

# Pacific Institute *for the* Mathematical Sciences

Year in Review 2023



Photo by Landon Parenteau



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  
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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, Athabasca University and First Nations 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).

Our mandate is to promote research in the mathematical sciences and their applications, to facilitate the training of highly qualified personnel, to create an equitable, diverse and inclusive community, to enrich public awareness of and education in the mathematical sciences, and to create mathematical partnerships with similar organizations in other countries (with a particular focus on the Pacific Rim). PIMS funds Research Networks, Collaborative Research Groups, Post-Doctoral Fellowships, seminars and other individual events on a competitive basis. PIMS activities are funded by the Natural Sciences and Engineering Research Council of Canada (NSERC), Simons Foundation, Prairies Economic Development Canada, member universities and by private donors.

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 administrator 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

**2023** saw exciting developments in new partnerships, programs and activities, while simultaneously renewing our commitments to our existing partners and continuing to deliver excellent programs.

It was an especially active year with a range of scientific events, novel programs, and notable achievements in education and outreach.

PIMS designated Summer 2023 as the “PIMS Action on Climate Thematic Summer” (PIMS ACTS) in recognition of the profound role the Mathematical Sciences play in tackling humanity’s major challenges. This period was marked by a host of activities including a two-week summer school on renewable energy, a green-themed Math to Power Industry (M2PI) workshop for graduate students and postdoctoral fellows, and a technical workshop on the mathematics of renewable energy. The workshop, organized by the recently formed “Forecasting and Mathematical Modelling for Renewable Energy” Collaborative Research Group (CRG), was followed with a public panel on climate change. The event was jointly organized by PIMS and the French Embassy in Canada as part of the “French-Ameri-Can Climate Talks” (FACTS) that have been held throughout North America in the past decade. These activities have created new collaborations, and we are looking forward to upcoming events that will further the momentum generated by PIMS ACTS.

In addition to the Forecasting and Mathematical Modeling for Renewable Energy CRG, we inaugurated our first PIMS Research Network (PRN) “The Kantorovich Initiative” which fosters collaboration between mathematical scientists at UW, UBC, UA, and SFU, and more broadly across the network. We are also thrilled to announce an upcoming launch of another PRN, “The Maud Menten Institute”, in mathematical biology, and a new CRG called “Structure-Preserving Discretizations and their Applications” in applied mathematics, which is set to begin in April 2024.

In Fall 2023, we welcomed a CNRS delegation for a site visit, where we showcased the activities of the PIMS-CNRS International Research Lab (IRL#3069) and our plans for expanding and deepening collaborations among mathematical scientists in PIMS Universities and in France. We hosted an inaugural PIMS Day, an online event that was part of our annual Directorate Open House and including presentations from PIMS CRGs, PRNs, and PIMS Postdoctoral fellows (PDFs), each of whom highlighted some of the cutting-edge research conducted throughout the PIMS community. In October, we also held our first in-person Scientific Review Panel meeting since the onset of the pandemic.

2023 also marked the first awards for the PIMS/ BIRS Team Up program. Successful applicants will spend two weeks at the Banff International Research Station with their research teams. This program specifically aims to assist groups that are often underrepresented or disadvantaged in the field, including women, gender-expansive individuals, members of minoritized groups, Indigenous scholars, and those with visible or invisible challenges. Early-career researchers with limited resources are also a particular focus of the program.

The PIMS network continues to grow in 2023. We are delighted that First Nations University (FNUUniv) has joined PIMS as an Affiliated Member. FNUUniv is dedicated to enhancing the quality of life and preserving, protecting, and interpreting the history, language, culture, and artistic heritage of First Nations. The FNUUniv-PIMS partnership will enable both organizations to collaborate in supporting Indigenous-led initiatives in the mathematical sciences, aligning with the principles of reconciliation. Special thanks to Prof. Edward

Doolittle of FNUUniv for his contributions to this exciting development!

