
 News from the Math Institutes

2004 AARMS Summer School

by Edgar Goodaire

The third annual AARMS Summer School was held again at Memorial University in St. John's from July 12 to August 6, 2004. As in previous years, four courses were offered with two different themes. About half the students took Number Theory and Number Theoretic Cryptology from Michael Bennett (UBC) and Renate Scheidler (Calgary), respectively, while the other half took Statistical Genomics and Mathematical Biology from Priscilla Greenwood (Arizona State and UBC) and Brian Sleeman (Leeds), respectively.

While still in its early stages, the AARMS Summer School is becoming increasingly well known. This year, we had over 100 applications and accepted 30 students from Austria, Croatia, Italy, Poland, Romania, Turkey and Spain, as well as the U.S. and Canada (six provinces).

AARMS activities are funded by Dalhousie University, the University of New Brunswick, Memorial University and the three Canadian mathematics institutes (the Fields, Centre de Recherches Mathématiques and the Pacific Institute for the Mathematical Sciences). Again this year, we acknowledge with gratitude support from the Student Committee of the Canadian Mathematical Society (wasn't it a party?), from MITACS, and from Aliant, Atlantic Canada's telecommunications company. We are also very pleased to acknowledge support this year from the Centre for Information Security and Cryptography at the University of Calgary.

We encourage all readers of this newsletter to send students to next year's AARMS Summer School which is currently being planned for Dalhousie University, Halifax, Nova Scotia. Our experience has been that the students and faculty who attend these Schools quickly form a closely-knit group and establish friendships and contacts which will serve them well for years to come. The School has a web site at <www.math.mun.ca/aarms/summerschools>.



Whale watching on a day off



News from the Centre de recherches mathématiques

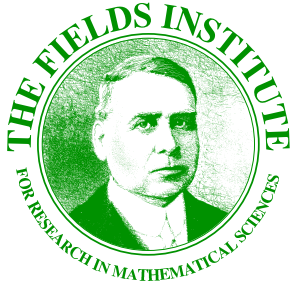
by Suzette Paradis

The CRM is pleased to announce that Francois Lalonde became Director of the CRM in September 2004, for a four year mandate. Professor Lalonde is the holder of a Canada Research Chair in differential geometry and topology at Université de Montréal, and he has been associated with the CRM since 1991.

The 2004-2005 theme year on the Mathematics of Stochastic and Multiscale Modeling is currently under way. It is dedicated to the applied mathematical tools (modeling, analysis, computation) needed to study multiscale systems which arise in a variety of areas in science and engineering. The fields of application, which will be discussed during the theme year, include climate modeling, front propagation, molecular dynamics, materials science, financial engineering, and rheological fluids. The organizers of the 2004-2005 theme year are A. Bourlioux (Montréal), J.-P. Fouque (North Carolina State), T.Y. Hou (Caltech), C. Le Bris (Ceramics, ENPC, Paris), A.J. Majda (Courant), R. Sircar (Princeton), T. Souganidis (Texas), A.M. Stuart (Warwick), P.F. Tupper (McGill) and E. Vanden-Eijnden (Courant). A.J. Majda (Courant) will be the holder of the Aisenstadt Chair during the Fall 2004 semester, and T.Y. Hou (Caltech) will be the Aisenstadt Chair holder during the Spring 2005 semester.

The 2005-2006 theme year is entitled Analysis in Number Theory, and will be devoted to the many interactions between those two fundamental disciplines. Indeed, number theory has been a fertile source of questions and motivated the development of sophisticated analytic theories both inside number theory and analysis: for examples, the theory of the Riemann zeta-function and allied L-functions and their application to the prime number theory; real harmonic analysis such as distribution of values of polynomials and the Kakeya problem; harmonic analysis and the representation theory of adelic groups and its crucial role in the all-encompassing Langlands program; and the foundation of p -adic analysis and its important recent role in the proof of the Dwork Conjecture and of p -adic variants of the Birch and Swinnerton-Dyer conjecture and the Stark conjectures. The main organizers of the 2005-2006 theme year are Andrew Granville (Montréal) and Henri Darmon (McGill). M. Bhargava (Princeton), K. Soundararajan (Michigan) and Terry Tao (UCLA) will be the holders of the Aisenstadt Chair for the 2005-2006 theme year.

