The Pacific Institute for the Mathematical Sciences Newsletter

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Contents

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- **Simon Fraser University**, **The University of Alberta**, **The University of British Columbia**, **The University of Calgary**, **The University of Victoria**, **The University of Northern British Columbia** and **The University of Lethbridge**.

Delgrande, Denney, Klawe and Ng Appointed to PIMS Board of Directors

PIMS is pleased to welcome four new members to its Board of Directors. At its January 29 meeting, the PIMS Board of Directord appointed James Delgrande and Maria Klawe. Don Denney and Stephen Ng were appointed at the May 29, 1999 Board meeting.

Dr. James Delgrande is a Professor of Computing Science at Simon Fraser University and he is the Director of the School of Computing Science. He received his Ph.D. from the University of Toronto in 1985. His research is in formal aspects of knowledge representation in artificial intelligence.

Please see ***Board Members,*** *page 12.*

Robert V. Moody Appointed Officer of the Order of Canada

Robert V. Moody, Professor of Mathematics at the University of Alberta, has recently been appointed Officer of the Order of Canada. For more than thirty years, Robert Moody has made significant contributions in algebra. In 1968, Victor Kac and Robert Moody independently discovered a generalization of classical Lie algebras, now known as Kac-Moody algebras. These algebras have found wide application in theoretical physics, especially in string theory and conformal quantum field theory. Deeply committed to his students and his research, Robert Moody is a role model for all aspiring mathematicians.

Robert Moody has been actively involved in PIMS since its founding. He is currently a member of the PIMS Scientific Review Panel. Also, Robert Moody and Akbar Rhemtulla are co-organizers of the PIMS Summer School in Algebra, which will be held at the University of Alberta from June 19 to July 14, 2000.

New PIMS Facility at SFU

Renovations are nearly complete at the new 3000 sq. ft. facility on the first floor of the East Academic Annex at Simon Fraser University. PIMS Postdoctoral Fellows will be able to move into their new offices in March. The facility will also house the offices of Peter Borwein, PIMS-SFU Site Director and Arvind Gupta, MITACS Program Leader.

Please see ***SFU Facility,*** *page 12.*

Director's Notes

Nassif Ghoussoub, FRSC

In this first issue of the PIMS Newsletter for 2000, I am pleased to announce two new initiatives of the Pacific Institute for the Mathematical Sciences. Both of these initiatives are in mathematics education, an aspect of the PIMS mandate which has been receiving ever increasing attention in recent months.

The first initiative is a poster campaign under the theme "Mathematics is Everywhere." It will feature the ever growing importance of Mathematics in modern society: From the art of Tying Knots and Risk Management to Genome Sequencing and Quantum Computing! Watch for posters in public transport systems (initially 100 selected buses in Vancouver and Victoria). These posters will also be displayed in schools, exhibitions, calendars and elsewhere. This campaign joins the mathematics poster campaign that was sponsored by the Centre de Recherches Mathématiques. Posters promoting awareness of mathematics were featured in the Montréal Metro from January 4 to January 31.

The second initiative is a semi-annual magazine entitled *Pi in the Sky*. It is designed to be a forum for dialogue between academic mathematical scientists, educators, students and the public at large. PIMS will be distributing this magazine to all high schools in British Columbia and Alberta.

Both of these initiatives are part of PIMS' contribution to the World Mathematical Year 2000, which is sponsored by UNESCO and the International Mathematics Union. They are also two of the many activities in PIMS' continuing Mathematics Awareness Campaign.

Our warmest congratulations to Robert Moody for his election as Officer to the Order of Canada and to Jim Arthur for winning NSERC's Gold medal. Robert and Jim have been two solid pillars of the Canadian mathematical community for more than two decades and these honours clearly confirm the strength and the standing of the mathematics community in the Canadian scientific research enterprise.

Robert Moody is actively involved in many activities at PIMS. Along with Akbar Rhemtulla, he is one of the principal organizers of the PIMS Miniprogramme in Algebra, which will be hosted at the University of Alberta from June 19 to July 14. He is also speaking at the upcoming Northwest Dynamics Symposium, which is being hosted by PIMS at the University of Victoria on May 6–8.

Finally, let me welcome Jim Delgrande, Don Denney, Maria Klawe and Stephen Ng to the Board of directors of PIMS. The institute should greatly benefit from their expertise and their long track record in developing and encouraging major initiatives connecting Canadian universities with the community at large.

Sir Christopher Zeeman to Lecture at PIMS, University of Victoria

March 21, 2000

PIMS at the University of Victoria is looking forward to hosting Sir Christopher Zeeman, who will give a PIMS Distinguished Lecture on "Geometric Unfoldings of a Difference Equation". This lecture will be videotaped and made available by streaming video from the PIMS website.

Professor Zeeman is an excellent lecturer who can make himself understood by experts and non-specialists as well. His talks always attract a large audience, whether given in academic circles or in elementary schools.

He studied at Christ's College, Cambridge, where he received his B.A. and Ph.D. degrees. He also started his career there as a College Lecturer in 1955. In 1964 he went to the newly established University of Warwick in Coventry. There he led the setting up of the Department of Mathematics and the Mathematics Research Center. Largely due to Zeeman's leadership skills, mathematics at Warwick received international reputation.

In 1988 he left Warwick, where he had been made an honourary professor. He became Principal at Hertford College, Oxford and Gresham Professor of Geometry at Gresham College, London. He retired from his Gresham post in 1994 and from his position of Principal in 1995.

Zeeman's research has been in a variety of areas such as topology, dynamical systems and mathematical applications to biology and social sciences. Perhaps he is best known for his work on catastrophe theory. Zeeman pioneered the applications of catastrophe theory in the biological, behavioral and physical sciences. He invented the Zeeman Catastrophe machine which is device that illustrates how small perturbation can give rise to a discontinuous consequence.

