Pacific Institute *for the* Mathematical Sciences

Year in Review 2022

Simon Fraser University • University of Alberta • University of British Columbia • University of Calgary
University of Lethbridge • University of Manitoba • University of Regina • University of Saskatchewan
University of Victoria • University of Washington

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Dr. Kristine Bauer, Co-Director, Industry
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About PIMS

The Pacific Institute for the Mathematical Sciences was founded in 1996; it is a consortium of universities in Western Canada and the University of Washington in the USA.

Member universities: Simon Fraser University, University of Alberta, University of British Columbia, University of Calgary, University of Lethbridge, University of Manitoba, University of Regina, University of Saskatchewan, University of Victoria and University of Washington.

Affiliates: Portland State University, the University of Northern British Columbia, and Athabasca University.

The Pacific Institute for the Mathematical Sciences (PIMS) is a collaborative network dedicated to the promotion of discovery, understanding and awareness in the mathematical sciences. PIMS brings together leading researchers from major universities across western Canada, as well as the University of Washington, and is an International Research Lab of the National Center for Scientific Research (Le Centre national de la recherche scientifique, CNRS).

PIMS sponsors and organizes educational and community outreach, Indigenous math camps, and summer schools for both teachers and students, as well as initiatives to promote diversity in mathematics, partnerships that bring mathematical research to industry, cutting edge mathematical and scientific research, and events across the PIMS network that promote advancement in computer science, pure and applied mathematics, and statistics.

The Central Office is at the University of British Columbia, with a PIMS site office and a Site Director local to each of the ten member universities. The site directors facilitate local opportunities and synergies, while the PIMS site offices provide administrative assistance for organizing local events. This distributed structure renders it quite unique, involving strong local site offices and activities, and allowing a broad impact across Western Canada and beyond.

The Board of Directors oversees the administration of PIMS, with membership consisting of a senior academic administrators from each of the member universities, as well as distinguished scientists and representatives from industry. An independent Scientific Review Panel composed of internationally renowned mathematical scientists assesses proposals for scientific events and programs.

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From the Directorate

2022 *has been a year of new beginnings for PIMS. We resumed a full slate of in-person activities, while diligently following safety protocols.*

We diversified our funding portfolio with support from the Natural Sciences and Engineering Research Council (NSERC), the Simons Foundation, Prairies Economic Development Canada (PrairiesCan), and the US National Science Foundation, and used this support to leverage funding from our member institutions, positioning us to build on our strengths in facilitating excellent and inclusive collaborative research and educational programs in the mathematical sciences.

New Leadership Structure

Starting July 1, 2022, Ozgur Yilmaz became the Director of PIMS, while Jayadev Athreya transitioned from his role as Interim Director to the role of Co-Director International, and Kristine Bauer joined the PIMS Directorate as Co-Director Industry. The portfolios of the newly created co-Directorate positions were designed in consultation with the PIMS Board and stakeholders to align with the strategic priorities of PIMS and to provide PIMS a **strong collaborative leadership team.**

Return to in-person events

With the relaxation of pandemic-related precautions, PIMS cautiously resumed in-person activities in 2022. After a two-year delay, the P**IMS-Centre de Recherches Mathématiques (CRM) Summer School in Probability** was held at UBC in June with in-person participation by almost 100 graduate students from across the world. The **2022 Séminaire de Mathématiques Supérieures on Floer Homotopy Theory** was also held at UBC with 62 participants and a total of 30 lectures.

Network-wide online activties

›› Network-wide colloquium

In 2021, we celebrated our 25th Anniversary with a new **Network-Wide Colloquium**, held online, with a fantastic collection of lecturers from all across the world. This series continued in 2022, with colloquia by Benoît Perthame (Sorbonne), Ingrid Daubechies (Duke), Holly Krieger (Cambridge), Bryna Kra (Northwestern), and Weinan E (Peking). These lectures are posted on the PIMS website www.mathrube.org, where consent is given. A huge thanks to PIMS University of Victoria Site Director Anthony Quas for his leadership and organization of this series.

›› Network-wide grad courses

Led by Nathan Ng, our PIMS ULethbridge site director, PIMS developed a suite of **Network-Wide Courses**, advanced graduate courses accessible to students across the PIMS network, helping to build strong research communities within PIMS.

›› PDF orientation and seminar

Pioneered by our former Deputy Director, Marni Mishna of SFU, and now led by our co-Director Industry, Kristine Bauer, the **Emergent Research Postdoctoral Fellow Seminar** highlighted the fantastic research done by PIMS postdoctoral fellows across the network. To help build community amongst our PDFs, and to introduce them to the PIMS network and its resources, we conduct an online orientation for our PDF community, emphasizing the great opportunities for research, education, and equity, diversity, and inclusion in the PIMS network.

›› Directorate open house and PIMS-at-a-glance

We held our second annual Directorate open house where we invited the PIMS community to drop in and connect with PIMS leadership. To increase awareness of the funding, education, and outreach we participate in, we created a PIMS-at-a-Glance info sheet and held a virtual "open house" session where we invited the PIMS community to drop-in to say hi, ask questions, and share their ideas about PIMS.

›› New Online Programs

PIMS launched the **Virtual Experimental Math Labs (VXML)**, modeled on successful labs at UWashington, UManitoba, and USask. The VXML brings together vertically integrated teams from across the PIMS network (faculty, postdocs, graduate and undergraduate students) to work on exciting research problems in the mathematical sciences through experimental, computational and visual mathematics, showcasing the mathematical sciences as a creative discipline.

To facilitate the transition to research for graduate students in the PIMS network via near-pear mentoring, we launched in 2022 the PIMS F**irst Year Interest Group (FYIG)** program, which brings together early-year graduate students with a PIMS Postdoc to study active research topics in the mathematical sciences. We currently have three FYIGs distributed across the PIMS network.

PRNs and CRGs

Collaborative Research Groups (CRGs) and the newly-developed PIMS Research Networks (PRNs) are at the heart of PIMS collaborative research activity. This year saw the start of a new CRG - **L-Functions in Analytic Number Theory** with organizers from UBC, University of Northern British Columbia and University of Lethbridge. This CRG started with flurry of activity including a launch event at the Banf International Research Station (BIRS). Other PIMS CRGs are in the fields of Optimal Transport, Quantum Topology, and Movement and Symmetry in Graphs. We are excited that the CRG on optimal transport, also known as the Kantorovich Initiative will transition to our first PIMS Research Network starting April 2023. Our new CRG on Renewable Energy will also launch in April 2023.

Postdoctoral Program

PIMS continued to host a strong PDF cohort of 18 new postdocs across its network of 10 universities. Supported by funding from the Simons Foundation and from our member institutions, PIMS launched the **PIMS-Simons postdoctoral program**, a way to recognize and recruit top postdoctoral researchers. The flexibility of this funding has also allowed us to sponsor postdocs in Math, Applied Math, and Statistics at the University of Washington.

PRIMA

PIMS hosted its largest-ever scientific meeting, the **Pacific Rim Mathematical Association (PRIMA)** 2022 Congress in Downtown Vancouver in December. Originally scheduled for 2021 and rescheduled to 2022 in light of the pandemic, PRIMA brought together over 250 distinguished mathematical scientists from around the Pacific Rim for a vibrant and exciting meeting, including engaging plenary and public lectures, and high-quality scientific special sessions. A highlight was the first in-person meeting of the **Indigenous Mathematicians Network**. Starting with an opening reception at the Museum of Anthropology, the PRIMA Congress helped PIMS strengthen its connections with mathematics institutes across the Pacific Rim.

