situation we say that $\phi$ and $\psi$ are *chain homotopic*.

A *category with models* is a category $\mathfrak{C}$ together with a set $\mathfrak{M}$ of objects of $\mathfrak{C}$. Now let $F$ be a covariant functor from a category $\mathfrak{C}$ with models $\mathfrak{M}$ to the category of free abelian groups. We say that F is *free* on $\mathfrak{C}$ *with models* on $\mathfrak{M}$ if there

is an indexed set $\{ g_j \in F(M_j) | j \in J, M_j \in \mathfrak{M}\}$ such that $(\forall X \in \mathfrak{C})$ the set $\{ F(f)(g_j) | j \in J, f \in \mathfrak{C}(M_j, X)\}$ is a basis for $F(X)$.

One final definition is in order: a covariant functor $G$ from a category $\mathfrak{C}$ with models $\mathfrak{M}$ to $\mathfrak{C}\mathfrak{C}_{\mathbb{Z}_{\geq}}$ is said to be *acyclic* on $\mathfrak{M}$ if $(\forall M \in \mathfrak{M})$, $H_*(G(M))$ is *acyclic* that is to say, $H_n(G(M) = 0$ for all $n \geq 1$ and $H_0(G(M)) \cong \mathbb{Z}$, with the isomorphism induced by the augmentation map. Then, the models M are said to be *acyclic* for G. Now we can state the following version of the AMT.

**Theorem** - *Let $F, G: \mathfrak{C} \to \mathfrak{C}\mathfrak{C}_{\mathbb{Z}_{\geq}}$ be covariant functors such that $F$ is free with models $\mathfrak{M}$ and $G$ is acyclic on $\mathfrak{M}$. Then, there exist natural transformations $\nu: F \to G$ preserving the augmentations and any two such transformations are naturally chain homotopic.*

The proof is done dimension by dimension, exploiting the acyclicity of the models. The following are two examples of free functors with acyclic models. Let $\mathfrak{Top}$ be the category of topological spaces, $\times : \mathfrak{Top} \times \mathfrak{Top} \to \mathfrak{Top}$ be the product functor, and $S_*: \mathfrak{Top} \to \mathfrak{C}\mathfrak{C}_{\mathbb{Z}}$ be the singular chain complex functor; the functors $\widetilde{F} = S_* \circ \times$ and $\widetilde{G} = S_* \times S_*$, with $S_* \times S_* (X,Y)_n = \oplus_{i+j=n} (S_i(X) \otimes S_j(Y))$, are free with acyclic models $(\Delta^n, \Delta^n)$, and $(\Delta^1, \Delta^j)$ with $i+j=n$, for $\widetilde{F}$ and $\widetilde{G}$, respectively. Incidentally, the AMT shows that these two functors are chain homotopy equivalent; this is the Eilenberg-Zilber Theorem, the basic step in obtaining the homology of a product of two spaces (the so-called Künneth Formula).

The AMT is the main theorem of Michael Barr's delightful book. It appears in the fifth chapter in a very general format and is preceeded (chapters one to four) by an excellent exposition of all the material in category theory, abelian categories, homological algebra (including Ext and Tor), the homology of chain complexes, and the theory of triples needed to state and prove the main theorem and some of its applications (chapters six to eight). In chapter six the author uses acyclic models to present a unified account of the cohomology theories of groups, Lie algebras and associative algebras (the readers would find it useful to revisit the old but still very influential book by Cartan and Eilenberg). Chapter seven shows how some cohomology theories in algebra are indeed induced by (co)triples. The final chapter deals with applications to topology. There are almost one hundred exercises for the student to try his or her hand at. Another nice feature is represented by the historical notes, some with interesting personal accounts (after all, Barr was one of the protagonists of the theory). The book is clearly a work of love: well-written, nicely presented, very informative. There are, alas, many misprints (which one could attribute to the "malevolence" of TeX).

To this reviewer the book could be very suitable for a course in homological algebra and algebraic topology, directed to students with some familiarity in these subjects.

**References**

*[1] S. Eilenberg and S. MacLane, Acyclic Models, Amer. J. Math. 75 (1953), 189-199;*

*[2] S. Eilenberg and J.A. Zilber, On products of complexes, Amer. J. Math. 75 (1953), 200-204.*

## CALL FOR NOMINATIONS / APPELS DE MISE EN CANDIDATURE

### The first CMS EXCELLENCE in TEACHING AWARD
### Le premier PRIX D'EXCELLENCE EN ENSEIGNEMENT de la SMC

The Award recognizes sustained and distinguished contributions in teaching. Full-time university, college, two-year college, or CEGEP teachers in Canada with at least five years teaching experience at their current institution can be nominated. The 2003 award will be presented at the CMS Summer Meeting in Halifax, NS in June 2004.

