Pacific Institute for the Mathematical Sciences

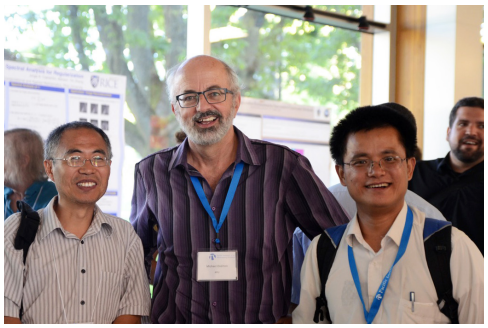
NEWSLETTER

Vol.16, Iss.2
Fall 2013

PIMS Summer Season

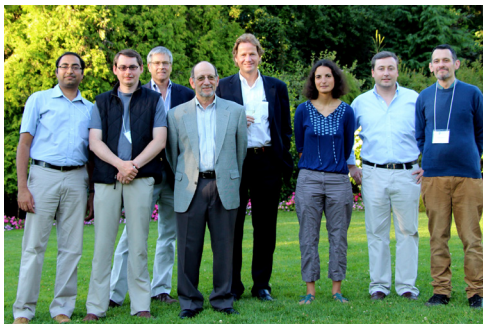
Summer 2013 was jam-packed with events, including a number of high profile lectures, workshops and conferences. Here are some photos highlighting just a handful of these events. Keep reading to find out more!

Automata Theory and Symbolic Dynamics



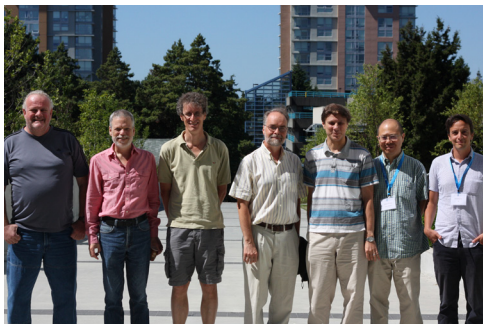
Numerical Linear Algebra and Optimization in honour of Michael Overton's 60th

High Dimensional Data Analysis



Complex Fluids and Flows in Industry, in honour of PIMS deputy Director, Bud Homsy's 70th

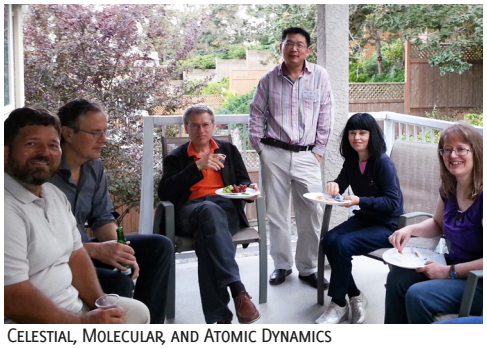
Analysis and Partial Differential Equations in honour of Nassif Ghoussoub's 60th



Recent Trends in Stochastic Analysis in honour of Ed Perkins and Martin Barlow's 60th

Recent Advances in Hodge Theory

PIMS



Celestial, Molecular, and Atomic Dynamics

What's Inside

Director's Message

Dear Colleagues,

This past summer saw a phenomenal flurry of activity at PIMS. The Math Biology IGTC organized a highly successful Summer School on Biological Invasions in May, which took place at the University of Alberta, in Edmonton. The UBC site hosted the Summer School on Hodge Theory in June and a number of workshops throughout the summer. Particular highlights were the conferences that honored our colleagues Nassif Ghoussoub, Ed Perkins, Martin Barlow and Bud Homsy, respectively. Where would we be without their marvellous contributions to PIMS and Canadian mathematics? At the University of Calgary PIMS hosted Recent Developments in Numerical Methods for Seismic Inverse Problems and Applications, with significant participation from both industry and academia. Similarly, our colleagues at the University of Victoria organized the impressive meeting, Celestial, Molecular and Atomic Dynamics, which was part of PIMS' Mathematics of Planet Earth activities. And the list goes on and on... showcasing the vibrancy of the PIMS community.