Equity, Diversity, and Inclusion

Equity, Diversity, and Inclusion are part of our core values. We are are working on several fronts to address these issues in the mathematical sciences community, through incredible work done by our EDI committee, co-chaired by Susan Cooper (UManitoba) and Chris Soteros (PIMS USask Site Director).

The PIMS **Indigenous Engagement Committee (IEC)** was established in 2021 and consists of distinguished mathematical scientists and

industrialists from Indigenous backgrounds. Since its inception, it has done exemplary work in identifying Indigenous-led efforts in the mathematical sciences that PIMS can collaborate with. The IEC had its first in-person meeting at the PIMS Central Offices in conjunction with the 2022 PRIMA Congress.

For example, PIMS is helping to support the Canadian meeting of the American Indian Science and Engineering Society (AISES), both by supporting the UBC AISES chapter which is hosting the meeting, and supporting travel from AISES members from other PIMS sites.

With our terrific education team, led by Dr. Melania Alvarez, we continue to sponsor summer camps for high school students and teacher workshops for teachers serving Indigenous students. These workshops help create pathways to careers in the mathematical sciences.

To support PIMS community members who want to learn more about EDI issues, we have sponsored, in collaboration with the Canadian Statistical Sciences Institute (CANSSI), targeted training activities for our members.

Math To Power Industry

Together with our partners in industry and government, PIMS offered a 3-week virtual Math to Power Industry (M2PI) workshop for graduate students and postdoctoral fellows in the mathematical and statistical sciences to gain the industry skills needed for success in their careers. This year four new industry partners joined M2PI: Awesense, Cedar Academy Society, Novion and Perfit. Thirty-five M2PI fellows gained hands-on experience as part of a team working on a real-world problem posed by an industry partner, and industrial partners gained valuable access to the cutting-edge problem solving capabilities of M2PI fellows. Teams presented an overview of the solutions they developed during the M2PI graduation ceremony, and during the ceremony M2PI announced its new partnership with Prairies Canada. Video of the graduation is available on MathTube.

Partnerships

In 2022, the PIMS Centre National de la Recherche Scientifique (CNRS) International Research Lab resumed in-person programs that support research collaborations between France and PIMS, including four PIMS-Europe Fellowships, two CNRS Postes Rouge Awards, and four CNRS Visitors in 2022.

We continue to work closely with our mathematical sciences institutes in Canada and across the world. We've developed exciting new exchange programs with premier research institutes in France, the US, and India, and collaborations on mathematics for public health and mathematics for climate change with our fellow Canadian Mathematical Sciences institutes.

A special new partnership with the Quantum Algorithms Institute (QAI) is establishing PIMS as a key partner in the North American ecosystem in quantum computing research. QAI also was a title sponsor of the 2022 PRIMA Congress.

Looking forward

In 2023, PIMS will focus on challenges facing humanity that require imminent solutions with contributions from the mathematical sciences. With this in mind, we are delighted to announce the summer of 2023 will be the **PIMS Action on Climate Thematic Summer (PIMS ACTS)** Special activities include a summer school and a workshop on clean energy, both organized by our newly founded CRG on Forecasting and Mathematical Modeling for Renewable Energy; a French Ameri-Can Talks (FACTS) conference (in collaboration with the French Consulate in Vancouver) on "Tackling Climate Change and the Just Transition to Renewable Energy", and focusing our M2PI projects on climate and clean energy.

Building on dicussions at PRIMA, with PRIMA public lecturer and International Centre for Mathematical Sciences (ICMS)-Edinburgh Director Minghyong Kim, PIMS recently joined a collaboration with ICMS on their **Mathematics for Humanity** program. Stay tuned for several jointly organized, hybrid events between the two institutes in 2023 and beyond.

›› Team-Up

Closer to home, PIMS is delighted to announce our new partnership with our sister institute, BIRS: the PIMS/BIRS Team Up! program. This program, inspired by the Simons Laufer Mathematical Sciences Institute's Summer Research in Mathematics program, provides opportunities for in-person collaboration to teams of mathematical scientists, targeting researchers whose research program may have been disproportionately affected by various obstacles like family obligations, professional isolation, access to funding, and the COVID-19 pandemic. This includes, but need not be limited to, women, gender-expansive, and minoritized groups, Indigenous scholars, individuals with visible/invisible challenges and early-career researchers with limited resources. A key goal of this program is for researchers with caregiving responsibilities to fully participate in its scientific activities.

Özgür Yilmaz
PIMS Director

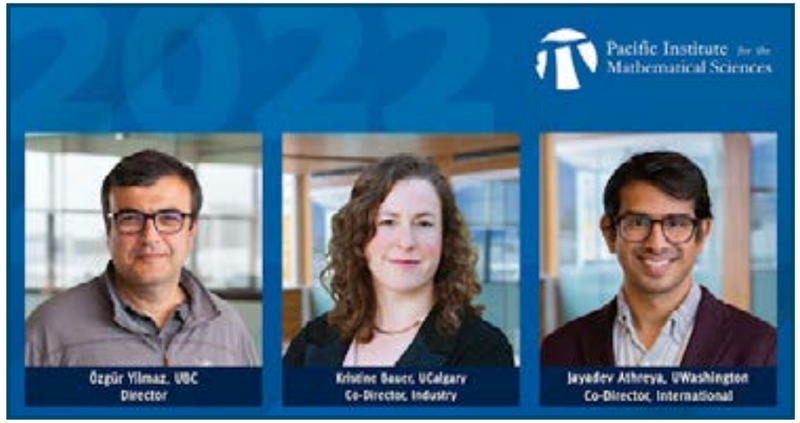
Jayadev Athreya
Co-Director, International

Kristine Bauer
Co-Director, Industry

2022 News & Announcements

Leadership Changes at PIMS

In the summer of 2022, PIMS created a new leadership model to fulfil its strategic goals. The PIMS Board approved the appointment of Professor Özgür Yilmaz as the new Institute Director. He was joined by Professor Kristine Bauer as the



Professor Özgür Yilmaz is the PIMS Director. Prof. Yilmaz, Professor of Mathematics at the University of British Columbia, served as the Interim Deputy Director from July 2021 to June 2022 before taking on this new role in July 2022. As the PIMS Director, he leads PIMS, guiding its scientific activities, and strategic and long-term planning. Prof. Yilmaz also serves as the Director of the PIMS-CNRS IRL.

Professor Kristine Bauer is the PIMS Co-Director, Industry. An Associate Professor at the University of Calgary, Prof. Bauer has been the Chair of the PIMS Jobs Committee and has been instrumental in leading the PIMS Math to Power Industry Workshop – an annual workshop connecting PIMS graduate students and highly qualified personnel with industry partners. She oversees the PIMS postdoctoral scholars program, advances strategic career development for researchers at PIMS, and leads industrial and non-academic partner relations.