Among Zeeman's books are *Catastrophe Theory* (1977), *Geometry and Perspective* (1987), and *Gyroscopes* (1989). An introduction to catastrophe theory is given by Zeeman in his beautifully written survey article "Bifurcation and Catastrophe Theory", Contemp. Math. (1981). In 1978, Zeeman gave the Christmas Lectures at the Royal Institution, out of which grew the Mathematics Master Classes for 13-year old children. These lectures are now used in forty centers in the United Kingdom.

He was the 63rd President of the London Mathematical Society between 1986-88. In 1982 he was awarded the Senior Whitehead Prize of the London Mathematical Society and in 1987 he became the Society's first Forder lecturer. Elected to the Royal Society of London in 1975, he was awarded the Society's Faraday Medal in 1988 and many other honorary degrees from several universities including Strasbourg (1974), Hull (1984), Warwick (1988), York (1988), Leeds (1990), Durham (1990), and Hartford (1992). Zeeman was knighted in 1991.

See **www.pims.math.ca/activities/lectures.html** for the location and time of the lecture.

PIMS/MITACS Group at UBC and the University of Calgary Develops Methods for Modelling Pricing of Electricity Markets

Traders must make educated decisions about when to buy and when to sell in both financial markets as well as commodity markets. The goal of the *Modeling, Trading and Risk in the Market* MITACS project is to develop tools to assist in this decision making process. For non-standard commodities, such as energy (electricity or natural gas) or time on long-distance communication channels (where it is a "use it or lose it" situation), this requires modeling and forecasting of supply, demand and price.

Project Leader Ulrich Haussmann (Math, UBC) leads a team of 10 faculty members and a number of post doctoral fellows and graduate students. The project members are Martin Barlow (Mathematics, UBC), Larry Bates (Mathematics and Statistics, U. Calgary), Nassif Ghoussoub (PIMS and Mathematics, UBC), Changfeng Gui (Mathematics, UBC), Ulrich Haussmann (Mathematics, UBC), Ali Lari-Lavassani (Mathematics and Statistics, U. Calgary), Jian Liu (Statistics, UBC), Anthony Peirce (Mathematics, UBC), Gordon Sick (Faculty of Management, U. Calgary) and John Walsh (Mathematics, UBC). The project's industrial partners are FinancialCAD (Surrey, BC), Powerex (Vancouver, BC) and TransAlta (Calgary, Alberta). The research activities of the project are conducted primarily at the PIMS/MITACS Financial Mathematics Laboratory in the PIMS Main Facility on the UBC campus and the Mathematical and Computational Finance Laboratory at the University of Calgary.

One main component of the project is the commodity market for energy and electricity, because Powerex and TransAlta are the trading arms of the two utility giants of Western Canada. The electricity markets are becoming increasingly open and deregulated, leading to the trading of electricity as a commodity. However, electricity is unlike any other commodity in that it cannot be stored (leading to an incomplete market, financially speaking), its trading has volume constraints (it must transit through transmission lines), and the price of electricity undergoes large sudden shocks and tend to revert back quickly (the process is far from being log-normal). Consequently, the familiar realm of Black-Scholes developed for stock and interest markets is not valid in the context of the electric market. This poses tremendous challenges to mathematicians as far as modelling goes. Furthermore, it introduces a great deal of computational complexity. It is fair to say mathematicians with expertise in probability and stochastic processes, applied mathematics, dynamics and numerical methods have a lot to contribute to the development of this emerging field. This is one of those cases where sophisticated mathematics and numerics are needed and the researchers in this project are glad to be at the forefront of these new and exciting developments.

The Mathematical and Computational Finance Laboratory at the University of Calgary is under the leadership of Ali Lari-Lavassani (Math, University of Calgary), an expert in non-linear dynamics, complexity theory and adaptive computational methods. The laboratory hosts a variety of computational platforms, which are being used to develop numerical algorithms for electricity pricing. The development work is done with MATLAB software on a 3 CPU, HPC Sun Server and Pentiums II and III. The final codes are then designed to fit the computational capability of a single processor Pentium, since this is how the models are being used in the industry.

Under the leadership of Martin Barlow (Math, UBC), the project members at UBC have developed several models for the price process of electricity. These models are generally multidimensional. When pricing derivatives, every additional dimension constitutes a major impediment to numerical implementation on a single processor machine.

The team at the Mathematical and Computational Finance Laboratory in Calgary have developed several generations of numerical algorithms for multi-asset derivatives used in energy. To address the problem of volume constraints they have developed a complete methodology for Swing options which are complex embedded multidimensional energy derivatives. In addition, they have managed to devise numerical algorithms for this problem that run quite efficiently on single processor Pentium computers.

The group in Calgary is currently developing new and interesting trinomial and finite difference numerical schemes for energy derivatives under mean reverting price processes. In collaboration with Dr. Tahir Choulli, a PIMS PDF, they are investigating convergence of very general trinomial processes for energy derivatives. Over the upcoming year, they will explore additional derivative models for energy. Theoretical investigations will focus on the existence, stability and convergence of numerical algorithms for implementing these models. Their numerical work will concentrate on developing efficient implementations of these algorithms.

For more information about the *Modeling, Trading and Risk in the Market* project, visit the webpage at **www.math.ubc.ca/~uhaus/mitacs/fin.html**. The home page of the Mathematical and Computational Finance Laboratory is **finance.math.ucalgary.ca**.

First MITACS Annual General Meeting
Toronto, Ontario on June 6–7, 2000
See www.mitacs.math.ca for more infomation.

PIMS Graduate Industrial Mathematics Modelling Camp

PIMS at SFU
May 22–26, 2000

The third annual PIMS Graduate Industrial Mathematics Modelling Camp will be held at the new PIMS facility at Simon Fraser University. The first Modelling Camp was hosted by SFU in 1998 and the second by the University of Alberta in 1999.

