Pacific Institute *for the* Mathematical Sciences
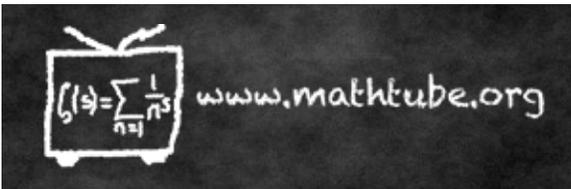
NEWSLETTER

Welcome to mathtube.org!

What is mathtube.org? It is a new multimedia resource hosted by the Pacific Institute for the Mathematical Sciences. mathtube.org gives users easy access to mathematical seminar and lecture materials including videos, notes and slides. mathtube.org is unique because it allows users to view slides and video at the same time, but also independently from one another. View a lecture at your convenience and have time to review anything that you missed. SEE PAGE 3 FOR MORE

What's Inside

PIMS welcomes two new site directors

This summer PIMS welcomed Nils Bruin at the SFU site and Peter Hoff at the U. Washington site. Many thanks to past directors Steve Ruuth and Gunther Uhlmann.

Nils Bruin is an Associate Professor of Mathematics at Simon Fraser University in Burnaby, BC. He is affiliated with the SFU Number Theory group, the Centre for Experimental and Computational Mathematics (CECM) and the IRMACS Centre (Explorations in Computational Number Theory project). Before his appointment at SFU in 2003, Professor Bruin was a Senior Research Associate with The Magma Group within the School of Mathematics at the University of Sydney and a PIMS Postdoctoral fellow at Simon Fraser University and University of British Columbia. His research centres around theoretical and computational questions in arithmetic geometry. He has organized several conferences and workshops, many of them with PIMS support.

Peter Hoff is an Associate Professor in the Department of Statistics and Biostatistics at the University of Washington in Seattle. He has developed a variety of Bayesian methods for multivariate data, including covariance and copula estimation, cluster analysis, mixture modelling and social network analysis. He gained his PhD in Statistics from the University of Wisconsin – Madison in 2000 and was the winner of the Leonard J. Savage Award for Outstanding Doctoral Dissertation in Bayesian Theory and Methods from the International Society for Bayesian Analysis. He has been at the University of Washington since 2000 and he is on the editorial board of the Annals of Applied Statistics, Journal of the Royal Statistical Society and Statistical Science.

Director's Message

I t is a great pleasure for me to write a few lines for the readers of the PIMS Newsletter. As you will read in these pages, 2011 has been an extremely active year for PIMS. With our Collaborative Research Groups organizing international thematic activities throughout Western Canada and even as far away as Seoul, South Korea. Moreover they have recruited highly talented thematic postdoctoral fellows, who will be developing research projects with the faculty associated to these projects.

This past summer was also remarkable due to the feverish activities centered around the ICIAM meeting in Vancouver in July. (See page 11). Our International Graduate Training Centre in Mathematical Biology continued to gain high praise for its contributions to research and graduate education. In "Lining Up Ducks in a Row" (page 8) you can read about an amazing example of the ubiquity of biological phenomena with deep mathematical underpinnings.

I want to take this opportunity to recognize the recipients of recent PIMS prizes: Mark Lewis (U.Alberta), CRM-Fields-PIMS Prize, Adam Oberman (SFU), CAIMS/PIMS Early Career Award in Applied Mathematics and Veselin Jungic (SFU) PIMS Education Award. Their accomplishments are truly amazing!

This year PIMS renewed its status as an Unité Mixte Internationale of the French CNRS, incorporating Regina and Saskatchewan as members. Thanks to this agreement we have hosted a steady stream of excellent young French researchers as well as postdoctoral fellows, thus helping to develop mathematical ties between Canada and France.

In this newsletter you will also have the opportunity to read about the many educational activities that PIMS is involved with all over Western Canada. This was recognized by a Year of Science Legacy grant, awarded by the Government of British Columbia.

Finally - we are very excited by the tremendous progress on the building which will house the new PIMS-UBC headquarters, we are scheduled to move in by September 2012! Our new infrastructure will be at the level of the finest research centres in the world. That is cause to celebrate.

Warmest regards,

Alejandro Adem
Director, PIMS
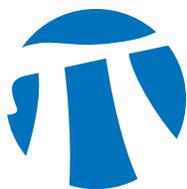
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University of Calgary – Dr. Clifton Cunningham (on sabbatical until Jan 2012), interim director Kristine Bauer
University of Regina – Dr. Donald Stanley
University of Saskatchewan – Dr. Raj Srinivasan
University of Victoria – Dr. Ian Putnam
University of Washington – Dr. Peter Hoff

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SCREENSHOT OF MATHTUBE.ORG

Why do we need mathtube.org? mathtube.org was created to meet the increasing demand of requests we were receiving to see footage of past PIMS lectures. mathtube.org gives global exposure to PIMS events and offers those who attended our lectures the chance to go back and review a particular talk; or those who didn't, a chance to see what they've missed. This new resource also gives added value to conference organizers and participants, as well as a great forum to see world-class speakers from all areas of mathematics and applied mathematics. These materials are an important resource and include contributions from some of the world's most distinguished contemporary mathematicians, for example the PIMS distinguished lectures, PRIMA Conferences and from the recent Applied Mathematics Perspectives thematic program.

Who is mathtube.org for? mathtube.org is for those interested and engaged in the mathematical sciences. Whether you are an undergraduate student, researcher, industry professional or mathematics school teacher, mathtube.org includes useful content that will help advance you in your field.

Where are the videos from? The videos are taken at PIMS member universities and include speakers from all around the world.

What areas of study does mathtube.org cover?
mathtube.org includes lectures from a very wide range of areas of the mathimatical sciences. mathtube.org features lectures from the PIMS IGTC in Mathematical Biology and the Collaborative Research Groups (CRG). mathtube.org also includes videos from education conferences such as 'Changing the Culture' which explores topics in mathematics education.