The deadline for nomination is **November 15, 2003**. For details regarding nomination procedure, please visit www.cms.math.ca/prizes or http://hed.nelson.com.

Le prix récompense des contributions exceptionnelles et soutenues en enseignement. Il s'address aux professeures et professeurs d'université, de collège ou de cégep au Canada ayant au moins cinq ans d'expérience dans leur institution présente. Ce premier prix sera présenté à la Réunion d'été 2004 de la SMC à Halifax, N.-É. en juin 2004.

La date limite pour soumettre une cadidature est le **15 novembre, 2003**. pour les détails sur la procédure de mise en nomination voir www.smc.math.ca/Prix ou http://hed.nelson.com.

# AMERICAN MATHEMATICAL SOCIETY

## Centennial Fellowships for 2004-2005
## Invitation for Applications Deadline, December 1, 2003

The AMS Centennial Research Fellowship Program makes awards annually to outstanding mathematicians to help further their careers in research. From 1997-2001, the fellowship program was aimed at recent PhDs. Recently, the AMS Council approved changes in the rules for the fellowships. The eligibility rules are as follows.

The primary selection criterion for the Centennial Fellowship is the excellence of the candidate's research. Preference will be given to candidates who have not had extensive fellowship support in the past. Recipients may not hold the Centennial Fellowship concurrently with another research fellowship such as a Sloan or NSF Postdoctoral fellowship. Under normal circumstances, the fellowship cannot be deferred. A recipient of the fellowship shall have held his or her doctoral degree for at least three years and not more than twelve years at the inception of the award (that is, received between September 1, 1992 and September 1, 2001). Applications will be accepted from those currently holding a tenured, tenure track, post-doctoral, or comparable (at the discretion of the selection committee) position at an institution in North America.

The stipend for fellowships awarded for 2004-2005 is expected to be approximately $60,000, with an additional expense allowance of about $1,700. Acceptance of the fellowship cannot be postponed.

The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Trustees have arranged a matching program from general funds. At most, two fellowships will be awarded for the 2004-2005 academic year. A list of previous fellowship winners can be found at *www.ams.org/prizes-awards*.

Applications should include a cogent plan indicating how the fellowship will be used. The plan should include travel to at least one other institution and should demonstrate that the fellowship will be used for more than reduction of teaching at the candidate's home institution. The selection committee will consider the plan in addition to the quality of the candidate's research, and will try to award the fellowship to those for whom the award would make a real difference in the development of their research careers. Work in all areas of mathematics, including inter-disciplinary work, is eligible.

The deadline for receipt of applications is December 1, 2003. Awards will be announced in February 2004 or earlier if possible.

Application forms can be printed from html or pdf files. Reference forms can also be printed from html or pdf versions.

If you would like application and reference forms sent to you by US mail, contact the

**Membership and Programs Department**
**American Mathematical Society**
**201 Charles Street**
**Providence, RI 02904-2294**
***prof-serv@ams.org***
**401-455-4107**

Completed application and reference forms should be sent to the AMS at the address given above.

## CMS MEMBERSHIP

**The 2004 Membership Notices will be mailed shortly. Please renew your membership as soon as possible. To renew electonically, please visit our website at *www.cms.math.ca.***

## ADHÉSION à la SMC

**Les avis d'adhésion 2004 seront postés sous peux. Veuillez renouveller votre adhésion le plus tôt possible. Vous pouvez aussi renouveller au site web *www.smc.math.ca.***

# NEWS FROM DEPARTMENTS

## Acadia University, Wolfville, NS

Appointments: Bao-Guo Jiang (Assistant Professor, term appointment, Complex Analysis); Wendy Finbow-Singh (Lecturer, term appointment, Geometry); Carlos Leon (Assistant Professor, term appointment, Statistics).

Promotions: Franklin Mendivil (to Associate Professor)

Resignations: Anthony Almudevar.

Visitors : Horst Lange (University of Cologne, September 2003)

Other News: Paul Cabilio is currently Acting Dean, and Tom Archibald is Acting Head.

## Saint Mary's University, Halifax, NS

Appointments: Hongbin Cui (Assistant Professor, Sept – Dec. 2003, Mathematics); Joseph MacInnes (Assistant Professor, 2003-2005, Computing Science)

Promotions: Robert Dawson (to full professor, Sept. 2003).

## University of Winnipeg, Winnipeg, MN

Appointments: Anna Stokke (Assistant Professor, Aug. 2003); Ross Stokke

(Assistant Professor, Apr. 2004); Ali Aberkane (Post-Doctoral Fellow, Sept 2003).

Awards/Distinctions : Dr. Ortrud Oellermann, Department of Mathematics/Statistics (2003 Erica and Arnold Rogers Award for Excellence in Research).