 News from the Math Institutes



Activities at the Fields Institute

Thematic Program in PDE by Walter Craig (McMaster)

Last year was perhaps the busiest year ever at the Institute. A seemingly continuous stream of events sprang forth from the thematic program in partial differential equations, organized by Walter Craig (McMaster), Nicholas Ercolani (Arizona) and Catherine Sulem (Toronto).

The subject of PDE is often taken to be a subset of applied mathematics, as many applications are posed in terms of differential equations—or as mathematical physics. It is central to many aspects of differential geometry—indeed, the proof which is currently the principal contender for the Poincaré conjecture depends on a careful and thorough study of the singularities of the heat flow for the Ricci curvature tensor. And of course, the study of PDE is a topic of analysis. The Fields Institute program took the point of view of all of the above.

Several of the workshops focused on the interface between mathematics and other scientific disciplines—for example *Calculus of Variations: Geometric Problems, Superconductivity, and Material Microstructures* (August 2003) presented a variety of approaches to variational problems and differential equations arising in physics and geometry, and *Patterns in physics* (November 2003) concentrated on many physical processes which give rise to a phenomenon of pattern formation, on scales from nanometers to cosmological dimensions.

Another workshop with a direct connection to a very active area of physics was the *Kinetic Theory Workshop* (March 2004). The physical basis of the equations of kinetic theory have to do with the evolution of large numbers of interacting particles; the topic is invoked in Hilbert's 6th problem, and the equations involve both the classical theory of partial differential equations and a strong physical insight. The goals of the modern theory are both to understand on a mathematically rigorous basis the connection between the evolution of mechanical systems of many particles and the description of its moments through the theory of thermodynamics. Applications can be found ranging from theorems on the rigorous basis of continuum mechanics, to the justification of the formulation of wave turbulence, to applications to studying traffic flow on modern freeway systems.

Yet another concentrated activity of the program year with this focus on physical applications was the *Conference on Free Surface Water Waves* (June 2004). This meeting was sponsored by a National Science Foundation grant under the Focused Research Group Program; the chair of the Conference Organizing Committee was Diane Henderson (Penn State), who was largely responsible for the breadth of points of view represented by conference participants, and the resounding success of the meeting. The conference emphasized direct communication between interested mathematicians and practicing ocean scientists. The number of renowned

experimentalists taking part in a mathematics conference surely must have established some sort of record in this case.

Some further events of interest were the autumn semester *Coxeter Lectures, Three Singular Variational Problems*, given by Craig Evans (Berkeley) in October 2003, the *Workshop on nonlinear wave equations* (March 2004), and, in May, the second set of Coxeter lectures, on the *Navier-Stokes equations for statistical hydrodynamics*, delivered by Sergei Kuksin (Heriot-Watt) and the *Distinguished Lecture Series* given by Jean Bourgain (Institute for Advanced Study) on applications of harmonic analysis and Hamiltonian dynamical systems to the study of PDE. Audio and/or slides for these events and most others are available at www.fields.utoronto.ca/audio/03-04/

The Thematic Program in the Geometry of String Theory by Lisa Jeffrey (Toronto)

This year's thematic program is on the *Geometry of String Theory* and will take place at both the Fields Institute and the Perimeter Institute in Waterloo. It has been organized by K. Hori, L. Jeffrey, B. Khesin and A. Peet, all from the University of Toronto, M. Kapranov from Yale, and R. Myers from the Perimeter Institute. It will present systematic, focused activities with the dual aim of discussing new results and putting new insights gained from physics into the general mathematical framework. The first half-year of the program will have a mathematical focus and the second half-year a physical one.