3

Around the sites

University of British Columbia Bud Homsy

The UBC PIMS site was buzzing with activity over the summer, with several meetings, workshops and summer schools. PIMS co-sponsored this year's SIAM Gene Golub Summer School and "Applied Mathematics Perspectives", a series of satellite workshops held in conjunction with the large ICIAM meeting in Vancouver. Both are highlighted later in the newsletter. A further benefit was longer-term visits by Michael Overton, Robert Muira, and Thomas Erneux. Conferences on Hyperplane Arrangements & Applications and Category Theory rounded out a very busy summer.

University of Calgary Kristine Bauer

Greetings from Calgary, AB! The Calgary PIMS site has been very active in 2011. We are very happy to welcome CRG postdoctoral fellows: Ce Bian and David Roe, who are participating in the L-functions and number theory CRG and Vlad Gheorghiu and Colin Train, who are participating in the Quantum Information CRG as well as CNRS visitor Jean-Francois Biasse.

We had a very industrious summer of 2011. Calgary hosted the conference Analytic Aspects of L-functions and Applications to Number Theory in June 2011.

University of Alberta Charles Doran

On April 11 we were very pleased to have our own Prof. Mark Lewis give his CRM-Fields-PIMS Prize Lecture: The Mathematics Behind Biological Invasion Processes. The lecture was one of the first to take place in the new Centennial Centre for Interdisciplinary Science (CCIS). The CCIS building even proved large enough to accommodate the 2011 Canadian Mathematics Society Summer Meeting. Shortly thereafter, at a June 15 Convocation ceremony, the University of Alberta awarded its first honorary degree to a mathematician, Fields Medalist Efim Zelmanov (UC San Diego).

University of Regina Donald Stanley

The PIMS activities in the summer started with the Prairie Network meeting at the end of April. It continued with the back-to-back Graphs, Designs and Algebraic Combinatorics Conference and the Prairie Discrete Math Workshop in July.

Our education program, 'Math on the Move' continued by visiting three rural communities in Saskatchewan. Coming up on November 5, there will be an aboriginal perspectives mathematics workshop co-hosted by PIMS education coordinator Harley Weston.

University of Saskatchewan Raj Srinivasan

The major activity that took place at was the PIMS Applied Math Seminar series. We have had very prominent and interesting speakers in the past six months. Professor Walter Craig (McMaster University), Professor Joel Feldman (University of British Columbia) and Professor David Brydges, Canada Research Chair (University of British Columbia) all gave lectures as well as Prof. Andrea Bertozzi (UCLA), who gave a talk entitled, "Swarming by Nature and by Design".

Simon Fraser University Nils Bruin

At Simon Fraser University we had a very busy summer. As a satellite to the ICIAM applied mathematics event, SFU hosted WAVES 2011, with the support of PIMS. With 230 participants this is an important recurring conference in itself. The event offered many opportunities for interaction between established and starting researchers in the field.

In August, PIMS co-sponsored Computational Math Day, an annual event where the SFU math department celebrates its distinct, both numerical and algebraic, computational emphasis and where graduate students and undergraduate research assistants show off their accomplishments in a poster contest.

SFU also hosted math camps for students and teachers over the summer as well as the annual 'Changing the Culture' conference for math educators. This year keynote speakers included Sharon Friesen (U of Calgary) and Walter Whiteley (York University).

University of Washington Peter Hoff

Along with the recent PIMS leadership change at the University of Washington, recent hires in the mathematical science departments have highlighted the University's focus on interdisciplinarity. Tyler McCormick, a recent PhD in Statistics from Columbia University, was appointed Assistant Professor of Statistics and Sociology. Hari Narayanan, a recent PhD in Computer Science from the University of Chicago, will be joining the UW as Assistant Professor of Statistics and Mathematics in the Spring.

University of Victoria Ian Putnam

The past six months has been a busy time for PIMS activities at UVic. First, we were pleased to host the Cascade Topology Seminar for the first time, with thanks to local organizer Ryan Budney. The CRG in Operator algebras and noncommutative geometry continued with the 39th edition of the Canadian Operator Theory Symposium and the IGTC in Math Biology held a summit and workshop. We were the hosts for the third biennial CanaDAM meeting, a very large conference devoted to a wide range of topics in discrete mathematics, and a workshop in Applied Analysis and PDE's.

Dan Coombs

The PIMS International Graduate Training Centre (IGTC) in Mathematical Biology underwent a significant change this summer. From August 1, 2011, Professor Dan Coombs of the University of British Columbia took over the position of director from Professor Mark Lewis of the University of Alberta. Professor Lewis has directed this specialized graduate program since its beginnings in 2007. During his tenure the IGTC has flourished, attracting outstanding local and international graduate students, as well as world-class visitors and speakers. "PIMS would like to recognize Mark Lewis' extraordinary vision and leadership in establishing the IGTC in Math Biology, which is unique in Canada," commented PIMS Director Alejandro Adem.

Under Professor Lewis' leadership, the training centre has been extremely successful in fostering student research (with over 50 papers published since 2008, including several in the top scientific journals) and career development (centre alumni are moving into excellent positions in academia and elsewhere). The activities of the centre provide an intellectual support network for mathematical biology across BC and Alberta, bringing students and faculty together and supporting our efforts to recruit the best possible group of trainees.

"In the short term I will be working on student recruitment and planning the annual research summit for 2012. A more serious challenge for the future is to seek expanded and diversified funding sources for the program, to allow us to increase student funding and compete for the most exceptional graduate students," said incoming director Dan Coombs.

Daniel Coombs received his BSc from the University of Sheffield in 1995 and his PhD from the University of Arizona in 2001. He subsequently held a postdoctoral position in the Theoretical Biology and Biophysics group at Los Alamos National Laboratory. He joined the faculty at the University of British Columbia in 2003, where he has been an associate professor since 2007. His research is primarily in the areas of theoretical immunology, cell-scale biophysics and within-host infectious disease dynamics. Dr. Coombs was the recipient of the 2010 PIMS/CAIMS Early Career Award in Applied Mathematics.