## University of Northern British Columbia, Prince George, BC

Promotions : Iliya Bluskov ( Associate Professor with tenure, 2003)

Awards/Distinctions : Jennifer Hyndman and Lee Keener both received a Teaching Excellence Award, 2003)

Other News: Sam Walters became the new chair of the Mathematics department.

## University of Waterloo, Waterloo, ON

Appointments: Z. Miskovic (Associate Professor, July 2001, Mathematical Physics); B. Ingalls (Assistant Professor, July 2002, Control Theory); A. Kempf (Associate Professor, Aug. 2001 , Mathematical Physics); Z. Miskovic (Associate Professor, July 2001, Mathematical Physics); N. Lanson (Assistant Professor, Jan. 2004 Computational Math.); M. Stastna (Assistant Professor, July 2004, Fluid Dynamics).

Retirements: F.O. Goodman (Professor, June 2002); G.J. Lastman (Professor, June 2003)

Visitors: Lu-Jing Hou (China, Mathematical Physics, Sept. 1 - Nov. 2003); R. Kucharczk (Poland, Quantum Surface Physics, Sept. - Dec.2003).

## University of Ottawa, Ottawa, ON

Awards/Distinctions: Barry Jessup received an Excellence in Education Prize.

**The most up-to-date information concerning all CMS Prize Lectureships & Awards programmes, including complete lists of recipients, can be found at:**

***www.cms.math.ca/Prizes/***

**Vous trouverez l'information la plus récente sur les prix et bourses de la SMC, y compris les listes de lauréats, sur le site Web suivant:**

***www.cms.math.ca/Prix/***

# 2002 - 2003 RECIPIENTS OF THE PRIME MINISTER'S AWARDS FOR TEACHING EXCELLENCE

**The following school teachers who taught mathematics (and other subjects) were among the recipients of the Prime Minister's Awards for Teaching Excellence for 2002-2003:**

**Certificate of Excellence**
Pascale Baillargeon (Qaqqalik School, Kimmirut, Nunavut).

**Certificate of Achievement**
Maggie Przyborowska (Windmere Secondary School, Vancouver)

Walter Swetlishoff (W.E.Graham School, Slocan)

Wes Myck (McNally High School, Edmonton)

Keith Farnworth (Grand Forks School, Christina Lake, Grand Forks)

Pat Bourne (Raymond School, Raymond)

Ken Overby (Teulon Collegiate Institute, Inwood, Teulon)

Terry Dallyn (Jonas Samson School, Meadow Lake)

Henri Van Bemmel (Marc Garneau Collegiate Institute, Toronto)

Michael McMaster (Marc Garneau Collegiate Institute, Toronto)

# YORK UNIVERSITY

## Faculty of Arts - Mathematics

Applications are invited for three tenure-track appointments at the Assistant Professor level in the Department of Mathematics and Statistics to commence July 1, 2004. Applications in the areas of Actuarial or Financial Mathematics, Mathematical Analysis, or Applied Mathematics (Computational or Industrial Mathematics) will be considered. Each successful candidate must have a PhD and is expected to have a proven record of research excellence and superior teaching ability. For the Actuarial or Financial Mathematics position, the candidate must have the background to teach and advise students in the department's actuarial program, and preference will be given to candidates who will contribute to existing areas of strength within the department. For the Analysis and Applied Mathematics positions, preference will be given to candidates who can strengthen existing areas of present and ongoing research activity. All positions at York are subject to budgetary approval. The selection process will begin January 5, 2004. Applicants should send resumes and arrange for three letters of recommendation (one of which should address teaching) to be sent directly to:

Actuarial Search Committee or Analysis Search Committee or

**Applied Mathematics Search Committee**
**Department of Mathematics and Statistics**
**York University**
**4700 Keele Street**
Toronto, Ontario
Canada M3J 1P3
Fax: 416-736-5757
*actuarial.recruit@mathstat.yorku.ca* or *analysis.recruit@mathstat.yorku.ca* or *applied.recruit@mathstat.yorku.ca*
*www.math.yorku.ca/Hiring*

York University is an Affirmative Action Employer. The Affirmative Action Program can be found on York's website at www.yorku.ca/acadjobs or a copy can be obtained by calling the affirmative action office at 416-736-5713. All qualified candidates are encouraged to apply; however, Canadian citizens and Permanent Residents will be given priority

# CRM-ISM POSTDOCTORAL FELLOWSHIP 2004-2005

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

The ISM coordinates the graduate programs in mathematics of six Québec universities (Concordia, Laval, McGill, Sherbrooke, Université de Montréal and UQAM). More than 200 faculty members participate in its ten programs: Algebra and Number Theory, Algebraic Computation and Algorithms, Analysis, Applied and Computational Mathematics, Category Theory and Applications Combinatorics, Geometry and Topology, Mathematical and Applied Statistics, Mathematical Physics, Nonlinear Dynamics, and Probability: Theory and Applications.