Among the fall's activities will be two graduate courses (one on string theory by Amanda Peet, and a second on mirror symmetry by Kentaro Hori), workshops on *Forms of Homotopy Theory: Elliptic Cohomology and Loop Spaces* (September 27-October 2 at the Fields Institute), and on *Mirror Symmetry* (November 19-23 at the Perimeter Institute), and the Coxeter Lectures by Nigel Hitchin (Oxford, November 15-17).

Please see the homepage of the program www.fields.utoronto.ca/programs/scientific/04-05/string-theory/ for full information, including activities in the winter semester. Particularly noteworthy are the Distinguished Lectures Series with Edward Witten of the IAS (tentatively scheduled for April 4-7) and a Summer School Program *Strings, Gravity and Cosmology* to be held at the Perimeter Institute June 20-July 8. The Geometry and String Theory Thematic Program will wind up in grand style with the premier international conference in string theory, Strings 2005, at the University of Toronto July 11-16.

Other Activities by Carl Riehm (Fields Institute)

The Thematic Programs for 2005-2006 will be Renormalization and Universality in Mathematics and Mathematical Physics during the fall term and Holomorphic Dynamics, Laminations, and Hyperbolic Geometry during the winter term.

Some further activities this year are the Applied Mathematics Colloquium—at the time of writing, it is tentatively scheduled to be held every other Wednesday—and the Seminar Series on Quantitative Finance which will meet monthly, along with a new series initiated last year: the PRMIA Risk Management seminars www.fields.utoronto.ca/programs/cim/04-05/PRMIA/. Other activities are the Distinguished Lecture Series in Statistical Sciences, on the subject of *Graphical Models, their Statistical Interpretations and Some Technical Developments* by David Cox (Oxford; September 14-15), the *Workshop on Data Mining Methodology and Applications* (October 28-30), and the *Symposium on the Mathematical and Statistical Methods in the Life Sciences* at the University of Guelph (November 12).

A complete listing of all Fields Institute activities from the present to next June can be found at www.fields.utoronto.ca/programs/scientific/#gsa

 News from the Math Institutes



Pacific Institute for the Mathematical Sciences

by Heather Jenkins

π *in the Sky* Magazine

The next issue of π *in the Sky* magazine will be the eighth. It will be out in the fall 2004. The main theme will be “*How mathematics can be used to predict and suggest controls for disease*”.



Based on this theme the issue will include the following three articles:

Mar Wonham (Centre for Mathematical Biology, UA): *The mathematics of mosquitoes and West Nile virus*

Fred Brauer (Mathematics, UBC): *What does Mathematics have to do with SARS?*

David Earn (Mathematics, McMaster University): *Mathematical modelling of recurrent epidemics*

These three articles were coordinated by **Mark Lewis** (Canada Research Chair in Mathematical Biology, UA).

The other articles in the issue include “*Kolmogorov, Turbulence and British Columbia*” by **Bob Stewart** (former Director of the Institute of Ocean Sciences at Sidney, BC) and **Chris Garrett** (Lansdowne Professor of Ocean Physics, UVic).



A figure from the article by Bob Stewart and Chris Garrett: The Towed Ocean Microstructure Instrument (TOMI) developed by Rolf Lueck at UVic. Here it is being recovered from the water in Knight Inlet after making simultaneous measurements of the turbulent small-scale fluctuations of velocity and temperature, as well as measuring the backscatter of high-frequency sound from biological organisms and the turbulence. The masts at right angles to the main body of the instrument contain other sensors and become vertical in the water, with the left one on top.

News from the Math Institutes

π in the Sky magazine is primarily aimed at high-school students and teachers, with the main goal of providing a cultural context/landscape for mathematics. It has a natural extension to junior high school students and undergraduates, and articles may also put curriculum topics in a different perspective.

