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PIMS Distinguished Chair **Dr Michael Shelley** writes about **Free Boundary Problems** in fluid dynamics on page 21.

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PIMS - The Road Ahead

Nassif Ghoussoub, Director

Created in 1996, the Pacific Institute for the Mathematical Sciences (PIMS) has now evolved into a unique bi-national scientific partnership involving all major universities of Alberta, BC and Washington State. In 5 short years, PIMS' scientists have collectively conceived of, and built an entity that has galvanized the mathematical community. The institute is now recognized world-wide as an effective new model for the mathematical sciences: one that addresses simultaneously the imperatives of research, education and technology transfer, and one that was able to unite a diverse community of many institutions over a geographically challenging area.

PIMS' early successes re-invigorated the Canadian mathematical science community and stimulated its institutions. The institute's proactive approach to industrial and education outreach, and its use of modern communication and dissemination tools, contributed to changing the culture, to erasing outdated perceptions and to increasing mathematical awareness. PIMS' energetic and vocal efforts on behalf of the mathematical sciences led to a re-affirmation of their key importance, whether in K-12 school programmes, or for leading edge Canadian R & D efforts.

Through a series of bold national and international initiatives (the **MITACS network,** the **Banff International Research Station**, the **Pacific Northwest Partnership** and the **Pacific Rim Initiative**), PIMS has raised the profile of Canadian research throughout the world. By developing key partnerships, PIMS multiplied the opportunities and attracted substantial investments from industrial, provincial, federal and foreign sources in support of Canadian-led research.

*please see "**Future of PIMS**" on page 2*

Banff Station Launched

Dr Tom Brzustowski, President NSERC: ***"The hallmark of a good idea is that so many people find it obvious once it has been mentioned - obviously!"***

Dr Rita Colwell, Director of NSF: ***"BIRS underscores how international co-operation adds up to more than what any nation could accomplish alone."***

Dr Brzustowski's and Dr Colwell's speeches are on pages 4-5.

On September 24, 2001, the governments of Alberta, Canada and the United States announced the establishment of a new international mathematical research facility in Banff, Alberta. The **Banff International Research Station for Mathematical Innovation and Discovery** (BIRS) will annually host thousands of top international scientists and researchers for intense workshops, collaborative research efforts, and training sessions across the entire spectrum of pure and applied mathematical sciences.

*please see "**Banff Station**" on page 25*

A Blueprint for the Future of PIMS

continued from page 1

Dr Nassif Ghoussoub, FRSC

To connect and cement a strong research base

PIMS is founded on the high-quality community of mathematical scientists present at its participating universities. To nurture this community as it takes on a leadership position in society and in the world's scientific enterprise, is the primary aim of PIMS. This goal has led our institute to assume a role that is both unique and ambitious in Canadian Science.

PIMS Collaborative Research Groups

In what is now its second phase of development, PIMS is embarking on a plan that will create and support collaborative multi-university teams of mathematical scientists. The objective is to build upon our new inter-university networks and use them as nuclei for providing global leadership, and for generating and sustaining the scientific programming of PIMS in the years to come.

Give me a place to stand and I will move the earth. —Archimedes

The PIMS' Collaborative Research Groups (CRG) are vehicles for networking between universities and for creating a research base that substantially enhances training programmes at all levels. The CRGs directly address the problems of retention and recruitment of faculty and give young faculty an effective network for the development of their research programmes. CRGs will also provide scientific leadership at the Banff International Research Station (BIRS) and some will have the potential to lead industrial projects through the MITACS network. They will build on existing links between the researchers of Western Canada and the US Pacific Northwest (PNW), thereby opening a new era of scientific collaborations between the two countries.

PIMS has identified 32 potential CRGs within its community. While some are already well established and structured, in most cases they are just forming. They fit into 5 broad research areas to which PIMS is strongly committed: *Fundamental Mathematics, Applied Mathematics, Mathematical Biology and Medicine, Statistical Sciences, and Theoretical Computer Science.*

Periods of Concentrated Activities

To provide the CRGs with appropriate resources, they will be dovetailed with a new PIMS programme supporting concentrated activities in 5-10 research areas each year. The programme, run on a competitive basis, will support multi-site activities of selected research groups in a particular field over a 1-2 year period of concentration. These periods are designed to promote longer term, multi-event interactions for CRGs at participating universities, in tandem with national and international collaborators and visitors. In its period of concentration, a CRG will receive priority from PIMS for (i) thematic programmes, (ii) workshops at BIRS, (iii) focussed research groups at BIRS and other PIMS sites, (iv) Postdoctoral fellowships, (v) visiting distinguished chairs, and (vi) PNW seminar series. Additional support is expected from partnerships (NSF, Perimeter Institute, AIM, Clay Institute, etc.) as well as teaching releases from participating departments.

With the above initiative, PIMS is creating new ways for its scientific programmes to be driven by its member scientists and encouraging grass-roots generation and long-term planning of its activities. It is also providing its researchers with means to assume leadership on the national and international level. It is promoting partnerships between its universities and facilitating the collaborative effort of its Canadian and US researchers while generating new opportunities. The initially selected periods of concentration, and the main coordinators of their CRGs are:

Upcoming Periods of Concentration at PIMS:

Inverse problems and applications, 2003
Main Coordinators: G. Uhlmann (UW), R. Froese (UBC), G. Margrave (U of C).

String Theory, 2003-05
Main Coordinators: G. Semenoff & M. Van Raamsdonk (UBC), A. Karch (UW).

Dynamics and related topics, 2003-05
Main Coordinators: I. Putnam (UVic), R. V. Moody (U of A), D. Lind, (UW).

Number Theory, 2003-05
Main Coordinators: M. Bennett & D. Boyd (UBC), P. Borwein & I. Chen (SFU).

Scientific Computing, 2003-05
Main Coordinators: B. Russell & M. Trummer, SFU, R. Leveque, UW.

Mathematical Ecology, 2003-05
Main Coordinators: M. Lewis (U of A), M. Kot (UW); M. Doebeli (UBC).

Topology and Knot Theory, 2004-06
Main Coordinators: D. Rolfsen (UBC), C. Peshke (U of A), P. Zvengrowski (U of C).

Probability and Statistical Mechanics, 2004-06
Main Coordinators: D. Brydges & E. Perkins (UBC), K. Burdzy (UW), B. Schmuland (U of A).

To build on PIMS' national and international initiatives

The impact of PIMS goes far beyond the strong roots planted in its community.

Banff International Research Station

In partnership with MSRI, PIMS has launched a major international research initiative in Banff. This unique joint Canada-US station, supported by NSF, ASRA and NSERC's MFA Programme, also calls for a serious commitment of the PIMS budget. Annually, more than 1700 mathematical scientists from around the world are expected to

participate in the Station's activities. BIRS' 2003 programme involved a competition between 118 proposals for the 40 weeks available. Among the selected workshops, 17 had lead organizers from Ontario universities, 13 from BC, 10 from Alberta, 6 from Quebec, 2 from Saskatchewan and 2 from Atlantic Canada. BIRS is a truly national initiative and a remarkable continental resource.

PIMS is committed to the further development of BIRS. It will continue to encourage and urge its sister Canadian institutes into a full scientific and financial partnership in BIRS. In particular, the institute is looking for the means to support travel costs of graduate students and PDFs, to expand the programme to 48 weeks per year and to prepare a solid funding base, in anticipation for a long-term partnership with NSF and ASRA.

The Pacific Northwest Partnership

In 2000, the University of Washington became a major partner involved in all aspects of the operations and management of PIMS. This unprecedented partnership has opened up a whole new era of scientific collaborations between the mathematical communities of the two countries. PIMS currently supports this collaboration through its sponsorship of the 12 PNW seminars and other joint activities.

PIMS is committed to developing further this partnership, in collaboration with the NSF, with the PNW universities and with the US mathematics Institutes. Joint activities include: Focussed Collaborative Research Groups with the NSF, joint summer graduate schools with MSRI, and a joint Canada-US industrial Mathematics programme in collaboration with the Minnesota-based Institute of Mathematics and its Applications (IMA).

The Pacific Rim Initiative

Together with other institutes in China, Taiwan and Japan, PIMS is developing scientific links throughout the Pacific Rim countries. Jointly they organize major Pacific Rim scientific events (Hong Kong `98, Beijing `99, Taipei `01, and Vancouver `04). The PIMS mini-programme on *Frontiers in Mathematical Physics* is a joint initiative with the Waterloo-based Perimeter Institute and the Korea-based Asia Pacific Center for Theoretical Physics (APCTP). The three partners are again joining forces on a two-year period of concentration on string theory.

PIMS will continue to lead the Canadian effort in collaborating with its partners in the Pacific Rim on a multitude of upcoming scientific programmes in Canada and elsewhere.

The integration of more universities into the PIMS distributive model

Now that the institute is widely recognized as an effective model for the mathematical sciences, it is not surprising that many universities in Canada and the US are requesting integration into its distributive structure. PIMS is committed to meeting such requests from the two universities in Saskatchewan. PIMS has also recently initiated a new comprehensive plan to address and support further the needs of the mathematical science community in Atlantic Canada.

PIMS is committed to provide additional support for the mathematical sciences in the Prairies and Atlantic Canada, and to assist in garnering matching funds from their universities and provincial governments.

To enhance PIMS' distinctively innovative programmes

A highly interdisciplinary programme

PIMS is committed to programmes that bring together groups from disparate disciplines (Math Economics and Finance `98, Mathematical Biology `99, Environmental Fluid Dynamics `01, Industrial Statistics `02). Besides distinguished mathematicians, these programmes often included Nobel laureates such as J. Mirrlees, D. Huxley, and the late M. Smith.

PIMS is developing a 3-year programme on "Mathematics and Multimedia" involving mathematicians, statisticians, computer scientists and electrical engineers. Imaging and Vision in 2003, Speech and Wireless Communication in 2004, and Mathematics, Computer Graphics and Human Computer Interaction in 2005.

PIMS commitment to training

Commitment to training is reflected by the multitude of summer schools, training camps and orientation workshops that it runs for the benefit of graduate and senior undergraduate students. The **PIMS' Schools in Environmental and Industrial Fluid Dynamics**, the **Schools in Mathematical Biology for Senior Undergraduates**, the **Graduate Industrial Modelling Camps**, the **PIMS-IAM-CSC Senior Undergraduate Modeling Workshops**, the **PIMS' Graduate Information Weekends** and **PDF Conferences** are run on an annual basis. Students are invited from every part of Canada to participate, with all expenses covered by PIMS. Others come to the summer schools at their own expense from as far away as Australia and New Zealand.

PIMS also sponsors Canadian student participation in US hot-topic workshops such as the recent one on **Statistical Genetics and Computational Molecular Biology** at the University of Washington. In the same spirit, PIMS will host the **2002 MSRI summer school on Computational Number Theory**. PIMS will partner again with the NSF on various Pan-American Advanced Studies Institutes: Dynamical Systems, Edmonton 2002; Inverse Problems, Santiago, Chile 2003.

PIMS will develop new graduate summer schools and training camps in emerging areas: Mathematical Genomics, Finance, Cryptography, Quantum Computing and other exciting areas.

A modern approach to communication and dissemination

PIMS is also a pioneer in live web casting of major scientific events, and lectures by its distinguished scientists and visitors are now available over the internet using on-demand streaming video. PIMS is the only Canadian institute to offer such services to the world's scientific community; it will continue to refine and expand these services.

A success story for NSERC's investment in research

NSERC's $630K annual investment in PIMS is about a quarter of its support for the 3 math institutes. It is nevertheless the cornerstone of an operating cash budget for PIMS that exceeded $3.3M in FY 00/01 including $1M in matching support by its participating universities and by the governments of Alberta and BC. This also includes $1.2M in cash contributions from 32 private sector partners,

*please see "**Future of PIMS**" on page 25*

Remarks of Dr Tom Brzustowski, President, NSERC

Joint Press Conference for the Banff International Research Station for Mathematical Innovation and Discovery, Banff, Alberta, September 24, 2001

Ladies and Gentlemen:

If I may begin, Rita, with a personal request to you: I would ask you on behalf of the entire staff of NSERC, the Natural Sciences and Engineering Research Council of Canada, to convey to our colleagues at the NSF, to the American mathematics community, and to the people of the United States our heartfelt regret and our profound outrage at the event of September 11.

I am very glad, as Nassif has already indicated that he is, that the event today was not postponed or cancelled, because to have postponed it or cancelled it would have given a victory to the terrorists. They might never have known of it, but we would have known.

"Let me congratulate PIMS, MSRI and MITACS for their intellectual involvement and their promise to deliver the fruits of this superb international collaboration."

Let me now move on to the most important thing that I have to do here. I have to read the magic words which make it official, and here they are. The Natural Sciences and Engineering Research Council of Canada is contributing $1.5 million towards the operation of BIRS from the year 2003 to the year 2006.

Now, we are here to celebrate a hugely important event. It is hugely important not just for the participating organizations, but for our nations, and for mathematics in the world.

Let me begin by congratulating PIMS, MSRI, and MITACS. (I'll stick with the acronyms, as life is too short to spell them all out.) Let me congratulate these three organizations for their intellectual involvement and their promise to deliver the fruits of this superb international collaboration.

Let me also congratulate the funding partners. Let me congratulate the National Science Foundation of the United States. You heard in the remarks of Dr. Colwell the extensive understanding of the importance of mathematics which has driven their decision. And let me congratulate the Province of Alberta where BIRS is located. This is a province which, in my opinion, really does have its act together when it comes to science and engineering research, and BIRS is yet another illustration of that.

The hallmark of a good idea is that so many people find it obvious once it has been mentioned — obviously! Why not?! You know that Oberwolfach has succeeded for many years. Why not, by way of developing a partnership in research in mathematics in North America, set up something that would be at least as good, and maybe far better? And so it was done - on a fast track and with quick decisions. Something was done that would not have happened, could not have happened, without the vision, the energy, the tenacity, and the leadership of one person, and that of course is Nassif Ghoussoub.

When I think of the many contributions Nassif has made in mathematics, I know they include some quite decent papers on partial differential equations. (I do look at Nature Nassif. I've seen your stuff.) Quite apart from that, his contributions as a leader in organizing mathematical activity in Canada have been extraordinarily important. And now we see the leadership stretching to international collaboration, and we welcome that.

"Mathematicians in an environment conducive to intellectual creativity will produce a great deal."

Now I should mention, perhaps for the benefit of our American colleagues rather more than the Canadian colleagues who are already convinced of this, just why this is such an important event. It is the next step in the emergence of Canadian mathematics into the prominence that it deserves. Canadian mathematicians have been good for a very long time. They have been very good, and we have many outstanding individuals, but Canadian mathematics in the corporate sense has been achieving the deserved prominence only very recently. The three institutes now active, CRM, Fields and PIMS, the Network of Centres of Excellence MITACS, are all contributing to that prominence. And today the international partnership that produced BIRS adds to it as well.

But BIRS is also important in another way. It puts the seal of recognition by the funding agencies on the way that mathematicians do research: the face to face contact, the debate of ideas, the closing of dead ends — perhaps in the presence of those who might have contributed to paving them in the first instance, the opportunity for people to change their minds, and the excitement of recognizing a really new development and the ability then to go off with colleagues and immediately talk about it some more. All these aspects of working together in a setting like BIRS are hugely important. Mathematicians assembled in an environment conducive to intellectual creativity will produce a great deal.