In July PIMS hosted a retreat among members of its community to develop ideas for the next funding cycle from NSERC. Two days of intense and fruitful discussions resulted in a number of new ideas and improvements for future PIMS programs. We are now busily preparing a proposal, with a November 1 deadline, to the recently established Collaborative and Thematic Resources Support in Mathematics and Statistics program at NSERC. I am grateful to the PIMS site directors and other scientists for their assistance with this process.

The CNRS-PIMS collaboration has brought five French researchers to PIMS sites this fall, including Frederic Robert and Philippe Castillon at UBC, Yvan LeBorgne and Yann Ponty at SFU and Dominikus Noll at UBC-Okanagan. PIMS has established itself as a very active Unité Mixte Internationale and our connections with French mathematics continue to flourish.

Our educational programs continue with great success, recently our Aboriginal mathematics initiatives received support from both the Royal Bank of Canada and the Actuarial Foundation of Canada. We also received generous support from individual donors – particular thanks are due to Haig Farris, Andy Wright and Ken Spencer.

Warmest regards,

Alejandro Adem
Director, PIMS

Pacific Institute *for the* Mathematical Sciences

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Teaching the Teachers

Andy Liu is the PIMS Education Coordinator and a Professor of Mathematics at the University of Alberta. He is an outstanding mathematical educator who has been internationally recognized for his many years of tireless work in education and outreach. He is a winner of the PIMS Education Prize (2010), the Deborah and Franklin Teppo-Haimo Award from the Mathematical Association of America (2004), the Adrien Pouliot Award from the Canadian Mathematical Society (2003), the Distinguished Teaching Award from the Pacific Northwest Section of the MAA (2002), the Delta Chi Teaching Excellence Award (2000), the 3M National Teaching Fellowship (1999), and was Canadian University Professor of the Year (1998). He was also the leader of the Canadian team to the International Mathematical Olympiad in 2000 and 2003.

As a math educator, he says, "Getting youth involved in math is our future; it's what we do." However, he isn't campaigning to get kids into math or to bombard them with arguments to convince them that "math is fun." Liu's approach to math education does not involve persuasion tactics, "That's what turns people off," he says. "You have to be good at something as a human being, for your intellectual life. It doesn't have to be mathematics, but it could be. Letting kids find math on their own makes it more enticing, something they can really enjoy."

Liu's career ambition had always been to become an elementary school teacher, however, once he'd received both his PhD and teaching certificate, he found that he held no appeal for the elementary schools, who incorrectly assumed that he would just bide his time until a bigger and better university position came along. Instead, he accepted a position at the University of Alberta, where one of his first tasks, ironically, was to design a course to teach others how to become elementary school math teachers.

Aware of the stigma against math and that education is not the first choice of many of the students who find themselves in that faculty, Liu strove to create a math course that would best prepare students to teach others. "I looked at the book they were using at the time, *Mathematics for Elementary School Teachers*, which had a chapter on each of arithmetic, algebra, geometry, etc; if the students came already versed in math it would have acted as a refresher, but for most they have no background in math. So, I determined that it was important for these students to learn less, but not less well. The course [we created] focuses only on arithmetic, but goes into it in depth and deals not only with the content, but the whole learning process."

Liu's efforts to improve math education go beyond the course taught at UA. With the Math Circle project he started in 1980 he has done a tremendous amount of outreach locally, and also travels internationally, bringing math education to college, university, high school and elementary school teachers and students. His Round the World trips have taken him mainly, but not exclusively, to very remote regions in Southeast Asia, where he delivers lectures to groups of anywhere from 30 to 350 participants. "After a lecture in one town, a van will pick me up and bring me to the next town, where I get dinner and a hotel room, and then I get up and give lectures in the morning and afternoon, and then the next van comes to bring me to the next stop until I have visited all of the towns on my itinerary. I go to places that nobody goes and they have never seen anything from the outside. They really appreciate what they are getting."