The format of the camp calls for students to work together in teams, under the supervision of invited mentors. Each mentor will pose a problem arising from an industrial or engineering application and will guide his or her team of graduate students through a modelling phase to a resolution. The chair of the organizing committee this year is Keith Promislow (Math & Statistics, SFU). The industrial mentors are:

Sharon Filipowski (Boeing), to be confirmed
Rachel Kuske (University of Minnesota)
Colin Please (University of Southampton)
David Ross (Kodak), to be confirmed
Donald Schwendeman (Renssalar Polytechnic Institute)

The deadline for application is April 15, 2000. For further information and registration see the webpage **www.pims.math.ca/industrial/2000/gimmc**.

PIMS Industrial Problem Solving Workshop

PIMS at the University of Alberta
May 29 – June 2, 2000

This workshop will follow the same highly successful format as PIMS' previous three Industrial Problem Solving Workshops held in Vancouver, Calgary and Victoria. This format is based on the Oxford Study Group Model, in which problems of relevant and current interest to the participating companies are posed to the workshop participants by experts from industry. The participating graduate students and academics will spend five days working on the problems and the results will be published in the workshop's proceedings. The advantages for participating students and academics are:

1. The challenge of applying your skills to new and relevant problems directly applicable to industry.
2. The opportunity for continued collaboration with the workshop's academic and industrial participants.
3. Help PIMS and mathematics in general, by showing businesses and governments the tangible benefits of supporting mathematical sciences.

Graduate students are encouraged to attend the *Graduate Modelling Workshop* in preparation for the *Industrial Problem Solving Workshop.*

The organizers of this year's workshop are Jack Macki and Bryant Moodie (Math, University of Alberta). For more information and registration see the webpage **pims.math.ualberta.ca/Pims/4IPSW_main.html**.

PIMS Fluid Dynamics Summer School

PIMS at the University of Alberta
July 30 – August 11, 2000

Participants at the Second Annual PIMS Summer School in Fluid Mechanics will attend a comprehensive series of lectures and will be given hands-on experience performing and analyzing experiments in the Environmental and Industrial Fluid Dynamics Laboratory, as well as running numerical simulations using research-level codes. Topics will include fluid dynamics fundamentals, industrial and environmental flows, geophysical fluid dynamics, turbulence modelling and computational fluid dynamics. Subjects will be taught at the graduate level.

This summer school is one of three summer schools in the world on fluid dynamics. The others are at the University of Cambridge and Woods Hole Oceanographic Institute. The PIMS school is unique in that it emphasizes computation fluid dynamics. The first PIMS Summer School last year was highly successful, with 28 participants, the maximum number that can be accommodated in the laboratory facilities. The organizers are Bruce Sutherland and T. Bryant Moodie (Department of Mathematical Sciences, University of Alberta).

Invited Speakers:

Paul F. Linden (University of California, San Diego)
James C. McWilliams (University of California at Los Angeles)
Frans T. W. Nieuwstadt (Delft University of Technology)

Core Lecturers:

John C. Bowman, *Turbulence Modelling*
Andrew B. G. Bush, *Climate Modelling*
Peter Minev, *Computational Fluid Dynamics*
T. Bryant Moodie, *Wave Theory*
Bruce R. Sutherland, *Stratified Flows*
Gordon E. Swaters, *Physical Oceanography*

For more information and registration see the webpage **taylor.math.ualberta.ca/∼bruce/events/fdss**.

Call for Applications:

Postdoctoral Position in Mathematical Finance

The Modeling, Trading and Risk in the Market (MTRM) group within the MITACS project based at the Pacific Institute of Mathematical Sciences, invites applications for two financial mathematics postdoctoral fellowships. The appointments are for one year, with expected renewal for a second year, and are subject to the availability of funds. Appointments will commence on July 1, 2000 and will be based at the University of British Columbia.

For additional information, please visit the webpage **www.pims.math.ca/opportunities/mitacs-pdf.html**.

Northwest Dynamics Symposium

PIMS at University of Victoria
May 6–8, 2000

This workshop will cover a variety of topics, including ergodic theory, symbolic dynamics, topological dynamics, aperiodic tilings and K-theory. The principal speakers that have confirmed to date are Mike Boyle (U. of Maryland), Bob Burton (Oregon State U.) Robert Moody (U. of Alberta) and Dan Rudolph (U. of Maryland). The organizers are Chris Bose (U. of Victoria), Doug Lind (U. Washington) and Ian Putnam (U. of Victoria). For more information please visit the webpage **www.pims.math.ca/science/2000/nwds**.

Second International Workshop on Scientific Computing and Applications

Kananaskis, Alberta, Canada
May 28 – June 1, 2000

The Second International Workshop on Scientific Computing and Applications will continue the tradition of the highly successful workshop held at the City University of Honk Kong in December 1998. The aim is to bring together mathematicians, scientists and engineers working in the field of scientific computing and its applications to solve scientific and industrially oriented problems. The organizers of the workshop are P. Minev and Y. Lin (University of Alberta). The workshop is sponsored by PIMS and the University of Alberta.

Invited Speakers:

W. Allegretto (University of Alberta)
O. Axelsson (Catholic University of Nijmegen)
R. Ewing (Texas A & M)
M. Fortin (Université Laval)
K. Y. Fung (Hong Kong Polytechnic University)
P. Gresho (Lawrence Livermore Laboratory)
R. Lazarov (Texas A & M)
B. Lee (NRC, Ottawa)
S. L. Lyons (Mobil Technology)
W. Sun (City University of HK)
T. Tang (Hong Kong Baptist University)
Zhong-Ci Shi (Academia Sinica)

For further information please visit the webpage **www.math.ualberta.ca/~pminev/SciComp2000**.

Frontiers in Mathematical Physics Workshop on String Cosmology

PIMS at UBC
July 24 – August 4, 2000

The goal of the Workshop is to bring together experts in string theory, nonperturbative gauge field theory and cosmology to explore the consequences for cosmology of the recent breakthroughs in fundamental field and string theory. These consequences may lead to a greatly improved understanding of the early Universe, and to the resolution of some fundamental problems for cosmology left unanswered by the present theories of the early Universe.