As a part of the PIMS Applied Mathematics Perspectives thematic program and the 2011 ICIAM Satellite Meetings, this summer saw the Mathematical Biology Workshop and IGTC Summit take place at the beautiful University of Victoria campus in Victoria, BC from July 13 - 16. The conference was well attended with 68 participants from across Canada and as far away as France, Italy, Japan, India and Australia. The program focused on mathematical physiology (especially gene and neural networks) and structured population dynamics.

Highlights included:
• The Education Afternoon Session on the theme of How to Develop Interdisciplinary Research Collaboration, with talks from Leon Glass (McGill), Simon Levin (Princeton) and Leah Edelstein-Keshet (UBC);

• The International Graduate Training Centre's student presentations by William Carlquist, Ulrike Schlaegel, Romain Richard, Jonathan Martin, Betsy Varughese and Anastasia Lukanyova;

• The mathematical biology poster contest which saw Cory Simon of UBC take 1st Prize and Ben Wilson (UVic), Bernhard Konrad (UBC), and Nessy Tania, Ph.D. (UBC) tie for 2nd Prize;

A special thank you goes out to the Scientific Committee, local organizing committee, and dedicated volunteers that helped to make this event successful.

IGTC STUDENT POSTER SESSION
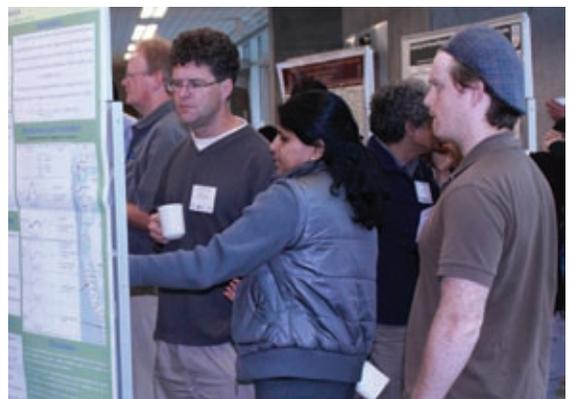
FORMER DIRECTOR MARK LEWIS AND STUDENTS

Collaborative Research Group Updates

Mathematics of Quantum Information

By Barry Sanders

The PIMS CRG for the Mathematics of Quantum Information, established in 2010, comprises quantum information groups at the Universities of British Columbia, Calgary, Washington and Simon Fraser University. The group is quite active with team members visiting each other, plus attracting top visitors including Fernando Brandão from Brazil's Universidade Federal de Minas Gerais, David Kribs from Guelph, Patrick Hayden from McGill, and Netanel Lindner from Caltech.

The CRG works at the forefront of mathematical quantum information with several significant results. These advances include non-randomized construction of highly entangled subspaces, a proof that the Affleck-Kennedy-Lieb-Tanaki states in condensed matter physics are a universal resource for quantum computation by local measurement, a closed formula for relative entropy of entanglement in all dimensions, and an efficient algorithm for optimizing adaptive quantum metrology processes. Major efforts are underway on quantum error control codes especially concerning the LU-LC conjecture.

L-functions and Number Theory

By Matthew Greenberg

The CRG in Number Theory and L-functions had four events in Spring-Summer 2011. From May 29 until June 3, 2011, the University of Calgary hosted the workshop Analytic Aspects of L-functions, one of the CRG's flagship events. This well-received workshop gathered 75 participants from North America, Europe, and Asia, from advanced undergraduates through senior faculty. The workshop featured lecture series by three number theory celebrities: Random Matrix Theory by Brian Conrey (AIM), Artin L-functions by Ram Murty (Queens), and Moments of Zeta Functions by Kanaan Soundararajan (Stanford). In their lectures, these experts succeeded in blending exposition at the graduate student level with emphasis on contemporary themes and state-of-the-art results in the field. These lecture series were complemented by invited talks by many researchers with international reputations. There was also a sequence of informal early evening lectures, expanding on important themes in analytic number theory and L-functions. The workshop was supported by PIMS, the University of Calgary, the iCORE chair in algorithmic number theory and cryptography, Microsoft Research, and Research in Motion.

Immediately following the Calgary workshop, the CRG organized a special session at the CMS (Canadian Mathematical Society) Summer Meeting at the University of Alberta, appropriately titled Number Theory and L-functions. This session brought together gifted postdocs and talented young faculty in order to make professional connections, foster future collaboration, and – of course – share their latest research.

Applied and Computational Harmonic Analysis

By Bin Han

The CRG on applied and computational harmonic analysis held two events in 2011: an international conference and a summer school. The International Conference on Applied Harmonic Analysis and Multiscale Computing (July 25-28, 2011) took place at the University of Alberta, Edmonton, Canada. This conference had 112 participants from 12 countries, and featured 65 presentations: 6 plenary talks, over 40 invited talks. The summer school after (July 29-31, 2011) had 51 participants with tutorial lectures given by: Steve Smale, Ding-Xuan Zhou, Zuowei Shen, and Bin Han. The CRG has hosted many visitors such as: Li-Qun Cao (China), Raymond Chan (Hong Kong), Song Li (China), Qun Mo (China), Yuesheng Xu (USA), and Xiaosheng Zhuang (Germany).

Fields Medalist and plenary speaker, Steve Smale
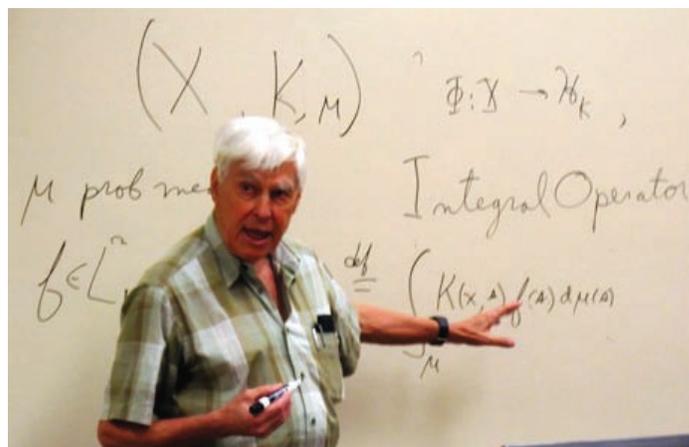
Applied and Computational Harmonic Analysis Conference participants

PIMS Postdoctoral Fellowships

PIMS invites nominations of outstanding young researchers in the mathematical sciences for Postdoctoral Fellowships for the year 2012-2013. **Please note that the deadline for receipt of applications has been changed to December 1, 2011.** Candidates must be nominated by at least one scientist or by a Department (or Departments) affiliated with PIMS. The fellowships are intended to supplement support provided by the sponsor, and are tenable at any of its Canadian member universities as well as at the PIMS affiliated universities.