If you are interested in submitting an article to π in the Sky please contact us at pi@pims.math.ca. All the issues of π in the Sky can be downloaded for free from www.pims.math.ca/pi.

The π in the Sky Editorial Board is comprised of:

Editor in chief: Ivar Ekeland (PIMS/UBC)

Managing Editor: David Leeming (UVic)

Editorial Board: Len Berggren (SFU), John Bowman (UA), John Campbell (Archbishop Mac-Donald Academic High School, Edmonton), Florin Diacu (UVic), Sharon Friesen (Galileo Educational Network, Calgary), Dragos Hrimiuc (UA), Klaus Hoechsmann (UBC), Wieslaw Krawcewicz (UA), Michael Lamoureux (UC), Mark MacLean (UBC), Alexander Melnikov (UA), Volker Runde (UA), and Wendy Swonnell (Lambrick Park Secondary School, Victoria).

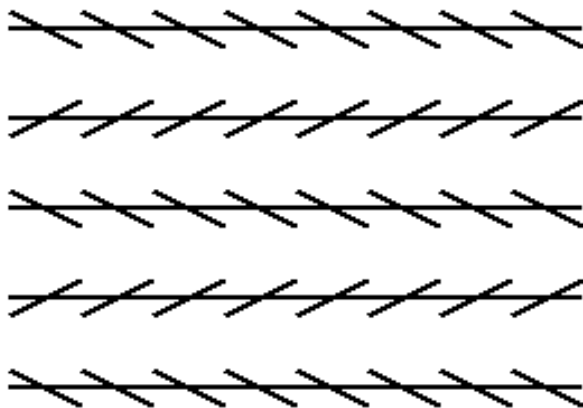
Editorial Coordinator: Heather Jenkins (PIMS)

Call for PIMS PDF Nominations

PIMS invites nominations of outstanding young researchers in the mathematical sciences for Postdoctoral Fellowships for the year 2005–2006. For details please see the website <http://www.pims.math.ca/opportunities/pdf.html>.

The deadline for submitting nominations is **Friday, January 21, 2005**. Please note that this is earlier than in previous years.

For more information about PIMS and its activities please see www.pims.math.ca.



Fun Image

Are the horizontal lines parallel?

 News from the Math Institutes

**MITACS Launches New Series Of
Workshops
by Karen Booth**



MITACS hosts a number of events every year that are designed to bring together partner organizations in the academic, public, private and not-for-profit sectors with university researchers to generate new areas of research and solutions to identified problems. MITACS supports single day workshops and seminars to multi-day summer schools, theme meetings and conferences. These events provide the opportunity for researchers to network with their peers and to interact with their partner groups, as well as other companies and organizations. This next year, MITACS will support Industry-University Workshops, the Annual Conference, and two Interchanges. MITACS also supports many workshops organized by our researchers, examples of which include events held this summer such as the Special Afternoon in Mathematical Biology, 4th Annual McMaster Optimization Conference: Theory and Applications, ADHOC-NOW '04, Quantum Information and Quantum Control Conference, and Special Program on Infectious Diseases.

A new series of Industry-University Workshops have been launched to address key research initiatives. At these workshops, academic researchers as well as industry and government experts meet to discuss user issues on a specific topic as well as the status of research initiatives. The goals are to create new research collaborations, establish future research priorities and exchange knowledge.

The first workshop, on Data Mining for Enhanced Business Results, will be held at the Banff International Research Station, October 14th–16th. Individuals from both industry and academia who are interested in data mining research and the application of advanced data mining techniques will share their experience and identify key issues they encounter. A focus for discussion will be data mining in support of enhancing business results, which will address issues such as customer segmentation, customer targeting, revenue management and pricing.