This workshop is co-sponsored by PIMS, the Canadian Insitute for Advanced Research and the Asia Pacific Center for Theoretical Physics. The organizing committee consists of Robert Brandenberger (Brown Univ.), Chaiho Rim (APCTP), Alexander Rutherford (PIMS), Bill Unruh (UBC) and Ariel Zhitnitsky (UBC).

Invited Speakers:

Tom Banks (Rutgers), tentative
Gia Dvali (New York Univ. and ICTP)
Nemanja Kaloper (CITA, Univ. of Toronto)
Lev Kofman (CITA, Univ. of Toronto)
Andrei Linde (Stanford Univ.), tentative
Rob Myers (McGill Univ.)
Burt Ovrut (Univ. of Pennsylvania)
Soo-Jong Rey (Seoul National Univ.)
Valery Rubakov (Inst. for Nuclear Research, Moscow)
Misha Shaposhnikov (Univ. Lausanne), tentative
E. Shuryak (Stony Brook)
Dam Son (Columbia Univ.)
Paul Steinhardt (Princeton Univ.)
Neil Turok (DAMTP, Univ. of Cambridge)
Gabriele Veneziano (CERN)

Only a limited number of places are available at the workshop. The deadline for applications is April 1, 2000. For more information and registration see the webpage **www.pims.math.ca/fmp/2000**.

Victoria Computational Cosmology Conference (VC3)

PIMS at the University of Victoria
August 21–26, 2000

This conference will bring together leading and well-established astrophysicists as well as young researchers. The goal of the conference is to discuss the interface between state-of-the-art observations and theory, particularly from the area of computational cosmology. Each day of the workshop will be devoted to one of the following five topics:

1. The Milky Way Galaxy as the Product of a Merger Sequence
2. The Cosmological Assembly and Evolution of Galaxies
3. The Impact of the Environment on Galaxies: Clusters, Groups, Filaments, and the Field
4. The Impact of Galaxies on Their Environments: the ICM and the IGM
5. The Ly-Alpha/Galaxy Connection: From Absorption Lines to Full-Fledged Galaxies

The maximum number of participants is limited to 100. We encourage applications from graduate students. If funding allows, we will attempt to provide a small subsidy to partially offset the costs of attending the meeting.

The deadline for submission of an abstract for oral or poster presentation is April 1, 2000. The deadline for registration is May 30, 2000. For more information and registration see **pinot.phys.uvic.ca/~jfn/vc3**.

PIMS Thematic Programme in Algebra
PIMS at the University of Alberta
June 19 – July 14, 2000

The PIMS Thematic Programme in Algebra consists of 4 weeks of instructional courses and research-level workshops/conferences in each of the three broad areas: Lie Theory (Lie groups and algebras), Group Theory & Representations, and the Mathematics of Aperiodic Order. In each area, there will be a one-week instructional school followed by a one-week research-level workshop/conference. The instructional schools are intended for graduate students, postdoctoral fellows, young Ph. D.'s, and exceptional undergraduates. Please note that there is special financial assistance available for participants in the instructional schools. The workshops/conferences are aimed at researchers, advanced graduate students, and others familiar with the area. Participants are welcome to attend any mix of instructional and workshops/conferences that interest them.

Thematic Programme Schedule

June 19–23	June 26–30	July 3–7	July 10–14
Lie Theory School	Lie Theory Workshop Group Theory School	Group Theory Workshop Aperiodic Order School	Aperiodic Order Workshop

Lie Theory

The lecturers at the School on Lie Theory are A. Pianzola (University of Alberta), *Lie Algebras* and S. Donkin (Queen Mary & Westfield College, London), *Algebraic Groups.*

Confirmed Participants in Lie Theory Workshop

G. Benkart (University of Wisconsin)
N. Bergeron (York University)
S. Berman, (University of Saskatchewan)
Y. Billig (University of New Brunswick)
A. Broer (Univerité de Montréal)
C. Dong (Univ. of California, Santa Cruz)
S. Donkin (Queen Mary & Westfield College, London)
Y. Gao, (York University)
M. Gaberdiel (Cambridge University)
T. Gannon (University of Alberta)
Y.-Z. Huang (Rutgers University)
O. Mathieu (IRMA, Strasbourg)
K.-H. Neeb (Technische Universität Darmstadt)
E. Neher (University of Ottawa)
C. Schweigert (Université Paris VI)
O. Smirnov (Randolph-Macon)

Group Theory and Representations

The lecturers at the School on Group Theory and representations are Michel Broué (Univ. de Paris VII), *Representations of Groups of Lie Type*, Peter Kropholler (Queen Mary & Westfield College, London), *Cohomological Methods*, Dan Segal (Oxford University), *Residually finite groups* and Aner Shalev (Hebrew University, Jerusalem), *Profinite and p-adic analytic groups.*

Confirmed Participants in the Group Theory Workshop

Michel Broué (Université Paris VII)
Steve Gersten (University of Utah)
Rod Gow (Dublin City University)
Peter Kropholler (Queen Mary & Westfield College, London)
A. Lubotzky (Hebrew University, Jerusalem)
A. Yu. Ol'shanskii (Moscow State University)
Geoffrey Robinson (University of Birmingham)
Dan Segal (Oxford University)
Aner Shalev (Hebrew University, Jerusalem)
Alex Turull (University of Florida)

Mathematics of Aperiodic Order

The lecturers at the School on Aperiodic Order are M. Baake (Universität Tübingen), *Introduction to aperiodic order, tilings, and diffraction*, J. Lagarias (AT&T Labs), *Discrete geometry and aperiodic point sets* and B. Solomyak (University of Washington), *Dynamical systems and aperiodic order.*

Confirmed Participants in the Workshop on Aperiodic Order

Jean-Paul Allouche (CNRS, Orsay)
Michael Baake (Universität Tübingen)
Jean-Pierre Gazeau (Université Paris VII)
Uwe Grimm (Technische Universität Chemnitz)
Petra Gummelt (Universität Greifswald)
Jeff Lagarias (AT&T Labs)
Boris Solomyak (University of Washington)

For registration and further information, please visit the website
http://www.pims.math.ca/algebra2000

Graph Theory and Combinatorial Optimization
Summer 2000 Thematic Programme

As part of the joint Fields-PIMS 1999-2000 Thematic Year in Graph Theory and Combinatorial Optimization, PIMS is hosting four summer workshop at the University of Victoria and Simon Fraser University.