Let me finally come to something that I have been saying for quite a little while, and frequently — maybe even weekly. It is more of a matter for generalists thinking about mathematics than it is for mathematicians. I really do believe that mathematics has been the language of high technology. And I also believe that mathematics is becoming the eyes of science, helping scientists in all fields drink from a fire hose of data. But for mathematics to function in this way, as the language and as the eyes, and as the many other things that mathematics is yet to become, there is need for continued effort to expand and strengthen the foundations of mathematics — the work of basic research in mathematics.

With that, let me conclude by congratulating one more person, as the focus now shifts from Nassif to Bob Moody. Let me congratulate Bob Moody on becoming the research director of BIRS. I think BIRS is very lucky to have Bob Moody; I think Bob Moody is very lucky to have BIRS. This is a hugely important international effort which will be important for Canadian mathematics, for mathematics in the United States, and ultimately for mathematics in the world. I congratulate all who participated in creating it. I thank our funding partners and I wish everybody success in the years to come.

Thank you very much

Remarks of Dr Rita Colwell, Director, National Science Foundation

Joint Press Conference for the Banff International Research Station for Mathematical Innovation and Discovery, Arlington, Virginia September 24, 2001

Good afternoon, everyone. I am Rita Colwell, director of the U.S. National Science Foundation, and it is a great pleasure to take part in this ceremony — really a "virtual ribbon-cutting" — today.

Our event connects two nations, the United States and Canada, exemplary neighbors who have always cherished peace between each other. In that tradition, today we inaugurate an enterprise that represents the best of the human spirit.

Following the tragic attacks on the United States two weeks ago, this event today lifts our spirits as it symbolizes our joint endeavor to push back the frontiers of knowledge. We have called today's event "Close Parallels"—a mathematical metaphor evoking the steadfast closeness of our nations.

The National Science Foundation supports cutting-edge science and engineering across the range of disciplines. We always strive to integrate research and education, really two faces of the same coin. We invest in the very best of the future, the fundamental research whose ultimate outcome no one can foresee. Mathematical research is an ideal example of such fertile ground for far-reaching investment.

Today NSF is very pleased to announce an award to the Mathematical Sciences Research Institute—MSRI. The award of $1.27 million over four years will support United States' participation at the Banff International Research Station for Mathematical Innovation and Discovery. The research station in the Canadian Rockies in Banff will provide a spectacular setting for intensive mathematical research, when it opens in 2003. The station is a project of both our nations, led by the Pacific Institute for the Mathematical Sciences in Vancouver, British Columbia, and MSRI, which I've already mentioned, located in Berkeley, California.

I cannot resist quoting the director of the Pacific Institute, Nassif Ghoussoub; he said that the Banff Centre will enable visitors to "live, eat and breathe mathematics." (I have to say that sounds like a very nourishing diet—talk about "brain food!")

Our NSF contribution joins Canadian support that will be described by our Canadian partners today. The NSF award will help support the travel and living expenses of participants in the research station's programs, especially those from the U.S. I should emphasize that our Canadian colleagues and funding agencies have taken the lead in bringing the Banff Centre into being. This activity underscores how international cooperation adds up to more than what any nation could accomplish alone.

Every important question of science and engineering is under study by researchers in nations around the world. The mathematical and statistical communities of the United States are at the forefront in engaging their counterparts abroad.

"In that tradition, today we inaugurate an enterprise that represents the best of the human spirit."

International connections in mathematics are important throughout a career in science. In June of this year, NSF helped to support the International Mathematical Olympiad, a competition that brought talented young people from more than eighty countries to Washington, D.C. for the annual event that was first held in Romania in 1959. It was a rare privilege for us to host the Olympiad in the U.S. However, every year, NSF hosts the U.S. Olympiad team in Washington to honor their achievements.

Our investment in the Banff Center is tangible proof of the vital and growing role of the mathematical sciences in all of science and engineering. I would like to show a few slides now, to illustrate this fundamental importance of mathematics.

E.O. Wilson writes that "...mathematics seems to point arrowlike toward the ultimate goal of objective truth." Indeed, mathematics is the ultimate cross-cutting discipline, the springboard for advances across the board. Mathematics is both a powerful tool for insight and a common language for science. A good example, pictured here, is the fractal, a famous illustration of how inner principles of mathematics enable us to model many natural structures. Cosmologists are beginning to draw an awesome portrait of the structure of the universe—using mathematics as the medium. On the other end of the scale, particle physicists sketch quantum phenomena, again with mathematics as their brush and palette. In the realm of climate, our ability to predict El Niño—the irregular shifts in ocean and atmospheric conditions—is a superb example of where mathematics and computing have brought us. The meeting of mathematics and medicine augurs well for discovery on many fronts. Mathematics and complexity theory, for instance, give insight into the human heart. The top pictures are computer simulations of the electrical activity in a normal heart. Below are abnormal patterns, or fibrillation. Mathematicians are investigating why some patterns of electrical stimulus are better at eliminating fibrillation. Mathematics and biology transform each other. The information science of life edges ever closer to electronic information science. Advances in understanding life may lead to new modes of computing, notably biological computing.

To strengthen the mathematical foundations of science and society, the National Science Foundation has proposed a new priority area. We seek to advance frontiers in three interlinked areas: fundamental mathematical and statistical sciences, interdisciplinary research involving the mathematical sciences, and mathematical sciences education.

I show this final slide as a mathematical metaphor. Fractal sets like we see here can be used to build computer models of clouds, plants, the surface of the sea, even networks of blood vessels. Yet, mathematics also transports us beyond the practical, into the realm of the imagination and art. A coming together of brilliant imaginations for a higher purpose will be a hallmark of the Banff Centre.

We look forward to an inspiring and long-lasting engagement among our mathematical scientists, our Canadian colleagues, and others from around the world, in a superb environment for communication and collaboration.

Report on the Banff International Research Station

by Robert Moody, BIRS Scientific Director

Dr Robert Moody, Scientific Director, BIRS

After the glossy events around getting BIRS off the ground and the official launch of BIRS by NSERC's President (Tom Brzustowski), NSF's Director (Rita Colwell), and the Chair of ASRA's Board (Robert Church) on September 24, it seems that we are in for a long wait until we actually begin the workshops at BIRS in March 2003. Nonetheless there has been a lot of BIRS activity going on. Most importantly the 2003 competition for BIRS events has taken place and we now have a full slate of workshops in a dazzling array of different areas, as well as a fairly full parallel programme of Focused Research Groups and Research In Teams.

The Evaluation of the BIRS 2003 Programme

The Call for Proposals for workshops at BIRS in 2003 was very enthusiastically received, resulting in 108 proposals. The overall level of proposals was outstanding, so much so that the BIRS Steering Committee was sorely tempted to go ahead and accept 20 or more additional proposals for 2004. To sort their ways through this abundance of riches, the various committees were guided in the first instance by the principle that BIRS has to be inclusive of all the mathematical sciences and that each year its programme should provide a broad sampling of these. Thus the proposals were broken down into some 22 areas, and within each area the proposals were evaluated and compared against each other. To the extent that these areas had worthy proposals (and they all did!) the committee then made sure that they were represented and that no area was grossly over- or underrepresented. Not surprisingly many really fine proposals fell by the wayside in this process. By the way, the BIRS Steering Committee made a decision early to eliminate any proposal that was closely linked to any of its members. This eliminated a number of excellent proposals, but we believe this was necessary for the integrity of the process.

It may be useful for future proposers to note the features the committees found themselves looking for in trying to make their selections:

- the proposal should be well-focused;
- the set of proposed applicants should be realistic and should be logical to the coherence and goals of the workshop;
- the workshop ought to be sufficiently innovative or sufficiently timely that holding it has significant potential to make a difference to the subject;
- the organizers (at least some) should be of recognized stature;
- the proposal should be written carefully, placing the above points clearly in the context of the present state of the subject.

A number of proposals were rejected for being too diffuse, attempting to cover too many areas at once, for not having a coherent set of participants, or for not making a convincing argument that they were different from any number of similar events elsewhere.

Beyond this there are other points, which though they were not of primary importance, still were on the minds of the committee.

- The committee would like to see each workshop make some effort to involve young and emerging talent in the form of post-docs or advanced graduate students.
- It is always good to keep in mind the appropriate representation of women in the list of participants.
- Priority will be given to those workshops that promote Canada - US research collaboration. Therefore, we would like to see that each workshop has at least one organiser from a Canadian institution and one from an instution in the United States.

Cartoon by Wieslaw Krawcewicz

Some proposals attempted to link themselves with back-to-back Focused Research Groups, or to pair themselves with other workshop proposals. This did not seem to work well, particularly since with so much competition the committees were reluctant to commit 2 weeks to any one group. However, the idea of making some more ambitious programmes into 7-day workshops was accepted as an alternative.

Also half-workshops (20 people for 5 days) were certainly welcome as a way to improve the number of different groups that could be hosted in a given year.

It is good to reiterate here the fact that there were many fine proposals that satisfied all these desiderata and still could not be accepted for lack of available weeks. We certainly wish to encourage people not to give up! BIRS will run, we hope, for many years, and there will be new opportunities. And PIMS is still pushing ahead to fund 8 more weeks each year at BIRS!

The Other Programmes at BIRS

We also had about fifteen proposals for the other side of the BIRS programme: Focused Research Groups and Research in Teams. These were all very worthwhile proposals and it was possible to satisfy all these requests, including hosting the Canadian Mathematical Olympiad Team for 2 weeks in the summer of 2003. In the off-months (March, April, October, November, December) of 2003 there is still available space for such activities. There is also lots of space for 2 day events (Friday/Saturday). Submissions for these events are still welcome and can be made via the BIRS website **www.pims.math.ca/birs**.

BIRS is also open to the concept of Summer Schools. However, since they come with a significant additional infrastructural and organizational needs, these programmes should be coordinated directly with PIMS and MSRI. Prospective proposers should start by contacting the appropriate institute director.

The Review Process

Although the mechanics of the selection process will no doubt evolve with time, it is basically a multi-stage process. All incoming proposals are placed in one master file and all 27 members of the BIRS Scientific Advisory Board (SAB) are invited to provide their written evaluations on-line on any proposal they wish to comment on.

In addition, each proposal gets reviewed by two members of the SAB, assigned by the Scientific Director according to expertise in the subject area. In some cases, external refereeing was also solicited.

All available information goes to the scientific panels of PIMS (resp., MSRI) who have the responsibility to select 12 (resp., 6) BIRS proposals of interest to their own scientific programmes from this file. The BIRS Scientific Steering Committee finishes off the selection process choosing another 22 workshops, based on the recommendations of its Scientific Advisory Board and on the input of the MITACS Scientific Director (for at least two weeks of industrially oriented workshops).

The PIMS Proposals

As mentioned above, the PIMS Scientific Review Panel has the responsibility to select 12 of the full set of proposals in the master BIRS file. What constitutes an appropriate BIRS workshop proposal for the PIMS Scientific Review Panel?

First, it has to satisfy all criteria of excellence and innovation that are required by the BIRS evaluation process. In addition, they have to be compatible with the PIMS scientific, industrial and educational programmes, as dictated by the provincial funding sources for the institute and of BIRS.

Priority is given to events that fit into other parallel PIMS activities – particularly the Graduate Industrial Modelling Camps, the PIMS new programme supporting Periods of Concentration for Collaborative Research Groups, the Thematic Programs, as well as various educational activities. Beyond that the proposals should also have a strong connection to groups, strengths, or on-going activities within the PIMS participating universities in Canada and in the US. For 2003, one week has been reserved for the IMA-PIMS Graduate Industrial Modelling Camp and another one has been left open to allow for the inclusion of a "hot topics" week.

Banff International Research Station - 2003 Programme

Five Day Workshops

01	15-Mar	21-Mar	Recent developments in Superstring Theory
02	22-Mar	28-Mar	Scattering and Inverse Scattering
03	29-Mar	4-Apr	Commutative Algebra and Geometry
04	5-Apr	11-Apr	BIRS Workshop on Noncommutative Geometry
05	12-Apr	18-Apr	Quantum Mechanics on the Large Scale
06	19-Apr	25-Apr	Computational Fuel Cell Dynamics-II
07	26-Apr	2-May	The Many Aspects of Mahler's Measure
08	3-May	9-May	Recent Advances in Algebraic and Enumerative Combinatorics
09	10-May	16-May	Statistical Mechanics of Polymer Models
10	17-May	23-May	IMA-PIMS Graduate Modelling Camp
11	24-May	30-May	Constraint Programming, Belief Revision, and Combinatorial Optimization
12	31-May	6-Jun	Symmetry and Bifurcation in Biology
13	7-Jun	13-Jun	Applicable Harmonic Analysis
14	14-Jun	20-Jun	Integration on Arc Spaces, Elliptic Genus and Chiral de Rham Complex
15	21-Jun	27-Jun	Point Processes — Theory and Applications
16	28-Jun	4-Jul	Joint Dynamics
17	5-Jul	11-Jul	Mathematical Biology: From Molecules to Ecosystems. The Legacy of Lee Segel
18	12-Jul	18-Jul	Perspectives in Differential Geometry
19	19-Jul	25-Jul	Differential Invariants and Invariant Differential Equations
20	26-Jul	1-Aug	Analysis and Geometric Measure Theory
21	2-Aug	8-Aug	Monge-Ampère Type Equations and Applications
22	9-Aug	15-Aug	Localization Behavior in Reaction-Diffusion Systems and Applications to the Natural Sciences
22	9-Aug	15-Aug	Defects and their Dynamics
23	16-Aug	22-Aug	Current Trends in Arithmetic Geometry and Number Theory
24	23-Aug	29-Aug	Computational Techniques for Moving Interfaces
25	30-Aug	5-Sep	A Creative Scientific Writing Workshop at BIRS
25	30-Aug	5-Sep	Locally Finite Lie Algebras
26	6-Sep	12-Sep	Regularization in Statistics
27	13-Sep	19-Sep	Topology in and around Dimension Three
28	20-Sep	26-Sep	Structural and Probabilistic Approaches to Graph Colouring
29	27-Sep	3-Oct	Stochastic Partial Differential Equations
30	4-Oct	10-Oct	Quadratic Forms, Algebraic Groups, and Galois Cohomology
31	11-Oct	17-Oct	BANFF Credit Risk Conference 2003
40	18-Oct	24-Oct	MITACS Special Industrial Forum
33	25-Oct	31-Oct	Current Trends in Representation Theory of Finite Groups
34	1-Nov	7-Nov	PIMS Hot Topics
35	8-Nov	14-Nov	MSRI Hot Topics
36	15-Nov	21-Nov	The Interaction of Finite Type and Gromov-Witten Invariants.
37	22-Nov	28-Nov	Theory and Numerics of Matrix Eigenvalue Problems
38	29-Nov	5-Dec	Nonlinear Dynamics of Thin Films and Fluid Interfaces
39	6-Dec	12-Dec	Calabi-Yau Varieties and Mirror Symmetry
40	13-Dec	19-Dec	p-adic Variation of Motives
40	13-Dec	19-Dec	Coordinate Methods in Nonselfadjoint Operator Algebras

Focused Research Groups (F) / Research in Teams (R) / Summer Schools (S)

R	26-Apr	10-May	Topological Orbit Equivalence for Dynamical Systems
F	10-May	24-May	Regularity for Hypergraphs
F	24-May	7-Jun	Topology and Analysis: Complementary Approaches to the Baum-Connes and Novikov Conjectures
F	7-Jun	21-Jun	Quantum Algorithms and Complexity Theory
S	21-Jun	28-Jun	Differential Geometry (MSRI)
S	28-Jun	10-Jul	IMO Training Camp
F	12-Jul	26-Jul	Problems in Discrete Probability
R	26-Jul	16-Aug	Representation Theory of Linearly Compact Lie Superalgebras and the Standard Model
R	2-Aug	16-Aug	Variance of Quasi-Coherent Torsion Cousin Complexes
R	16-Aug	30-Aug	Invariant Manifolds for Stochastic Partial Differential Equations
R	16-Aug	6-Sep	Local Uniformization and Resolution of Singularities
F	6-Sep	20-Sep	Arithmetic of Fundamental Groups

PIMS Awards Ceremony at SFU Harbour Centre

TD Securities

Three PIMS Prizes for research, education and industrial outreach were awarded at the PIMS Banquet held at SFU's Harbour Centre Campus on December 1.

