NEWSLETTER

Leadership News

James Colliander Appointed Deputy Director of PIMS

The Pacific Institute for the Mathematical Sciences is pleased to announce the appointment of James Colliander as Deputy Director of PIMS for a five-year period, starting on July 1, 2015. Professor Colliander will also assume a faculty position in the Department of Mathematics at the University of British Columbia.

James Colliander is currently a faculty member at the University of Toronto. His field of research is at the interface of partial differential equations, harmonic analysis and dynamical systems.

Professor Colliander obtained his PhD at the University of Illinois in 1997. After postdoctoral positions at MSRI and UC-Berkeley he took a faculty position at the University of Toronto, where he has been a full professor since 2007. Among his many awards he was a recipient of a Sloan Foundation Fellowship (2003), the McLean Award (2007) and the Outstanding Teaching Award in Arts and Science (2010) at the University of Toronto. He has been a Visiting Professor at the University of Paris and a Member of the Institute for Advanced Study in Princeton. Professor Colliander is also the Founder and CEO of Crowdmark, an education technology company that was awarded the Connaught Seed Stage Startup Award at Toronto in 2013.

PIMS Director, Alejandro Adem noted, "The appointment of James Colliander as Deputy Director brings significant academic strength, energy and know-how to the PIMS team. He is an impressive and dynamic mathematician who is full of novel ideas that will benefit the entire spectrum of PIMS activities. I am delighted that we were able to recruit him. I also want to thank the current Deputy Director (Bud Homsy) for the wonderful job he has done over the past five years. He has been a key figure in the leadership at PIMS."

What's Inside

Former PIMS Deputy Director announced as UBC's 13th President

PIMS congratulates Arvind Gupta, current CEO and Scientific Director of Mitacs and former PIMS Deputy Director, on his appointment as the 13th President and Vice Chancellor of the University of British Columbia.

Alejandro Adem, PIMS Director, remarked, "Arvind Gupta is a remarkable individual who has played a leading role in promoting science and innovation in Canada. He was one of the founders of PIMS and we are thrilled to see a member of the mathematical sciences community take on such a distinguished leadership role."

Photo Credit: Martin Dee, UBC Public Affairs

Dear Colleagues,

It is a pleasure for me to inform you about the current state of affairs at PIMS. First and foremost has been our application to NSERC for renewal of funding for the period 2014-2019. A proposal was submitted on November 1, 2013 and a reverse site visit in Ottawa was scheduled for early January, 2014. Unfortunately these plans were wrecked by the polar vortex which made flying into Ottawa impossible on the scheduled dates! Finally, our review took place on March 16 and 17. All three Canadian mathematics institutes were reviewed within a three-day period, so it was a great occasion for building some inter-institute camaraderie. As of today we still have not heard back from NSERC; please stay tuned for an announcement from PIMS about the whole process and information about the exciting new activities that are planned for the next five years.

I am delighted to announce the appointment of James (Jim) Colliander as the next Deputy Director of PIMS. Jim is a distinguished mathematician on the faculty at the University of Toronto, working on the topic of partial differential equations and harmonic analysis and will start his position at PIMS (as well as a faculty position at UBC) on July 1, 2015 (more details on the cover!).

PIMS has launched two new Collaborative Research Groups (CRGs). The Applied Combinatorics CRG (based at SFU, Saskatchewan and UBC) will showcase the multiple applications of combinatorial techniques in the natural sciences. The Applied, Algebraic and Geometric Topology CRG (based primarily at Calgary, Regina, Victoria and UBC) proposes to bring together the applied, algebraic and geometric sides of the subject through a variety of innovative thematic and training activities. Meanwhile the ongoing CRG in Geometry and Physics will be organizing a plethora of activities this summer, including the gargantuan *String-Math* conference in Edmonton.

This summer PIMS will be buzzing with lots of training events for students and postdocs including the *PIMS Probability Summer School,* a Focus Period on the *Economics and Mathematics of Systemic Risk*, the *PIMS-SFU Undergraduate Summer School on Multiple Zeta Values* and the *PIMS-IMA Mathematical Modeling in Industry Workshop*. Similarly our education activities are in full swing, they are too numerous to be listed here, but let me take this opportunity to thank all of our PIMS Education Coordinators for their wonderful contributions.