The second workshop, on Cyber Security, will be held on November 22nd and 23rd in Ottawa. The focus of this workshop will be on Cyber Security research and the application of developments to better secure information systems and communications networks. Participants will share their experience and pinpoint key issues in securing their systems and networks. Academic researchers will share the results of their research and discuss their current research program. All participants will discuss future research priorities in Cyber Security in support of enhancing the security of information systems and communications networks. This will include topics such as secure routing, intrusion detection and monitoring, denial of service, privacy and anonymity, risk analysis, surveillance and disaster response.

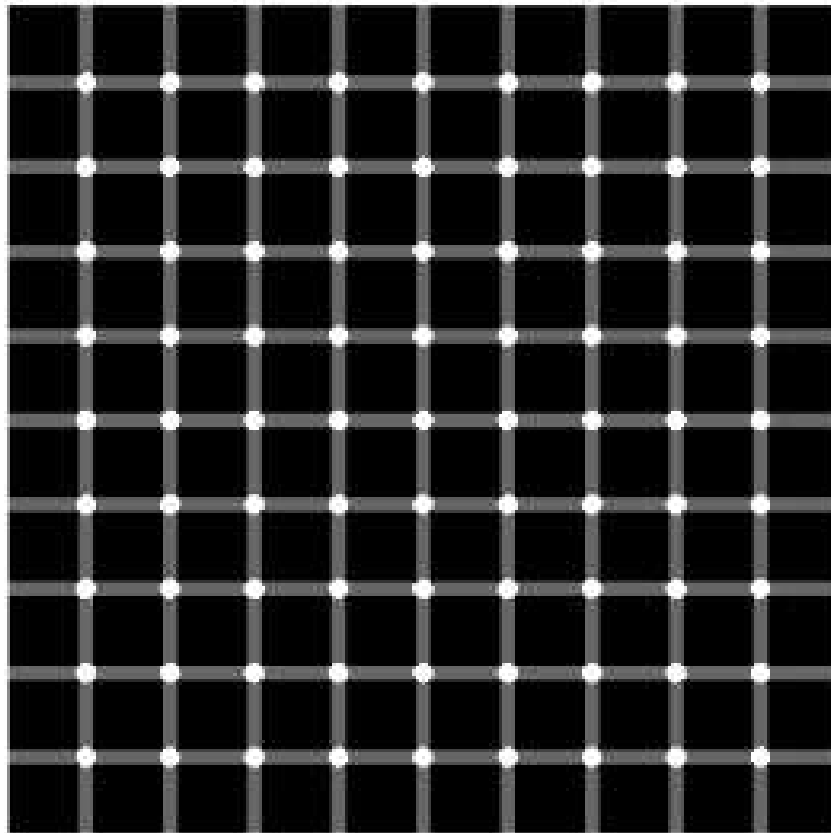
Other workshops are currently being considered and new ideas are welcome. Visit the MITACS website, Events: Conferences, Workshops and Seminars at <http://www.mitacs.ca/main.php?mid=10000162&pid=102> for more information.

News from the Math Institutes

The MITACS 6th Annual Conference and Interchange will be held May 12 - 14, 2005 at the University of Calgary. The theme of the conference is “The Mathematics of Energy”, with the Interchange having specific focus on “Advanced Modelling for the Energy Sector”. These events offer an excellent opportunity for academics and industry to meet and exchange ideas, and to explore potential relationships with research partners. Students in the network are able to network and present their research through posters and presentations. The event is expected to bring together key business leaders, government representatives, and academics to address innovative uses of mathematics in the energy sector. One area that will be highlighted at the Interchange is modelling for the oil and gas sector. New innovations by MITACS scientists in seismic imaging are helping to more accurately predict the success of oil drilling, and new developments in fluid analyses are better predicting fluid flow, heat and mass transfer and chemical reactions - discoveries which are improving efficiencies in the oil and gas industry, and are expected to one day expand to applications in the medical, aerospace and automotive sectors.

For more information on MITACS visit <www.mitacs.ca>.

**Fun
Image**



Schrauf, M., Lingelbach, B., Wist, E.R. (1997)
The scintillating grid illusion. *Vision Research*,
37, 1033–1038