The **PIMS Research Prize** is selected by the Institute's Scientific Review panel which consists of: David Boyd, Gordon Slade, Nick Pippenger (UBC), Alistair Lachlan (SFU), Bob Moody (U of A), Ian Putnam (UVic), Ron Graham (San Diego), Dan Matkowski (Chicago), David Brillinger (Berkeley) and Gang Tian (MIT).

The 2001 PIMS Research prize has been awarded to Kai Behrend. Kai studied mathematics at the University of Hamburg graduating in 1983. After a master's degree at the University of Oregon and a Diploma at the University of Bonn, he received his Ph.D. at the University of California at Berkeley in 1991, under Arthur Ogus. His thesis was on

Ken Foxcroft (TD Securities), Research Prize Winner Kai Behrend and Ron Graham (San Diego)

the "Lefschetz Trace Formula for the Frobenius Morphism of an Algebraic Stack". Kai was a Moore Instructor at MIT from 1991-1994 after which he joined UBC.

Yuri Manin writes: "Partly in collaboration with Barbara Fantechi, Kai produced the first ever algebraic geometric construction of the Kontsevich virtual fundamental class and general Gromov-Witten invariants for arbitrary smooth projective algebraic manifolds".

Kai's construction has provided a key step in the understanding of Gromov-Witten invariants and made possible some of the deepest work so far in enumerative algebraic geometry.

Kai is also regarded as one of the world's top experts in the burgeoning area of algebraic stacks. Fields medalist Maxim Kontsievitch writes: "The work of Kai Behrend is of the highest level and is absolutely fundamental in algebraic geometry".

Kai Behrend has also received the 2001 Coxeter-James prize of the Canadian Mathematical Society.

The **PIMS Education Prize** for 2001 is awarded jointly to two very dedicated individuals: Dr Wieslaw Krawcewicz, Professor at the University of Alberta and Dr Klaus Hoechsmann, Professor Emeritus at UBC. The PIMS Education prize committee, consisting of the six Site Directors, was unanimous in choosing these two from a field of seven nominees, that are all very deserving individuals in their own right.

Wieslaw Krawcewicz is the creator and moving force behind the highly successful new magazine "Pi in the Sky," which was launched two years ago under PIMS sponsorship. This magazine, devoted to improving awareness of mathematics among high school students, has been distributed free of charge to all high schools in Alberta and British Columbia, as well as selected sites throughout North America.

It has an attractive format, lots of jokes and cartoons, as well as articles written on mathematical topics, often with an angle of relevance to teenage life. For example, the first issue had its lead article entitled "A Date with Math" and had five enthusiastic schoolgirls on the cover. The magazine is also available online.

As one of his colleagues commented, "At the beginning I was skeptical. I did not believe that such a project could be finalized. Wieslaw was extremely active in convincing and encouraging people, including myself, to participate. He did all kinds of work from editing and writing articles to making cartoons and math jokes. He had long discussions with high school students, undergraduates, teachers and other people involved in education. Wieslaw's enthusiasm is contagious."

Dick Peter (Dean of Science, U of A) and Education Prize Winner Wieslaw Krawcewicz

The director of curriculum and programmes in the Edmonton public school system remarked "Our high school mathematics department heads all look forward to the magazine and frequently utilize its contents to enrich the math programme for their students. This publication has certainly helped to increase interest in mathematics. The contributions of Dr Krawcewicz to the students in Edmonton Public Schools have been and continue to be significant in helping to raise the bar in mathematics education. He is a most deserving candidate for the PIMS Education award."

One of Wieslaw's colleagues noted that "the University of Alberta (and I expect other PIMS universities as well) is seeing the positive effect of Dr Krawcewicz's efforts. Since the introduction of the magazine, enrollment in the first-year Honours Calculus classes at UA has approximately doubled; enrollment in our second year class has actually tripled. The magazine has made many students aware that mathematics can be interesting."

Sharing this year's prize is another person who has worked far beyond the call of duty in math education and increasing public awareness and appreciation of mathematics, Professor Klaus Hoechsmann. Even before PIMS existed, he has been devoted to the cause of mathematics education. At UBC he developed, and was the first teacher of, the course "Mathematics by Inquiry" (Math 336), which has become the centrepiece of the new Certificate Programme for Mathematics Teachers, cosponsored by the Mathematics department and the Curriculum Studies department of the Education Faculty. It is a course designed to provide hands-on mathematical experience to educators. One of his former students — now teaching mathematics at a BC high school — remarked "Using the principles he teaches, 'mathematics, like singing, is for everyone — not only the three

tenors.' Klaus inspires teachers to love and understand mathematics."

Upon becoming Chair of the PIMS Education Committee, Klaus truly went into high gear, putting tremendous enthusiasm into PIMS' educational and outreach programmes. He co-organized the innovative "Changing the Culture" conferences, a BC forum for elementary, high school, and post-secondary math educators. Klaus was instrumental in creating the PIMS Elementary School Mathematics Contest (ELMACON) in partnership with the BC Association of Mathematics Teachers. He has spent countless hours with BCAMT people and individual teachers, made presentations at schools and conferences, and completely revamped PIMS' activities in K-12 education. Many contributions to "Pi in the Sky" were authored by Klaus.

To celebrate the year 2000, the International Mathematics Year, Klaus designed and executed the hugely successful "Mathematics is Everywhere" poster campaign. Each month of the year a new poster would appear on buses in the lower mainland, with an attractive graphic and a mathematical problem, offering a $100 prize for its solution, along with a web address for further information. The enthusiastic response of the public was beyond anyone's expectations. These posters also became the basis for the first PIMS calendar, which are now becoming collector's items. A sequel to this poster campaign, celebrating Women in Mathematics, was developed by staff in the PIMS office, with Klaus' encouragement.

The most innovative and ambitious of Hoechsmann's contributions, perhaps, is the full-length play "Hypatia's Street Theatre." This is a dramatization based on the life of an early woman mathematician and philosopher in Alexandria, and is unique in that it actually teaches mathematical concepts within the play. It was performed in December 2000 to a full house in the Frederic Wood theatre on the UBC campus. Klaus not only wrote the script (with the assistance of professional playwright Ted Galay), but worked with the professional actors and stage crew throughout the rehearsals. He also paid for the production, devoting all of his (modest) stipend as a PIMS employee to the cause. Because of this, the nominators argued that there was really no conflict in awarding the PIMS Education prize to one of our own employees. Indeed the prize is richly deserved for all the effort Klaus has devoted over the years to mathematical education and public awareness.

The PIMS Scientists thank Ken Foxcroft and TD Securities for their generous sponsorship of the PIMS Prizes.

This year the committee, Dr Arvind Gupta (Chair, MITACS), Dr Shahid Hussein (Telus), Mr Randy Savoie (Ballard Powersystems), Mr Jack Fujino (Stantec), Dr Bryant Moodie (University of Alberta), and Dr Chris Bose (University of Victoria), received seven nominations for the **PIMS Industrial Prize**. They were impressed by the significant contributions made by all the candidates. It is clear that industrial-university research programmes are thriving across the country.

The committee felt that two nominations stood out from the others. After considerable debate, they chose to recommend that Dr Michael Kouritzin (University of Alberta) and Dr Martin Puterman (University of British Columbia) share this year's industrial prize.

The committee was very impressed that so early in his career, Dr Kouritzin has established a strong and well known industrial research programme. He founded the PINTS Centre (Predictions in Interacting Systems) which is supported by MITACS and PIMS. The centre focuses on novel filtering theory to track various types of objects from lost ships to pollution. His industrial partners unanimously agreed that Michael's research is having a significant impact on their own business plans.

Ken Foxcroft, Industrial Prize Winner Michael Kouritzin (U of A), Michael Boorman (Dean of Science, U of C), Arvind Gupta (Director, MITACS)

It is difficult to imagine anyone who has put more time and energy into establishing close university-industry collaborations than Dr Puterman. Dr Puterman has a long and distinguished research career, most recently winning the Lancaster Prize. He was also an early advocate of industry-university research as pivotal to operations research. This lead to the creation of the Centre for Operations Excellence (COE) at UBC. COE recieves signficant support from MITACS, PIMS, and a signficant number of partner companies. Dr Puterman's vision of giving students high level research training in an industrial-university setting is a model that is a testament to what can be accomplished through vision and hard work.

Ken Foxcroft, Michael Boorman, Industrial Prize Winner Martin Puterman, Arvind Gupta

The keynote address at the ceremony was given by Dr Philippe Tondeur, Director of the Division of Mathematical Sciences at the National Science Foundation and Professor of Mathematics at the University of Illinois in Urbana-Champaign.

During his years at NSF Dr Philippe Tondeur has become an articulate voice for the role of the Mathematical Sciences in the U.S. Science and Engineering enterprise. It is worth noting that even after the tragic events of September 11th the NSF has received an 8.4% increase for Fiscal Year 2002.

Closer to home, the birth of BIRS will always be connected to the leadership of Philippe Tondeur at the NSF. There is no doubt that the world mathematical community owes BIRS to the clarity of vision and to the far-sightedness of Philippe Tondeur.

Nassif Ghoussoub (PIMS) and Philippe Tondeur (NSF)

2002 Thematic Programmes

PIMS is organising two thematic programmes in the year 2002: "Asymptotic Geometric Analysis" and "Selected Topics in Mathematical and Industrial Statistics".

Thematic Programme A: Asymptotic Geometric Analysis

Scientific Committee:
Vitali Milman (co-chair, Tel Aviv)
Nicole Tomczak-Jaegermann (co-chair, U of A)
Nassif Ghoussoub (PIMS and UBC)
Robert McCann (U. Toronto)
Gideon Schechtman (Weismann Inst.)
Gilles Pisier (U. of Paris VI and Texas A&M)

Asymptotic Geometric Analysis is concerned with the geometric and linear properties of finite-dimensional convex bodies, especially with the asymptotics of various quantitative parameters as the dimension of the underlying space tends to infinity. The techniques here combine geometric, analytic, probabilistic and combinatorial methods. The main directions of study are:

- Convex Geometric Analysis including problems from Classical Convexity and Isomorphic Geometry.
- Asymtotic Combinatorics including questions in Complexity Theory and Computational Geometry.
- Certain aspects of Statistical Physics that deals with "Threshold" and "Phase Transition" phenomena.

The main probabilistic tools used are deviation inequalities and the concept of concentration of measure phenomenon, which in fact is, an isomorphic form of isoperimetric type inequalities. Measure Transport methods and related PDEs have provided new and powerful Geometric Inequalities of Brunn-Minkowski and Brascamp-Lieb type as well as novel approaches to Log-Sobolev and Talagrand-type inequalities. The subject is also connected with quantized functional analysis via important estimates for the distribution of eigenvalues and norms of random matrices, as well as with some aspects of free and quantum information theories, operator spaces and non-commutative L_p spaces.

The goal of this thematic programme is to bring together some areas of Mathematics and Computer Science which are dealing with asymptotic behavior of different parameters when the dimension, or a number of other relevant free parameters, increases to infinity. The main directions of this subject of study are Convex Geometric Analysis (Asymptotic Theory of Convex Bodies and Normed Spaces), some problems of Discrete Mathematics (one may call it Asymptotic Combinatorics) including problems of Complexity Theory, and some problems of Statistical Physics. Closely connected are also some directions in Probability and in PDEs, including non linear PDEs arising from problems in Convex Analysis and Geometric Inequalities. The main activity will concentrate around Convex Geometric Analysis, but understood in a very broad sense, as the intent is to involve a large number of main people of other related fields.

The intent is to bring together senior experts and young researchers, postdocs and advanced Ph.D. students, with an emphasis on a major participation from the young generation.

Programme

Conference on Convexity and Asymptotic Theory of Normed Spaces
PIMS-UBC, July 1-5, 2002

Organisers: Erwin Lutwak (Warsaw) and Alain Pajor (Marne-La-Vallée).

Topics include classical convexity, Radon transform and Fourier methods in convexity, asymptotic theory of high dimensional convex bodies, geometric functional inequalities and probabilistic methods in convexity, isoperimetric-type inequalities.

Concentration Period on Measure Transportation and Geometric Inequalities
PIMS-UBC, July 8-12, 2002

Organiser: Robert McCann (U. Toronto)

This concentration period will focus on transportation of measure methods and their applications, concentration of measure phenomenon, geometric functional inequalities (Brascamp-Lieb, Sobolev, entropy, Cramer-Crao, etc), "isomorphic" form of geometric inequalities and probabilistic methods.

Workshop on Phenomena of Large Dimensions
PIMS-UBC, July 14-20, 2002

Organisers: Vitali Milman (Tel Aviv), Michael Krivilevich, Laszlo Lovasz (Microsoft Research) and Leonid Pastur (U. Paris VII).

Topics include different phenomena observed in complexity theory, asymptotic combinatorics, asymptotic convexity, statistical physics and other theories of very high parametric families (or large dimensional spaces).

Focused Research Groups on Random Methods and High Dimensional Systems
PIMS-UBC, July 21-August 5, 2002

Organisers: Vitali Milman (Tel Aviv) and Nicole Tomczak-Jaegermann (U. Alberta).

Topics include the asymptotic behavior of different parameters when the dimension, or a number of other relevant free parameters, increases to infinity. The main direction is the study of the asymptotic theory of convex bodies and normed spaces as well as their applications to combinatorics and phase transition phenomena.

Workshop on Non-commutative Phenomena and Random Matrices
PIMS-UBC, August 6-9, 2002

Organisers: Gilles Pisier (U. Paris VI and Texas A&M) and Stanislaw Szarek (U. Paris VI and Case Western Reserve).

Topics include the distribution of eigenvalues of random matrices, norms of such matrices, some aspects of free and quantum information theories, applications in many fields, quantized functional analysis and operator spaces and non-commutative L_p spaces.

Workshop on Banach Spaces
PIMS-UBC, August 12-15, 2002

Organisers: Bill Johnson (Texas A&M and Ted Odell (U. Texas, Austin).

This workshop will focus on the asymptotic theory of Banach spaces and other applications of local theory to the geometry of infinite dimensional Banach spaces.

Thematic Programme B: Selected Topics in Mathematical and Industrial Statistics

Programme Organizers:
Richard Lockhart (SFU)
Charmaine Dean (SFU)
Peter Guttorp (U. Washington)
Chris Field (Dalhousie)
R.H. Zamar (UBC)
Randy Sitter (SFU)
Agnes Herzberg (Queen's)
Michael Kouritzin (U. Alberta)

Statistical models became, in the late 20th century, extremely complex and high dimensional. One goal of this programme is to identify opportunities and challenges for model development and criticism and to begin to outline approaches to assessment of complex models. This requires bringing together leading practitioners and philosophers of scientific, Bayesian and frequentist modelling statistics with leading researchers in model assessment, validation and goodness-of-fit.