Finally I want to end my remarks by thanking those who have generously supported PIMS activities, in particular members of our Board of Directors, as well as our recent anonymous donor!

With best wishes,

Alejandro Adem
Director, PIMS

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Thank you to:

University of British Columbia BUD HOMSY

At the UBC site, the *Computer Science Distinguished Lecture Series* continued with speakers Vincent Hayward, Regina Barzilay, David Woodruff, Michael Kearns, Colin Camerer and Monica S. Lam. The *PIMS/UBC Distinguished Colloquium Series* featured Jaroslav Nesetril, Robert Guralnick and Linda Petzold.

University of Saskatchewan RAJ SRINIVASAN

From February 28 to March 1, USaskatchewan hosted *The 14th Colloquiumfest*, which explored the present state of fixed point theory. In Education, PIMS and The Department of Mathematics and Statistics have been doing outreach work in a Cree teacher's classroom. Stavros Stavrou, the Outreach Coordinator, has been collaborating on lesson plans that fulfill the curriculum objectives while using traditional teachings (see more on page 7).

University of Calgary CLIFTON CUNNINGHAM

At the Calgary site, four *PIMS/Shell Lunchbox Lectures* were held in March (March Madness) including our very own Anthony Quas (PIMS UVic Site Director) as a speaker. Recent PIMS Distinguished Visitors to the site include arithmetic geometers Lassina Dembele (Warwick) and Takashi Suzuki (Chicago). Calgary's two weekly UC-UBC seminars have been going strong since September 2013: the *Bruhat-Tits Seminar* and the *p-adic L-functions Seminar* and the Optimization CRG is going full tilt now! We would also like to welcome our new Site Administrator, Melissa Wrubleski.

University of Washington PETER HOFF

This past fall, UWashington and Microsoft hosted the *Pacific Northwest Probability Seminar*, featuring speakers from the US and Canadian Northwest, as well as many other international speakers. PIMS, UW and UBC also organized the *Bellingham Algebraic Geometry Seminar*, held at Western Washington University. Interdisciplinary activities have included the *Math Across Campus* colloquium, featuring Simon Levin of Princeton this past fall, as well as the development of the new *Trends in Optimization* seminar (TOPS), organized by faculty from Math, Statistics and Computer Science.

University of Victoria ANTHONY QUAS

At the University of Victoria, we organized two very successful *Math Mania* events at Braefoot and Lake Hill Elementary Schools (read more on page 7). Michael Tsatsomeros of Washington State University was a PIMS Distinguished Speaker, and gave a fascinating lecture on *The Envelope of a Matrix*.

University of Regina DONALD STANLEY

At URegina, the year started off with a number of events. On Pi Day (March 14) our math students gave away 68 pies wearing their pi t-shirts, while Shaun Fallat gave a public lecture about pi. On March 17-19 Peter Zvengrowski from the University of Calgary gave a series of three talks on number theory and topology and Patrick Maidorn organized the *Math Kangaroo* competition for grades 1-12 which took place on March 23. Ivo Dell'Ambrogio from the University of Lille in France will visit the Topology and Analysis groups from April 16 to May 14.

University of Lethbridge AMIR AKBARY

Our weekly N*umber Theory and Combinatorics Seminar* continued, including speakers: Renate Scheidler (UCalgary), Eric Naslund (Princeton), Mohammadreza Jooyandeh (Australian National University), David Roe (University of Calgary), Olivier Ramaré (CNRS and Université de Lille 1), and Daniel Fiorilli (UMichigan). Professor Ramaré gave a series of six lectures in February and March, covering a range of topics in analytic number theory.

In addition to weekly *Fun With Math* sessions for high school students, Jana Archibald, Abbas Momeni, and Soroosh Yazdani organized a *Day of Math* for junior high and high school students on March 23, which is a contest that is divided into four parts: Bernoulli Trials, a team math relay, *Math Jeopardy*, and the *Math Kangaroo* competition.