The CRM is a national research center in the mathematical sciences. Its ongoing areas of research include: algebra and combinatorics, analysis, differential equations and approximation theory, dynamical systems, geometry and topology, mathematical physics, number theory, numerical analysis, optimisation and multidisciplinary research, and probability and statistics. Each year, the CRM organizes a wide range of events attracting participants from around the world. The main theme for 2004-2005 is "Applied Mathematics", in particular the Mathematics of Complex Multiple-Scale Systems. However, high-quality applications in all fields of interest to the CRM or to the ISM are welcome. The theme for 2005-2006 will be "Number Theory and Analysis".

Applications must arrive at the ISM by Friday January 2, 2004. The following documents are required: a curriculum vitae, a statement of research and three letters of recommendation. An e-mail address (if available) must be provided with all correspondence. Please indicate in your application which ISM program best represents your research interests. Candidates are strongly encouraged to mention on their applications the professors and research groups with whom they would like to work. To find out more about individual professors' research interests, please consult the web sites of each affiliated Mathematics Department, which are all accessible through the ISM website at http://www.math.uqam.ca/ISM/ or at CRM's website at http://www.crm.umontreal.ca. Applications must be sent to:

**Professor S. Twareque Ali, Director**
**Institut des sciences mathématiques**
**Case postale 8888, succursale Centre-ville**
**Montréal (Québec) H3C 3P8 Canada**
**Fax : (514) 987-8935**
*ism@math.uqam.ca*

# BOURSES POSTDOCTORALES CRM-ISM 2004-2005

L'Institut des sciences mathématiques (ISM) et le Centre de recherches mathématiques (CRM) sollicitent des candidatures dans le cadre de leur programme conjoint de bourses postdoctorales débutant en septembre 2004. Les bourses sont d'une valeur de 32 000 $ CAN pour un an, renouvelables une fois. Le montant de la bourse correspond à une tâche sans enseignement. Les boursiers peuvent éventuellement obtenir une charge d'enseignement pour laquelle ils seront rémunérés. La bourse postdoctorale CRM-ISM s'adresse aux chercheurs débutants ayant obtenu leur doctorat dans les cinq ans précédant la demande.

L'ISM coordonne les programmes d'études supérieures en mathématiques et de statistique de six universités québécoises (Concordia, Laval, McGill, Sherbrooke, Université de Montréal et UQAM). Plus de 200 professeurs et professeures participent aux dix programmes suivants: algèbre et théorie des nombres, analyse, combinatoire algorithmique et calcul algébrique, dynamique non linéaire, géométrie et topologie, mathématiques appliquées et calcul scientifique, physique mathématique, probabilités: théorie et applications, statistique mathématique et statistique appliquée, théorie des catégories et applications.

Le CRM est un centre national de recherche en sciences mathématiques. Les recherches qu'on y poursuit portent entre autres sur les domaines suivants: l'algèbre et la combinatoire, l'analyse, les équations différentielles et la théorie de

l'approximation, la géométrie et la topologie, l'analyse numérique, l'optimisation et les recherches multidisciplinaires, la physique mathématique, les probabilités et la statistique les systèmes dynamiques, et la théorie des nombres. Le CRM organise chaque année un large éventail d'activités scientifiques faisant appel à une participation internationale. Le thème principal de l'année 2004-2005 sera les "Mathématiques appliquées", plus particulièrement les mathématiques des systèmes complexes multi-échelles. Cependant, toute candidature touchant à un centre d'intérêt du CRM ou de l'ISM peut être prise en considération. Le thème pour l'année 2005-2006 sera "Théorie des nombres et analyse".

Les candidatures doivent parvenir à l'ISM au plus tard le vendredi 2 janvier 2004. Les candidats sont priés de joindre les pièces suivantes: un curriculum vitae, une brève description des intérêts de recherche et trois lettres de recommandation. Autant que possible une adresse électronique doit être jointe à toute correspondance. Vous êtes prié d'indiquer sur votre demande quel programme de l'ISM correspond le mieux à vos intérêts de recherche. Les personnes intéressées sont fortement encouragées à contacter les professeurs et les groupes de recherche avec lesquels elles aimeraient travailler. Pour s'informer des intérêts de recherche des professeurs, les candidats sont invités à consulter les sites web des départements membres de l'ISM accessibles par le site web de l'ISM à l'adresse http://www.math.uqam.ca/ISM/ ou encore le site web du CRM à l'adresse http://www.crm.umontreal.ca. Les candidatures doivent être envoyées à:

**S. Twareque Ali, Directeur**
**Institut des sciences mathématiques**
**Case postale 8888, succursale Centre-ville**
**Montréal (Québec) H3C 3P8 Canada**
**télécopieur : (514) 987-8935**
*ism@math.uqam.ca*

香港城市大學
City University of Hong Kong

City University of Hong Kong is a young and dynamic institution directly funded by the Government of the Hong Kong Special Administrative Region through the University Grants Committee (Hong Kong). Its strategic plan is an ambitious one, reflecting its aspirations to become one of the leading universities in the Asia Pacific region by achieving excellence in teaching and research. The student population is approximately 18,500 (11,800 full-time and 6,700 part-time). The medium of instruction is English.