Liu teaching students to make an origami dog with three identical units (at Wilgehof School, Broemfontein, South Africa, 2012).

He lectures on topics of general interest, with material from the Math Circle. "There is no specific mathematical background involved to solve these problems, but there are a lot of math ideas," says Liu.

As Liu eases his way into retirement, he anticipates that his free time will produce many more offers to deliver international lectures. He will also stay on as PIMS' Education Coordinator in Alberta, and complete a book he currently has with a publisher. In addition, he has "three other books on the front burner and seven more on the back burner."

In all of his work in math education and outreach, he stresses this: "There is a lot of emphasis on math in real life. This is nonsense. That's not why we learn math, and that's not why we need math. You don't need to learn math to exist in the world; you learn math because you enjoy it." PIMS has been incredibly grateful to have Liu assist with our education outreach, and hope that he continues this role for years to come!

Around the Sites

University of British Columbia Bud Homsy

This summer, the UBC site hosted multiple conferences, receptions and special guests. In addition to High Dimensional Data Analysis, Automata Theory and Symbolic Dynamics and Recent Advances in Hodge Theory, PIMS hosted a number of celebratory conferences: Analysis and Partial Differential Equations (Nassif Ghoussoub); Numerical Linear Algebra and Optimization (Michael Overton); Recent Trends in Stochastic Analysis, (Ed Perkins and Martin Barlow) and Complex Fluids and Flows in Industry (PIMS Deputy Director, Bud Homsy).

University of Washington Peter Hoff

Many PIMS-related activities took place at UW this summer, including Richard Tapia's talk in the Math Across Campus series – a colloquium designed to bring together students and researchers in quantitative sciences – as well as the West Coast Optimization Meeting, sponsored by UW and PIMS. In June, UW hosted this year's Pacific Northwest Number Theory Conference, which featured speakers from Canada and the Western United States and in July, UW and PIMS co-sponsored a Research Training Group Summer School on inverse problems and PDEs.

University of Alberta Charles Doran

It was a particularly busy summer at the University of Alberta. Kicking things off, were two major research events in Edmonton for young mathematicians/statisticians: The 10th PIMS Young Researcher's Conference (May 21-24), immediately followed by the Inaugural Statistical Society of Canada Student Conference (May 25). Also on May 25 was the 2013 Canadian Statistical Sciences Institute Annual Meeting, which featured both the CANSSI Board Meeting and a Scientific Program on *Spatial and Temporal Modeling in Climate Science and Public Health*.

These above events in statistics were satellite to the main event — The 41st Annual Meeting of the Statistical Society of Canada — (May 26-29). That same week began the PIMS IGTC Mathematical Biology Summer School on *The Mathematics Behind Biological Invasions* (May 27-June 14). The following month welcomed another group of mathematically talented high school students for the 2013 Alberta Summer Mathematics Institute (July 2-August 2).

University of Saskatchewan Raj Srinivasan

In Saskatchewan Math Mania has been garnering attention, with articles from both CBC News and the University of Saskatchewan College of Arts and Science highlighting new initiatives for Aboriginal students. For more information turn to page 8.

University of Victoria Marcelo Laca

A highlight at UVic since the last newsletter was Nader Masmoudi's (Courant Institute) talk on *Nonlinear Inviscid Damping for 2-d Euler Equations* (July 4).

The main event at Uvic this summer was the *Celestial, Molecular, and Atomic Dynamics* workshop (July 29-Aug 2). Florin Diacu (UVic) was the main organizer. Top experts from North and South America, Europe, Asia and Australia presented and discussed the connections between dynamical systems modeling the motion of planets, molecules and atoms. The participants left with a deep sense of accomplishment from the new results shared by participants, the informal exchange of ideas and the new collaborations that developed.

CRM-FIELD-PIMS Prize lecture: Bruce Reed

Simon Fraser University Nils Bruin

In May, distinguished visitor Frits Beukers (Utrecht University) gave lectures on modern developments in the analysis and arithmetic of hypergeometric functions.