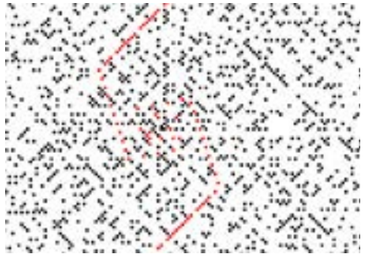
Professor Jayadev Athreya is the PIMS Co-Director International. He will expand on PIMS' international collaborations. Prof. Athreya, Professor of Mathematics at the University of Washington, is strategically placed in this role, being able to integrate both Canadian and American researchers and connect the PIMS community with leading international institutes across the globe.

New Site Director at the University of Calgary: Professor Wenyuan Liao

In mid-2022 PIMS welcomed Professor Wenyuan Liao as the new Site Director at the University of Calgary. A professor of mathematics at the Department of Mathematics and Statistics, Prof. Liao's primary research is in numerical analysis and scientific computation. He focuses on the development and analysis of accurate and efficient numerical methods for partial differential equations and the related inverse problems. He has been actively involved in various PIMS activities for the past 15 years, including the organization of the PIMS Lunchbox Lecture Series. Prof. Liao's appointment as Site Director is a natural continuation of this work with PIMS, and we look forward to his continued involvement in research and academic administration.

2022 Collaborative Reseach Groups

At the core of PIMS activities are the Collaborative Research Groups (CRGs), which bring together researchers across many universities to focus on particular topics with funding for conferences, workshops and support of highly qualified personnel, including postdoctoral fellows.



In 2022 PIMS supported six CRGs in the research areas below:

High Dimensional Data Analysis: 2018 - 2022
The HDDA CRG aimed to address three areas: bridging the gap between theory and practice in applications of sparse recovery; methods for large-scale optimization and deep learning and sampling.

Quantum Topology and Its Applications: 2020 -2024
quanTA brings together a unique and energetic team consisting of specialists in condensed matter physics and topological superconductivity, algebraic topology, algebraic and differential geometry, integrable systems, and quantum technologies, all drawn from Prairie universities and institutes.

Novel Techniques in Low Dimension: 2020 - 2024
This CRG takes up problems bridging Thurston-style geometric topology and Floer and representation theoretic techniques in low dimensions, by working between subdisciplines in search of new structure. Doing this is motivated by key open problems in low-dimensional topology, for instance, the characterization of those 3-manifolds with simplest-possible Floer homology.

Pacific Interdisciplinary Hub on Optimal Transport (PIHOT): 2021 - 2023
The Pacific Interdisciplinary hub on Optimal Transport (PIHOT) is a Collaborative Research Group examining the research and applications of Optimal Transportation across a wide audience of researchers, students, industry, policy makers and the general public.

Movement and Symmetry in Graphs: 2021 - 2024
The focuses on Graph Theory, a thriving discipline that lies at the interface of computer science and pure mathematics. Their goal is to strengthen overlapping and complementary areas of algebraic graph theory, combinatorial matrix theory, graph and hypergraph infection and percolation, and extremal combinatorics.

L-Functions in Analytic Number Theory: 2022 - 2025
Analytic number theory focuses on arithmetic questions through the lens of L-functions. These generating series encode arithmetic information and have connections with a host of other mathematical fields, such as algebraic number theory, harmonic analysis, Diophantine approximation, probability, representation theory, and computational number theory. The main focuses of this CRG include moments of L-functions and automorphic forms, explicit results in analytic number theory, and comparative prime number theory.

2022 Around the Sites

Across our PIMS network we hosted a number of in-person and hybrid lectures, seminars and workshops. Highlights from each of the PIMS Sites are provided below.

UNIVERSITY OF VICTORIA

2021-22 was a busy year for PIMS events at UVic. There were 4 PIMS-supported postdocs. UVic hosted conferences on genomics and pharmaceuticals; non-equilibrium statistical mechanics; and four-dimensional topology, as well as a Probability Day. PIMS supported seminar series on discrete mathematics and the mathematics of ethical decision-making and nonlinear dynamics. PIMS hosted a long-term CNRS visitor from France. Courtney Schumacher, a climate modeler at Texas A&M came for two PIMS-supported visits to collaborate with Boualem Khouider on building models of large-scale storms.

UNIVERSITY OF BRITISH COLUMBIA

In 2022 UBC contiuned its strong, vibrant, and diversified program of PIMS activities, including workshops, summer schools, distinguished visitors and seminar series. A major highlight was the Summer School on Probability, an intensive 3-week summer school held at UBC-Vancouver for the eighth time since 2004. These summer schools feature two main courses and several mini-courses on advanced topics, all taught by world class leaders, as well as numerous short talks, given by early career mathematicians. The participants (this year including 75 graduate students and postdocs), live in residence at UBC and bond together through informal discussions and hikes, providing an ideal learning environment. Many alumnae of past probability summer schools have gone on to become leading experts in the subject. Another highlight was a 3-day Western Canadian Mathematical Biology workshop, held at UBC-Okanagan, that provided a unique networking opportunity focusing on practical professional issues of importance to a group of 40 graduate students and postdocs, many of whom gave poster presentations. In addition, there were lectures given by an eminent CNRS researcher on recent advances in eco-evolutionary dynamics.

SIMON FRASER UNIVERSITY

Research activities returned to the normal level at SFU in 2022. Two seminars traditionally supported by PIMS, the Applied Computational Math Seminar (originally Computation Math Seminar) and the Discrete Math Seminar, had frequent meetings in hybrid forms. Two new seminars were added to the list: the Number Theory and Algebraic Geometry Seminar and Operations Research Seminar. On the educational side, the annual Changing the Culture event was held successfully in the remote form. SFU also offered a PIMS network-wide course in 2022.

UNIVERSITY OF CALGARY

The 2022 Richard & Louise Guy Lecture Series was given by Andrew Granville (Université de Montréal) in the Fall. The 2022 PIMS UCalgary Math and Philosophy Lecture was given by Emily Riehl (Johns Hopkins University). After a two-year hiatus due to the pandemic, the PIMS Lunchbox Lecture series has resumed, with two talks given by Dr. Quan Long (University of Calgary) in the Fall and Dr. Wilten Nicola (University of Calgary) in the Winter. The 2022 Math Attack Summer Camp for Girls, organized by Lauren DeDieu (University of Calgary) and Sean Graves (University of Alberta), was held at the University of Calgary and the Banff International Research Station (BIRS). The camp aimed to encourage girls to pursue their passion for mathematics and make connections with peers who shared similar interests. We bid farewell to PIMS PDF Sacha Ikonicoff, who accepted an offer for a postdoctoral fellowship at the University of Ottawa. We also welcomed Cintia Pacciano, who is working with Cristian Rios.