### Assistant Professor
### Department of Mathematics/
### Liu Bie Ju Centre for
### Mathematical Sciences *[Ref. A/418/49]*

The successful candidate will be required to teach undergraduate and postgraduate courses in the Department of Mathematics; supervise research students; conduct research in areas of physically applicable Mathematics and perform duties as assigned by the Director of the Liu Bie Ju Centre for Mathematical Sciences and the Head of Department of Mathematics.

Applicants should possess a PhD degree in Mathematics (Applied Mathematics) or a related discipline with a strong background in applied analysis. In particular experience in perturbation and asymptotical methods, a very strong knowledge in mathematical modelling of material sciences and an excellent research record are desirable qualifications. Preference will be given to a person who can interact with existing staff.

### Monthly Salary (subject to review) and Conditions of Service

Starting salary and level of appointment will be commensurate with qualifications and experience.

Appointment will be initially on a 3-year fixed-term contract with contract-end gratuity. Fringe benefits include annual leave, medical and dental schemes. Provision of housing benefit is under review.

### Information and Application

Further information is available at http://www.cityu.edu.hk, or the University's listerver at "hrmail@ctylnk.cityu.edu.hk". Please send your application letter enclosing a current curriculum vitae to the Human Resources Office, City University of Hong Kong, 83 Tat Chee Avenue, Kowloon, Hong Kong by **15 January 2004**. Please quote the reference of the post in the application and on the envelope.

# BRIEF BOOK REVIEWS

S. Swaminathan

## Conjecture and Proof, by Miklös Laczkovich,

*The Mathematical Association of America, 2001, x + 118 pp.*

The title reminds us of the slogan "conjecture and prove!" of Paul Erdös. This book is based on the lectures for a one-semester course of the Budapest Seminars in Mathematics, a programme designed and initiated by Paul Erdös and others for American and Canadian students with the intention to offer undergraduate courses conveying the tradition of Hungarian mathematics.

Topics from various fields are discussed in two parts. Part I deals with proofs of impossibility and proofs of nonexistence including irrationality, geometric constructions, algebraic and transcendental numbers, Cauchy's functional equation and geometric decompositions. Part II is concerned with constructions and proofs of existence including the pigeonhole principle, Liouville numbers, uncountable sets, isometries, invariant measures, Banach-Tarski paradox, Cantor set, Peano Curve, Borel sets and the diagonal method.

After a brief introduction of the topic, important and easily accessible results and methods are given. However, "easily accessible" does not mean "elementary"; deep theorems are also discussed. Each section concludes with exercises for which brief hints for solution are provided.

## Proceedings on Moonshine and Related Topics

*edited by John McKay and Abdellah Sebbar, CRM Proceedings and Lecture Notes, Vol. 30, xii + 268 pp. American Mathematical Society, 2001.*

This volume contains talks, and in a couple of cases extended versions of talks, given at the Moonshine Workshop held in May 1999 at the *Centre de Recherches Mathématiques* in Montreal.

The term "Moonshine" was used by J. H. Conway and S. P. Norton in their paper "Monstrous Moonshine", Bulletin of London Math. Soc. 1979, concerning the "Monster" simple group (the order of which has 54 digits) conjectured by Bernd Fischer and Bob Griess in 1973. The editors write in the Preface that "a glance at the contents will reveal that the connection of some papers to moonshine has proved to be a very fertile area and it does not stretch the imagination to believe that many more threads will be drawn together before we understand what is really going on."

All classical Moonshine themes are presented, namely the Monster simple group and other finite groups, automorphic functions and forms and related congruence groups, and vertex algebras and their representations. These topics appear either in a pure form or in a blend of algebraic geometry dealing with algebraic surfaces, Picard-Fuchs equations and hypergeometric functions.

## The Kowalevski Property

*edited by Vadim B. Kuznetsov, CRM Proceedings & Lecture Notes, Vol. 32, xii + 232 pp. American Mathematical Society, 2002*

In April 2000 a workshop was held at the University of Leeds on "Mathematical Methods of Regular Dynamics" dedicated to the 150th birth anniversary of Sophie Kowalevski, supported by the London Mathematical Society. This volume contains 15 survey talks based on the workshop's talks together with a few invited contributions, all being within the integrability area pioneered by Sophie Kowalevski. The book begins with two articles by Roger L. Cooke about Sophie Kowalevski's contributions to mathematics, "Kovalevskaya's mathematical work" and her interesting life story, 'The life of S. V. Kovalevskaya.'