Simon Fraser University NILS BRUIN

SFU saw various lectures in our PIMS-CSC distinguished speaker series, including a mini-workshop on January 10-11, featuring David Levermore, and various regional speakers. The very successful *Taste of Pi* series of events for talented high school students is now in its tenth year.

This spring SFU hosted *Frontiers in Biophysics*, and looks forward to the *Pacific Northwest Number Theory Conference*. The main event this summer will be the month-long Undergraduate Summer School on *Multiple Zeta Values*.

University of Alberta CHARLES DORAN

The UAlberta site has focused on CRG activities. The CRG in Applied and Computational Harmonic Analysis (2011-2014) ran a two-day BIRS workshop (August 30-September 1, 2013) and hosted a number of visitors including X. Zhuang (City University of Hong Kong) and J.L. Guermond (Texas A&M). The CRG in Geometry and Physics (2013-2016) has run a weekly *Geometry and Physics Seminar* since September 2013. The group is focused on preparations for the *2014 String-Math Conference* suite of events in June.

CRG in Applied, Algebraic and Geometric Topology: 2014-2018

Topology is a central area of mathematics, with broad interactions with many other fields as well as emerging applications to subjects such as robotics, economics, computer science and large data set analysis. The subject often is divided into its applied, algebraic and geometric constituents, each of which is a thriving subfield with interesting problems and lots of activity. However the compartmentalization of topology makes the training of students and postdocs a major challenge, as there are many common concepts and natural opportunities for cross-fertilization that are lost by emphasizing a narrow focus.

This CRG emphasizes all three aspects of topology mentioned above, providing opportunities for exploring new lines of research and for training the new generation of students and young researchers with emphasis on both depth and breadth. Recent exciting developments in topology such as the solution of the Kervaire Invariant One problem, the proof of the Virtually Haken Conjecture, as well as the emergence of algebraic topology as a tool for analyzing large data sets indicate that this is an especially opportune time to organize thematic activities in this important discipline.

Activities for 2014 include the workshop, *Algebraic Topology: Methods, Computations and Science Conference*, May 26-30 at UBC and the *West Coast Algebraic Topology Summer School*, July 7-12 at UBC, which will focus on Topological Field Theories.

CRG Organizing Committee: K. Bauer (Calgary), R. Budney (Victoria), J. Palmieri(Washington), A. Pettet (UBC), D. Rolfsen (UBC), D. Sinha (Oregon) and D. Stanley (Regina).

Applied Combinatorics: 2014-2017

Discrete models and their properties underlie many physical phenomena and hence combinatorics has long been applied to study problems in physics and chemistry. Meanwhile, the field of combinatorics is an independent subject which has evolved considerably over the past 20 years. Not coincidentally, so have computational technologies and the field of theoretical computer science. The application of combinatorics to problems in physics, biology and chemistry are under-used despite their wide applicability. In fact, given a proper understanding of the underlying combinatorial structure, and modern computing power, one can now predict large scale behaviour, and understand whether a given property is rare, or expected. Enumeration, random generation, parameter analysis — each are steadily becoming within reach for increasingly complex models. A central aim of this CRG is to transport known results about combinatorial structures to other domains of science.

Activities for 2014 will include the *PIMS Analytic RNA Combinatorics Workshop* (*PARC*), April 15- 16 at SFU and the satellite conference to *CAIMS 2014: Combinatorial Applications to Biology, Chemistry and Physics*, June 21-27 at USaskatchewan.

CRG Organizing Committee: M. Mishna (SFU), K. Yeats (SFU), Andrew Rechnitzer (UBC) and C. Soteros (USaskatchewan).