SFU also organized the 16th Changing the Culture — a conference on math education — as well as three math camps: two for students and one for teachers, in Burnaby and Surrey.

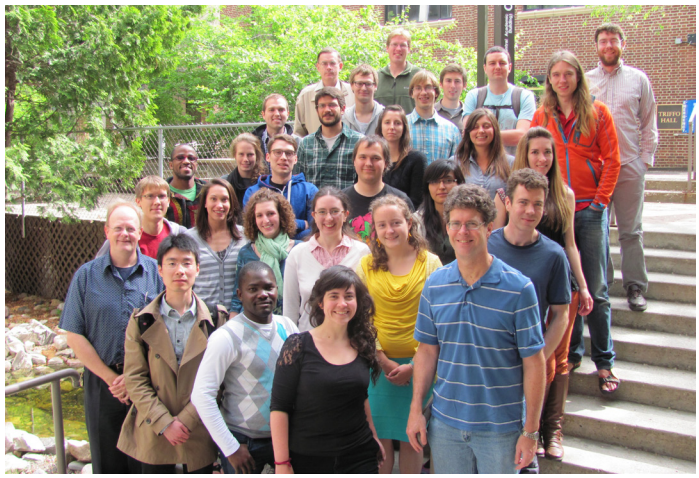
Bruce Reed delivered his CRM-FIELD-PIMS Prize lecture, a symposium on Mathematics and Computation was held, as well as the international conference Selected Areas in Cryptography — the 20th edition of the conference and the first time it was held in Western Canada.

By Dan Coombs, IGTC Program Director

The PIMS International Graduate Training Centre (IGTC) program supports graduate student research training and career development in the broad area of mathematical biology. Its activities and student fellows (currently 11 students) are generously supported by PIMS and Mprime. The IGTC program is now entering its last year of student funding and all students are scheduled to complete the program by the end of this academic year.

Since the last newsletter, the IGTC held its most important event of the year, the graduate summer school on Biological Invasions at the University of Alberta, organized by Thomas Hillen and Mark Lewis and featuring distinguished lecturers Alan Hastings (UC Davis), Jonathan Sherratt (Heriot-Watt) and Sergei Petrovskii (Leicester).

We are looking forward to this year's instalment of the IGTC Student Summit, to be held at the Banff International Research Station, November 8-10. The theme will be *Career Transitions and Development in Math Biology.* Professionals from academia, government and industry will provide perspectives on the challenges and opportunities of a career in mathematical modelling, from the graduate level, through postdoctoral positions, to permanent positions in different areas. Specific topics will include understanding the tenure process, academic versus industrial views on publications and understanding possible challenges faced by women and visible minorities in science. A full report will appear in the next issue of the newsletter.



Biological Invasions summer school participants

Around the Sites cont'd

University of Lethbridge Amir Akbary

The Fifth Alberta Number Theory Days, organized by Brandon Fodden (ULethbridge) and David Roe (UCalgary) was this spring's main event for number theorists in Alberta. The event was held at BIRS and featured nine lectures by Alberta number theorists and a lecture by Noam Elkies (Harvard).

In August we held a number theory seminar on *Spliting of Abelian Varieties* by Kumar Murty (UToronto) and in September, welcomed James Parks to the number theory group as a PIMS postdoctoral fellow. Upcoming activities include two weekly seminar series: Lethbridge Number Theory and Combinatorics seminar and PIMS Lethbridge Seminar in Optimization.

University of Calgary Clifton Cunningham

Highlights from the UCalgary site include: two math contests and a Lunchbox Lecture in April; two more Lunchbox Lectures and the North-South Dialogue in May; two Optimization CRG conferences in June; two Quantum Information CRG conferences, another on seismic inverse problems and a huge CMS math camp in July; a workshop on Curves and Applications and another on Applied Harmonic Analysis in August; the Guy Lecture by Carl Pomerance in September and the 35th Alberta Statisticians meeting in October. The Site also welcomes its new Educational Coordinator, Indy Lagu.