1n 1889 Sophie Kowalevski wrote a fundamental paper published in the Acta Mathematica for which she was awarded a prestigious Bordin Prize. This ground breaking paper opened up a whole new area of mathematical research. In the paper a new technique, now known as the Kowalevski property, was introduced and ingeniously used to solve the first integrable system of enormous complexity, the famous Kowalevski top.

Because of the importance of the paper, which is a beautiful demonstration of the triumph of the classical theory of complex analysis, and because of the extensive mathematical research generated by it, the original paper of Sophie Kowalevski is reproduced at the end of the volume as a tribute to her achievements.

## Differential Equations and Dynamical Systems

*edited by A. Galves, J. K. Hale and C. Rocha, Fields Institute Communications, vol.31, American Mathematical Society, 2002.*

This volume contains papers contributed by participants in the Conference on Differential Equations and Dynamical Systems, held at the Instituto Superior

Técnico in Lisbon, Portugal, in June 2000. The conference was held in celebration of the seventieth birthday of Professor Waldyr Miniz Oliva, who, after a distinguished career in Sao Paulo, Brazil, is Professor Catedratico Convidado at the Instituto Superior Técnico, Universidade Técnica de Lisboa.

The volume contains an overview of the current research over a wide range of topics, extending from qualitative theory for ordinary, partial or functional differential equations to hyperbolic dynamics and ergodic theory.

# UNIVERSITY OF TORONTO

## Tenured positions in the Department of Mathematics

The University of Toronto solicits applications for one or more tenured positions in the Department of Mathematics, to begin July 1, 2004. Rank and salary will be commensurate with qualifications. The main areas of research interest are partial differential equations, geometric analysis, applied and computational mathematics, and algebra/number theory; however, exceptional candidates in any field of pure and applied mathematics are encouraged to apply.

It is intended that the successful applicants will be nominated for a Canada Research Chair. Accordingly, candidates are expected to be outstanding mathematicians, whose research and teaching will make major contributions to the quality and stature of the department.

Applicants should send their complete C.V. including a list of publications, a short statement describing their research programme, all appropriate material about their teaching, and the AMS Standard Cover Sheet. They should also arrange to have at least four letters of reference sent directly to the Search Committee, Department of Mathematics, University of Toronto, 100 St. George Street, Room 4072, Toronto, Ontario, Canada M5S 3G3.

**Additional information is available at our Web page:**
*www.math.toronto.edu/jobs*

Priority will be given to applications received by November 15, 2003. Applications after this date will be considered until the positions have been filled.

The University of Toronto offers the opportunity to teach, conduct research and live in one of the most diverse cities in the world, and is strongly committed to diversity within its community. The University especially welcomes applications from visible minority group members, women, Aboriginal persons, persons with disabilities, members of sexual minority groups, and others who may contribute to further diversification of ideas.

**Any inquiries about the application should be sent to**
*mathjobs@math.toronto.edu*

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# UNIVERSITY OF TORONTO

## Tenure-track or tenure level positions, Department of Mathematics

The Department of Mathematics, University of Toronto anticipates openings at the tenure-track or tenure level. Preference will be given to researchers in the area of analysis or algebra. Rank and salary will be commensurate with qualifications.

Candidates are expected to have demonstrated excellence in both teaching and research after the Ph.D.; in particular, a candidate's research and teaching record should show clearly the ability to make major contributions to the quality and stature of the department.

Applicants should send their complete C.V. including a list of publications, a short statement describing their research programme, all appropriate material about their teaching and the AMS Standard Cover Sheet. They should also arrange to have at least four letters of reference sent directly to the Search Committee, Department of Mathematics, University of Toronto, 100 St. George Street, Room 4072, Toronto, Ontario, Canada M5S 3G3. At least one letter should be primarily concerned with the candidate's teaching.

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**Any inquiries about the application should be sent to**
*mathjobs@math.toronto.edu*

# UNIVERSITY OF TORONTO AT MISSISSAUGA

## Tenure-track appointment in the Department of Mathematical and Computational Sciences

The University of Toronto at Mississauga, University of Toronto, Department of Mathematical and Computational Sciences. Applications are invited for a tenure-track appointment at the Assistant Professor level. Appointment commences 1 July 2004. Preference will be given to researchers in the areas of Algebra, Number Theory, and Cryptography. However, exceptional candidates in any field of pure or applied mathematics are encouraged to apply. Salary commensurate with experience. Candidates are expected to have demonstrated excellence in both teaching and research after the Ph.D; in particular, a candidate's research record should show clearly the ability to make significant original and independent contributions to Mathematics. Letters of application with curriculum vitae, including a list of publications, a short statement describing the candidate's research programme, all appropriate material about the candidate's teaching, and the AMS Standard Cover Sheet should be sent to the Search Committee, Department of Mathematics, University of Toronto, 100 St.George Street, Room 4072, Toronto, ON M5S 3G3, Canada. Priority will be given to applications received by November 14, 2003. Applications received after this date will be considered until the positions have been filled. Applicants should ask four references to send a letter of recommendation under separate cover to the same address by the same deadline; at least one letter should be primarily concerned with the candidate's teaching.