PIMS Bits
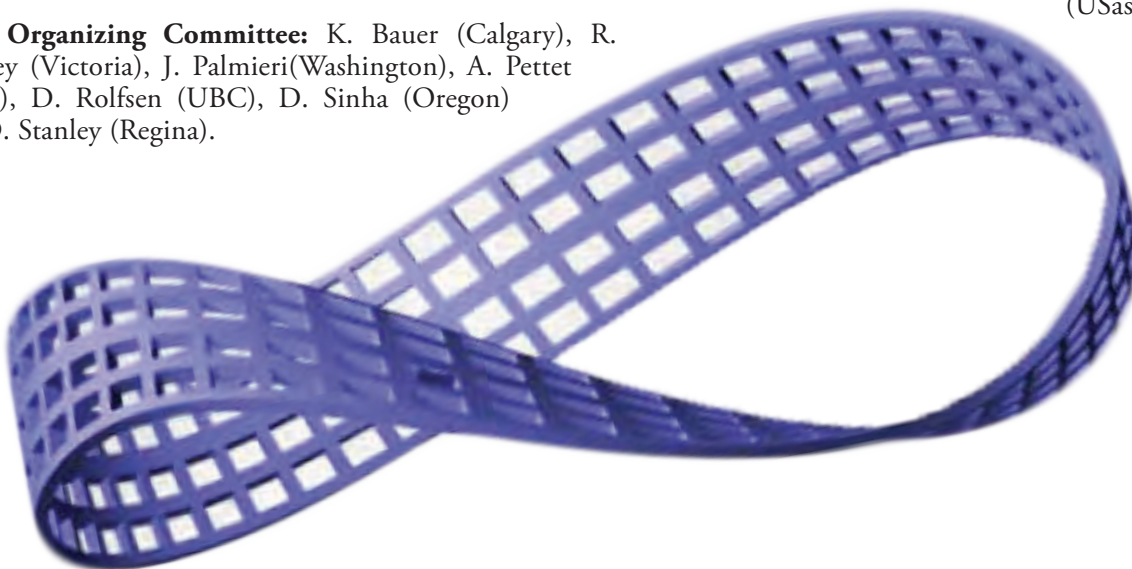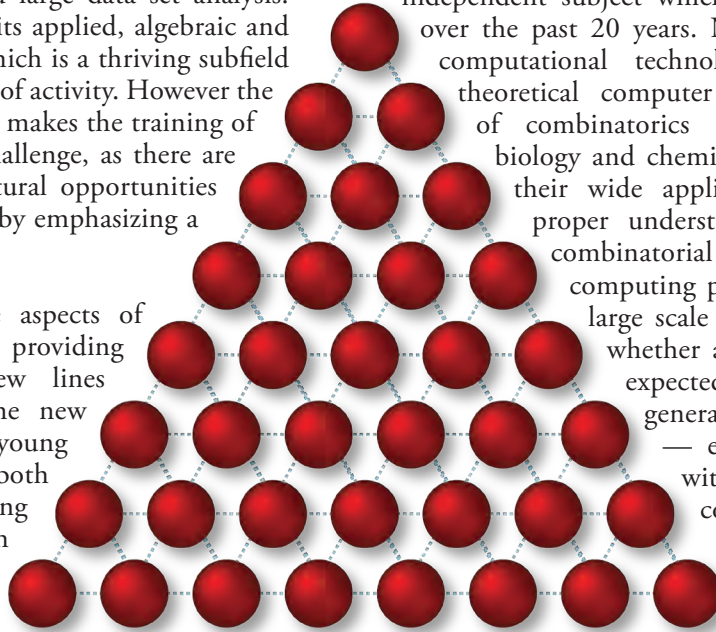
• **Recent award recipients:** Susan Milner (University of the Fraser Valley), PIMS Education Prize; Geoff Wild (Western), CAIMS/PIMS Early Career Award in Applied Mathematics; and Niky Kamran (McGill), CRM/Fields/PIMS Prize.

• **Site Director updates:** Anthony Quas (longtime editor of PIMS' *Pi in the Sky* magazine for high school students) began his term as interim site director at UVic and Raj Srinivasan returned from his one-year administrative leave at USaskatchewan. Chris Hoffman has been appointed as the new site director at UWashington, and will begin his term on July 1, 2014. We thank Marcelo Laca (UVic), Chris Soteros (USaskatchewan) and Peter Hoff (UWashington) for their excellent service!