For the 2012-2013 competition, held in January of 2012, the amount of the award will be $20,000 and the sponsor(s) is (are) required to provide additional funds to finance a minimum total stipend of $40,000.

Rankings of candidates are made by the PIMS PDF Review Panel based on the qualifications and potential for interaction with PIMS programs and partners. PIMS Postdoctoral Fellows will be expected to participate in all PIMS activities related to the fellow's area of expertise and will be encouraged to spend time at more than one site. To ensure that PIMS Postdoctoral Fellows are able to participate fully in Institute activities, they may not teach more than two single-term courses per year.

Nominees must have a Ph.D. or equivalent (or expect to receive a Ph.D. by December 31, 2012) and be within three years of their Ph.D. at the time of the nomination (i.e., the candidate must have received her or his Ph.D. on or after January 1, 2009). The fellowship may be taken up at any time between September 1, 2012 and January 1, 2013. The fellowship is for one year and is renewable for at most one additional year.

The PIMS PDF nomination/application process takes place entirely online on MathJobs. Having selected their nominees, sponsors direct them to apply online at **www. mathjobs.org/jobs/PIMS**. Nominees are required to arrange for two letters of reference, and upload a curriculum vitae and a statement of research interests.

Sponsors must upload their own reference letters (these are in addition to the two reference letters mentioned just above) and a statement of financial support. **Please note that application is by nomination only; unsolicited applications will not be considered.** Please note that all nominees must apply through MathJobs; this includes nominees from PIMS Collaborative Research Groups.

Complete applications must be uploaded to MathJobs by December 1, 2011. (Note that this date is 2 weeks earlier than in previous years.)

For further information, visit: **http://www.pims.math.ca/scientific/postdoctoral** or contact: **assistant.director@pims.math.ca.**

CNRS / PIMS Postdoctoral Fellowships

Postdoctoral candidates from institutions in France are eligible for CNRS / PIMS fellowships. The application procedure is different than that for regular PIMS Postdoctoral Fellowship nominees. Rather than having their nominees apply online, sponsors must send the complete nomination package to:

Attn: CNRS/PIMS PDF Competition
Pacific Institute for the Mathematical Sciences
200 - 1933 West Mall
University of British Columbia
Vancouver, BC V6T 1Z2 Canada

and indicate their eligibility for this special category in the sponsorship letter.

Details:
Nominations must include:
1. curriculum vitae
2. statement of research interests
3. three letters of reference (including one from a sponsoring professor)
4. statement of anticipated support from the sponsor

PIMS accepts no responsibility for incomplete packages, or for individual components of a nomination package being sent to any of our offices.

Please address questions to:
assistant.director@pims.math.ca

Deadline: December 1, 2011

Lining Up Ducks in a Row

Leah Edelstein-Keshet, June 2011

Research can be challenging and arduous, but sometimes a discovery arises by serendipity. Such was the case with a project carried out by former PIMS IGTC PhD student Ryan Lukeman and his co-supervisors (Leah Edelstein-Keshet and Yue Xian Li). Ryan had been writing a PhD thesis on mathematical models for schools and flocks. He derived conditions under which such flocks form perfect structures, with equally-spaced individuals, all moving coherently. He had already found interesting results and had material ready for a thesis.

It was on one winter day in 2008 that his advisor happened to take a stroll along the boardwalk of Canada Place, a popular tourist destination in Vancouver BC. She noticed flocks of surf scoters in strangely regular formations, diving to forage along the water's edge. She suggested that Ryan have a look. Using his own camera and tripod, and much patience and ingenuity, Ryan reinvented himself as a "field biologist". He waited patiently for the birds day after day, recorded their movements, designed and calibrated the set-up, and then used Matlab to digitize and quantify the positions and velocities of each bird. By pooling together images for many hundreds of birds, he was able to produce density maps such as the one shown below. Quantifying the interactions in moving social animals is notoriously challenging. This project represents one of the first to track individuals within a flock numbering tens to hundreds of members.

The data revealed interesting structure: Each duck had a repulsion zone (in which neighbors were excluded), and an attraction zone, further out. Alignment was found to be strongest along the sides (not shown). But even more than this, each bird was seen to clearly prefer its nearest neighbor to be just in front or back.

Using the data and results of his analysis, Ryan was able to test a sequence of mathematical models finding one that was best able to describe what he saw. He found that mutual repulsion is the strongest social force, followed by attraction, alignment, and interaction with one frontal neighbor. The project has been published in the Proceedings of the Academy of Sciences USA, http://www.pnas.org/content/107/28/12576.full and made a cover story of the AMS Notices (April 2011). It was also featured in an editorial in Nature 466: 163.

Ryan Lukeman has since graduated with a PhD from the University of British Columbia and is now an assistant professor in mathematics at St Francis Xavier University in the Maritimes.
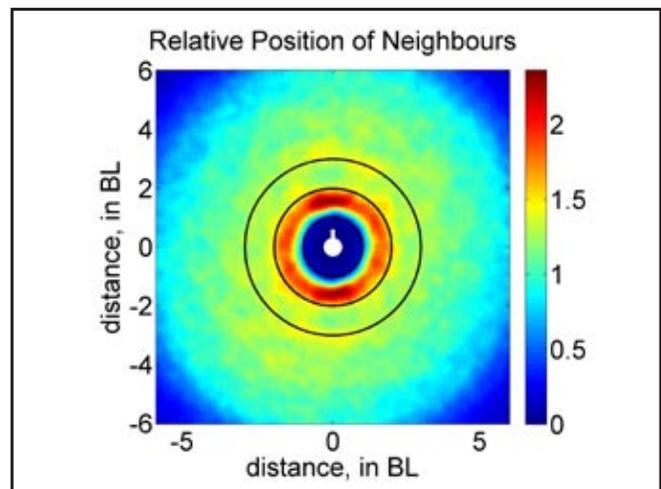
A density map showing the likeliest (dark red) and least likely (dark blue) place to find a neighbor. The white circle with "beak" is a focal individual, surrounded by a (blue) repulsion zone. A neighbor is most often directly in front or directly behind the given bird.