UNIVERSITY OF ALBERTA

During the year 2022, we supported six PIMS postdocs at the University of Alberta. Scientific highlights supported by PIMS at the university include a course on High-Dimensional Geometric Analysis, five speakers for the Mathematical and Statistical Sciences Colloquium, the 2022 Canada Chapter Symposium of the International Chinese Statistical Association, and three external speakers for the Seminar in Mathematical Biology. PIMS activities also included various education-oriented events such as the James Math Circle Tutor for the Decima Robinson Support Centre, the 2022 Alberta Mathematics Summer Camp for thirty grade 8-10 students, and a pilot project called Indigenous Mathematics Camp, where three Indigenous students were tutored in their mathematical development.-

UNIVERSITY OF LETHBRIDGE

The PIMS CRG L-functions and Analytic Number Theory launched their series of network graduate courses in the Fall with the popular Analytic Number Theory 1 (Habiba Kadiri). A description of their activities and collaborative projects was presented at BIRS in November, and the weekly seminar, organized by the postdocs (Kübra Benli, Fatma Çiçek, and Ertan Elma) reached 30 participants internationally every week. The Number Theory and Combinatorics seminar is now organized by PIMS PDF Félix Baril-Boudreau. Presented in a hybrid format, it also welcomed 4 visitors in-person. The Alberta-Montana Combinatorics and Algorithms Day, co-organized by Hadi Kharaghani, was held at BIRS in June 2022. The Prairie Discrete Mathematics workshop, co-organized by Joy Morris, was held at the University of Regina in June.

UNIVERSITY OF SASKATCHEWAN

The Geometry, Algebra and Physics (GAP) seminars (hybrid in-person/virtual seminars hosted by the university) featured 11 exciting talks in 2022 by a diverse range of speakers, including graduate students, postdocs, and faculty based both regionally and internationally. The PIMS Collaborative Research Group (CRG) in Quantum Topology and its Applications (quanTA) continued to lead exciting activities at its USask hub, where techniques from pure mathematics are informing new approaches to quantum materials, quantum computing, and quantum sensing, and leading to coverage in venues such as Scientific American (which in March 2022 featured the work of USask-based quanTA faculty member Steven Rayan and quanTA CRG Postdoctoral Fellow Kazuki Ikeda).
The CRG has also been at the centre of network-wide events, including a PRIMA 2022 session on New Trends in Geometry and Mathematical Physics, which involved significant participation from both the USask and UAlberta hubs and from current and recent PIMS PDFs. USask also hosted a PIMS Network-Wide graduate class on Statistical Machine Learning by Li Xing. Xing also co-organized the Statistics in Genomics, Pharmaceutical Science and Health Data Science Conference at UVic. Several USask faculty and students started working on new PIMS VXML projects in 2022.

UNIVERSITY OF REGINA

In 2022, the University of Regina PIMS Distinguished Lecture Series resumed with two virtual talks by Stefan Vaes (KU Leuven) on February 11 and Tatjana Miljkovic (Miami University) on October 14.
These were followed by an in-person PIMS Distinguished Lecture from Alexander Kupers (University of Toronto-Scarborough) on October 28. In the Summer of 2022, the university hosted research visits by Ferdinand Ihringer (University of Ghent) and Sebastian Martensen (NTNU Trondheim), as well as a viewing party in June for the hybrid Prairie Discrete Mathematics Workshop Event organized by the PIMS CRG Movement and Symmetry in Graphs. Our University of Regina Topology Seminar was a hybrid event that was able to meet weekly in the Fall semester thanks to seminar support from PIMS.

UNIVERSITY OF MANITOBA

The Prairie Discrete Mathematics Workshop 2022 was held online in June 2022, and co-organized between the University of Manitoba (Karen Gunderson - faculty) and Hermie Monterde (PhD student), the University of Regina (Karen Meagher - faculty) and the University of Lethbridge (Joy Morris - faculty). This workshop had 6 invited speakers who gave 1 hour plenary talks and 10 speakers who gave 15 minutes contributed talks. Contributed talks were mostly given by junior researchers (postdocs and graduate students). There was also a round of 3 minutes talks on open problems. This workshop attracted about 60 participants.
The Summer Workshop In Mathematics (SWIM) was held at the University of Manitoba in August 2022. The workshop presents material delivered in Mathematics courses at the University of Manitoba to early and middle years teachers and helps enhance their skills and background in Mathematics. Talks are given by instructors from the Department of Mathematics. This event had 11 participants. 05C50 Online is a virtual seminar about graphs and matrices held twice a month on Fridays via Zoom. This is organized by Stephen Kirkland and Hermie Monterde (University of Manitoba).

UNIVERSITY OF WASHINGTON

PIMS activities at the University of Washington (both in person and online) are growing rapidly boosted by funding from the Simons Targeted Grants to Institutes Programs. Highlights include supporting salary supplements and travel funding for PIMS-Simons postdocs in mathematics, applied mathematics, and statistics. UW faculty have organized a series of high-quality scientific events which PIMS has been delighted to support, including (but not limited to) a conference on Combinatorial, Computational, and Applied Algebraic Geometry (in celebration of UW PhD alumnus Bernd Sturmfels); a Conference on Random Matrix Theory and Numerical Linear Algebra; and the Western Algebraic Geometry Seminar. PIMS also continues to help support the UW-PIMS Mathematics Colloquium, the Math Across Campus public lecture series, and a new interdisciplinary Distinguished Seminar in Optimization and Data.

Postdoctoral Fellows

Each fall, the Pacific Institute for the Mathematical Sciences (PIMS) invites nominations of outstanding young researchers in the mathematical sciences for postdoctoral fellows for the following year. Candidates must be nominated by a mathematical scientist (broadly construed) or a department at a PIMS Member University. The fellowships are intended to supplement support provided by the sponsor, and are tenable at any of PIMS' Canadian member universities: Simon Fraser University, the University of Alberta, the University of British Columbia, the University of Calgary, the University of Lethbridge, the University of Manitoba, the University of Regina, the University of Saskatchewan, and the University of Victoria. In addition, each one of the PIMS' Collaborative Research Groups and Research Networks is allocated a number of PDFs, the selection of which is determined by an assessment panel. Thanks to the support of the Simons Foundation, the PIMS-Simons Postdoctoral award is a salary supplement awarded to excellent candidates from any of the PIMS universities. PIMS PDFs are required to attend an orientation at the beginning of their term and to present their work at the Emergent Research Seminars.