Dynamic Graph Problems

June 4–10 at The University of Victoria

Organizers: Monika Henzinger (Google, Inc.) and Valerie King (University of Victoria)

The goal of this workshop is to bring together experts on various topics in the area with interested students and researchers, to discuss the current state of the field, identify promising directions for research, and do some problem-solving. Topics include: proving lower bounds, problems in computational geometry, new and old problems for undirected and for directed graphs, problems on trees, and applications to networks, data bases and programming languages.

Principal Speakers

Bob Tarjan (Princeton Univ. and Intertrust)
Stephen Alstrup (ITU, Copenhagen)
David Eppstein (Univ. of California, Irvine)
Faith Fich (Univ. of Toronto)
Pino Italiano (Univ. degli Studi di Roma)
Roded Sharan (Tel Aviv University)
Mikkel Thorup (AT & T Research)

Graph Decompositions

June 18 – July 1 at Simon Fraser University

Organizing Committee: Brian Alspach, chair, (University of Regina), Reinhard Diestel (Universität Hamburg), Herbert Fleischner (Austrian Academy of Science), Ron Gould (Emory University) and Chris Rodger (Auburn University)

The workshop will consist of a series of invited instructional lectures whose purpose is to survey the current status of a variety of important graph decomposition problems. The workshop will deal only with edge decomposition problems. Some time slots will be kept open for participants to provide complementary talks or responses to the invited lectures.

Principal Speakers

Darryn Bryant (University of Queensland)
Edward Dobson (Mississippi State)
Mark Ellingham (Vanderbilt University)
Herbert Fleischner (Austrian Academy of Science)
Hans-Dietrich Gronau (Universitat Rostock)
Jiuqiang Liu (Eastern Michigan)
Chris Rodger (Auburn University)
Mateja Sajna (Capilano College)

Flows, Cycles, and Orientations

July 2–14 at Simon Fraser University

Organizer: Luis Goddyn (Simon Fraser University)

This workshop presents an opportunity for participants to identify and work collaboratively on current problems in graph/matroid theory which broadly fall into the above three categories. Topics may concern algorithmic, polyhedral, algebraic, probabilistic, or extremal aspects, and may involve embeddings, flow/colouring theory, circuit/bond covers, matroids and connectivity.

Colourings and Homomorphisms

July 16–29 at Simon Fraser University

Organizing Committte: Pavol Hell, chair (Simon Fraser University), Jing Huang (University of Victoria), Rick Brewster (Capilano College), Gena Hahn (Université de Montréal)

The workshop will consist of a series of invited instructional lectures, addressed to graduate students, and highlighting recent developments in graph colourings and their generalizations - including circular and oriented colourings, and, more generally, graph homomorphisms.

Principal Speakers

Mike Albertson (Smith College)
Noga Alon (Tel Aviv University)
Adrian Bondy (UniversitĆlaude Bernard Lyon 1)
Tommy Jensen (Universität Hamburg)
Bojan Mohar (University of Ljubljana)
Jarik Nesetril (Universite Charles, Prague)
Andre Raspaud (Université Bordeaux)
Bruce Reed (CNRS, Paris)
Gert Sabidussi (Université de Montréal)
Norbert Sauer (University of Calgary)
Claude Tardif (University of Regina)
Bjarne Toft (Odense University)
Peter Winkler (Bell Labs)
Xuding Zhu (Taiwan)

For registration and further information, please visit the website
http://www.pims.math.ca/graph2000

National Programme Committee

Last year the three Canadian Institutes in the Mathematical Sciences, CRM, Fields and PIMS, initiated a new programme for the support of joint activities in the mathematical sciences. This programme is administered by a National Programme Committee, which makes recommendations to the Directors of the three institutes. The mandate includes:

(i) allocating funds provided by the three institutes to support conferences and workshops in the mathematical sciences across Canada. These will primarily be activities that fall outside of the main purview of the three institutes, or that would benefit from joint institute funding.

(ii) allocating funds for the support of activities that are held at the meetings of the three Canadian mathematical science societies: Canadian Mathematical Society, Canadian Applied and Industrial Mathematical Society, Statistical Society of Canada.

(iii) assist the National Societies in supporting graduate students to attend these scientific meetings.

(iv) annually coordinating the organization of three Institute Sessions to be held at the meetings of the Canadian Mathematical Society.

(v) coordinating international programmes and other ventures where it is advantageous for the three Institutes to act as a whole.

The six member committee consists of the Deputy Director and one member of the scientific advisory panel at each institute.

A call for proposals is made semi-annually with proposals due on September 15 and March 15. Primary administrative responsibility for the programme will rotate between the three Institutes on an annual basis. Submissions will be to the Deputy Director of the institute administering the programme in that year following the guidelines available on the web site of that institute. This year the Committee is chaired by Michael Lamoureux, Deputy Director of PIMS, and the members of the committee are Martin Barlow (UBC/PIMS), Jacques Belair (CRM), Bradd Hart (McMaster/Fields), Niky Kamran (McGill) and David Sankoff (CRM/Fields).

For the year April 1, 2000 to March 31, 2001 the three institutes will jointly allocate up to $100,000 for activities under this programme.