Photo credit: Ryan Lukeman

A surf scoter flock in an eye-catching formation at the completion of a dive to forage for mussels.

First Nations Education: top priority at PIMS

SUMMER CAMP STUDENTS AND TEACHERS

This summer, 20 First Nations students in grades 10 and 11 attended the 'Emerging Aboriginal Scholars' summer camp jointly run by PIMS and the UBC First Nations House of Learning. The camp ran for five weeks from July 4 to August 5, 2011.

As part of the camp, these students took English and Math classes each morning and three afternoons per week they participated in an internship program which placed each student with university or affiliated faculty and staff. Other afternoons were spent speaking to elders and meeting with members of the aboriginal community who are successfully working in a variety of fields.

The goal of these camps is to provide a strong academic background, foster a sense of pride in the Aboriginal culture and to establish a sense of community.

The internship aspect of the camp gives the students real life and hands-on experience in an area of their interest in a low pressure, high achieving environment.

Summer camp organizer and BC Education Coordinator Melania Alvarez comments on the camp's objectives; "We want to give the kids the chance to see what happens at UBC and let them see that opportunities do exist for them. We want them to be empowered and also get them thinking about their future."

Take for example grade 11 student, Frankie, who will be using a spectrometer in the lab of Professor Ed Grant in UBC's Department of Chemistry. Frankie's role will be to test the viability of using this piece of equipment to determine the composition of aerosols in the atmosphere as part of a larger study in which Professor Grant is involved.

This summer camp is one of many math education programs that PIMS runs to benefit First Nations students, these programs include teacher training, mentorships, scholarships and math outreach events in rural parts of BC such as Kamloops, Port Alberni and Lytton.

For many Aboriginal students, the idea of going to university can be daunting: however the hope is that this combination of community support, positive experiences and encouragement will change this view.
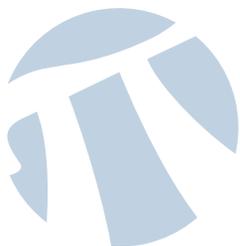
Over 3.5 million hits for Math Central

Beginning its 17th year, Math Central (http://mathcentral.uregina.ca/) continues to be a successful tool for teachers. The site currently gets in excess of 3.5 million hits per month from approximately 250,000 visitors. Math Central attracts answer submissions from keen mathematicians from all over the world including recent submissions from Italy, Romania, Turkey and Indonesia.

This site is maintained by PIMS Education Coordinator Harley Weston and faculty and students in Mathematics and Statistics and Mathematics Education at the University of Regina in Saskatchewan.

The newest part of the site is Aboriginal Perspectives. It is a companion website to Math Central and contains mathematics and science lesson ideas with an Aboriginal focus for K-12 teachers. In the past two years mathematics lesson ideas have been created for this site to be used in workshops for teachers. Support from PIMS has been used to help hire the students who write the lessons and facilitate the workshops.

> CALL FOR TEACHERS: Any grade six Regina teachers who would like to participate in a workshop that focuses on incorporating Aboriginal perspectives into mathematics lessons. The workshop takes place on November 5, 2011 in Regina. For more information visit WWW.PIMS.MATH.CA and follow the links to education events.

U. of Alberta Education Celebrates Young Minds Andy Liu, PIMS Education Coordinator

Celebration of Mind
This is an annual event to commemorate the passing of the great Martin Gardner. The students at Stratford Junior High School and Queen Elizabeth High School put on two SNAP Math Fairs at the Telus World of Science Edmonton on October 21 and 22 respectively, and students from the SMART club put on a third on October 23.

Visit to H. A. Kostash School, Smoky Lake.
Six classes of junior high students from Stratford took their SNAP Math Fair on the road on December 7, visiting a country school. They set up the show in the gymnasium, and each class of the school came by to try the puzzles. A local class was designated as the host class. They had lunch together with the visitors and exchanged their experiences in living in their environment.

Ted Lewis Workshop at BIRS for the SNAP Math Fair
This is an annual three-day conference at the Banff International Research Station, discussing the administrative and academic details of running SNAP Math Fairs. It was organized by Tiina Hohn of Grant MacEwan University.

World Youth Mathematics Intercity Competition
This contest was held in Denpasar, Indonesia from July 18 to 23. Three teams of Alberta junior high school students participated. Nine of the students were from Alberta and one guest student from Taiwan. Thank you to the parents, the Indonesian government and ConocoPhillips Canada for their support.