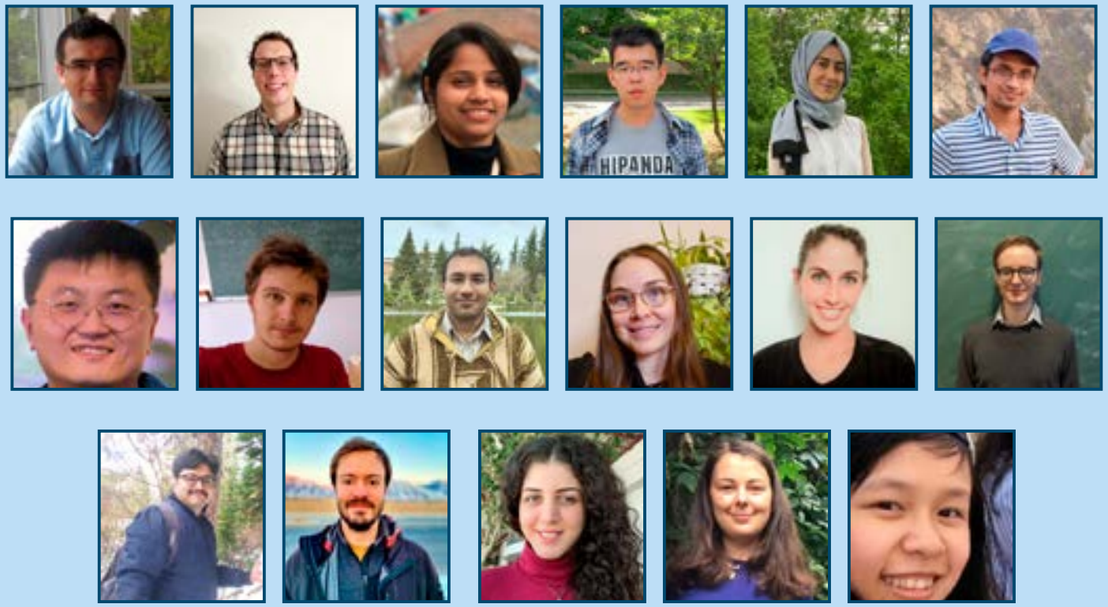
2022 Postdocs

Andrii Arman (UManitoba)
Félix Baril Boudreau (ULethbridge)
Jyoti Bhadana (UAlberta)
Shiping Cao* (UWashington)
Fatma Çiçek (UNBC)
Nabarun Deb (UBC)
Guodong Gai (UBC)
Timon Salar Gutleb* (UBC)
Mohammad Jabbari (URegina)
Jane Shaw MacDonald (SFU)
Amrei Oswald* (UWashington)
Cintia Pacchiano (UCalgary)
Nicholas Rouse (UBC)
Kumar Roy (UVictoria)
Matthew Rupert (USaskatchewan)
Mahsa Nasrollahi Shirazi (UManitoba)
Kristyna Zemkova (UAlberta/UVictoria)
Xiaowen Zhu* (UWashington)

***PIMS-Simons PDF**

2022 PIMS Postdocs*

*in alphabetical order



Featured Postdoctoral Fellow: Mahsa Shirazi

Postdoctoral Researcher at the University of Manitoba

Mahsa N. Shirazi is currently doing her postdoctoral fellowship at the University of Manitoba. She completed her bachelor's and master's degree at the Shiraz University of Technology in Iran. Mahsa didn't always know she would become a mathematician; she spent a lot of time in her third year as an undergraduate deciding whether to pursue mathematics or fine arts. "I liked them both very much", she admits. Eventually, she chose a math major, but it wasn't until her graduate studies where, for the first time, she had a taste of conducting research, and realised she had made the right choice. Mahsa's growing interest in linear algebra and graph theory led her to connect with other researchers in the area. She reached out to Profs. Shaun Fallat and Karen Meagher (URegina) after reading their papers and becoming intrigued with their research work. Currently, her interest in mathematics is centred around the world of graph theory, where she conducts her postdoctoral research under the supervision of Karen Gunderson (UManitoba). We connected with Mahsa to learn more about her academic work, and what life in Winnipeg has been like so far.

Tell us about your academic journey; what field are you in and how did you connect with your current PDF supervisor Karen Gunderson at the University of Manitoba?

My research interests lie primarily in graph theory, matrix theory, and combinatorics. These three areas are tightly connected and complement each other. I am fascinated by the fact that one can understand and solve a graph theory problem by exploring the corresponding matrix problems and vice versa. I began my PhD program in 2018 after connecting with Profs. Shaun Fallat and Karen Meagher (URegina), where I concentrated more on algebraic graph theory. In a main research project, I used graph theory to answer a family of questions that arise in Design theory. In particular, her thesis was on extensions of the famous Erdös-Ko-Rado (EKR) theorem to perfect matchings and uniform set partitions. Such results give the size and structure of the largest set of t-intersecting objects. Our results can be found in two published papers and a submitted article: "The Erdös-Ko-Rado theorem for t-intersecting families of perfect matchings", with Shaun Fallat and Karen Meagher, "An extension of the Erdös-Ko-Rado theorem to uniform set partitions", with Karen Meagher and Brett Stevens, and " An extension of the Erdös-Ko-Rado theorem to set-wise 2-intersecting families of perfect matchings" (single-author).

In addition, as part of the Discrete Math Research Group (DMRG) of the University of Regina, I have done some research work on combinatorial matrix theory. An interesting question in spectral graph theory is about the structure of the eigenvectors of matrices associated with graphs. In one of our projects, we studied graphs for which their Laplacian matrix can be diagonalized with a weakly Hadamard matrix. The results can be found in the paper, "Weakly Hadamard Diagonalizable Graphs".

Around that time, I also attended different conferences and workshops, including the "7th Graph Searching in Canada" (GRASCan) workshop in Regina. I first met my current postdoctoral fellowship supervisor, Karen Gunderson, at GRASCan, who gave a wonderful talk on "Finding small percolating sets". I had several more encounters with Prof. Gunderson at different conferences (both online and in-person), and by the time my graduation was coming around, she informed me about an opening for a postdoctoral position with the PIMS CRG on Movement and Symmetry on Graphs. I took my chance to apply for the position and got an offer!

In our current project, Karen and I are working on a special type of strongly regular graphs called friendship graphs. Also, as part of the DMRG group, I am able to collaborate with Karen Gunderson, Karen Meagher, and Joy Morris, where we are working on an extremal graph theory problem related to the EKR problem.

Are you teaching this semester, or did you do so in the previous semester? If so, what courses did you teach? What was the experience like, and was there anything you learned or took from it?

I taught a course in Combinatorics (of course, my favourite topic to teach!) in Fall 2022. This was the first semester after COVID-19 at the University of Manitoba and classes were starting to be held in person again. Teaching the course in person was a nice experience; it was fun to see the reactions on the students' faces when they finally understood a topic. I was lucky to have active students as well; one of them, Karan, ended up doing a project as part of the PIMS Virtual Experimental Math Lab (VXML) program. This semester, I am co-supervising Karan and another student, Anu (an undergraduate student from the University of Saskatchewan), with Raghu who is also a postdoctoral fellow at the University of Regina.

Research talks from PIMS Postdocs can be found on **www.mathtube.org**.

PRIMA 2022 Highlights

With support from its funding partners and title sponsor the Quantum Algorithms Institute, PIMS hosted the *Pacific Rim Mathematical Association (PRIMA)* 2022 Congress, bringing together hundreds of mathematical scientists from around the Pacific Rim. The PRIMA Scientific Committee was chaired by PIMS co-Director, International, Jayadev Athreya, and Professor Bobby Wilson of the University of Washington.

Participants at the 2022 PRIMA Congress. Left to Right: PRIMA Scientific Committee Co-Chair, Bobby Wilson (UWashington) and Jayadev Athreya (UWashington); Plenary speaker, Isabel Hubard (UNAM); Erin Griffin (Seattle Pacific University) at the Early Career Research Chowcase; Shouhei Honda (Tohoku University) at the Geometric Analysis Special Session, and Plenary speaker Yang Wang (HKUST).

Participants at the 2022 PRIMA Congress. Left to Right: PRIMA Opening Reception at the UBC Museum of Anthropology (MOA); Akina Kuperus (UVictoria) at the Early Career Research Showcase; PIMS Director Ozgur Yilmaz; Congress speaker Narutaka Ozawa (Kyoto University); Musqeum Elder, Jewel Thomas presenting at the PRIMA 2022 Opening Ceremony; SageMath representative Blaec Bejarano at PRIMA Career Fair; PRIMA participant and volunteer Matt Spragge (SFU).