In December 1999, the Committee approved support for the following slate of scientific activities:

Western Canada Linear Algebra Meeting
University of Manitoba, May 26 – 27, 2000
Contact: P. ven den Driessche (UVic) ⟨pvdd@math.uvic.ca⟩
Webpage: www.math.uregina.ca/~tsat/wclam/wclam00.html

Special Functions 2000
Arizona State University, May 29 – June 9
Contact: L. Vinet (McGill) ⟨vinet@CRM.UMontreal.CA⟩

Statistical Society of Canada, 2000 Conference
Ottawa, June 4–7, 2000
Contact: D. Murdoch (Univ. of Western Ont.) ⟨murdoch@fisher.stats.uwo.ca⟩

Math 2000 Meeting
McMaster University, June 10–13, 2000
The National Programme Committee is providing support for:

- CAIMS Sessions
- CMS Session in Mathematical Biology
- CMS Session in Symplectic Geometry

Webpage: camel.math.ca/CMS/Events/math2000/main.html

Topological and Variational Methods in Nonlinear Analysis
Warsaw, Poland, June 19–23, 2000
Contact: W. Krawcewicz (U. Alberta) ⟨wkrawcew@math.ualberta.ca⟩

First Prairie Industrial Problem Solving Workshop
Brandon, Manitoba, August 7–11, 2000
Contact: L. Batten, (Univ. of Manitoba) ⟨batten@cc.umanitoba.ca⟩

CMS Winter 2000 Meeting
University of British Columbia, December 10–12, 2000
Web: camel.math.ca/CMS/Events/

- Session in Probability Theory

Call for Proposals:

National Programme Committee

The National Programme Committee of the three Canadian Insttiutes in the Mathematical Sciences (CRM, Fields, PIMS) invites applications for funding of conferences and workshops in the mathematical sciences. The deadline for applications is **March 15, 2000**.

For more information and details about the application procedure, please see the webpage **www.pims.math.ca/opportunities/natprogcomm.html**. Email enquiries may be directed to the address npc@pims.math.ca.

Report on Particles, Fields and Strings '99

The 1999 Frontiers in Mathematical Physics Workshop, entitled *Particles, Fields and Strings* took place at the Pacific Institute for Mathematical Sciences site at the University of British Columbia between August 2 and 20, 1999.

There were sixty-eight participants. Of these, sixteen were postdoctoral Fellows, fourteen were graduate students and the remainder were more senior scientists. Participation in the workshop was truely internation, with scientists from Russia, Korea, Japan, Taiwan, USA, Canada, Italy, France, England, Spain, Denmark and Ireland among the participants.

There were two seminars per day during the Workshop. The schedule provided a significant amount of time for discussions and scientific work. Collaborations were encouraged. The seminar speakers were a combination of invited speakers and other participants. The presence of invited speakers provided a scientific focus to the workshop and strengthened the quality of the seminars.

The main scientific topic was recent developments in superstring theory. The two main themes were the IKKT matrix model of type IIB strings and the AdS/CFT correspondence. Other topics, such as the role of K-theory in string theory, the structure of supersymmetric Yang-Mills theory and some general questions about the solutions of supergravity were also discussed. Igor Klebanov (Princeton University) presented a series of three review lectures on the AdS/CFT correspondence. Joe Polchinski (ITP Santa Barbara) gave a series of two lectures discussing some more advanced issues in that subject. Other invited speakers were Peter Horava (CalTech), Seungjoon Hyun (Seoul), Hikaru Kawai (Kyoto), Kimyeong Lee (Seoul National U.), Amanda Peet (Santa Barbara) and S. Rajeev (Rochester).

Report on 24$^{\text{th}}$ Cascade Topology Seminar

The 24$^{\text{th}}$ Cascade Toplogy Seminar was held at PIMS-UBC on October 2–3, 1999. It was in honour of Professor Erhard Luft, who recently retired from the Department of Mathematics at UBC. Approximately 50 participants attended from the PIMS universities, Oregon State University, the University of Oregon, Portland State University, the University of Washington and the Mathematical Sciences Research Institute. The seminar was jointly sponsored by PIMS and the National Science Foundation, USA.

The speakers at the seminar were:

Alejandro Adem (University of Wisconsin), *Periodicity, Euler Classes and Group Actions*

Guillermo Moreno (Centro de Investigacion del IPN and University of Oregon), *The Zero Set of the Hopf Map*

John Palmieri (University of Washington), *Stable Homotopy Theory and the Steenrod Algebra*

Leila Schneps (ENS Paris) *Diffeomorphisms of Topological Surfaces and the Absolute Galois Group*

Denis Sjerve (UBC), *On the Mathematical Contributions of Erhard Luft*

The next Cascade Topology Seminar will be held at Portland State University on May 20–21, 2000.

Report on PIMS Postdoctoral Fellow Workshop

The Second Annual PIMS PDF was held at the PIMS-UBC office on December 4–5, 1999. At this workshop PIMS Postdoctoral Fellows presented seminars on their research. It also provided an opportunity for the PDF's, who have their offices at the five PIMS sites, with an opportunity to interact both scientifically and socially. Lectures presented at the workshop were:

Siva Athreya (UBC), *Connections Between Partial Differential Equations, Probability and Stochastic Differential Equations*

Ioan Bucataru (UA), *Voltera-Hamilton Production Models with Discounting: General Theory and Concrete Examples*

Ricardo Carretero (SFU), *Reconstructing Spatio-temporal Chaotic Dynamics from Observations*

Alexandra Chavez-Ross (UBC), *Aggregation Models for Beta-amyloid Plaque Formation in Alzheimer's Disease*

Tahir Choulli (UC), *A Class of Stochastic Processes and Applications to Mathematical Finance*

Igor Fulman (UC), *Ideals in Non-selfadjoint Algebras Associated to Semidynamical Systems*

Madhu Nayakkankuppam (UBC, SFU, UA), *Optimization Over Symmetric Curves*

Miro Powojowski (UC), *The Imaging Problem in Electric Resistivity Tomography (ERT)*

Gengsheng Qin (UVic), *Empirical Likelihood Ratio Confidence Interval for the Trimmed Mean*

Michael Segal (UBC), *Piercing and Center Problems*

Ladislav Stacho (SFU), *New Upper Bounds for Chromatic Number of a Graph*

Bret Stevens (SFU), *Mathematics and Literature*

Konstantin Zarembo (UBC), *Guage Fields and Anti-de-Sitter Supergravity*

Call for Proposals:

PIMS Scientific Activities

The Pacific Institute for the Mathematical Sciences (PIMS) invites proposals for institute activities in the mathematical sciences. Proposals should be for conferences, workshops, seminars or related activities to occur after April 1, 2001. The deadline for applications is **March 17, 2000**.