Alberta Summer Mathematics Institute (ASMI) Charles Doran, PIMS Site Director

From July 11 – August 12 we welcomed 20 mathematically talented Albertan high school students to campus to attend the second annual Alberta Summer Mathematics Institute (ASMI). These students attended several lecture series by distinguished U of A faculty, supplemented with computer classes on mathematical typesetting (LaTeX) and computation (Sage). Eight additional guest lectures on special topics rounded out the curriculum. This was followed by two weeks of directed mathematical research. On August 12 the students presented their findings to the ASMI staff and fellow students (see pictures). ASMI 2011 is the first to be entirely funded by PIMS.
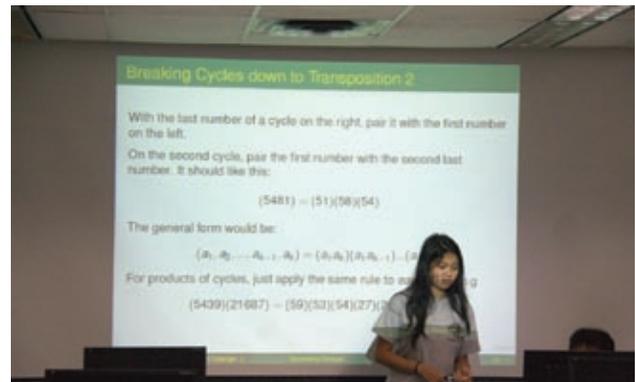
ASMI Students giving presentations
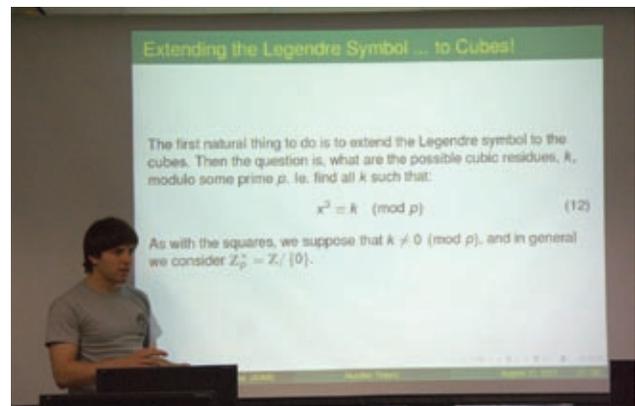
Report on the 2011 Gene Golub SIAM Summer School

Laurent Demanet, MIT

The 2011 Gene Golub SIAM Summer School (G2S3) took place on the campus of the University of British Columbia in Vancouver, Canada, on July 4-15, 2011. The theme of the summer school was Waves and Imaging. A diverse international crowd of 50 selected graduate students took part in the event. The focus of the summer school was on the interdisciplinary mathematics underlying different modalities of tomographic imaging such as radar, medical CT, and seismic. Four mini-courses were given by Margaret Cheney (radar imaging, RPI), Frank Natterer (computerized tomography, WWU Muenster), Josselin Garnier (imaging in random media, Paris VII), and Laurent Demanet (seismic imaging, MIT). Lectures were given in the morning, and the afternoons were reserved for computer exercises. This format is not normally offered in a university setting.

Gene Golub Summer School participants

The summer school was a success by many accounts, including the feedback received from the SIAM survey, informal conversations, and the obvious engagement and hard work of the students toward learning the material. The social aspects of the school were also a success: the students had many extra-scholar activities (including weekend outings) and the group will keep in touch via a Facebook group and an email list. It was also nice to see that many students had extended their stay for the ICIAM conference, also in Vancouver and right after the summer school.

Applied Mathematics Perspectives Report

Ian Frigaard, UBC

Approximately 250 people from around the world attended Applied Mathematics Perspectives workshops on the UBC campus, July 13-17, 2011. Seven workshops targeted diverse areas of applied mathematics including imaging, fluid mechanics, delay differential equations, numerical solutions of differential equations, Ricci flows and reproducible research. Two further workshops were held at University of Victoria and an additional two at BIRS. This sequence piggy-backed on the ICIAM meeting and allowed a greater focus in concentrated areas. PIMS, MITACS, BIRS and CAIMS/SCMAI were co-organisers of the events, with additional travel support from NSF.

Two of the workshops addressed fluid flows: non-Newtonian rheologies, interfacial and multi-phase flows were some of the foci. Applications were drawn from diverse industries, other natural flows and even games (organisers: Balmforth, Frigaard & Homsy). An entire workshop focused on numerical solution of incompressible flow problems (organisers: Minev & Schoetzau).

AMP DINNER CRUISE

Delay differential equations occur in models of physical and biological systems, ranging from laser physics through traffic flow to disease modelling. The commonalities in techniques were emphasised in one workshop (organisers: Campbell, Humphries, Krauskopf & Sieber). Uri Ascher was feted in a workshop addressing the numerical solution of constrained differential equations (organisers: Greif & Spiteri).

Image formation, processing and analysis, inverse problems, compressive sensing wavelets and frames, statistical methods and visualization were themes of the medical and geophysical imaging workshop (organisers:Lamoureux, Lancaster & Margrave), which drew many industrial participants.

Another workshop with strong industrial participation was the reproducible research workshop (LeVeque, Mitchell & Stodden). Computation has become a vital component of research in applied areas of mathematics and all areas of science and engineering. Unfortunately, the software and data that drives this computation is too often developed and is managed in a haphazard fashion prone to error and difficult to replicate or build upon. This workshop addressed some of the associated issues.

As well as diversity in subject and application, coordination of the workshops to run simultaneously allowed cross-pollination of ideas over communal lunches, coffee breaks and social events. A number of participants presented their work in more than one workshops and junior participants presented their work in a joint poster session. The prize winners were Sarah Hormozi (UBC) and Vladimir Bukshtynov (McMaster) - congratulations!

SARAH HORMOZI, UBC

PIMSBits

• The BC government has announced that PIMS will be receiving legacy funding from their recently concluded Year of Science in BC. Only Science World and PIMS were singled out for this special funding. The funding ($100,000) will be focused on our First Nations/Aboriginal Program throughout the province.

• PIMS has renewed its CNRS agreement with the incorporation of Regina and Saskatchewan.

• On April 1, 2011 the University of Northern British Columbia (UNBC) officially became an affiliate member of PIMS.

• Recent PIMS award recipients: Prof. Mark Lewis (U.Alberta), CRM-Fields-PIMS Prize, Prof. Adam Oberman (SFU) was awarded the 2011 CAIMS/PIMS Early Career Award in Applied Mathematics and Prof. Veselin Jungic was awarded the PIMS Education Prize.

• Ms. Betsy Varughese, a Ph.D. student in Applied Mathematics at the University of Alberta and a PIMS IGTC Fellowship student was recently awarded the CIHR Frederick Banting and Charles Best CGS Scholarship. Her research integrates mathematical

modeling with epidemiological methods and clinical data to better understand transmission dynamics of tuberculosis within and among Aboriginal communities in the prairie provinces.

• Pi Day, was celebrated at the University of Regina with several speakers debating and reflecting on the wonders of Pi! Speakers included PIMS postdoc Shahla Nasserasr who talked about the applications of pi.