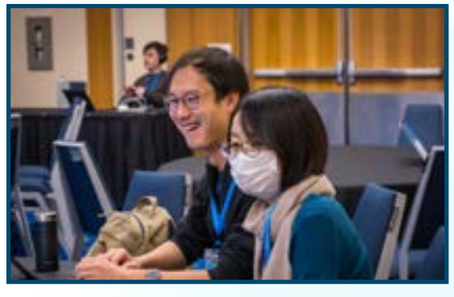


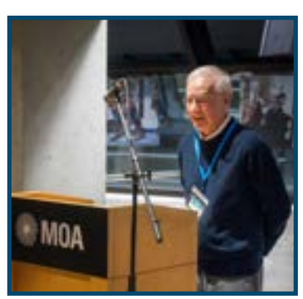




Left to Right: Plenary Speaker, Ciprian Manolescu; PIMS PDF Reinier Kramer (UAlberta); PIMS Board Chair, Engin Ozberk; Indigenous Mathematicians Forum; PIMS Co-Director Industry, Kristine Bauer; QAI CEO Louise Turner, Special Session Speaker, Yokinobu Toda (Kavli IPMU, University of Tokyo) and participants at the congress.








Left to Right: Congress Dinner opening address; UBC Vice President Research, Gail Murphy; Boeing Representative, Mel Kelly; NSERC President, Alejandro Adem; participants at the congress; PRIMA Co-Founders Nassif Ghoussoub (UBC) and Doug Lind (UWashington); session participant, Jim Bryan (UBC), Public Speaker, Minhyong Kim (University of Warwick), Plenary Speaker Katherine Stange, and PIMS Education Coordinator Melania Alvarez, with Musqueam Elder, Jewel Thomas.

2022 Prizes & Awards

CRM-Fields-PIMS Prize
Bálint Virág, University of Toronto

Professor Virág was awarded this prize for his exceptional contributions to mathematical research, more specifically in the area of probability. His research has spanned a wide range of cutting-edge areas of probability, including random matrix theory, Kardar-Parisi-Zhang (KPZ) universality, random sorting networks and more. Referees cited the introduction of the "Brownian Carousel", by Virág and his former postdoc, Valkó, to describe the distribution of the point process arising from the collection of eigenvalues of large random matrices, noting its beauty and its fruitfulness in terms of leading to new results and links between probabilistic objects. Referees also point to his recent papers with his former graduate student, Duncan Dauvergne, and others on the "Directed Landscape", which is a probabilistic model arising as the limit of last passage percolation, expected to appear as the limit of all KPZ models.

PIMS Education Prize
Sean Graves, University of Alberta

Sean Graves is a faculty lecturer in the Department of Mathematical and Statistical Sciences and the Coordinator for the Decima Robinson Support Centre at the University of Alberta. A lecturer since 2011, he has received numerous awards from the University of Alberta for his teaching and service. In 2017, he was awarded the William Hardy Alexander Award for Excellence in Undergraduate Teaching. Graves has also been the lead organizer for University of Alberta's "SNAP Math Fairs" each year since 2007, and a co-organizer of the Canadian Mathematics Society's "Alberta Math Summer Camp," for students aged 12-15 years.

The selection committee was extremely impressed by his energy and enthusiasm towards teaching, and the impact of his work developing mathematical talent through outreach.

UBC/ PIMS Early Career Award
Josh Zahl, University of British Columbia

Dr. Josh Zahl, is the recipient of the 2022 UBC - PIMS Mathematical Sciences Young Faculty Award.

Dr. Zahl is an associate professor at UBC and works in several fields of mathematical research: discrete mathematics, harmonic analysis, and geometric measure theory moving effortlessly between these fields. He has made useful and important contributions to the Kakeya problem as well as other problems in combinatorics and analysis. Zahl completed his Ph.D. in 2013 at UCLA; was an NSF postdoctoral fellow at MIT from 2013-2016; and joined the faculty at UBC in 2016. Outside of math, he explores the BC coast mountains.

CAIMS PIMS Early Career Winner
Elina Robeva, University of British Columbia

Prof. Elina Robeva of the University of British Columbia is awarded the 2022 CAIMS/PIMS Early Career Award in recognition of her deep contributions in the intersections of mathematical statistics, applied algebraic geometry, and machine learning, and for novelty and breadth of applications in tensor decompositions, density estimation, and the study of diffraction-limited superresolutions.

PIMS Industry Highlights

Math to Power Industry (M2PI)

PIMS and our partners have offered the Math to Power Industry (M2PI) workshop every summer for the past two years. This workshop trains young mathematical scientists for jobs in important industry sectors in Canada. The program begins with an intensive training program (software best practices, business and communications, and project management) and includes group collaborations with industry partners and academic mentors.

In 2022, PIMS hosted the third M2PI workshop online. This year 9 teams of problem solvers, academics and industry professionals worked together to demonstrate the power of the mathematical sciences in advancing solutions to problems that are valuable to Canada's economy. Our 2022 industry partners were: **Aerium Analytics**, **Awesense**, **Big River Analytics**, **Cedar Academy Society**, **Environmental Instruments Canada**, **Ioto**, **Novion**, **Natural Resources Canada** and **Perfit**.

PIMS-University of Calgary Lunchbox Lectures

In Calgary, the Lunchbox Lectures enable busy professionals to learn the latest developments from PIMS scientists. In 2022, two speakers presented lectures at the Downtown campus: Dr. Quan Long for "Transfer Learning for Machine Learning with Applications", and Dr. Wilten Nicola for "Spiking Networks and Neuromorphic Computing". PIMS would like to give special thanks to Carrie Ragan (University of Calgary) for helping organize the talks.

PIMS Online Programs

Network-wide Colloquium Series

Starting in 2021, PIMS inaugurated a high-level network-wide colloquium series. Distinguished speakers gave talks across the full PIMS network, with one talk per month during the academic term. The series continues to be a steady feature of our online programming. Pictured above are the 2022-23 speakers, whose talks are listed below.

- January 20, 2022 - Monge-Kantorovich distance and PDEs: Benoît Perthame, Laboratoire Jacques-Louis Lions, Sorbonne
- February 24, 2022 - Mathematician helping Art Historians and Art Conservators: Ingrid Daubechies, Duke University
- March 24, 2022 - Transcendental values of power series and dynamical degrees: Holly Krieger, University of Cambridge
- September 29, 2022 - Infinite patterns in large sets of integers: Bryna Kra, Northwestern University
- October 20, 20222 - AI for Science; and the Implication for Mathematics: Weinan E, Peking University

PIMS Network-wide Graduate Courses

These courses utilize the PIMS network to deliver a rich variety of graduate level courses in the mathematical sciences at PIMS member universities. This program benefits instructors by reaching a larger potential audience and students by offering a broader variety of courses. Students at PIMS sites can typically receive credit for the courses in this program through the Western Deans Agreement (some conditions and fees may apply). Instructors offering courses apply in the spring and fall, and if selected, meet with members of the PIMS Digital Collaboration Committee to discuss logistics and support. Selected courses are advertised throughout the PIMS network and may be eligible for course related expenses.