For more information and access to an electronic form for submitting proposals, please visit the webpage **www.pims.math.ca/opportunities/proposals.html**. Proposals may also be emailed to the address proposal@pims.math.ca. Enquiries should be directed to Sandy Rutherford, PIMS Scientific Executive Officer, at sandy@pims.math.ca.

Alternative Math Education Night a Success in Sydney

The Alternative Math Education Night, which was held on November 23, 1999 at Sidney Elementary School on Vancouver Island was a great success. Almost 300 students and parents took part in the event, which was organizered by the PIMS Education Team at the University of Victoria.

The success of the Alternative Math Education Nights has lead to numerous requests from other schools on the Vancouver Island to arrange similar events. The next event, called *Math Mania,* will take place at Burnside Community School in Victoria on March 1, 2000. A group of enthusiastic volunteers from the University of Victoria Departments of Mathematics and Statistics and Computer Science, as well as graduate and undergraduate students, will demonstrate "fun" methods to teach math and computer science concepts. Among the demonstrations will be exciting geometrical models from straws and paper, an impossible balancing act, mathematical puzzles, a guessing game, a sorting network, a penny game, a set game, incredible soap bubbles, and much more. See the website **www.math.uvic.ca/pims/altmath/march1.html** for more details.

Report on PIMS Graduate Weekend

This year the PIMS Graduate Weekend was held at UBC and SFU on February 12–13. PIMS hosted 43 of the top undergraduates in mathematics, computer science and statistics from across Canada. The students attended a variety of lectures and presentations on graduate programmes in the mathematical sciences at the PIMS universities.

On Saturday, the students visited SFU. In the morning they attended presentations by Peter Borwein, Kori Inkpen, Luis Goddyn and Charmain Dean from SFU. Pauline van den Driesche spoke about the graduate programmes in the mathematical sciences at the University of Victoria and Michael Lamoureux presented information on graduate studies at the University of Calgary. In the afternoon the students toured some of the research facilities at SFU and ended the day with a buffet dinner at the Diamond University Club.

On Sunday, the students visited the University of British Columbia, where they were hosted at the PIMS-UBC facilities. Presentations were made to the students by Denis Sjerve, Goerge Bluman, Nassif Ghoussoub, Anthony Peirce, Robert Miura, Dave Boyd, Dale Rolfsen, Martin Barlow, Alan Wagner and Nancy Heckman. Samuel Shen, from the University of Alberta, gave a presentation on the benefits of doing graduate work at the University of Alberta. After lunch, the students broke up into small groups to tour the research facilities and discuss with faculty members.

PIMS thanks Kori Inkpen (Computer Science, SFU), Randy Sitter (Math & Satistics, SFU), Denis Sjerve (Math, UBC) and Sandy Rutherford (PIMS) for organizing the programme for the weekend. PIMS acknowledges the Department of Mathematics (UBC), Department of Computer Science (UBC), the VP Research (SFU), School of Computer Science (SFU), Centre for Systems Science (SFU), Faculty of Graduate Studies (UBC), Department of Mathematics and Statistics (SFU) and Department of Statistics (UBC) for providing additional support to make this event possible.

Evening of Mathematics Math Evening SFU, Harbour Centre

March 2, 2000

The next event on the series of SFU Math evenings sponsored by PIMS will take place at the SFU Harbour Centre on Thursday, March 2 in the Fletcher Challenge Theatre. Speaking at the evening will be Dr. Keith Promislow (Mathematics & Statistics, SFU) and Dr. Bret Stevens (IBM/PIMS Postdoctoral Fellow, SFU).

Keith Promislow will speak on *Mathematics of Fuel Cells.* He is conducting his research on fuel cells through the PIMS/MITACS project, *Mathematical Modeling and Scientific Computation.* Ballard Powersystems is one of the industrial partners in this project.

Bret Stevens will give a lecture entitled *Mathematics and Literature: Cross Fertilization.* Brett has long been interested in connections between mathematics and the arts.

To register for the evening contact Dr. Malgorzata Dubiel, Department of Mathematics & Statistics, SFU (email: dubiel@cs.sfu.ca). For more information see the web page **www.pims.math.ca/education/Various/MathEve1.html.**

PIMS Elementary Grades Math Contest PIMS at UBC

May 13, 2000

This annual contest, initiated and organized by Dr. Cary Chien of David Thompson Secondary in Vancouver and Dr. Klaus Hoechsmann of PIMS, provides a great opportunity for elementary school students to experience mathematics as an exciting sport. The contest is open at the nominal cost of $5 to all students in grades 5 to 7.

The contest is modelled after the successful MathCounts competitions for high school students and it is expected that many of the participants will "graduate" to MathCounts when they attend high school. This is the second year of the contest. The inaugural contest last year was a great success, with 320 students partipating. This year, we look forward to even higher participation.

For registration and more information see the webpage **www.pims.math.ca/education/Elmacon**. A set of 50 sample problems with solutions is provided on the webpage.

Year 2000 is World Mathematical Year

The International Mathematical Union (IMU) declared the year 2000 to be World Mathematical Year (WMY 2000) in the *Declaration of Rio de Janeiro on Mathematics* of May 6, 1992. The *Declaration of Rio de Janeiro* sets three goals:

1. the determination of great mathematical challenges of the 21st century
2. the promulgation of mathematics, both pure and applied, as one of the main keys for development
3. the recognition of the systematic presence of mathematics in the information society

In its November 11, 1997 plenary meeting, the UNESCO General Conference approved a resolution to sponsor WMY 2000. This resolution was co-sponsored by the following 15 countries: Belgium, Benin, Brazil, Colombia, Cote d'Ivoire, Denmark, France, Ireland, Luxembourg, Philippines, Netherlands, Russian Federation, Spain, Thailand, Uzbekistan.