Robust Statistics and Statistical Computing deal with methods designed for processing large data sets of uneven quality (databases containing outliers, gross errors, missing data, etc.). One focus is on the efficient computation of robust estimates using very large data sets.

Design and Analysis of Experiments are at the heart of the statistical sciences. Yet - unlike the designs originating from agricultural problems developed by Sir Ronald Fisher in the 1920's—many industrial problems are not well-explored in the statistical literature. To help North American industry compete globally, advanced statistical methods suitable for real applications need to be further developed.

Programme

Workshop on the Role of Statistical Modelling in the 21st Century
PIMS-SFU, May 4-6, 2002

Organisers: Richard Lockhart, Charmaine Dean (SFU), and Peter Guttorp (UW).

Statistical models have become more and more complex. This workshop will bring together leading practitioners and philosophers of scientific, Bayesian and frequentist modelling statistics with leading researchers in model assessment, validation and goodness-of-fit. The goals are to identify opportunities and challenges for model development and criticism and to begin to outline approaches to assessment of complex models.

International Conference on Robust Statistics (ICORS 2002)
UBC, May 12-18, 2002

Organisers: Luisa Fernholz (Temple Univ.), Ursula Gather (Dortmund), Chris Field (Dalhousie) and R. H. Zamar (UBC).

This conference will be a forum for new developments and applications of robust statistics and statistical computing. Experienced researchers and practitioners, as well as younger researchers, will come together to exchange knowledge and to build scientific contacts.

The conference will centre on methods designed for processing large datasets of uneven quality (databases containing outliers, gross errors, missing data, etc.). This conference expects to touch upon many different aspects of data analysis in a fashion which integrates theoretical and applied statistics. One focus will be on the efficient computation of robust estimates using very large data sets.

Design and Analysis of Experiments,
Coast Plaza Suites Hotel
Vancouver, July 14-18, 2002

Organisers: Randy Sitter (SFU), Derek Bingham (Michigan), Bruce Ankenman (Northwestern) and Agnes Herzberg (Queen's).

Many industrial problems are not well-explored in the statistical literature. To help North American industry compete globally, advanced statistical methods suitable for real applications need to be further developed. Statistical experimental designs, developed by Sir Ronald Fisher in the 1920's, largely originated from agricultural problems. Although the design of experiments for industrial and scientific problems may have the same basic concerns as design for agricultural problems, there are many differences: (i) industrial problems tend to require investigation of a much larger number of factors and usually involve a much smaller total number of runs (observations), (ii) industrial results are more reproducible, (iii) industrial experimenters are obliged to run their experimental points in sequence and are thus able to plan their follow-up experiments guided by previous results, unlike agriculture, in which all results are often harvested at one time, and (iii) models can be very complicated in industrial and scientific experimentation, sometimes they are nonlinear, and computer modelling and finite element analysis is required.

PIMS-MITACS Workshop on Filtering Theory and Applications
U of A, July 20-26, 2002

Organisers: Robert Elliott (U. of Calgary), Michael Kouritzin (U. of Alberta), Tom Kurtz (U. of Wisconsin at Madison), Hongwei Long (U. of Alberta)

Filtering theory is an active and current research field attracting many applied probabilists. In particular, there is increasing interest in applying filtering theory to real-world problems in areas such as mathematical finance, target detection and tracking, communication networks, pollution tracking, weather prediction, traffic management, and search and rescue. We believe that the proposed meeting will help to advance scientific development of filtering theory and its applications and offer benefits to industry. In particular, this meeting will encourage local research activity in this field and identify additional industrially-motivated filtering problems.

The meeting is planned to precede the 2002 IMS Probability Symposium in Banff.

Wieslaw Krawcewicz

New Members to the Scientific Review Panel of PIMS

Continuing members of the PIMS Scientific Review Panel

- Dr Nassif Ghoussoub, Director, PIMS
- Dr David Brillinger, Professor of Statistics, University of California, Berkeley
- Dr Robert V. Moody, Professor of Mathematics, University of Alberta
- Dr Ian F. Putnam, Professor of Mathematics, University of Victoria
- Dr Gang Tian, Professor, Massachusetts Institute of Technology
- Dr Ronald Graham, Professor of Computer Science and Engineering, University of California, San Diego

SRP members with term finishing December 31, 2001

- Dr David Boyd, Professor of Mathematics, University of British Columbia
- Dr Richard Ewing, Professor of Applied Mathematics, Texas A&M University
- Dr Richard Karp, Professor of computer Science, University of California, Berkeley
- Dr Alistair Lachlan, Professor of Mathematics, SFU
- Dr Bernard J. Matkowsky, John Evans Chair in Applied Mathematics, Northwestern University
- Dr Nicholas Pippenger, Professor of Computer Science, UBC
- Dr Gordon Slade, Professor of Mathematics, University of British Columbia

Nominees for January 1, 2002 - December 31, 2004 term

- Dr David Brydges, Professor of Mathematics, University of British Columbia
- Dr Hugh Williams, Professor of Mathematics, University of Calgary
- Dr Gunther Uhlmann, Professor of Mathematics, University of Washington
- Dr Bob Russell, Professor of Applied Mathematics, Simon Fraser University
- Dr Randy Goebel, Professor of Computer science, University of Alberta
- Dr Elizabeth Thompson, Professor of Statistics, University of Washington

David Brydges received the Ph.D. in 1976 at the University of Michigan under the direction of Paul Federbush. He held a postdoctoral position at Rockefeller University working for James Glimm. In 1978 he became Assistant Professor at the University of Virginia. He was promoted to Full Professor of Mathematics and Physics in 1981 and became Commonwealth Chair in 1996. He was recently appointed as a Canada Research Chair at the University of British Columbia.

Brydges received the Alfred P. Sloan Research fellowship in 1982. He has given numerous lectures throughout the world including courses in Lausanne in 1992, Centre Emile Borel in 1998 and the NachDiplom programme at ETH, Switzerland. He is on the Executive Committee and is the treasurer for the International Association of Mathematical Physics.

His interests are centred on the Renormalization Group in quantum field theory, statistical mechanics and probability, in particular self-avoiding walk.

Randy Goebel is currently professor and chair in the Department of Computing Science at the University of Alberta. He received B.Sc. (Computer Science), M.Sc. (Computing Science), and Ph.D. (Computer Science) from the Universities of Regina, Alberta, and British Columbia, respectively.

Professor Goebel's research is focused on the theory and application of intelligent systems. His theoretical work on abduction, hypothetical reasoning and belief revision is well know, and his recent application of practical belief revision to scheduling and web mining is now having industrial impact. Randy has previously held faculty appointments at the University of Waterloo and the University of Tokyo, and is actively involved in academic and industrial collaborative research projects in Canada, Australia, Europe and Japan.

Gunther Uhlmann received the Ph.D. in 1976 at MIT under the direction of Victor Guillemin. He held postdoctoral positions at Harvard, the Courant Institute and MIT. In 1980 he became Assistant Professor at MIT and in 1985 he moved to the University of Washington as an Associate Professor. He was promoted to Full Professor in 1987.

Uhlmann was awarded the Annual National Prize of Venezuela in Mathematics in 1982. He received the Alfred P. Sloan Research fellowship in 1984 and a John Simon Guggenheim fellowship in 2001. He has given numerous lectures throughout the world included an invited address at the Portland meeting of the AMS in 1991, the CBMS-NSF lectures on "Inverse Problems and Non-Destructive Evaluation" in 1995 and an invited lecture at the International Congress of Mathematicians in Berlin in 1998.

His current interest is inverse problems in particular inverse boundary value problems and inverse scattering problems. In these problems one attempts to determine internal parameters of a medium by making measurements at the boundary of the medium or by remote observations.

Hugh Williams holds the iCORE Chair in Agorithmic Number Theory and Computing at the University of Calgary and is a professor in the Mathematics and Statistics Department at that institution. His main research interests are in computational number theory, cryptography and the design and development of special-purpose hardware devices. His work in computational number theory extends from analyzing the complexity of number theoretic algorithms to the actual implementation and testing of such algorithms.

Dr Williams has published more than 130 refereed journal papers, 20 refereed conference papers and 20 books or (chapters therein) . From 1983-85, he held a national Killam Research Fellowship. He has been an associate editor for Mathematics of Computation since 1978 and is also a member of the editorial boards of two other journals. Dr Williams has also served on the Natural Science and Engineering Research Council (NSERC) Grant Selection Committees for both Computing and Information Science (1972-75) and Pure and Applied Mathematics (1991-94), and chaired the latter from 1993-94. He has also been a member of the Steacie Awards Selection Committee.

Robert Russell received the Ph.D. in 1971 at the University of New Mexico under the direction of Lawrence Shampine. In 1971 he became Assistant Professor at Colorado State University and in 1972 he moved to Simon Fraser University. He was promoted to Full Professor in 1981. He has held numerous visiting positions throughout the world, including at Stanford, University of Auckland and Imperial College (as an SERC Fellow).

Russell's travels include as an Invited Scholar at the USSR and Chinese Academies of Science

PIMS and Shell Canada sponsor "Calgary Lunchbox Lecture Series"

The Pacific Institute for the Mathematical Sciences with the support of Shell Canada will be presenting the Lunchbox Lecture Series to be held in downtown Calgary at the Shell Centre. These lectures, given by academic experts, will focus on mathematical techniques and applications relevant to the oil and gas industry and will demonstrate the utility and beauty of applied mathematics. The talks are aimed at a general audience and attendance may qualify for APEGGA Professional Development Hours. With the generous support of Doug Brade at Shell Canada, PIMS will "bring the university downtown" by organising talks on the application of mathematics at noon hour in a downtown venue. Shell is providing a light lunch for the attendees. For more information contact Marc Paulhus at paulhusm@math.ucalgary.ca please visit **www.math.ucalgary.ca/pims/lunchbox.**

Scheduled Talks

February 12: **Michael Lamoureux**, U of C
Wavelets in Industry

April 16: **Rita Aggarwala**, U of C
Designing better industrial experiments

May 21: **Antonin Settari**, U of C
Mathematics of coupled reservoir and geomechanical modeling

June 13: **Ian Frigaard**, UBC
Advances in understanding well-construction fluid mechanics: Cementing flows and turbulence

Fall Pacific Northwest Statistics Meeting in Victoria, September 2001

by Mary Lesperance, University of Victoria

The fall Pacific Northwest meeting in Statistics was held in Victoria on November 16, 2001, and as usual, it was sponsored by PIMS.

Subhash Lele, from the University of Alberta, gave a stimulating presentation on the analysis of data that depicts the form of objects. The form of an object is that characteristic which remains invariant under a group of transformations consisting of translation, rotation and possibly reflection. He showed that many commonly used methods base inference on non-identifiable parameters and he discussed the scientific implications of those methods. Throughout the presentation, he related the theoretical concepts to his projects on the shapes of skulls of children with Down's syndrome which motivated his theoretical work.

Jenny Bryan's illuminating seminar was entitled "Finding Informative Genes based on Microarrays and Deletion Sets". Her work focuses on modelling gene expression data where it is informative to find sets of genes that exhibit interesting expression profiles or groups of genes that appear to be functionally related. In her talk, she discussed the research questions posed for such data and the challenges and opportunities they present for statisticians.

PIMS Scientific Review Panel

continued from page 12

and as a plenary speaker at SIAM's Dynamical Systems Conference in 2000. His journal editorships have included SIAM Journal on Numerical Analysis and SIAM Journal for Scientific Computing. He is a founding member and past Vice President of CAlMS (Canadian Applied and Industrial Mathematics Society), has served two terms on NSERC's Grant Selection Committee in Computer Science, is on IMACS Board of Directors, and is a Canadian representative for ICIAM.

His field of research is scientific computing, with special emphasis on the numerical solution of PDEs and ODEs. An interest is in dynamical systems and computational methods which preserve qualitative features of solutions of differential equations. This has recently been in the context of developing mathematical software using adaptive gridding techniques.

Elizabeth Thompson received a B.A. in Mathematics (1970), a Diploma in Mathematical Statistics (1971), and Ph.D. in Statistics (1974), from Cambridge University, UK. In 1974-5 she was a NATO/SRC postdoc in the Department of Genetics, Stanford University. From 1975-81 she was a Fellow of King's College, Cambridge, and from 1981-5 was Fellow and Director of Studies in Mathematics at Newnham College. From 1976-1985 she was a University Lecturer in the Department of Pure Mathematics and Mathematical Statistics, University of Cambridge. She joined the faculty of the University of Washington in December 1985, as a Professor of Statistics. Since 1988, Dr Thompson has been Professor also of Biostatistics, and since Spring 2000, she is also an Adjunct Professor in Genetics (now Genome Sciences) at the University of Washington, and an Adjunct Professor of Statistics at North Carolina State University. She served as Chair of the Department of Statistics from 1989-94. In 1981, she was elected a member of the International Statistical Institute, and in 1988, she was awarded an Sc.D. degree by the University of Cambridge. She gave the R.A. Fisher Lecture at the Joint Statistical Meetings in Toronto 1996. In the same year she gave the Neyman Lecture (IMS) at the Joint Statistical Meetings in Chicago. In 1998, she was elected a Fellow of the American Academy of Arts and Sciences. In 2001, she received the inaugural Jerome Sacks Award for Cross-Disciplinary Research from the National Institute for Statistical Science, and was also awarded the Weldon Prize, an international prize for contributions to Biometric Science awarded by the University of Oxford.

Dr Thompson's research interest is in the development of methods for inference from genetic data, and particularly from patterns of genome sharing observed among members of large and complex pedigree structures, whether of plants, animals, or humans. Questions of interest range from human genetic linkage analysis to gene extinction in higly endangered species, and from inference of relationship to inferences of the genetic basis of traits, Her current focus is on developing research and education in Statistical Genetics at the University of Washington.

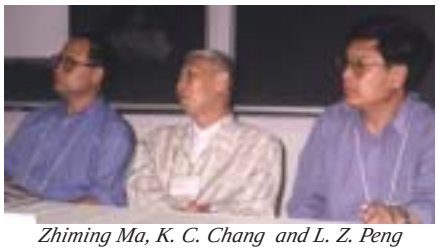
Second Canada-China Mathematics Congress, UBC, August 2001

This Congress built on the success of the first one held at Tsinghua University, Beijing, in August 1999, and was aimed at developing further the collaborative research effort between the two countries. It was sponsored by the 3x3 Canada-China initiative, the Centre de Recherches Mathématiques, the Fields Institute for Research in Mathematical Sciences, the Pacific Institute for the Mathematical Sciences and the MITACS Network of Centres of Excellence.

Organising Committee:
Nassif Ghoussoub (PIMS)
Dale Rolfsen (PIMS UBC)
JingYi Chen (UBC)
Xiao Jiang Tan (Peking University)
Lizhong Peng (Peking University)
Dayong Cai (Tsing Hua University)
XingWei Zhou (Nankai University)
JiaXing Hong (Fudan University)

Officers of the Chinese Delegation:
- Zhi Xing Hou (President of Nankai University, Director of Mathematical Centre of Chinese Education Ministry)
- Wang Jie (Vice director, Chinese Nature Scientific Foundation),
- Zhiming Ma (President, Mathematical Society of China)
- L.Z. Peng (Secretary, the Mathematical Society of China)
- K.C. Chang (Director, Mathematical Centre of Chinese Education Ministry)

Officers of the Canadian Delegation:
- Tom Brzustowski (President of NSERC)
- Barry McBride (Vice-President Academic and Provost, UBC)
- Nassif Ghoussoub (PIMS Director and National Math. Coordinator for 3x3 Canada-China Initiative)
- Arvind Gupta (MITACS program leader)
- Ken Davidson (Director, Fields Institute)
- Jacques Hurtubise (Director, CRM)



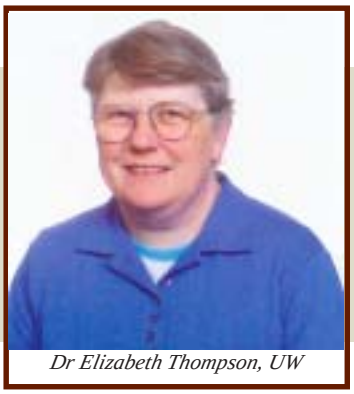
Zhiming Ma, K. C. Chang and L. Z. Peng at the CCC opening ceremony.