**Additional information is available at our Web page:**
*www.math.toronto.edu/jobs*

The University of Toronto offers the opportunity to teach, conduct research and live in one of the most diverse and cosmopolitan locations in the world. The University also offers opportunities to work in a range of collaborative programs. The University of Toronto is strongly committed to diversity within its community and especially welcomes applications from visible minority group members, women, Aboriginal persons, persons with disabilities, members of sexual minority groups, and others who may contribute to the further diversification of ideas. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

**Any enquiries about the application should be sent to**
*mathjobs@math.toronto.edu*

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# UNIVERSITY OF TORONTO

## Limited Term Assistant Professorship at the Department of Mathematics

The Department invites applications for one or more limited term Assistant Professorships which may become available, subject to budgetary approval, for a period of one to three years beginning July 1, 2004. Duties consist of teaching and research, and candidates must demonstrate clear strength in both. Preference will be given to candidates with recent doctoral degrees. Salaries commensurate with qualifications.

Applicants should send their complete C.V. including a list of publications, a short statement describing their research programme, all appropriate material about their teaching and the AMS Standard Cover Sheet. They should also arrange to have at least three letters of reference sent directly to the Search Committee, Department of Mathematics, University of Toronto, 100 St. George Street, Room 4072, Toronto, Canada M5S 3G3. To ensure full consideration, all information should be received by November 15, 2003.

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# CALENDAR OF EVENTS / CALENDRIER DES ÉVÉNEMENTS

**OCTOBER 2003 OCTOBRE**

**17-19** Atlantic Provinces Council on the Sciences (APICS) Mathematics, Statistics and Computer Science conference (University of Prince Edward Island, Charlottetown, PEI)
*www.math.upei.ca/apics2003*

**20 - 22** Workshop on Concentration Phenomenon, Transformation Groups and Ramsey theory – University of Ottawa, Ontario, Canada
*www.fields.utoronto.ca/programs/scientific/03-04/cgr/*

**20-24** IMA Workshop 2: Comparative Genomics (University of Minnesota, Minneapolis, MN)
*http://www.ima.umn.edu/complex/fall/c2.htm*

**NOVEMBER 2003 NOVEMBRE**

**14-18** Workshop on Patterns in Physics
(The Fields Institute, Toronto, ON)
*www.fields.utoronto.ca/programs/scientific/03-04/pde/physics/index.htm*

**DECEMBER 2003 DÉCEMBRE**

**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*

**15 - 19** 28th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing
(Melbourne, Australia)
*www.cm.deakin.edu.au/comb2003melbourne*

**17 - 20** First Joint AMS-India Mathematics Meeting
(Bangalore, India)
*www.ams.org/meetings/*

**22 - 25** International Conference on Analysis and Applications (BHU, Varanasi, India)
*rspathak@banaras.ernet.in*

**JANUARY 2004 JANVIER**

**5-9** Workshop on Large N limits of U(N) Gauge Theory in Physics and Mathematics
(CRM, U. de Montreal, Montreal, QC)
crm@ere.umontreal.ca

**21 - 30** Advanced Course on Ramsey Methods in Analysis
(Bellaterra, Barcelona, Spain)
*Joan Bagaria: www.crm.es/RamseyMethods*

**FEBRUARY 2004 FÉVRIER**

**2 - 13** Advanced Course on Contemporary Cryptology
(Bellaterra, Barcelona, Spain)
*Paz Morillo: www.crm.es/ContemporaryCryptology*

**9-13** Session on Geometric Aspects of Functional Analysis (GAFA) of the Joint Meeting of the New Zealand Mathematical Society and Israeli Mathematical Union
*www.mcs.vuw.ac.nz/~mathmeet/vic2004/index.shtml*

**MARCH 2004 MARS**

**4-6** Workshop on Spectral Geometry
(CRM, U. de Montreal, Montreal, QC)
*crm@ere.umontreal.ca*

**APRIL 2004 AVRIL**

**4 -7** Fractal 2004, Complexity and Fractals in Nature, 8th International Multidisciplinary Conference
(Vancouver, BC)
*www.kingston.ac.uk/fractal/*