In addition to the WMY 2000 programme, the IMU established the *Turn of the Century Committee*, which will organize an effort to envision what the great mathematical challenges of the 21st century will be. The members of the *Turn of the Century Committee* are:

Jacob Palis, chair (IMU secretary)
V. I. Arnold (Steklov Mathematical Institute, Moscow)
F. Hirzebruch (Max-Planck Institut für Mathematik)
L. Lovász (Hungarian Academy of Sciences and Yale)
B. Mazur (Harvard University)
S. Mizohata (University of Kyoto)
G. D. Mostow (Yale University)
J. Tits (Collège de France)
W. P. Thurston (Mathematical Sciences Research Institute)
S. R. S. Varadhan (Courant Institute)

Mathematics institutes around the world are participating in WMY 2000. One of the recent activities was the Joint Mathematics Meeting, co-sponsored by the American Mathematical Society, Mathematical Association of America, and Society for Industrial and Applied Mathematics at Washington, DC on January 19–22, 2000. At this meeting, CRM, DIMACS, the Fields Institute, IMA, IPAM, MSRI and PIMS hosted the Mathematical Sciences Institutes Reception. PIMS was represented at this reception by Nassif Ghoussoub, its director.

In Canada, the CMS, the CRM, the Fields Institute and PIMS each have WMY 2000 activities. The CMS and the three institutes are sponsoring a WMY 2000 meeting at McMaster University from June 10–13, 2000. The CRM is sponsoring a series of posters on the Montréal métro, which draws public awareness to the importance of mathematics. The Fields Institute is hosting a WMY 2000 Symposium on the legacy of John Charles Fields. It will be held at the Royal Ontario Museum on June 7–9, 2000. PIMS is sponsoring a campaign of twelve posters throughout the year on public transit in Western Canada. PIMS is also launching the mathematics education magazine *Pi in the Sky.*

Each of the PIMS posters focuses on an example of mathematics in the world around us. A related math question is posed and people are encouraged to visit a PIMS webpage to learn more. On the webpage, more background on the problem is provided and an electronic form for submitting proposed solutions is available. Correct solutions are eligible to win $100 in a draw, which will be held at the end of each month.

Currently posters are running on the #99 and #135 bus lines in Vancouver and on selected buses in Victoria. Look for PIMS WMY 2000 posters on public transit in Vancouver, Victoria, Edmonton and Calgary during the coming months.

Related Webpages

PIMS WMY 2000 Sunflower Poster Page:
www.pims.math.ca/sunflower

WMY 2000 Symposium on John C. Fields:
www.fields.utoronto.ca/jcfields-legacy.html

CRM WMY 2000 Page:
www.crm.umontreal.ca/math2000

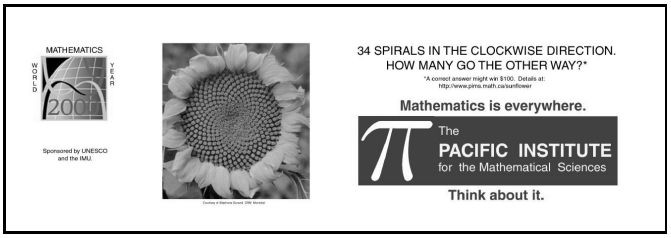
CMS WMY 2000 Symposia
www.cms.math.ca/CMS/Events/math2000

Newton Institute WMY 2000 Poster Page
www.newton.cam.ac.uk/wmy2kposters

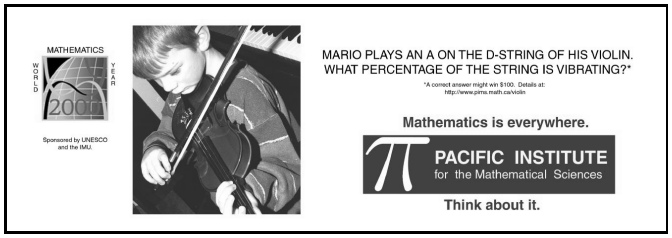
WMY 2000 Homepage:
wmy2000.math.jussieu.fr

IMU Homepage:
www.mathunion.org

UNESCO Homepage:
www.unesco.org



On the Buses in February



On the Buses in March

Continued from page 1.

Board Members

Dr. Don Denney received his Ph.D. from the University of Waterloo in 1978 and spent two years as a post-doctoral fellow at the University of Colorado engaged in atmospheric chemistry studies and in developing statistical pattern recognition techniques. He is Manager of Information Services at Syncrude Canada-Ltd and Director of PRECARN/IRIS. He served as the PRECARN/IRIS Board Chair for 1999–2000.

Dr. Maria Klawe is a Professor of Computer Science and Dean of Science at the University of British Columbia. She received her Ph. D. from the University of Alberta in 1977. She is the founder and director of the Electronic Games for Education in Math and Science (E-GEMS) project, a large-scale collaborative project involving computer scientists, mathematics educators, teachers, children and professional game developers. She has also served on many boards and advisory councils, including the Board of Trustees of the American Mathematical Society (chair 1995–96), the Computing Research Association (vice-chair 1993–95), and the BC Premier's Advisory Council on Science and Technology (1993 to present).

Dr. Stephen Ng received his Ph.D. in Electrical Engineering from University of Waterloo in 1977. His research interests are in queuing and stochastic processes in multiple access communication systems. Since 1997, he is Senior Manager of Nortel Networks Global External Research program.

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SFU Facility

Aside from office space, the 3000 sq. ft. facility will also have two computer labs and access to a seminar room. This summer, PIMS will host 3 of the workshops in the Graph Theory and Combinatorial Optimization Thematics Programme at PIMS-SFU.

PIMS now has facilities space to host visiting scientists and PDF's at both UBC and SFU. The facility at UBC was completed last June and many workshops have already been hosted there. PIMS-UBC, which is about 5000 sq. ft., houses the Director's Office, offices for PIMS PDF's and visiting mathematical scientists, as well as computer facilities.

PIMS at UBC

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