Shahla Nasserasr

• PIMS Education Coordinator Malgorzata Dubiel (SFU) was awarded the 2011 YWCA Women of Distinction Award and the 2011 Adrien Pouliot Award from the CMS in recognition of her outstanding contributions to mathematics education in Canada.

Efim Zelmanov

Efim Zelmanov is a Professor of Mathematics at the University of California, San Diego. He is a Fields Medalist and former member of the PIMS Scientific Research Panel. He was appointed as the Rita L. Atkinson Chair in Mathematics at UCSD in 2002. His other awards include Member of the National Academy of Sciences (USA), Foreign Member of the Royal Academy of Spain, Foreign Member of the Korean Academy of Science, Fellow of the American Academy of Arts and Sciences and the College de France Medal.

Professor Zelmanov was awarded an honorary degree at the University of Alberta on Wednesday, June 15, 2011. The following is a transcript of his convocation ceremony address.

"Eminent Chancellor, Madame President, Representatives on the Board of Governors, Dear Friends and Colleagues, I feel deeply moved by this honor from the University of Alberta. Edmonton is a special place on the world algebraic map. This is a place of people whose works I studied as a student and then visited many times for professional reasons. When I ask myself if I deserve this big honor I feel humbled....

For a few minutes I have the ear of esteemed colleagues, not necessarily mathematicians, to say something about mathematics. Mathematics has two sides. The first one is linked to technological progress. Mathematics is a powerful tool in aeronautics, medical imaging, communications research, etc.

However, there is another side: proof. In experimental sciences the criterion of truth is repeated experiment. In mathematics there is "Her Majesty Proof". John von Neumann said that the concept of proof changed several times during his lifetime. What impresses me, though, is how little it has changed in the last 2,000 years.

We trace our (mathematical) ancestry to Ancient Greeks who made Art of finding relations between mathematical objects. They invented the concept of Proof, which breathed life in otherwise dull (though useful) formulas. I would be curious to see any practical value of the beautiful Greek proof of irrationality of the square root of 2. It is just a pure Art, a pursuit of beauty and artistic pleasure.

The art of mathematics is the most elite of all the arts.

Mathematical masterpieces can be understood and enjoyed by very few people, often counted on the fingers of two hands. At the same time it is the best - supported art. In the US it is supported neither by the National Endowment for the Arts nor the National Endowment for the Humanities, but by the National Science Foundations, Industry, the Military, etc. Why do they do that? I guess, because during the last half-a-century the most abstract seemingly detached from reality mathematical concepts have miraculously turned the most applied. 160 years ago the mathematical genius Galois invented finite fields. When I was a student in Novosibirsk about 40 years ago we were taught that only "decadent" algebraists and number theorists can be interested in such abstract and "useless" objects as finite fields. Today finite fields lie at the foundation of computer based coding theory and public key cryptography. Each time you login to your e-mail account or get money from an ATM machine or watch a DVD, you indirectly use nontrivial abstract algebra and Galois's finite fields.

E. Wigner called it the "unreasonable effectiveness of mathematics".

Last, but not the least, I want to say a few words about the Mathematical Community.

The motto of the World Chess Federation is "we are all one family". To an even greater extent it applies to mathematicians. The Mathematical Community, especially the North American Mathematical Community, is a truly multi - ethnic inclusive group, where people are (largely) judged by their merits. It is a pleasure and an honor to belong to this group."

Ravi Vakil is a Professor of Mathematics at Stanford University where he is also the Robert K. Packard University Fellow and the David Huntington Faculty Scholar. He was the 2009 Earle Raymond Hedrick Lecturer at Mathfest. He has received numerous awards for both his research and his teaching including an AMS Centennial Fellowship, a Frederick E. Terman Fellowship, and an Alfred P. Sloan Research Fellowship. Ravi is also Canadian and has received both the Coxeter-James Prize from the CMS and the André-Aisenstadt Prize from the CRM. Ravi is an informal advisor to the useful website, Mathoverflow.net

PIMS Chats with Ravi Vakil

While he was in Vancouver to deliver the annual Niven Lecture, PIMS sat down for a quick chat with Stanford Professor Ravi Vakil.

Briefly can you tell me about the lecture you just gave, "The Mathematics of Doodling."
The lecture I just gave is about asking questions and asking the *right* question and learning how to do that. It's hard to find right answers, but sometimes it's harder to find the right questions.

What interests you the most about what you do?
I love watching the creative process in action. I love thinking about thinking. And what I like most about giving talks like this is hearing the questions that people ask. Today I encountered things that were new to me, and that's what I enjoy.

Mathematics is so much more of a social subject than any other fields of enquiry, you have to talk to people, you can't just read, you can't just think on your own, you have to understand it as part of a larger community.

Your bio says you're a fan of mathoverflow.net?
Yes, it's a culture changing website. It changes how we interact with other mathematicians in a way that we all want to. Everyone wants to answer everyone else's questions, and this emphasizes the importance of travelling somewhere and having random conversations. The serendipity is so essential. And mathoverflow this is a way of doing the same thing, with the disadvantage of not being physically there to talk to some one, but with some advantages of being able to ask so many people in the 'hive mind', not knowing who will know your answer.

One of our star freshman students was so happy one day, she mentioned to me that she'd answered a question that a mature researcher had posed on mathoverflow.net and it related to something she had thought about in highschool, and it was just an amazing connection that wouldn't have happened anywhere else.

Suggestions of other useful discussion websites for mathematics.
I'd recommend these blogs:
• **Terry Tao**, religiously read by many people. http://terrytao.wordpress.com/
• **Tim Gowers**, Cambridge http://gowers.wordpress.com/
• **Secret Blogging Seminar**, Berkeley, it's not so secret http://sbseminar.wordpress.com/

If you could give me two words that would best describe your career in mathematics what would they be?
Fortunate, I've been lucky in a number of ways.
Fun, I'm a pleasure seeking mathematician.

Mathematical and Statistical Challenges for Sustainability
Excerpts from the Executive Summary

By Julie Rehmeyer

Editors: Margaret (Midge) Cozzens and Fred S. Roberts

Last November PIMS co-sponsored the Workshop on Mathematical Challenges for Sustainability. The following is an excerpt from the executive summary of the report from this workshop.