• **A Taste of Pi** In March, the 10th anniversary of the *A Taste of P*i series kicked off at SFU. The series, which provides high school students with the opportunity to attend presentations given by distinguished faculty members about their research, about new and exciting developments in the mathematical sciences, and about contemporary applications of mathematics, is sponsored by the SFU Department of Mathematics and IRMACS – Interdisciplinary Research in the Mathematics and Computational Science with support by the SFU Faculty of Science and PIMS.

Community News

Major Funding Announced for BIRS-Affiliated Facility in Oaxaca, Mexico

In February, 2014 the Governor of the Mexican State of Oaxaca, Gabino Cué Monteagudo, and the Director General of the National Council for Science and Technology (CONACyT), Enrique Cabrero Mendoza, announced funding (43-million pesos) for the construction and operations of Casa Matemática Oaxaca (CMO), a research facility that will become the home of a new BIRS-affiliated site at El Centro de las Artes (CASA), in Oaxaca, México.

Nassif Ghoussoub, the founding director of PIMS (1996-2003) is the Scientific Director of The Banff International Research Station (BIRS), which opened in 2003 as the result of efforts led by the Pacific Institute of the Mathematical Sciences (PIMS), the Mathematical Sciences Research Institute (Berkeley, CA) and the help and participation of the Mathematics of Information Technology and Complex Systems (MITACS).

This new facility will run 25 workshops in 2015 (in addition to those that will be hosted in Banff). Construction of the new CMO facility will commence in the very near future, on this picturesque site that, not unlike The Banff Centre, is a place of high culture, drawing in artists, students, intellectual leaders and other creative forces.

PIMS Director, Alejandro Adem said of the new partnership, "PIMS is proud of its role in founding BIRS, which is now a major North American initiative. The Casa Matemática Oaxaca will bring lots of high level mathematicians to México. The PIMS community is very excited about this project and will be major contributors to the scientific activities in Oaxaca."

THE GOVERNOR OF OAXACA, GABINO CUÉ MONTEAGUDO, THE DIRECTOR GENERAL OF CONACYT, ENRIQUE CABRERO MENDOZA AND THE FOUNDER OF CASA, FRANCISCO TOLEDO BREAK GROUND ON FEBRUARY 7, 2014

Sustainable Economics

Ivar Ekeland was the Canada Research Chair in Mathematical Economics at the University of British Columbia from 2003 to 2011. During his career, he has served as the President of Université Paris-Dauphine, Director of the research centres CEREMADE and Institute Finance-Dauphine as well as Director of PIMS from 2003 to 2008. He has been awarded prizes from the French Academy of Sciences, the French Mathematical Society, and the Belgian Academy of Sciences and has received honorary doctorates from UBC, from Saint Petersburg State University of Economics and Finance and from the University of Vienna.

Ekeland is the founding editor of the Annales de l'Institut Henri Poincaré-Analyse Nonlineaire and the editor-in-chief of Mathematics and Financial Economics. He has written several books, including reflections on, or popularization of, mathematics. For these contributions, Ekeland was awarded the Prix Jean Rostand by the Association des Ecrivains Scientifiques de France and the Prix d'Alembert by the Société Mathématique de France.

In 1970 Ekeland played a critical role in the creation of The Université Paris-Dauphine. "We had to compete with Paris 6 [the Pierre and Marie Curie University], which was focused on pure mathematics, so we took a different angle. Math is not a science; it is a language and you cannot teach it by itself. Traditionally, you teach math and physics, but we decided there to take a different approach." Instead, they paired math and economics, creating the first mathematics-economics bachelor and master's degrees in France and possibly the world. The structure was extremely successful and now includes math, economics, finance and computer science.

After his term as President of the Université Paris-Dauphine, Ekeland turned to economics, which in turn led him to explore many ideas pertaining to the mathematics of planet earth. "Consider our planet as a large computer that has become too slow. Technology is advancing so that its old software [ie. biological phenomena] cannot keep up or correct itself."