**MAY 2004 MAI**

**3-8** AARMS-CRM Workshop on Singular Integrals and Analysis on CR Manifolds
(Dalhousie University, Halifax, NS)
*http://math.mun.ca/aarms*

**4-7** Workshop on Spectral Theory and Automorphic Forms (CRM, U. de Montreal, Montreal, QC)
*crm@ere.umontreal.ca*

**MAY 2004 MAI**

**24-28** Workshop on Hamiltonian Dynamical Systems (jointly with the Fields Institute)
(CRM, U. de Montreal, Montreal, QC)
*crm@ere.umontreal.ca*

**28 - 31** International Conference on Mathematics and its Applications (Hong Kong)
*http://www.cityu.edu.hk/rcms/icma2004*

**JUNE 2004 JUIN**

**1-11** Workshop on Semi-classical Theory of Eigenfunctions and PDEs (CRM, U. de Montreal, Montreal, QC)
*crm@ere.umontreal.ca*

# CALENDAR OF EVENTS / CALENDRIER DES ÉVÉNEMENTS

**JUNE 2004 JUIN**

**10-14** CCWEST 2004, National Conference for the Advancement of Women in Engineering, Science and Technology (Brock University, St. Catharines, ON)
*http://www.brocku.ca/fms/ccwest2004*

**13 - 15 CMS Summer Meeting / Réunion d'été de la SMC** (Dalhousie University, Halifax, Nova Scotia)
Monique *Bouchard: meetings@cms.math.ca*

**18-23** Mathematical Foundations of Learning Theory (Barcelona, Spain)
*Gábor Lugosi: www.crm.es/MathematicalFoundations*

**27 - July 2** European Congress of Mathematics (Stockholm, Sweden)
*Ari Laptev: laptev@math.kth.se*

**30-July 7** Fourth World Congress of Nonlinear Analysis(WCNA 2004) (Hyatt Orlando, Florida)
*http://kermani.math.fit.edu/ — wcna2004@yahoo.com*

**JULY 2004 JUILLET**

**4 - 11** The 10th International Congress on Mathematical Education (Copenhagen, Denmark) *www.ICME-10.dk*

**5-9** 19th "Summer" Conference on Topology and its Applications (University of Cape Town, South Africa)
*http://www.mth.uct.ac.za/Conferences/Topology*

**5 - 16** Advanced Course on Automata Groups (Bellaterra, Barcelona, Spain)
*Warren Dicks: www.crm.es/AutomataGroups*

**12 - 15 First Joint Canada-France meeting of the mathematical sciences / Premier congrès Canada-France des sciences mathématiques**, (Toulouse, France)
*www.cms.math.ca/Events/Toulouse2004/*
*www.smc.math.ca/Reunions/Toulouse2004/*

**JULY 2004 JUILLET**

**18-24** International Conference on General Relativity and Gravitation (Dublin, Ireland)
*m.a.h.maccallum@qmul.ac.uk*

**26-30** Workshop on Spectral Theory of Schrödinger Operators (CRM, U. de Montreal, Montreal, QC)
*crm@ere.umontreal.ca.*

**AUGUST 2004 AOÛT**

**2-6** Workshop on Dynamics in Statistical Mechanics(CRM, U. de Montreal, Montreal, QC)
*crm@ere.umontreal.ca*

**6-7** New Directions in Probability Theory (Fields Institute, Toronto,ON)
*http://www.imstat.org/meetings/NDPT/default.htm*

**DECEMBER 2004 DÉCEMBRE**

**11 - 13 CMS Winter Meeting / Réunion d'hiver de la SMC**, (McGill University, Montréal, Québec)
*Monique Bouchard: meetings@cms.math.ca*

# RATES AND DEADLINES 2003 / TARIFS ET ÉCHÉANCES 2003

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|---|---|---|---|
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| February/février | December 1 décembre |
| March/mars | January 15 janvier |
| April/avril | February 15 février |
| May/mai | March 15 mars |
| September/septembre | July 1 juillet |
| October/octobre | August 15 août |
| November/novembre | September 15 septembre |
| December/décembre | October 15 octobre |
| **Maximum page size / taille maximum des pages:**<br>Back page/4e de couverture: 7.5 x 8.5 in/pouces<br>Inside page/page intérieure: 7.5 x 10 in/pouces | |

*The CMS Notes is mailed in the first week of the issue month. Subscription to the Notes is included with the CMS membership. For non-CMS members, the subscription rate is $50 (CDN) for subscribers with Canadian addresses and $50 (US) for subscribers with non-Canadian addresses.*

*Les Notes de la SMC sont postées la première semaine du mois de parution. L'adhésion à la SMC compred l'abonnement aux Notes de la SMC. Le tarif d'abonnement pour les non-membres est de 50 $ CAN si l'adresse de l'abonné est au Canada et de 50 $ US autrement.*