University of Regina Donald Stanley

On September 24-26 Ragnar-Olaf Buchweitz (University of Toronto) gave a series of lectures on: *The McKay correspondence and ubiquity of Coxeter-Dynkin diagrams; The McKay correspondence and noncommutative algebraic geometry* and *Yet another look: The McKay correspondence, preprojective algebras, and maximal Cohen-Macaulay modules.*

On the educational outreach side, in summer 2013 the Math on the Move program visited schools in rural Saskatchewan, and on October 5 hosted our annual Math Camp for grade 7-12 students.

The 2nd Pacific Rim Mathematical Association (PRIMA) Congress

June 24-28, 2013 Shanghai Jiaotong University, China

The Pacific Rim Mathematical Association (PRIMA) was founded in 2005 as an association of institutes, societies and universities in the Pacific Rim, with the goal of expanding mathematical interactions and activity in the region. The first PRIMA congress was held in Sydney in 2009.

PIMS has played a leading role in the establishment and development of PRIMA. This year at the opening ceremony PIMS' Director, Alejandro Adem, delivered a speech that both thanked the local hosts for organizing such an impressive event and identified the main goals of the congress.

The 2013 PRIMA Congress was very successful; with an attendance of over 800 participants from all over the Pacific Rim, including Australia, Canada, Chile, China, Colombia, Hong Kong, Japan, Korea, Mexico, New Zealand, Singapore, Taiwan, the US and Vietnam. There were 11 excellent plenary talks in a variety of areas of the mathematical sciences as well as 23 special sessions which were remarkable for their diversity and quality. In addition, there were two very entertaining public lectures. The first was by Cedric Villani (recent Fields medallist), entitled *Of Triangles, Gas, Prices and Men*; the second was delivered by Ronald Graham on *Computers and Mathematics: Problems and Prospects*.

The meeting was generously funded by a number of institutes and agencies in the Pacific Rim, and Prof. Shi Jin and his colleagues from Shanghai Jiaotong did a wonderful job as local organizers.

The next PRIMA Congress will be held in the summer of 2017 in Oaxaca, Mexico.

Ronald Graham

Cedric Villani

Martin Barlow

2013 PRIMA

Andrea Bertozzi

Shi Jin

Alejandro Adem

Choosing Solitary Numbers

Sun-Yung Alice Chang has been a mathematics professor at Princeton since 1998. She was born in China, but grew up in Taiwan, where she received her high school and undergraduate education. She attended graduate school at the University of California, Berkeley.

She recalls her beginnings in mathematics as more of a rational decision: "Many people would say that they love math and they knew that's what they wanted to pursue, but that's not me. It was a choice. I was good in math at elementary and high school, but I had a passion for both math and Chinese literature. Choosing to major in mathematics in college was [a decision made] partly out of practical considerations–I thought that during the difficult economic environment in Taiwan after the Second World War, I had a much better chance to become independent and make a good living with a technical background."

However, that doesn't mean she didn't pursue her career with determination and much success. Chang's accomplishments include an Alfred P. Sloan Fellowship (1979) and a Guggenheim Foundation Fellowship (1999). She served as vice president of the American Mathematical Society (AMS) (1989- 1991) and was awarded the AMS Ruth Lyttle Satter Prize for outstanding contributions to mathematics research by a woman in 1995. In 2009 she was elected to the US National Academy of Sciences.

In her PhD thesis, Chang focused on classical analysis, specifically, the analysis of one complex variable. She realized that the boundaries between mathematical areas are not as rigid as many think, in particular the boundary between complex and real analysis. "One field can influence the development of the other. And the influence goes both ways. I noticed that methods in real analysis can be more flexible. After I graduated, I continued to work in my thesis direction, analysis in one complex variable, but I also began to work on problems in (real) harmonic analysis."

In her early career she was classified as a harmonic analyst, but never confined herself to a specific discipline. With her husband Paul Yang, a geometer, she often exchanged ideas and once they began to really talk about their research problems, began to do some joint work "on what is called conformal geometry, a branch of geometry, in which methods in partial differential equations often play an important role."