Plenary Speakers:
Robert Moody (University of Alberta)
Catherine Sulem (University of Toronto)
Zhiming Ma (Academic Sinica)
Mark Lewis (University of Alberta)
Jie Xiao (Tsinghua University)
Yiming Long (Director of the School of Mathematical Sciences, Nankai University)
Xiaoman Chen (Fudan University)
Weiyue Ding (Director of the Institute of Mathematics, Peking University),
Gordon Slade (UBC)
Ian Putnam (University of Victoria)
Gang Tian (MIT)
Henri Darmon (McGill University)

At the Second Canada-China Congress, August 20-23, 2001, in Vancouver, Dr Tom Brzustowski, President of the Natural Sciences and Engineering Research Council of Canada (NSERC) is shown with the Canadian and Chinese delegations.

Workshop in Statistical Genetics and Computational Molecular Biology

December 16-18, 2001, University of Washington, Seattle



Dr Elizabeth Thompson, UW

This successful three-day workshop was aimed at students from the mathematical, computational, and statistical sciences who may be considering graduate study and research in these areas of mathematical and computational biology. It was organised by the programmes in Statistical Genetics and Computational Molecular Biology at the University of Washington with Elizabeth Thompson (UW) as the main organiser.

PIMS awarded a total of 13 travel scholarships to students from Simon Fraser University, the University of British Columbia and the University of Calgary.

The following people spoke at the workshop:

David Baker (Biochemistry, UW) ,
Protein Structure Prediction;
Jenny Bryan (UBC),
Finding Informative Subsets of Genes;
Joe Felsenstein (Genetics, UW),
Trees of genes within and between species: molecular biology meets population biology;
Jinko Graham (Statistics and Actuarial Science, SFU),
Testing and Estimation of Recombination Breakpoints in a Set of Aligned Sequences;
Phil Green (Molecular Biotechnology, UW),
Analyzing Genome Sequences;
Kathleen Kerr (Biostatistics, UW),
Gene Expression Microarrays: Classical Statistics and Modern Genomics;
Charles Kooperberg (FHCRC),
Sequence analysis using logic regression;
Leonid Kruglyak (FHCRC);
John Mittler (Microbiology, UW),
Population genetics and dynamics of HIV-1 infection;
Stephanie Monks (Biostatistics, UW),
Studying the Genetics of Gene Expression;
Maynard Olson (Genome Center, UW),
Resequencing Segments of the Human Genome: Experimental and Statistical Considerations;
Ram Samudrala (Microbiology, UW),
Modelling genome structure and function;
Elizabeth Thompson (Statistics, UW),
Inferring Gene Locations from Genetic Data on Pedigrees;
Martin Tompa (Computer Science and Engineering, UW),
Discovering Regulatory Motifs in DNA Sequences;
Ellen Wijsman (Division of Medical Genetics, School of Medicine, UW),
Gene finding in human populations

Interested readers are referred to the workshop webpage at http://depts.washington.edu/statgen/Statgen/workshop.shtml.

The Second Lethbridge Workshop on Designs, Codes, Cryptography and Graph theory (DCCG 2001)

July 9-14, 2001, University of Lethbridge

Sponsored by PIMS, University of Lethbridge, and Verisign Inc.

by Hadi Kharaghani, University of Lethbridge

The Second Lethbridge Workshop on **Designs, Codes, Cryptography and Graph Theory** was held from July 9-14 at the University of Lethbridge. Instructional lectures were held each morning, with talks on individual papers in the afternoons.

Brian Alspach of the University of Regina gave a series of 3 instructional lectures on vertex-transitive graphs. Charles Colbourn, now at Arizona State University, gave a series of 3 instructional lectures on applications of combinatorial designs. Chris Rodger of Auburn University gave a series of 3 instructional lectures on coding theory. Doug Stinson of the University of Waterloo gave a series of 3 instructional lectures on the Discrete Logarithm Problem as applied to cryptography. Vladimir Tonchev gave an instructional lecture on combinatorial designs as applied to digital communication. All of the instructional lectures were well-balanced, entertaining and informative, pitched at a level appropriate to non-experts with some discrete mathematical background, yet describing some of the cutting edge of research in these fields. Workshop organisers were extremely fortunate in attracting mathematicians of such eminence in their fields who are also talented expositors of their work.

There were 44 registered participants in the workshop, from eight countries: Canada, the United States, the United Kingdom, Australia, Italy, Spain, Korea and Iran. Participants included employees of SaskTel and the Department of National Defense, in addition to the academic registrants. Communication and a collaborative atmosphere were fostered by a session on open problems, as well as much informal discussion during the times available for social activities during the week.

The workshop was an enjoyable, informative and invigorating experience for participants, who left with their understanding of designs, codes, cryptography and graph theory having been both broadened and enriched.

The workshop was organised by Wolf Holzmann, Hadi Kharaghani and Jim Lui. In addition to photos from the workshop, a list of invited speakers and abstracts of talks are available at **www.cs.uleth.ca/dccg/**.

The Edmonton Extravaganza of Conferences — July-August 2002

by Russ Greiner, University of Alberta

In 2001, the world came to Edmonton, for the IAAF World Championships in Athletics. The world is returning to Edmonton in the summer of 2002 — this time for academic reasons: Over a three-week period in July-August 2002, PIMS, the University of Alberta together with the City of Edmonton will have the honour of hosting the following eight prominent international conferences:

AAAI'02, American Association of Artificial Intelligence
www.aaai.org/Conferences/National/2002/aaai02.html — the pre-eminent conference in Artificial Intelligence.

KDD'02, Knowledge Discovery and Datamining
www.acm.org/sigs/sigkdd/kdd2002/ — the largest international conference in Knowledge Discovery and Datamining.

ISMB'02, Intelligent Systems for Molecular Biology
www.cs.ualberta.ca/~ismb02/ — the largest international conference in bioinformatics/computational biology.

UAI'02, Uncertainty in Artificial Intelligence
www.cs.ucla.edu/~uai02/ — the primary international forum for presenting new results on the use of principled methods for reasoning under uncertainty within intelligent systems.

IDEAS'02, International Database Engineering and Applications Symposium
http://database.cs.ualberta.ca/ideas02 — an international forum for discussion of the problems of engineering database systems involving not only database technology but the related areas of information retrieval, multimedia, human machine interface and communication.

CG'02, Third International Conference on Computers and Games
www.cs.ualberta.ca/~cg2002 — a major international forum for researchers and developers interested in all aspects of artificial intelligence in computer game-playing.

CanDB, Canadian Database Workshop
http://db.cs.ualberta.ca/candb/ — a biannual workshop grouping Canadian academics in databases to discuss their current research and research issues.

SARA, Symposium on Abstraction, Reformulation and Approximation
www.cs.ualberta.ca/~holte/SARA2002 — an Artificial Intelligence symposium on all aspects of abstraction, reformulation, and approximation.

There is also a number of satellite conferences, workshops and symposia — please see http://www.cs.ualberta.ca/Edmonton2002.

Each of these conferences represents a field with sophisticated mathematics and fascinating intellectual challenges. In addition, each is addressing useful, important real-world problems.

We invite all of the PIMS members to participate, by submitting a manuscript, by contacting the organizers to help arrange an accompanying workshop or tutorial, by encouraging your company to provide financial support, or simply by attending, and mingling with the other 3500 attendees!

We look forward to seeing you, and your contributions, in Edmonton this summer!

PIMS hosts SciCADE 2001

International Conference on Scientific Computation and Differential Equations

by Uri Ascher, UBC, and Manfred Trummer, SFU

The Pacific Institute for the Mathematical Sciences hosted this conference in the Coast Plaza Hotel, Vancouver, from July 29 to August 3, with about 230 registered attendees from Canada and abroad. The meeting was also sponsored by Fields, NSERC and SIAM.

Scientific Committee	Local Committee
Uri Ascher (Chair)	Uri Ascher (Chair)
Georg Bock	Eldad Haber
Kevin Burrage	Bob Russell
Arieh Iserles	Steve Ruuth
Linda Petzold	Manfred Trummer
Bob Russell	Jim Varah

Plenary speakers included:
Lorenz Biegler (CMU)
Kevin Burrage (Queensland)
Stephen Campbell (North Carolina State)
Luca Dieci (Georgia Tech)
Leslie Greengard (Courant Institute)
Thomas Hou (Caltech)
Christian Lubich (Tübingen)
Reinout Quispel (La Trobe)
Sebastian Reich (Imperial College, London)
Gustaf Soderlind (Lund)
Demetri Terzopoulos (New York and Toronto).

The conference theme was scientific computing involving the numerical solution of differential equations (ordinary and partial differential equations, dynamical systems, differential algebraic equations and software)

Numerical techniques in applications were emphasized. These included: optimization and optimal control, chemical and mechanical engineering, stochastic differential equations, level-set methods, molecular dynamics, computer graphics and robotics.

At the banquet, Bob Russell expressed the organisers' appreciation for all the support received from the staff at PIMS.

Conference Website:
www.pims.math.ca/scicade

PIMS Graduate Information Weekend

by Luis Goddyn, SFU, and Denis Sjerve, UBC

On the weekend of January 12 and 13, PIMS together with SFU and UBC, hosted the Sixth Annual Graduate Information Weekend.

Twenty-eight potential graduate students with exceptional undergraduate records were invited from across Canada for a weekend in Vancouver, in order to be introduced to graduate programmes at UBC, SFU, UVic, U of A, and U of C.

The result was two long, but fruitful days of contact and information for the students, and unequalled opportunities for various groups in the Mathematical Sciences to present their programmes.

The programme at UBC started with introductions by George Bluman, the head of the Mathematics Department at UBC, and Dale Rolfsen, the UBC site director for PIMS. Ed Perkins gave an address relating his experiences as a graduate student.

The remainder of the day was filled with presentations from various research groups at UBC: Alan Wagner for Computer Science, Bertrand Clarke for Statistics, Jim Bryan representing algebraic geometry, David Brydges representing mathematical physics, Ian Frigaard representing applied mathematics, Izabella Laba representing analysis, Greg Martin representing number theory, and Laura Scull representing topology. During the afternoon there were campus tours and a chance for students and faculty to meet one-on-one.

On the social side there was a Saturday afternoon lunch at Hillel House on the UBC campus and in the evening there was a reception at the Graduate Student Centre, hosted by the graduate students in the Mathematics Department at UBC. Thanks go to David Burggraf, Theodore Kolokolnikov, Gabriel Mititica and Connie Wilmarth.

At Simon Fraser University the following groups were represented. Applied and Computational Mathematics: Dave Muraki, Bob Russell, Steve Ruuth, Manfred Trummer (faculty), Mohamed Mahmoud, Tatiana Marquez-Lago, Leslie Fairbairn, Colin Macdonald, Jeffrey Gilmore, Benjamin Ong (students); Computing Science: Dave Mitchell, Torsten Möller, Joseph Peters, Eugenia Ternovska (faculty), Leila Kalantari (student); Mathematics and CECM: Jon Borwein, Imin Chen, Steve Choi, Luis Goddyn, Alistair Lachlan, Petr Lisonek (faculty), Kevin Hare, Laura Chavez, Alan Meichsner, Gregory Fee, Jennifer De Kleine, Mason Macklem, Stephen Tse (students), William Galway; Statistics: Charmaine Dean, Richard Lockhart, Carl Schwarz (faculty), Ruth van den Driessche, Yiqing Li, Jason Nielsen, Simon Bonner, Michael Lo (students). The level of interest expressed by all these people is highly appreciated. Special thanks to Dr Jonathan Driver, SFU Dean of Graduate Studies, for his participation in the event.

Presentations were made by Manfred Trummer (SFU PIMS Site Director), Jonathan Driver (SFU Dean of Graduate Studies), Dave Muraki (Applied Mathematics), Imin Chen (Pure Mathematics), Jon Borwein (CECM), Carl Schwarz (Statistics & Actuarial Sciences), and Torsten Möller (Computer Science).

The students were given tours of various laboratories in Computing Science, Statistics and the Centre for Experimental and Constructive Mathematics. There was plenty of time for informal contact between the students and potential programme advisors or supervisors.

This annual PIMS programme is unique in Western Canada, providing a forum in which talented undergraduates can preview and select the specialty which best suits their interests and ability. The payoff is many-faceted: groups and laboratories are populated with better-matched students, students get the programmes they really want, and the strength of Western Canada's mathematical sciences is promoted.

Participants at the Graduate Student Recruitment weekend enjoy lunch and animated discussions

From PIMS' Mailbag:

I wanted to thank you for providing me with this opportunity. The weekend was well planned, travel instructions were clear and easy to follow (even for someone like myself with an extremely poor sense of direction) and the accommodation was comfortable. In addition to my overall enjoyment of the weekend, I was greatly impressed with the city of Vancouver, its universities, and all the presenters at the conference. The opportunity to spend time with students from throughout Canada with similar interests was fascinating. This weekend has given me a lot to think about, and revealed a realm of possibilities I did not know existed.

My sincere thanks,

Erinn O'Marra
Wilfrid Laurier University

I just wanted to thank you for organising the PIMS graduate weekend. I had a great time, and now have many good things to say about the PIMS affiliated universities. I also really appreciate PIMS' generosity in funding us for the weekend.

Thanks again,

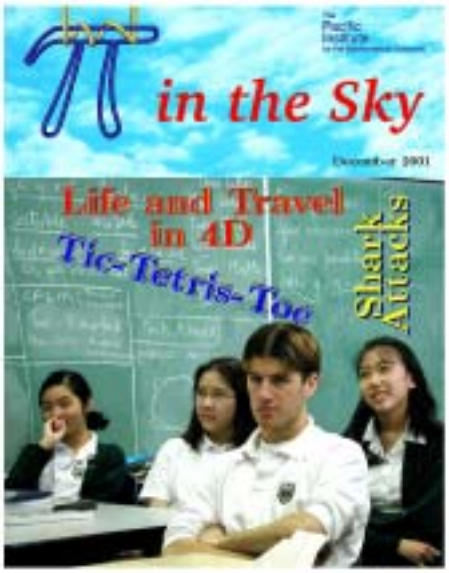
Shirin Yazdanian
York University

Pi in the Sky: December 2001 Issue

The fourth issue of the PIMS Educational Magazine **Pi in the Sky** features students from Tempo School in Edmonton on the cover. These students were visited by five University of Alberta mathematicians in October 2001. The students were shown how mathematics can be fun and interesting at the same time. They also learned all about the **Pi in the Sky** magazine.

The new issue includes the game "Tic-Tetris-Toe" by Andy Liu, a biography of "Karl Weierstraß" by Volker Rundle, insight into "Life and Travel in 4D" by Tomasz Kaczynski, an explanation of "Shark Attacks and the Poisson Approximation" by Bryron Schmuland, and "The Rose and the Nautilus: A Geometric Mystery Story" by Klaus Hoechsmann. There is also the usual wealth of math jokes and challenges.