Courses were offered between Jan 1, 2022 and Dec 31, 2022 and included the following:

- Differential Equations in Algebraic Geometry: Charles Doran (University of Alberta)
- Explorations in Information Security and Privacy: Michael Jacobson, Jr. (University of Calgary)
- Extremal Combinatorics: Karen Gunderson (University of Manitoba), Karen Meagher (University of Regina), and Venkata Raghu Tej Pantangi (University of Lethbridge)
- High-Dimensional Geometric Analysis: Alexander Litvak and Vladyslav Yaskin (University of Alberta)
- Introduction to Algebraic Topology: Kristine Bauer (University of Calgary)
- Introduction to Mathematical Biology: Eric Cytrynbaum (University of British Columbia)
- Perturbation Methods for Partial Differential Equations and Applications: Michael Ward (University of British Columbia)
- Theory of Probability and Applications: Donald Estep (Simon Fraser University)
- Mathematical Data Science: Lele Wang (University of British Columbia)
- Parallel Programming for Scientific Computing: Raymond Spiteri (University of Saskatchewan)
- Mathematical Modeling of Complex Fluids: James Feng (University of British Columbia)
- Optimal Transport + Biology: Geoff Schiebinger (University of British Columbia)
- Analytic Number Theory I: Habiba Kadiri (University of Lethbridge)
- OT+Bio - Single Cell Analysis: Geoff Schiebinger (University of British Columbia)
- Statistical Machine Learning for Data Science: Li Xing (University of Saskatchewan)
- Mathematical Models in Cell Biology: Leah Edelstein-Keshet (University of British Columbia)

Digital Collaborations

PIMS has developed expertise in cloud computing and, in partnership with **Compute Canada** and **Cybera**, launched the **JupyterHub** service for researchers and students in Canada and at the University of Washington. The Syzygy project enables staff, students and faculty members at Canadian higher education institutions to access Jupyter using their existing institutional credentials. Jupyter is a powerful open-source web application that facilitates collaboration on live code, equations, visualization and narrative text. Syzygy is deployed at 26 Canadian universities and the University of Washington. Syzygy has been used by over 46,000 people and is regularly used by thousands every day. Individual users are given a curated computational environment customizable to research, teaching, and training needs. By developing and making these computational resources accessible, PIMS has positively impacted the infrastructure for the mathematical sciences; for example, SFU Statistics uses Jupyter notebooks via Syzygy for roughly 500 students per term.

The **Callysto** project, created by PIMS in partnership with Cybera, uses the same architecture as Syzygy augmented with a rich set of interactive learning resources focused on training teachers and K-12 students in data science and computational thinking. Callysto has been used by over 80,000 students and 3,000 teachers, and the resources created are used and updated via an open source model. The CanCode program was recently renewed, and PIMs and Cybera have received funding to extend Callysto to 2024. The theme of the activities in 2022 was “Developing Responsible Digital Citizens”.

PIMS International Partnerships

PIMS - CNRS Collaboration

The Centre National de la Recherche Scientifique (National Center for Scientific Research) is a government-funded research organization, under the administrative authority of France's Ministry of Research. The PIMS - CNRS International Research Lab (IRL) has been championing the mutual exchange of knowledge since 2007. It builds and fosters collaboration in the mathematical sciences between Western Canada and France.

Flagship PIMS-CNRS Programs:

CNRS Visitors: Distinguished French researchers (at CNRS or a French university) spend the academic year at one of PIMS member universities and participate in research activities. PIMS hosted 41 visitors since 2007.

PIMS-CNRS Fellowship: This program supports faculty at PIMS member universities for long-term visits to France fostering collaboration.

PIMS–CNRS Student Mobility Program: This program is geared for senior undergraduates, graduates and postdoctoral scholars. Support is provided for 3-6 month student exchanges between PIMS member universities and universities/eligible institutions in France.

PIMS-CNRS Postdoctoral Fellowships: This award is targeted to applicants that are French, or who have completed their PhD degree in France. Sine 2007 PIMS has awarded more than 25 PIMS - CNRS Postdoctoral scholarships.

L - R: Charlotte Montel, the Science Advisor in the French Cosular office, Dr. Chantal Barin, Science and Higher Education Attaché, PIMS Director Ozgur Yilmaz, and PIMS UBC Site Director, Brian Marcus.

The **PIMS-CNRS IRL #3069**, originally signed in 2007 and renewed in 2019, has been an integral component of efforts to facilitate and encourage research collaborations between mathematical scientists at PIMS member universities in North America and researchers across France.

Education Overview

PIMS sponsors and coordinates a wide assortment of educational activities. We are dedicated to **increasing public awareness** of the importance of mathematics and want young people to see that mathematics is a subject that opens doors to **careers in science, industry and many other exciting fields.**

PIMS believes that **training the next generation of mathematical scientists** and **promoting diversity within mathematics** cannot begin too early. From its inception, PIMS has supported educational initiatives, including:

- Organizing interesting, fun and challenging math events for children of all ages.
- Facilitating access to information about math education matters to parents, teachers and university faculty. (Newsletters, workshops, conferences, special publications, etc.)
- Coordinating workshops to facilitate communication between parents, teachers, mathematicians and math educators.
- Publishing Pi in the Sky, a math magazine for high school students, to promote mathematics, increase the involvement of high school students in mathematical activities, and promote careers in mathematical sciences.
- Holding the Elementary Math Contest (ELMACON) for grades 5-7 students.
- Organizing a series of mathematical events in schools (Math Fairs in Alberta and Math Mania in B.C.).
- Supporting Math on the Move in rural Saskatchewan.
- Hosting the annual Changing the Culture conferences for school teachers.

PIMS promotes numeracy and mathematical education in First Nations communities. At the request of several First Nations schools, we organize week-long teacher training sessions. We have also developed a mentorship program where faculty and students from local universities pair with school teachers to assist in their mathematical training and provide a support network.

Changing the Culture: May 20

The annual Changing the Culture Conference, organized and sponsored by the Pacific Institute for the Mathematical Sciences, brings together mathematicians, mathematics educators and school teachers from all levels to work together towards narrowing the gap between mathematicians and teachers of mathematics, and between those who do and enjoy mathematics and those who think they don't. Changing the Culture has been held every year, in person, at SFU Harbour Centre in Vancouver. Due to pandemic restrictions, the 2020 -2022 conferences were held online—more than 100 educators joined via Zoom.

2022 PIMS Math Summer School for Elementary Teachers: July - August.

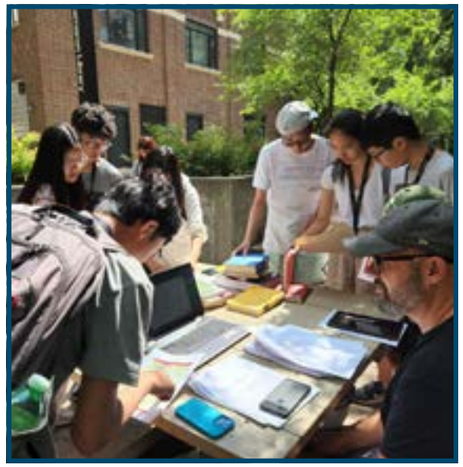
Throughout the month of July, elementary school math teachers from districts all over BC met with PIMS Education Coordinator, Dr. Melania Alvarez, and UWaterloo Lecturer, Cameron Morland. Together they practiced various exercises, shared ideas, and watched videos — all for the purpose of getting their students hyped on mathematics. For many of the teachers the journey over five weeks was hard and intense, and allowed them to develop new ways of mathematical thinking in their personal lives as well as teaching schedules. A favorite was the "crazy-fun arts and crafts activities" that actually contain sophisticated math concepts. Compass arts, origami, popsicle stick mysteries, pattern-hunting with Pascal's triangles, and cellular automata fun — to name just a few. Jo-Ann Chiu, one of the participants, was inspired to learn that what she does now in the primary years will make a long-term impact on students even when they go on to high school and university, and, if they choose, employment in industry.