"Learning to live sustainably on Earth is going to require enormous advances in our understanding of the natural world and our relationship with it. To acquire that understanding, progress in the mathematical sciences is essential.

But mathematical scientists are only beginning to become involved in sustainability research, and many mathematicians, statisticians, and many other scientists are uncertain of the role that mathematics has to play. To redress this, six North American mathematical research institutes, together with the U.S. National Science Foundation, sponsored the Mathematical Challenges for Sustainability Workshop held at the DIMACS Center at Rutgers University, November 15-17, 2010, gathering 40 leaders in the mathematical sciences together to lay out a roadmap of the mathematical and statistical challenges in sustainability science. This report is a distillation of their work.

The participants saw that the mathematical sciences challenges are enormous. Sustainability issues are hugely complex, requiring more subtle scientific and mathematical and statistical tools than we currently have to unravel them. Just asking the right questions is a challenge in and of itself. Climate models, for example, are extraordinarily complex, created by scientists from many disciplines, and require extremely powerful supercomputers to run, yet they provide only a crude and imprecise approximation of the true processes affecting climate. They are raising mathematical and statistical questions that have never before been faced, and right now, we don't have the answers.

Almost every sustainability challenge we face requires new mathematical tools. For instance, saving the world's fisheries will require us to understand the mechanisms of evolution of fish populations and to develop intricate strategies for assuring a stable and ample supply of fish under environmental stressors of various kinds. Addressing these challenges requires countries with competing interests to work together, and that cooperation has to be attained with no world governing body to enforce it. The only way an agreement will work is if participating countries are eager to adhere to it because doing so is in the self interest of each one – but such agreements are so difficult to create that they demand the power of new mathematical tools for bargaining and fair allocation, which have barely begun to be used in creating fishery treaties.

Economic issues, which are deeply interwoven with sustainability issues, raise their own mathematical and statistical challenges. To decide how much we should spend to protect an ecosystem, for example, we need to be able to forecast the economic impacts of our decisions. But our current models of the economy are woefully lacking – as the 2008 financial crisis dramatically demonstrated. The starting assumptions in these economic models is that the market will stay in equilibrium and that all participants will behave rationally, but those assumptions are simply not true, and in many cases, they're not even close to being true. Furthermore, economics and the environment are intricately connected, with economic issues affecting the environment and the environment in turn affecting the economy. Thus the only way to understand the real impacts is to integrate economic models with mathematical models of climate, energy, biodiversity, etc., a task that presents dramatic new challenges. Moreover, with the increase in the world population, we may have to revisit the definition of a healthy economy.

Meeting these mathematical and statistical challenges is going to require more mathematical scientists to get involved, new ways for mathematical scientists to interact with other disciplines, and greater levels of funding for mathematical work in sustainability."

The entire report can be viewed at: *http://dimacs.rutgers.edu/SustainabilityReport/SustainabilityReport_Final08-02.pdf*

Coming up in 2012

June 4-29, 2012 - PIMS-Mprime Summer School in Probability at UBC, Vancouver.

June 25- July 13 - 2012 - Winter school on Geometric Partial Differential Equations at Australian National University, Canberra.

June 17-22, 2012 - 12th Canadian Number Theory Association Meeting at the University of Lethbridge, Alberta.

June 17-28, 2012 - Math Modelling in Industry at the University of Calgary, Alberta

For more PIMS events visit www.pims.math.ca

MONTE CARLO METHODS for QUANTITATIVE FINANCE - PIMS Industrial Short Course

A course for risk managers, quantitative analysts and others who want to learn how to make use of Monte Carlo and related techniques.

Date: February 22-24, 2012
Location: SFU Harbour Centre, Vancouver BC

Learn how to:
• use Monte Carlo methods for accurate option pricing, hedging and risk management.
• understand what the values produced by Monte Carlo computations mean and how much confidence should be placed in them in practice.
• increase the efficiency of their Monte Carlo applications through variance reduction techniques and the use of quasi-Monte Carlo methods.
• incorporate the latest developments into their current practice.

Feedback from previous participants:
"Good overview of [the] Monte Carlo simulation method and its application to commodity markets and risk management."
"This will enable me to explore Monte Carlo simulation in my quantitative work and build stronger analytical/quantitative skills."

Instructor: Tony Ware is an Assoc. Prof. in the Dept of Mathematics and Statistics at the University of Calgary, where he is the Director of the Mathematical and Computational Finance Laboratory. He works with energy companies including Nexen, TransAlta, Enmax, Louis Dreyfus Energy and Direct Energy.

For more information visit **pims.math.ca** and follow the links to Industrial Short Courses

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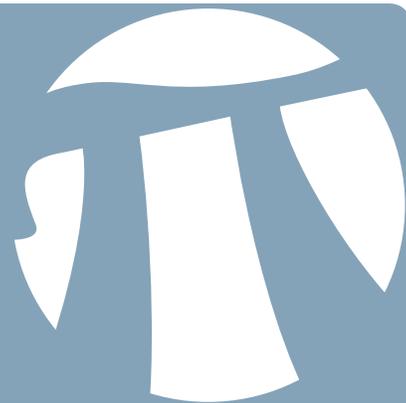
Pacific Rim Mathematical Association (PRIMA)
2013 Congress & Call for Special Sessions

June 24-28, 2013

Shanghai Jiaotong University Shanghai, China

Confirmed Plenary Speakers:

Martin Barlow (UBC)

Andrea Bertozzi (UCLA)

Weinan E (Princeton)

Jun-Muk Hwang (KIAS)

Vaughan Jones (UC Berkeley)

Zhi-Ming Ma (Chinese Academy of Sciences)

Matilde Marcolli (Caltech)

Maryam Mirzakhani (Stanford)

Arun Ram (Melbourne)

Shuji Saito (Tokyo)

Weiping Zhang (Nankai University)

CALL FOR SPECIAL SESSIONS:

The organizing committee invites the Pacific Rim community to submit proposals for special sessions by **December 1, 2011.** Visit the PRIMA 2013 Congress website: **http://www.primath.org/prima2013** for more details on submissions.