Pi in the Sky is distributed to schools in British Columbia and Alberta as well as math departments through-out North America. To



download a PDF file of the magazine visit the webpage **http://www.pims.math.ca/pi**, or to be added to the "Pi in the Sky" mailing list email or write to PIMS.

2001 Esso - CMS - PIMS Summer Math Camp at SFU

by Malgorzata Dubiel

PIMS and the Department of Mathematics at Simon Fraser University hosted for the first time a regional Math Camp for high school students. The Esso-CMS Camps are organised at various universities across Canada. They are designed to provide students interested in and with a demonstrated talent for mathematics with a variety of enrichment activities in a fun and rewarding environment.

The camp ran from June 25-29 at the SFU Burnaby Campus. The activities consisted of talks and problem sessions given by the SFU Mathematics and Statistics faculty and graduate students, a Campus tour, and a visit to the SFU Engineering labs. Twenty-four students from 16 schools participated in the camp.

The following sessions were offered:

Len Berggren, Lessons from the History of Mathematics

Jonathan Borwein, Exploring Math on the Internet

Peter Borwein, Much Ado about Pi

Imin Chen, Cryptography

Luis Goddyn, The Lonely Runner and Other Problems

Mary Catherine Kropinski, Swimming in Syrup

Petr Lisonek, Mathematics with Maple

Carl Schwarz, One Fish, Two Fish, Red Fish, Blue Fish

Petr Lisonek, Putnam Competition Problems

Ronald Haynes, An Algorithm to Compute the Roots of Polynomials?

Mahdad Khatirinejad Fard, Inequalities

The session leaders were also giving daily problems to the participants. The best solutions were rewarded with prizes.

For more information about the camp, including the schedule and pictures, see:
www.cecm.sfu.ca/~lisonek/mathcamp.html
The camp was organised by Malgorzata Dubiel and Petr Lisonek.

The camp was supported by grants from the Canadian Mathematical Society, the Imperial Oil Charitable Foundation, the Pacific Institute for the Mathematical Sciences and by the SFU Department of Mathematics.

A problem solving group at the PIMS Math Evening on February 9, 2002.

Upcoming in Vancouver

April 4-6: Greater Vancouver Regional Science Fair, UBC

April 26: Changing the Culture V, Harbour Centre, SFU

May 25: PIMS Elementary Grades Math Contest, UBC

June 10-14: Summer School on Applications of Computational Geometry, SFU

Math Fair 2002 is coming up this April 4, 5, and 6 as part of the Greater Vancouver Regional Science Fair. Everyone in grades 7 to 12 is encouraged to develop a project within mathematics, statistics, or computation. Students who participate in mathematical projects gain insight into the beauty, importance, and usefulness of mathematics in a wide variety of settings. By displaying their projects in a science fair, others can also learn and benefit from each student's hard work. Completed projects should be submitted directly to the Science Fair Foundation of British Columbia at Science World, Website www.sciencefairs.bc.ca, no later than March 13. Teachers or students wishing more information about the Math Fair, possible math-related projects, or guidance with projects should contact Janet Martin by email at **jamartin@pims.math.ca**.

Two of the youngest helpers at PIMS, Max Trummer and Joseph Ghoussoub, enjoy a game of chess after patiently gluing labels on envelopes.

Upcoming in Victoria

The 5th **F.A.M.E.** (Forever Annual Mathematics Exhibition) is on Wednesday, April 10, 2002, at the S.J. Willis Educational Centre.

Math Mania Night at Lampson Street Elementary School, 670 Lampson Street, Esquimalt, Victoria, B.C.
Tuesday, May 28, 2002, 7-8:30 p.m.

CH News did a live report on our **Math Mania** night at Sooke Elementary School in October. Come visit the webpage at www.pims.math.ca/education/2001/mathmania/october2.html where you can now watch the report in realvideo or hear it in real audio or in mp3 format. The mp3 file can also be downloaded.

Changing the Culture

by Malgorzata Dubiel

The Fifth Annual Changing the Culture conference will take place Friday, April 26, 2002, at the SFU campus at Harbour Centre.

The conference, organised and sponsored by the Pacific Institute for the Mathematical Sciences, will again bring together mathematicians, mathematics educators and school teachers from all levels to work together towards narrowing the gap between mathematicians and teachers of mathematics, and between those who do and enjoy mathematics and those who do not.

The conference theme this year is "**Rigour and Intuition in Mathematics**". The keynote speaker will be **Brent Davis**, Canada Research Chair in Education at the University of Alberta in Edmonton. The title of his talk is "**Straight to the point: Unsound logic, literalized metaphor, and other tragic errors in the mathematization of mathematics teaching**".

The conference is free, but registration is required. For more information, please contact Malgorzata Dubiel, Department of Mathematics, SFU, dubiel@cs.sfu.ca.

PIMS-IAM-CSC Senior Undergraduate Math Modelling Workshop, February 16-17, 2002, UBC and SFU

The Pacific Institute for the Mathematical Science (PIMS) along with the Institute of Applied Mathematics (IAM) at the University of British Columbia and the Centre for Scientific Computing (CSC) at Simon Fraser University sponsored an undergraduate workshop on problems in applied mathematics for senior undergraduate students.

The workshop ran for two days with the first day at UBC and the second day at SFU.

Faculty mentors outlined each of the applied problems to all the participants. The students then chose one of the problems to work on each day. The mentors presented lectures in which the tools for the modelling and analysis of the problem were developed. The mentors then helped groups of approximately 8 students to develop the models and to answer the questions posed. The workshop culminated with a brief presentation by each of the groups working on the chosen problems.

The mathematical tools used in the workshop are accessible to 3rd and 4th year undergraduates in mathematics, applied mathematics, physics and applied science. The workshop is an opportunity to meet students from across Canada.

The Student Committee of the Canadian Mathematical Society sponsored Saturday's reception, the Department of Mathematics at SFU sponsored Sunday's dinner.

The problems discussed included:

- Setting Stable Cement Plugs in Oil Wells (Mentor: **Ian Frigaard**, Mathematics, Mechanical Engineering, UBC)
- Characterization of Internet Traffic and its Impact on Network Performance (Mentor: **Ljiljana Trajkovic**, Engineering, SFU)
- Finding the tumor (Mentor: **Anthony Peirce**, Mathematics, UBC)
- Scientific Visualization of Large Data Sets (Mentors: **David Muraki**, Mathematics, and **Torsten Möller**, Computer Science, SFU)

For further details please see the webpage **www.pims.math.ca/industrial/2002/summw**

Grade 4 and 5 students discussing math problems at the PIMS Math Evening on February 9, 2002

Upcoming in Alberta

January-March (every Wednesday):
Junior High Math Nights, Mount Royal College, Calgary

Math Fairs: "That's a Good Problem"

February 28:	Pineridge Community School, Calgary
April 19:	C Ian McLaren School, Black Diamond
April 25:	Glendale Elem. School, Calgary
May 8:	Cecil Swanson Elem. School, Calgary
May 22:	Nellie McClung Elem. School, Calgary

March 21: **Math Fair**, University of Alberta

April 10-13: **Calgary Youth Science Fair**, Calgary

May 11-19: **1st School of Mathematical Biology for Senior Undergraduates**, University of Alberta

Sixth PIMS Industrial Problem Solving Workshop (IPSW)

University of British Columbia, Vancouver, May 27-31, 2002

by Marc Paulhus

The IPSW workshop will follow the same highly successful format as PIMS' first 5 workshops held in Vancouver (1997), Calgary (1998), Victoria (1999), Edmonton (2000) and Seattle (2001). Six problems will be posed to the workshop participants by industry experts. The problems are relevant and of current interest to the participating industry. The workshop participants (both faculty and graduate students) then spend the rest of the week working on these unsolved problems with the help of a company representative and some select academic 'mentors'. On the fifth day, oral presentations from each group are made before the whole assembly. A Conference Proceedings will be compiled and published by PIMS after the workshop, and distributed freely to over 500 companies. Proceedings from previous PIMS-IPSWs may be viewed at www.pims.math.ca/publications.

We are currently searching for industrial problems for the 6th PIMS IPSW. Companies interested in posing a problem to are invited to download the "Call for Problems form" at www.math.ucalgary.ca/pims/invitation.pdf.

Participation by graduate students and faculty from the US and Canada is encouraged. Financial support is available, particularly for graduate students who will also attend the PIMS 5th Graduate Industrial Mathematics Modelling Camp the previous week. Students will also have the opportunity to attend the MITACS AGM which is held at the University of British Columbia from May 23 - 25, 2002 (please see page 26).

Limited funds in the form of travel reimbursements and accommodation expenses are available for faculty participants, for whom the IPSW workshop offers the following benefits:

- The challenge of applying their skills to new and relevant problems directly applicable to industry.
- The opportunity for continued collaboration with the workshop's academics and industrial participants.
- The opportunity to help promote the role of the mathematical sciences by showing businesses and governments the tangible benefits of supporting mathematical sciences.

The website for the workshop is at **www.pims.math.ca/industrial/2002/ipsw.**

GIMMC and IPSW 2002

Details about the administration of the workshop, financial support and problem descriptions (once finalized) can be found on the webpages www.pims.math.ca/industrial/2002/ipsw/ and www.pims.math.ca/industrial/2002/gimmc/.

GIMMC-IPSW Organising Committee:

Chris Bose	Ian Friggard
Huaxiong Huang	Randy LeVeque
Jack Macki	Marc Paulhus
Keith Promislow	Manfred Trummer

Fifth PIMS Graduate Industrial Math Modelling Camp (GIMMC)

Simon Fraser University, Burnaby, May 18-23, 2002

The GIMMC will provide training experience for up to 60 graduate students who will have an opportunity to learn techniques of mathematical modelling under the supervision and guidance of experts in the field. All graduate students should apply to attend the training camp GIMMC at Simon Fraser University during the previous week. Graduate participants at the GIMMC are automatically registered for the IPSW and will be fully funded for both events. Students interested should apply as soon as possible through the website **www.pims.math.ca/industrial/2002/gimmc.**

Confirmed Mentors:

Chris Budd, University of Bristol
Tim Myers, University of Cape Town
Miro Powojowski, Algorithmics Inc. Toronto
Yongji Tan, Fudan University
Brian Wetton, Univ. of British Columbia

Participants at last year's IPSW at the Univeristy of Washington in Seattle.

Computing Free Boundary Problems in Moving Fluids

by Professor Michael Shelley, Courant Institute of the Mathematical Sciences, New York University

This article is an overview, based on his first introductory lecture, of the five lectures given by Michael Shelley at PIMS–SFU in November and December of 2001.

What is a free boundary problem (FBP) in fluid dynamics? Figure 1 shows one. This is an experiment performed by John Bush and Buckingham of MIT. A fluid flowing from a pipe hits a flat plate, and is expelled sideways as an expanding sheet. This sheet breaks up into jets of liquid that themselves continue to collide and split to form a linked pattern. In this flow both the inertia and viscosity of the fluid are important physical factors, as is the surface tension of the very dynamic boundary of the liquid.

And so, a free boundary problem occurs when the dynamics of a fluid system involves determining also the dynamics of a boundary. This boundary could be that which actually bounds the fluid, as in Figure 1, or it could be a boundary that separates two different fluids, or even a boundary within a single fluid. FBPs are very common and central in fluid dynamics, often visually arresting, and yet difficult to study. As an applied mathematician, one needs a firm grasp of the experimental data, and facility in mathematical modeling and analysis. Simulation plays an especially important role in their mathematical study and the beautiful dynamics seen in Figure 1 lies beyond our current abilities.

Mathematically, we approach FBPs by considering a time-dependent domain $\Omega(t)$, with boundary $\Gamma(t)$, which contains a fluid. Our goal is to determine the motion of $\Omega(t)$ and thus of $\Gamma(t)$. For "regular" fluids, like water and glycerin, the evolution in space and time of the fluid's velocity $\mathbf{u}(\mathbf{x}, t)$ is described well by the Navier-Stokes (N-S) equations, which is a version of Newton's second law for a continuously deformable media:

$$\rho\left[\frac{\partial \mathbf{u}}{\partial t} + \mathbf{u}\cdot\nabla\mathbf{u}\right] = -\nabla p + \mu\Delta\mathbf{u} \qquad (1)$$

Here $p(x,t)$ is fluid pressure, ρ the fluid density, and μ the shear viscosity. We are usually interested in incompressible fluids, and so Eq. (1) is supplemented by the condition $\nabla\cdot\mathbf{u} = 0$, which is an expression of conservation of mass. This is a global constraint on the system and means that the dynamics has an elliptic boundary value problem at its core. In free boundary problems, the incompressibility constraint is a strongly complicating factor in how these problems are treated both analytically and numerically.

Figure 1: Fluid hits a flat plate, and is expelled sideways. From "Fluid polygons", by R. Buckingham and J. Bush, Physics of Fluids 13, S10 (2001).

To finish the mathematical description we need boundary conditions at $\Gamma(t)$, which we now imagine separates two fluid domains $\Omega_1(t)$ and $\Omega_2(t)$. One boundary conditions says that $\Gamma(t)$ moves at the velocity of the fluids on either sides, which are equal, or

$$\textit{velocity of } \Gamma = \mathbf{u}_1|_\Gamma = \mathbf{u}_2|_\Gamma$$

The next condition is more complicated. Fluid boundaries will typically exert a force, or stress, on the surrounding fluids. Rewrite the RHS of the N-S equations as

$$-\nabla p + \mu\Delta\mathbf{u} = \nabla\cdot\mathbf{\Pi} \qquad (2)$$

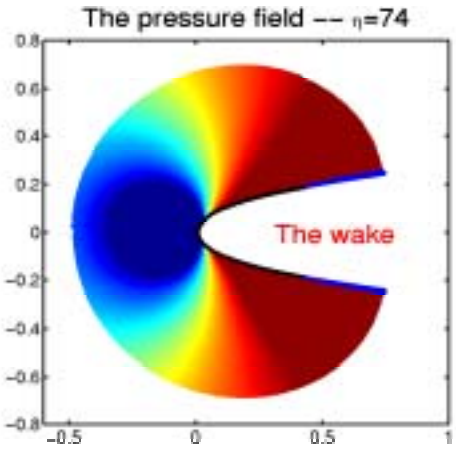


Figure 7: Numerical determination of fluid flow, wake, and body deformation using an elastic surface.

The matrix $\mathbf{\Pi}$ is called the stress tensor, and describes the internal stresses of the fluid. The second boundary condition is that the jump in fluid stress across the boundary is given by the stress $\mathbf{S}$ exerted by the boundary on the fluid, or

$$[\mathbf{\Pi}|_\Gamma]\cdot\hat{n} = \mathbf{S}.$$

This closes the system but for the prescription of $\mathbf{S}$, where more very interesting physics can enter the problem. If the two fluids are immiscible, then there is surface tension and $\mathbf{S}$ is taken as proportional to the mean curvature of the boundary. If the boundary is a mechanical object, like the material of a flag, then $\mathbf{S}$ must capture the inertial, and other, forces of that surface.