His research has led him to the conclusion that, in addition to the physical inertia of climate change (once carbon gets into the atmosphere it will stay there for hundreds of years) there is an economic inertia. "You can stop the destruction of the environment, but once it is destroyed you can never go back. You can set a limit from above, say that you will not destroy more than 50% of the amazon forest, but if you destroy 50%, you will never be able to get back to 60%." The irreversibility of this type of situation comes about because everyone expects someone else to fix the problem, which results in no one taking action.

A basic assumption from early economics had been that society behaves like an infinite individual looking into the future and thinking about how to allocate resources to gain the most happiness. "People think it's like physics – like a gas is full of atoms – atoms are identical and they don't care about each other, people are not," explains Ekeland. "Those who will be most affected by climate change are not born yet, collectivities do not act or react like individuals, and we cannot model their decisions in the same way."

Another aspect of Ekeland's work in climate change is in time inconsistency, the premise of which is that the incentive to keep a commitment is significantly less than the incentive to make the commitment. The problem with climate change is that governments cannot commit to tomorrow, because they may no longer be in power. "They can really only commit this year's budget; all the rest is empty promises." The consequence of this is that there is no incentive for governments to adopt the best policy on climate change because if tomorrow's government does not agree, it will likely be reversed. And the best policy is useless if it is not accepted by the next government.

The kind of economic problems Ekeland is currently working on – as part of a project on sustainable development at Dauphine, working with other economists, and with a colleague at UBC – involve determining what a good policy should or could look like.

"I think that Western Canada is the best place to explore the mathematics of climate change because it is a region that still has plenty of natural resources and an interest in maintaining them: the pine beetle, the controversy about the ecological and health impacts of farming salmon… people are aware that there is a problem. People at PIMS have been working on this type of thing and should continue to exploit those ties with mathematical biology, fisheries and statistics. The opportunities and incentives are there!"

Community Engagement - Saskatchewan

Stavros Stavrou, the education Outreach Coordinator at USaskatchewan, has been making headlines with an enthusiastic new program aimed at enriching the mathematics education of First Nations, Inuit and Metis students. Together with Norma Bear, at St. Frances School, he has been co-teaching a Grade 6 math class and collaborating on lesson plans that teach the curriculum objectives while using traditional Cree teachings to motivate the concepts. Stavrou hopes to expand the program to include more schools and classrooms next fall.

Stavrou, whose research is in two areas: pure mathematics (in the context of study linear and multilinear algebra) and mathematics education (related specifically to ethnomathematics, particularly First Nations perspectives on math education), received the Young Alumni Excellence Award, awarded by USaskatchewan on March 4, 2014.

Math Mania - at Braefoot and Lake Hill Elementary Schools

On February 4, a team of eighteen volunteers presented Math Mania at Braefoot Elementary School in Victoria, to one hundred parents, students and teachers – this was the first time for Math Mania at this school. On March 5, the volunteers visited Lake Hill Elementary School. With only 137 children in the school there was an amazing turnout of approximately 90 kids, teachers, parents and a number of grandparents. The acting principal, Amy Polson, reported very positive feedback on the event.

Braefoot and Lake Hill Elementary

The past four Math Mania events have seen a new trend. "We have set up several activities in the school on the morning of the event... Each class will then spend half an hour with some carefully chosen hands-on activities. In addition, we display one or two 'teaser' activities that are only revealed in the evening at Math Mania" explains UVic Education Coordinator, David Leeming. This allows students who are unable to attend the evening sessions to be exposed to the activities.

As the Math Manias evolve, they are continually adding new activities to their repertoire, which keeps the events fresh, particularly for return visits to schools.

Education Associates - Alberta

This program allows colleges and universities (outside of PIMS member universities) to engage with PIMS' education outreach and its goal to improve the educational experience for teachers, students, and the community by facilitating the sharing of ideas and resources.