"Nowadays people think of me as a geometric PDE-er working on problems in conformal geometry. I still classify myself as an analyst, but in many circles, my work overlaps with people in geometry."

As a woman in mathematics, Chang recognizes that her experiences have been different from the majority, even more so because in her earliest years in mathematics, she did not realize how isolating the experience of being a woman mathematician could be. "At National Taiwan University, where I attended college, I only realized much later that I came from a very special class. Normally in a class of 40 students, five or six are women, but in my class there were 11-12 girls. It happened that we formed a strong bond – we studied and socialized together…. I never felt that being a woman mathematician was [to be] special or alone or isolated. This feeling of being a bit unusual and isolated or that the percentage of women was very small only occurred to me after I became a graduate student at Berkeley."

When Chang arrived at Berkeley there were no women faculty. It was only in 1974, the year she graduated, that female instructors were hired. "Everybody was talking about [how] 'the time for women has arrived; change will come,' but actually, that wasn't the case." Although the situation has improved, she explains, there are still a very small number of women on faculty at the mathematics department at most universities.

"In my heart of hearts, I feel that mathematics is a very good profession for women" she says. And her advice for them would be "to form a group and bond and make connections so that later on you don't feel so isolated."

"I am very lucky in that regard" she explains. She has felt very supported. Also, she is optimistic for the future of women in mathematics. "I think things are changing in a very positive direction!" she says.

Mathematics Summer Camps for Aboriginal Students in Vancouver

PIMS and the UBC House of Learning hosted the five-week summer camp, Emerging Aboriginal Scholars, for students attending grades nine to 12. Thirty students took Math and English each day and three days a week, gained work experience with a faculty member in the area of their choice. This year, four students worked with a UBC Faculty of Forestry professor to describe how past generations of aboriginals interacted with BC forests, uncovering the stories of culturally modified trees in the hope that they may be preserved.

Transitional Summer Camp Students at graduation

PIMS also hosted the five-week Transitional Summer Camp (held at Brittania Secondary School) for Aboriginal students transitioning from elementary to high school; they took math, English, and sports each day and once a week, had a cultural mentorship lesson with Elders. This year, representatives from Cameras 4 Change – a non-profit society that provides educational, arts-based workshops – worked with the students on a photography project and at the students' graduation, presented each student with a free camera.

These camps were supported by the Government of BC, the Vancouver Foundation, UBC and private donors.

Math Mania Success in Saskatchewan

At the University of Saskatchewan, the Department of Mathematics and Statistics and PIMS have developed a number of new Math Mania initiatives for Aboriginal students, thanks to funding from the Government of Saskatchewan.

"An important aspect of this program is establishing connections and building relationships with students and teachers in these northern communities," says Stavros Stavrou, outreach coordinator for Math Mania. "Engaging students in mathematics is difficult in general, and is more challenging in these northern schools that have limited resources."

The Math Mania team has been busy developing activities that infuse First Nations, Metis and Inuit perspectives, intended to help students connect with the subject matter. "We hope our collaboration with these (northern) communities will increase mathematical literacy, and show that math is more than tedious pen-and-paper calculations; it is about discovering, describing, and modeling the world around us" he says.

RBC and the Actuarial Foundation of Canada Support PIMS Programs

About 100 Aboriginal children in rural BC attended math summer camps hosted by UBC thanks to a gift from the RBC Foundation. The camps, organized by PIMS and UBC Mathematics, aim to foster an interest in mathematics among Aboriginal K-12 students.

Over the past six years, PIMS and UBC have worked with approximately 1,000 Aboriginal students, 200 teachers at First Nations schools, and many public schools with a substantial percentage of Aboriginal students. Their efforts are increasing graduation rates for Aboriginal students, and providing them with a solid foundation in mathematics.

The Actuarial Foundation of Canada, part of whose mission is to promote youth awareness and education in mathematics and financial matters, has also donated funds to PIMS to support the development and implementation of teachers' workshops around the province.

Student Shaniece Angus and Kim Roberts, Branch Manager, RBC Royal Bank