The second lecture discusses numerical methods that are used to circumvent some of the special difficulties that arise with surface stresses such as surface tension, or elasticity, which depend on the geometry of the boundary. Such stresses bring high spatial derivatives, both nonlinearly and nonlocally, into the dynamics,

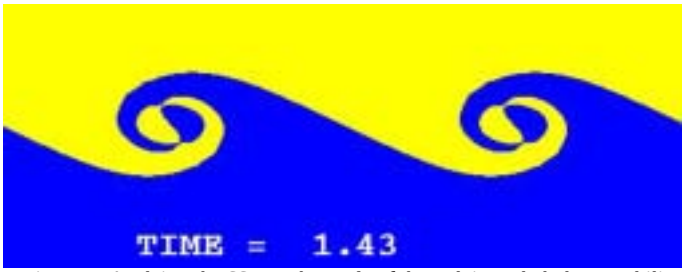


Figure 2: Applying the SSD to the study of the Kelvin-Helmholtz Instability.

making naive implementations of the dynamics very stiff. In Hou, Lowengrub and Shelley [1,2] is developed the "Small-Scale Decomposition", which is a basis for numerical methods that remove these difficulties, and have become a standard method for this class of problems (see Hou, Lowengrub, & Shelley [3]). These methods have lead to the discovery of unexpected phenomena. A classical free-boundary problem that captures the mixing of two fluids shearing past one another arises from the Kelvin-Helmholtz instability. Figure 2 shows the result of applying the SSD to study the development of the KH instability when the two fluids are immiscible, and the interface between them is under a surface tension. The interface began nearly flat, and has "rolled-up" into intricate spirals. Further, we found that the interface generically collided with itself – as is nearly the case in the figure – yielding finite-time "topological singularities" that are presumably the precursors to the formation of separated fluid droplets.

FBPs are also closely associated with problems in pattern formation in soft condensed matter, which is the subject of the third lecture. The fluid archetype arises from Hele-Shaw cells, which is the simple experimental setup of two glass plates separated by a small gap. After filling this gap with a fluid, say glycerine, air is pumped in through a small hole to form an expanding bubble that displaces the liquid. This bubble is unstable to the Saffman-Taylor instability, which is mediated by surface tension, and yields densely branched patterns which have been much studied and simulated (see [1,3]). There are related fundamental instabilities in solidification processes, and, in biology, similar patterns emerge in the growth of bacterial colonies.

However, other interesting things also happen when the cell is filled with more exotic liquids, like liquid crystalline fluids or polymeric liquids. These fluids are "non-Newtonian" and can store and release stress, or have flow dependent viscosities, among other novelties. (The stress tensor is no longer that found in Eq. (2), but is more complicated, and often unknown.) While these fluids behave strangely, they are also part of our modern life, making their way into computer displays and shampoos. Modeling of these systems becomes central, the resulting mathematical descriptions more involved, and the simulations even more difficult [4,5]. Figure 3 shows an experiment by Peter Palffy-Muhoray and Roland Ennis at the Liquid Crystal Institute (Kent State) when the outer fluid is "shear-thinning", a common property of nematic and polymeric liquids. Plainly the pattern is structured around a few stable fingers, and looks much like a snowflake. Figure 4 shows a numerical simulation using a shear-thinning version of "Darcy's Law", which governs Hele-Shaw flows. These simulations reveal that the emerging fingers are associated with strongly reduced viscosities at their tips.

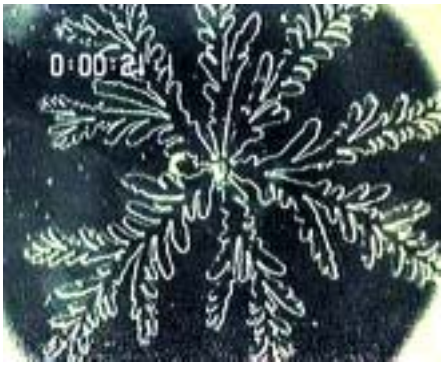


Figure 3: An experiment showing the nonlinear development of Saffman-Taylor instability in a non-Newtonian liquid. Courtesy of Peter Palffy-Muhoray and Roland Ennis (Liquid Crystal Institute, Kent State University).

A very different kind of free boundary problem involves "inertial boundaries". Inertial boundaries include heavy surfaces which interact with the fluid, like flags and fish. In these cases the inertia of the object is an important factor in the resulting fluid interaction. For these problems the surface stress, **S**, is now a function of the acceleration of the interface (inertial forces), and other internal stresses of the mechanical object; Surface stress now reflects much more than just geometry. Figure 5 shows the result of immersing such an inertial object in a strongly flowing fluid. In this experiment, performed at the Courant Institute Applied Math Lab, a silk thread is suspended into a flowing soap-film. This is an experimental analog of a 1-D flag in a 2-D flow. When the thread is long enough, so that its mass comes into balance with the mass of the fluid with which it interacts, it begins to flap like a flag. The interaction of fluids with such boundaries is an area of current and active research, both in formulation and simulational methods (see Zhu & Peskin [7] for some first simulations in this direction).

Figure 5: A suspended silken thread flapping in a running soap-film.

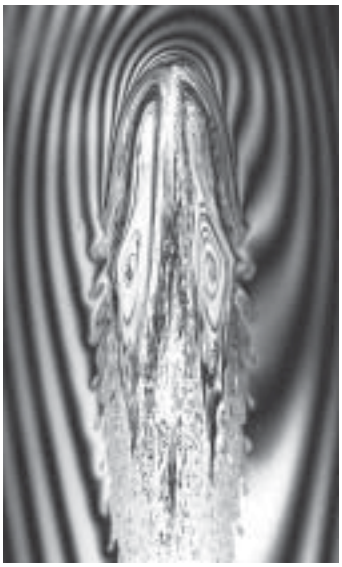


Figure 6: A nylon fiber being deformed by the oncoming flow of a running soap-film.

In the final lecture is discussed very recent work concerning body flexibility and fluid drag. The motivation for this is the observation that in a strong wind, a flexible leaf will change its shape,

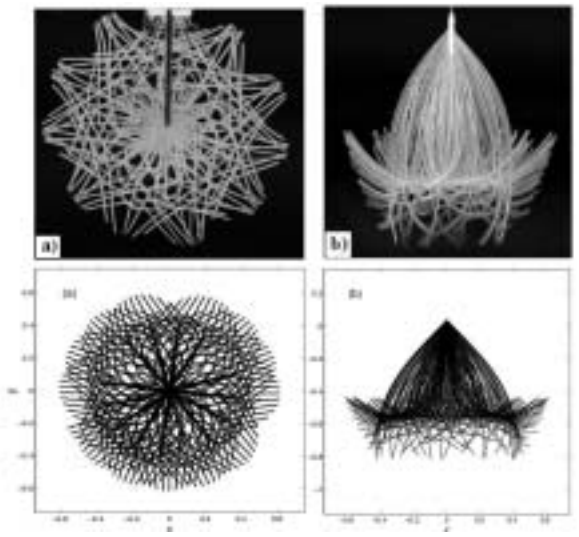


Figure 8: Hanging oscillating chain.

Figure 8 shows a comparison of experiment and theory for the nonlinear patterns that form when a hanging chain is oscillated at its support point. This is the most classical, indeed the grand-daddy, of "inertial free boundary problems". See *Physical Review Letters 87, #11 (2001), by Andrew Belmonte, Shaden Eldakar, Michael Shelley, and Chris Wiggins.*

which can yield a decrease in drag. To study this effect experimentally a flexible plate is placed in a flowing soap-film, and its drag is measured as the flow velocity U increases and the "body" becomes more streamlined. (Figure 6, courtesy of Alben, Xia, Zhang, and Shelley, in preparation). The experimental finding is that rather than growing like U^2, as is expected and found for a rigid body, the drag grows like U^α for some $\alpha < 2$. Shelley and his collaborators have constructed mathematical models, and solved them numerically, that simulataneously solve for the flow, the body deformation, and the wake. A numerical solution of this flow model is seen in Figure 7. Analysis of this mathematical model reveals a transition in drag behavior at a critical non-dimensional flow velocity: Below the transition, drag scales as U^2, and above the transition as $U^{4/3}$.

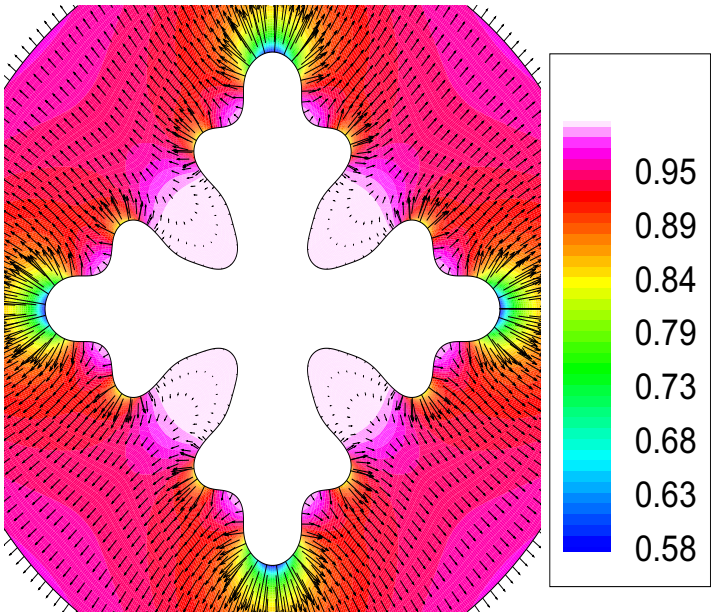


Figure 4: Numerical simulation of the Saffman-Taylor instability in Hele-Shaw cells.

Dr Michael Shelley is Professor of Mathematics at the Courant Institute of Mathematical Sciences at New York University, where he is also co-Director of the Courant Applied Mathematics Laboratory, an experimental laboratory in fluid dynamics and related areas. Besides his interests in fluid dynamics and free-boundary problems, Dr Shelley also works actively in the neuroscience of vision. He was the PIMS Distinguished Chair at SFU, November to December 2001.

Dr Shelley thanks David Muraki, Manfred Trummer, and the PIMS staff for making his stay at SFU so enjoyable and stimulating, and Ronald Haynes for assisting in the preparation of this article.

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New PIMS Executive

Four of the PIMS sites have new site directors: Jim Muldowney (University of Alberta), Gary Margrave (University of Calgary), Jim Morrow (University of Washington), and Manfred Trummer (Simon Fraser University) join the continuing site directors Dale Rolfsen (University of British Columbia) and Florin Diacu (University of Victoria) on the PIMS Executive.

University of Alberta

James Muldowney was appointed Site Director for the University of Alberta on September 1, 2001.

James Muldowney

Jim received his BSc and MSc degrees from the National University of Ireland before coming to Canada to work for his PhD at the University of Alberta. Following a Ford of Canada postdoctoral fellowship he served on the faculty of the University of Oklahoma returning to Alberta in 1968.

Muldowney's research is in the area of differential equations and dynamical systems with a special interest in the evolution of lower dimensional surface areas in dynamics.

He has served two terms as Associate Chair for Graduate Studies and Research in the Department of Mathematical Sciences. He has also served an Associate Dean in the Faculty of Graduate Studies and Research, where he was responsible for the development of the University Teaching Programme to prepare graduate students for careers in postsecondary teaching.

Jim has received the Faculty of Science Teaching Award and the University of Alberta Rutherford Teaching Award. Jim will bring a vast amount of experience to the role of Site Director at the University of Alberta.

University of Calgary

Professor Gary Margrave is the new Site Director for the University of Calgary.

Dr. Margrave is an Associate Professor in the Department of Geology and Geophysics, who joined the University of Calgary in 1995 after 15 years with Chevron Corporation as Senior Staff Geophysicist. His research in exploration geophysics includes the development of advanced mathematical techniques for application to problems in seismic imaging. Dr. Margrave is also Associate Director of the Consortium for Research in Elastic Wave Exploration Seismology (CREWES), co-leader of a MITACS project in Pseudo-differential Operator Theory and Seismic Imaging (POTSI), and Associate Editor of "Geophysics", the leading journal in exploration geophysics. His wide experience will be a valuable addition to the PIMS team.

Gary Margrave

University of Washington

James A. Morrow is the PIMS Site Director for the University of Washington. Dr. Morrow is a Professor of Mathematics at the University of Washington. He received a BS in Mathematics in 1963 from the California Institute of Technology. He held an NSF Graduate Fellowship at Stanford University. He received a PhD in Mathematics under the direction of Kunihiko Kodaira at Stanford University in 1967. He has held positions at the University of California at Berkeley and Rice University. He was appointed to a position at the University of Washington in 1969. He has served as Graduate Program Coordinator and Undergraduate Program Coordinator for the Department of Mathematics at the University of Washington.

Jim Morrow

Jim was one of the originators of the Pacific Northwest Geometry Seminar (in 1974). He has been the director of an NSF REU site at the University of Washington on Discrete Inverse Problems since 1988. He has been the director of Mathday, an annual event for high school students since 1994.

Jim has written two books, Complex Manifolds (with K. Kodaira) and Inverse Problems for Electrical Networks (with E. Curtis). His current research is on discrete inverse problems.

Simon Fraser University

In September, Manfred Trummer was appointed the new Site Director of PIMS at SFU.

Manfred Trummer has been Associate Professor of Mathematics and Computing Science at SFU since 1989. Manfred received his M.Sc. (Dipl.Math.ETH) and Ph.D. (Dr.sc.math.) from ETH Zürich. He has held academic appointments at the University of North Carolina, UBC, MIT, Graz (Austria), Zürich (Switzerland), and Auckland (New Zealand). His area of research is numerical analysis and scientific computing.

Manfred Trummer

Manfred has been involved in a number of PIMS events and activities such as organising events in the Pacific Northwest numerical analysis seminar series, and as a member of the local committee of the PIMS sponsored SciCADE 2001 conference.

Who to contact

Each Site Director is responsible for one of the major directions at the institute. He is the main contact person for that task (vis-a-vis the director, the staff and the whole community). The briefs of the present members of the PIMS Executive are:

Florin Diacu
Scientific Dissemination

Gary Margrave
Industrial Outreach

James Morrow
Pacific Northwest Initiatives

Jim Muldowney
Mathematical Education

Dale Rolfsen
Research Programmes

Manfred Trummer
Communications

A Blueprint for the Future of PIMS

continued from page3

targeted for its industrial projects in FY 00/01. In addition, PIMS receives substantial infrastructure support from its participating universities, including two fully equipped 5,000 sq.ft. research facilities at UBC and SFU. PIMS' $500K investment in more than 30 postdoctoral fellows every year is also matched — at least equally — by its industrial partners and its affiliated departments. In effect, NSERC's institute grant has been leveraged seven-fold by PIMS.

Furthermore, in its quest for developing BIRS, PIMS has attracted $1.7M from ASRA and $1.95M from NSF: a first for Canadian research. All this adds up to a remarkable rate of return for NSERC's 1998 farsighted initial investment in PIMS.

The institute is poised for a dramatic expansion in its area of operation and influence in the scientific world, and also in the scope and diversity of its programmes. We are hopeful that NSERC's support for PIMS in this next phase (2003-07) would allow the institute to fulfill its ambitious mission for Canada.

The next steps

In this next phase, PIMS will have three major thrusts in priorities:

♦ **To sustain the regional, national and international initiatives that the institute has developed in its first phase**. In particular, the MITACS network, the Banff International Research Station, the Pacific Northwest Partnership, and the Pacific Rim Initiative.

♦ **To foster and support collaborative multi-university teams that will form the critical mass necessary for success**. PIMS will accomplish this by supporting periods of concentrated activities for competitively selected *Collaborative Research Groups.*

♦ **To share its successes in multiplying research opportunities, by including as many scientists and as many institutions in Canada and in the US as viable in its distributed model.** As a first step, PIMS will integrate into its operations all interested universities in Saskatchewan and Oregon. PIMS is also committed to its new plan to adequately address and support the needs of the mathematical sciences community in Atlantic Canada.