At the Concordia University College of Alberta, Rossitza Marinova reports multiple Math Kangaroo activities, as well as two teams of eight elementary school students travelling to Burgas, Bulgaria to take part in the *Bulgaria International Mathematics Competition*: *www.bimc2013.org.*

students in Burgas, Bulgaria

At Red Deer College, Manny Estabrooks reports on several initiatives, primarily, the establishment of a Math Learning Center with particular features intended to address those issues which impede students from being successful in their math courses. A *Mathematics of Games and Gambling* show promoted mathematics and statistics in everyday life, as well as several other initiatives they have been exploring such as Kangaroo Math and Math Fair.

Highlights - Spring 2014
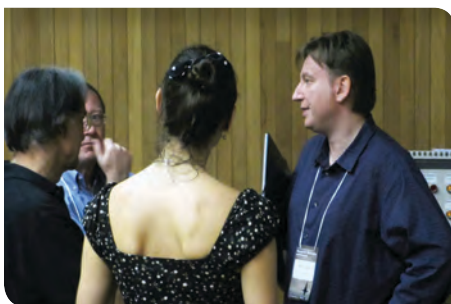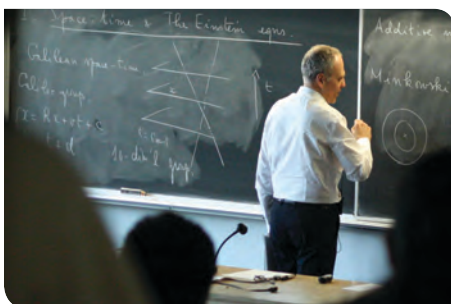

Robert Guralnick

Olivier Ramaré seminar

The 14th Colloquiumfest: Samer Assaf, Rene Bartsch (sitting) and Tristan Tager

Mathieu Desbrun

Niky Kamran

Lunchbox lectures

The PIMS/Shell Lunchbox Lectures was in full force this spring with four lectures being held in March on a variety of topics. Speakers included: Anthony Quas (PIMS UVic site director), on *Oceans and Multiplicative Ergodic Theorems*; Jesus De Loera (University of California, Davis), on *One Hundred Years of Helly's Theorem*; JF Williams (Simon Fraser University), on *Numerics with Error Bars: Rigourous numerics, computer generated proofs and the future of the mathematician* as well as Robert Owens (University of Montreal) with *On Oscillations in Microvascular Networks*.

Olivier Ramaré

Also in March, Olivier Ramaré (CNRS/Université de Lille 1) gave nine PIMS Distinguished Lectures and seminars primarily at ULethbridge, but also at UBC and UCalgary. Ramaré, whose field of expertise is analytic number theory, with an emphasis on sieve methods and explicit results, gave talks spanning topics from *A Comparison of Perron's Formula and Smoothing* to *Bilinear Forms on Prime Numbers* to *Log-Free Zero-Density Estimates*. The talks were well-attended and Prof. Ramaré had many fruitful interactions with faculty, postdocs, and students present.

Crm-fields-pims prize lecture

On April 7th, Niky Kamran (McGill University) delivered a captivating talk to a packed room at UBC. The talk was entitled, *General Relativity, Differential Geometry and Differential Equations; Stories From a Successful Menage-a-trois*. Kamran is James McGill Professor in the Department of Mathematics and Statistics at McGill University.

Frontiers in biophysics

On March 15th, SFU hosted a conference to create and strengthen connections between multidisciplinary researchers at local institutions who have interests in modelling problems in cellular and molecular biology, single molecule studies, networks of interacting biomolecules and whole cell approaches to biophysics. This is currently the only event in this part of the continent that encourages and emphasizes discussion and communication between participants with mathematics, physics, computing science and biology backgrounds.

Pims marsden memorial lecture

On April 7th, at the Instituto Nacional de Matematica Pura e Aplicada (IMPA), in Rio de Janeiro, Mathieu Desbrun's (Caltech) lecture on *Geometric Discretization for Computational Modeling* attracted an audience of nearly 130 atendees. Desbrun's lecture was stimulating, humorous and well-received, generating substantial discussion. Two of the three previous Marsden Memorial Lecturers (A. Weinstein and R. Montgomery) were in attendance.