Jo-Ann Chiu - Participant

My biggest transformation has been switching from teaching a linear curriculum to teaching a spiral curriculum. For example, I am planning on starting every Monday with a number families focus that will be referred to for the entire week, and teach numeracy in a more integrated way, such as addition and subtraction simultaneously. Then, finishing the week with combination geometry-art activities. I have also learned great open-ended math activities that can be added to students' choices of math centres. I think students will enjoy those activities so much that they may even choose to do them during their spare time— and practise sophisticated math concepts at the same time. Some of my favourites that I learned from this course are: Pattern-hunting with Pascal's triangle, cellular automata arts, maximum-length sequencing using beading crafts, and origami.

CMS-PIMS Regional Math Camp (July 31 - August 7).

The **2022 CMS Regional Math Camp** (Alberta) took place at the University of Alberta between July 31 and August 7. The summer camp brought together mathematically inclined school students in Alberta with the goal of providing opportunities for networking and training in mathematics and mathematical problem solving. With the organizational support of Sean Graves, University of Alberta, around 30 students in grades 7 to 10 participated at this year's activities which were designed to foster individual and collaborative problem solving. The format gave all participants time to think, interact, discuss common interests, and promote collaboration.



CMS-PIMS Regional Math Camp (Summer 2022)

2023 Outlook

PIMS events and activities to look forward to in 2023 include:

April: New PIMS Research Network: Kantorovich Initiative

PIMS Research Networks (PRNs) are large scale collaborations between academic, industrial and public sector partners. These partnerships are intended to help the mathematical science community address grand challenges such as the ongoing climate emergency, sustainable resource management, resilience to future epidemics and fairness and justice in human society. We are excted that our first PRN, the Kantorovich Initiative will be launched in April 2023.

April - October: PIMS Action on Climate Thematic Summer (PIMS ACTS)

In the summer of 2023 PIMS will host a thematic period focusing on the mathematics of climate, renewable and clean energy. Activities include:

PIMS Summer School on Forecasting and Mathematical Modeling for Renewable Energy: We will host students at the University of Calgary for training in key methodologies for forecasting and mathematical modeling of renewables.

Workshop on Mathematical Methods in Renewable Energy: Hosted at PIMS UBC, this workshop will bring together more than 50 particpants to discuss mathematical modelling of climate change.

FACTS Panel on Climate Change: This public event will bring together five panelist to discuss climate change and the movement towards renewable energy. It will be held on July 27th, 2023 at UBC Robson Square.

M2PI special focus on climate and clean energy: We are currently inviting non-academic partner organizations to consider participation in this workshop from July 10- 31. M2PI 2023 is green-themed! We are particularly interested in problems involving energy diversification, clean tech, problems related to climate change and other problems in the realm of climate resilience.

April - October: Mathemalechemy Exhibition

Conceived in early Fall 2019, as the brainchild of mathematician Ingrid Daubechies and fiber artist Dominique Ehrmann, the Mathemalchemy project became in 2020 an exciting collaborative enterprise, driven by the energy and enthusiasm of twenty-four mathematical artists and artistic mathematicians. After more than a year of meeting only remotely (because of the Covid pandemic) and fabricating components in their separate locations, they met in the summer of 2021, all duly vaccinated, and built a large multimedia art installation that celebrates the creativity and beauty of mathematics.

The Exhibition will be at the Beaty Biodiversity Museum at UBC, from April 1 to October 31, 2023. A **Public talk and opening reception with Ingrid Daubechies and Dominique Ehrmann will take place on April 1.**

2023 Event Highlights

SEMINARS, CONFERENCES & WORKSHOPS

1 January – Ongoing	**Geometry, Algebra & Physics (GAP) Seminars** University of Saskatchewan
1 January – Ongoing	**Optimization Seminar Series** University of Washington
1 January – Ongoing	**Scientific Computing & Applied Industrial Math (SCAIM) Seminar Series** University of British Columbia
18 - 21 January	**Testing Gravity 2023 (TG 2023) Conference** Simon Fraser University
25 January - 31 May	**Emergent Research: The PIMS PDF Seminar Series** Network Wide - Online
16 February	**PIMS Network Wide Colloquium: Helen Byrne (Oxford)** Network Wide - Online
18 - 19 March	**Canadian Western Algebraic Geometry Symposium** Simon Fraser University
23 March	**PIMS Network Wide Colloquium: Alessio Figalli (ETH Zürich)** Network Wide - Online
4 - 5 May	**Alberta Mathematics Dialogue (AMD) 2023** Mount Royal University
22 - 26 May	**Computational and Mathematical Population Dynamics 6** University of Manitoba & University of Winnipeg
27 - 28 May	**Western Canada Linear Algebra Meeting** University of Regina
5 - 8 June	**Canadian Discrete and Algorithmic Mathematics (CanaDAM) 2023** University of Manitoba & University of Winnipeg
9 - 11 June	**Alberta Montana Combinatorics and Algorithm Days** Banff International Research Station
12 - 16 June	**Hodge Theory, Mirror Symmetry, and Physics of Calabi-Yau Moduli** Heidelberg University
7 - 9 July	**Statistical Data Science Conference** University of Victoria
26 - 28 July	**Mathematical Methods in Renewable Energy** University of British Columbia - Vancouver
27 July	**FACTS Panel on Climate Change** University of British Columbia - Robson Square

SUMMER SCHOOLS

29 May – 9 June	**PIMS CRG Summer School on Forecasting and Mathematical Modeling for Renewable Energy** University of Calgary
12 - 23 June	**Data Science Boot Camp** University of Saskatchewan

COLLABORATIVE RESEARCH GROUPS

2020 – 2024	Novel Techniques in Low Dimension: Floer Homology, Representation Theory & Algebraic Topology
2020 – 2024	Quantum Topology and its Applications
2021 – 2023	Pacific Indterdisciplinary Hub on Optimal Transport
2021 – 2024	Movement & Symmetry in Graphs
2022 – 2025	L-Functions in Analytic Number Theory
2023 - 2026	Forecasting and Mathematical Modeling for Renewable Energy

PIMS RESEARCH NETWORKS

2023 - 2026	Kantorovich Initiative

INDUSTRY EVENTS

10 - 31 July	**Mathto Power Industry Workshop** Online

K-12 EDUCATION EVENTS

29 April	**Elementary Math Contest (ELMACON)** University of British Columbia - Vancouver
13 May	**ScienceRendezvous.ca** PIMS Sites Canada-wide
12 May	**Changing the Culture** Simon Fraser University
July	**Math Summer School for Elementary Students** University of British Columbia - Vancouver

MATHEMATICS & ARTS

April - October	**Mathemalchemy Exhibition** University of British Columbia - Vancouver

For more information and updates, visit www.pims.math.ca

Pacific Institute *for the* Mathematical Sciences

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