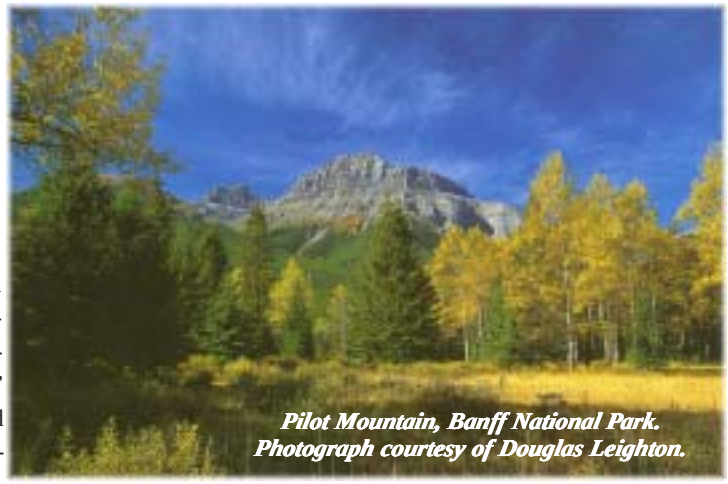
Banff International Research Station

continued from page 1

The joint venture is spearheaded in Canada by the Pacific Institute for the Mathematical Sciences (PIMS) and in the US by the Berkeley based Mathematical Sciences Research Institute (MSRI). The facility will also profit from the active participation of the Mathematics of Information Technology and Complex Systems Network of Centres of Excellence (MITACS).

At a ceremony held simultaneously in Washington DC and Banff, the National Science Foundation of the United States committed $1.95M, the Alberta Science Research Authority $1.7M and the Natural Sciences and Engineering Research Council of Canada $1.5M towards the operation of BIRS from 2002 to 2005. The station will also be supported by the British Columbia Ministry of Competition, Science and Enterprise through its sponsorship of PIMS.

The facility will be housed at the well-known Banff Centre, which has already won acclaim for its programmes in music, mountain culture, writing and publishing, visual arts, and its centre for management. "The bringing together of imaginative minds through BIRS is directly in line with The Banff Centre's mandate," says Mary Hofstetter, president and CEO, The Banff Centre. "This mandate is to support creative excellence, foster innovative research opportunities, and encourage cross-disciplinary exploration and discovery." BIRS is the first of its kind in North America. Modelled on two similar European facilities, BIRS is expected to enhance research capacity and help develop the careers of young researchers both in North America and around the world. This is the first time that Canada and the US have collaborated on this type of facility.



Pilot Mountain, Banff National Park. Photograph courtesy of Douglas Leighton.

> ***"BIRS will become a focal point for leading mathematical research in Canada and the world."***

"BIRS will become a focal point for leading mathematical research in Canada and the world," says Dr Nassif Ghoussoub, Director of PIMS. "This facility offers a scope for graduate training that is second to none and we will endeavour to bring as many students as possible to BIRS" says Dr. Robert V. Moody, Scientific Director of BIRS.

The main mode of operation will be five-day workshops involving approximately 40 researchers chosen by a distinguished scientific panel on the basis of international competition. "A facility like BIRS is something that we've been talking about in North America for many years now. MSRI feels fortunate to be one of the architects of a facility that is destined to become a jewel for North American mathematical research," notes Dr David Eisenbud, Director of MSRI.

Dr Arvind Gupta the Director of MITACS added, "BIRS will bring together academics, students, industrial scientists in an environment that will foster innovation, stimulate new ideas, and create lasting research partnerships. This is truly a remarkable venture between Canada and the United States."

Further information on BIRS can be found at **www.pims.math.ca/birs.**

MITACS Funding

On October 23, 2001 the Honorable Brian Tobin (former Minister of Industry) announced that MITACS will receive $10.8M in funding over the next three years. This funding comes as part of the MITACS mid-term review of its progress. MITACS received the maximum amount of funding available to the network.

Networks of Centres of Excellence are assigned four years of monies when they are first funded. An additional three years of funding is available to them on successful completion of a mid-term review. In the case of MITACS, the initial funding of $14.4M covered the 1999-2002 period. Early in 2001, MITACS submitted a strategic plan to the NCE outlining plans for these last three years of its mandate. In May, 2001 a review committee met with eight MITACS representatives (Arvind Gupta, Nassif Ghoussoub, Bruce Clayman, Claudine Simpson, Bryan Barry, Nancy Reid, Brenda Law, Joanna Biernacka) in Toronto. The $10.8M awarded to MITACS is a culmination of this review process.

Joining Mr Tobin for the official announcement were Dr Tom Brzustowski, the President of the Natural Sciences and Engineering Research Council and Chair of the NCE Steering Committee, Dr Marc Renaud, President of the Social Sciences and Humanities Research Council, Dr Alan Bernstein, President of the Canadian Institutes of Health Research and Mr Jean-Claude Gavrel, Director of the NCE program. A total of nine NCE's were awarded funding at the ceremony.

Mr Tobin spoke passionately about the need for fostering a climate of innovation in Canada and the central role that the NCE program plays in Canada's innovation strategy. He noted that MITACS has shown that it is making a significant contribution to Canada's innovation pipelines.

Call for Letters of Intent for New MITACS Projects

The MITACS NCE expects to make a call for letters of intent for new MITACS projects. Both small projects (maximum funding $50,000) and large projects (maximum funding $200,000) will be considered. Projects are also expected to solicit non-NCE partner funds. For detailed submission instructions, guidelines, and a template for your submission please visit the MITACS web page at **www.mitacs.math.ca** after March 1, 2002.

Questions should be directed to MITACS at mitacs@mitacs.math.ca or any of the three Canadian mathematical sciences institutes (CRM, Fields or PIMS).

MITACS Mobility Programme

The MITACS Board of Directors has approved an **HQP Mobility Fund** to allow MITACS students and postdoctoral fellows to travel to projects outside their home university.

The MITACS HQP Mobility Programme encourages the sharing of expertise between projects and facilitates the training of highly qualified personnel. The fund is designed to cover reasonable travel costs for graduate students and post-doctoral fellows working within MITACS who will benefit from an extended visit (normally between one and four months) to a MITACS project outside their home university. We would like to encourage trainees participating in all MITACS projects to explore the possibilities that this fund affords

The rules and the application for this fund are now available on the MITACS web page **www.mitacs.math.ca.**

MITACS AGM 2002

Jean-Claude Gavrel, Director of the NCE program,at last year's MITACS AGM in Montreal

MITACS invites you to its 3rd Annual General Meeting held on May 23-25, 2002 at the University of British Columbia in Vancouver. This year's meeting will focus on applications of statistics in industry. AGM 2002 will be of special interest to graduate students and postdoctoral fellows in the mathematical sciences. You are invited to showcase your research at the MITACS exhibition through posters and demonstrations. Canadian industrial representatives will also be on-hand to discuss opportunities in their firms and showcase their technology. We strongly encourage students to present posters and demos featuring research conducted by their teams.

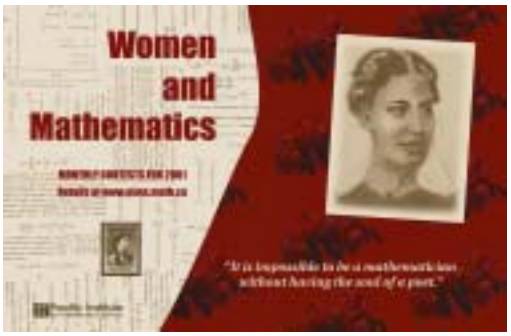
MITACS is committed to supporting the attendance of graduate students and postdoctoral fellows at the AGM 2002 events. To this end a large number of subsidies have been set aside. Please complete an on-line registration form to apply.

For more information and registration visit our website:
http://www.mitacs.math.ca/agm2002/

The Women and Mathematics Poster Campaign Comes to an End

by Heather Jenkins

The PIMS poster campaign and web-based contest "Women and Mathematics" concluded at the end of January 2002 after 12 successful months. Posters were distributed to schools in BC, Alberta and Washington State,



October poster featuring Sofia Kovalevskaya.

as well as to departments and individuals throughout North America who had requested to be added to the mailing list, and to libraries in the Vancouver area. As with the "Mathematics is Everywhere" campaign of 2000, a wall calendar featuring the full set of pictures and quotes was published. This calendar was designed by Heather Jenkins and Krisztina Vasarhelyi.

In September we featured Emmy Noether arguably greatest woman mathematician ever. Her talent for abstraction was unique and she was legendary for her ability to inspire students and stimulate creative and productive research. One of her students, van der Waerden, writes: "For Emmy Noether, relationships among numbers, functions, and operations became transparent, amenable to generalisation, and productive only after they have been dissociated from any particular objects and have been reduced to general conceptual relationships."

Emmy Noether,
one of the great mathematical minds.

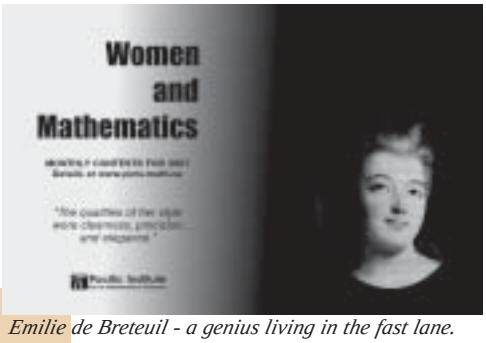
Russian Sofia Kovalevskaya, best known for her work on partial differential equations, was the subject of the October contest. She studied under Karl Weierstrass and the Cauchy-Kovalevskaya Theorem bears her name. Her introduction to mathematics was through the wallpaper in her room which came from the pages of an old calculus text! She was inspired by the mysterious symbols and resolved to find out more about them.

In November observational astronomer Caroline Herschel appeared. Her brother, the famous astronomer William Herschel, rescued her from a dreary fate of household chores and encouraged her to study, and she did so with great enthusiasm. Caroline's first major scientific breakthrough was the discovery of a comet, and her first experience in mathematics involved the calculation of the positions of nebulae. She also catalogued every discovery that she and William had made.

Maria Gaetana Agnesi, a child prodigy, gifted in mathematics and languages whose only dream was to help others, was featured in December. Maria's most famous publication was a teaching text that helped make calculus accessible to people other than professional mathematicians. Her "academic career"

Astronomer Caroline Herschel
appeared in November.

ended relatively early in her long life when she abandoned mathematics and devoted herself solely to charitable deeds.

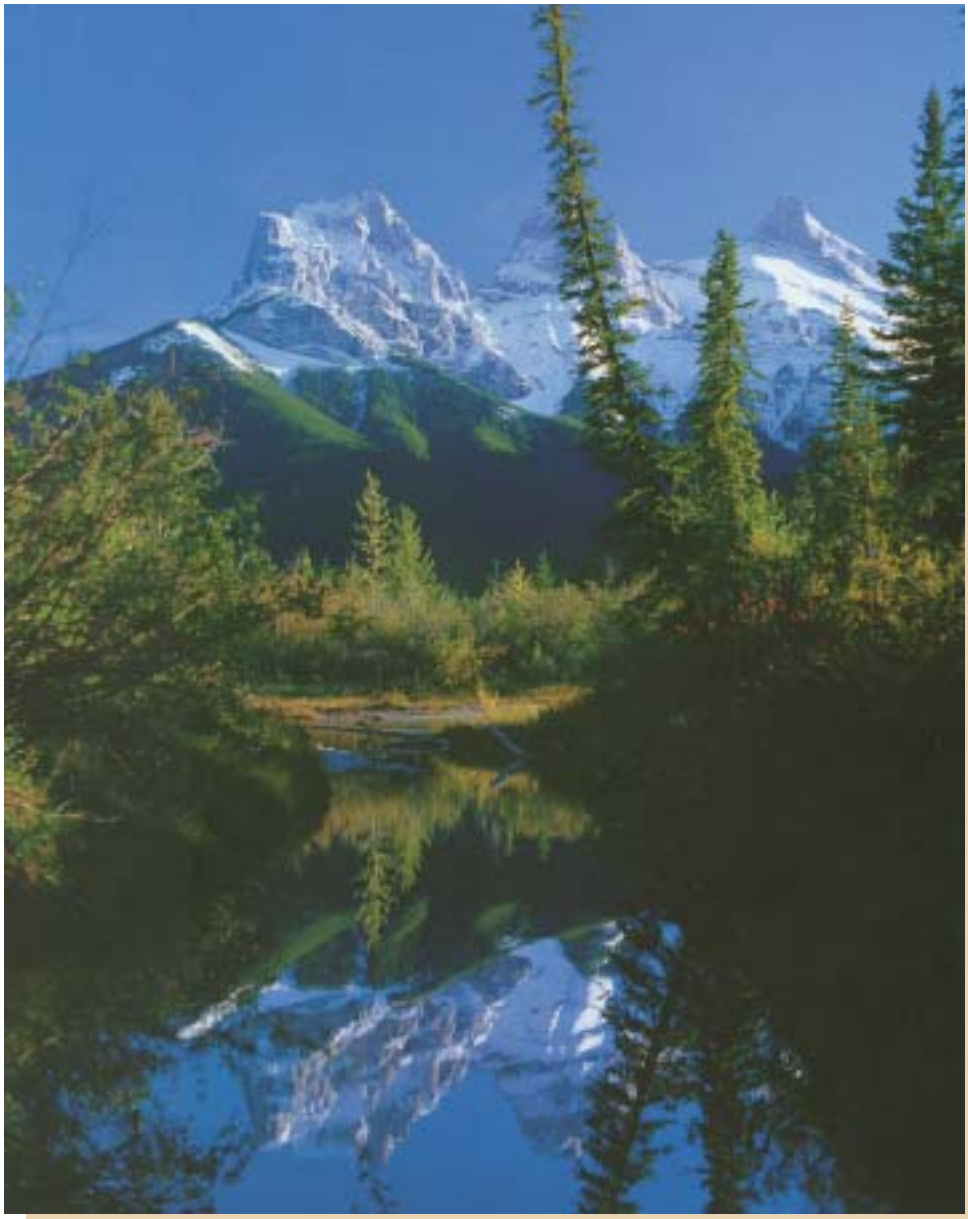


Emilie de Breteuil - a genius living in the fast lane.

The final month of the contest featured Emilie de Breteuil, a genius, who lived a fast and reckless life in Paris society. She had a passionate interest in Newton's work and her translation of Newton's "Principia", for many years the only French translation, helped to shape the direction for subsequent work in mathematics in France.

December poster showing Maria Gaetana Agnesi.

The recent winners of the contest will feature in an upcoming issue of the PIMS newsletter. To download a copy of any of the posters please visit the web page www.pims.math.ca/education/2001/women/.



Three Sisters, Kananaskis Country near Banff. Photo courtesy of Douglas Leighton.

PIMS is supported by:

- **The Natural Sciences and Engineering Research Council of Canada**
- **The Alberta Ministry of Innovation and Science**
- **The British Columbia Ministry of Competition, Science and Enterprise**
- **Simon Fraser University**
- **University of Alberta**
- **University of British Columbia**
- **University of Calgary**
- **University of Victoria**
- **University of Washington**
- **University of Northern British Columbia**
- **University of Lethbridge**

Newsletter Editors: N. Ghoussoub, H. Jenkins and M. Trummer

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This newsletter is available on the world wide web at www.pims.math.ca/publications.


Pacific Institute for the Mathematical Sciences
Magazine
PIMS - The Road Ahead
Banff Station Launched
Pacific Institute for the Mathematical Sciences

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