Between April 1 and October 31 of 2023, PIMS hosted the Mathemalchemy Exhibit at the Beaty Biodiversity Museum at UBC. Created by Ingrid Daubechies, a prominent world-leading mathematician, and Dominique Ehrmann, a Canadian fiber artist, and in collaboration with a team of more than 20 other artists and scientists, Mathemalchemy is a unique and collaborative art exhibit exploring the beauty of mathematics (which includes art inspired by the research of PIMS Co-Director, International, Jayadev Athreya). We were happy to have Ingrid Daubechies and Dominique Ehrmann join the opening event for Mathemalchemy to deliver a talk and provide a tour of the exhibit.

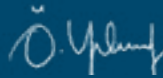
Our online programs are focused on building community, and include features such as the Emergent Research PDF Seminar, the Network-Wide Colloquium with invited distinguished researchers from around the world, Network-Wide graduate courses, First-Year Interest Group (FYIG) and Virtual Experimental Mathematics Lab (VXML) programs, and the Math to Power Industry Workshop (M2PI) featuring teams of graduate students, postdoctoral fellows and industry mentors. All of these events continue to grow and be models for collaboration across a distributed institute.

## Looking Forward.

In 2024, PIMS will continue focusing on grand challenges facing humanity. We are excited about two upcoming collaborative events with our international partners. The first is the France-Western Canada Workshop on Ocean and Polar Sciences, focusing on the role of mathematical sciences in these fields. This workshop is co-organized by PIMS, the Centre National de la Recherche Scientifique (CNRS), and the Consulate General of France in Vancouver, and will host prominent scientists from Western Canada and France. Shortly after, we will co-host together with the International Centre for Mathematical Sciences (ICMS) in Edinburgh the PIMS-ICMS Twinned Lectures “Land and Sea”: Mathematics of the Climate Crisis. This hybrid event will have a special format: it will feature an in-person talk by Rashid Sumaila (UBC) at the PIMS Central Office in Vancouver, an in-person talk by Emily Shuckburgh (Cambridge) at ICMS in Edinburgh, and a trans-continental Q&A period where the speakers and audiences in both locations will have the opportunity to interact.

On a different note, we are also looking forward to our first PIMS PDF Summit, which will bring together PIMS Postdoctoral Fellows from all PIMS Universities. This will give the PIMS PDF cohort an opportunity to showcase their research and expand their networks, leading to new collaborations. We will also have our first PIMS Industry Day, which will give M2PI graduates a chance to showcase their work at an in-person event and network with industry members.



  
Özgür Yılmaz  
PIMS Director



  
Jayadev Athreya  
Co-Director, International



  
Kristine Bauer  
Co-Director, Industry

## PIMS Becomes a New Partner at the Joint Mathematics Meeting (JMM)

The Centre de recherches mathématiques (CRM), the Pacific Institute for the Mathematical Sciences (PIMS), and the Atlantic Association for Research in Mathematical Sciences (AARMS) signed a joint long-term partnership agreement with the American Mathematical Society (AMS) to organize a plenary address and an associated special session at the Joint Mathematics Meeting (JMM), beginning in 2024.

The first CRM-PIMS-AARMS invited address will be given by **Henri Darmon (McGill University)** at JMM 2024. Professor Darmon's talk will be on **"Fourier coefficients of modular forms"**.



## First Nations University joins PIMS as an Affiliate Member

The Pacific Institute for the Mathematical Sciences (PIMS) is pleased to announce that First Nations University (FNU) has joined PIMS as an Affiliated Member. FNU is dedicated to enhancing the quality of life and preserving, protecting, and interpreting the history, language, culture, and artistic heritage of First Nations. This partnership with PIMS will enable both organizations to collaborate in support of Indigenous-led initiatives in the mathematical sciences, aligning with the principles of reconciliation.



"The partnership with FNU is distinctive because the field of mathematical sciences, as an encompassing discipline, has much to gain from Indigenous ways of knowing," noted PIMS Director Özgür Yılmaz. "The depth of knowledge from leading Indigenous Mathematicians aligns with PIMS values, and this partnership will provide FNU with support from several of PIMS' strategic programs."

## New Site Director at Simon Fraser University: Professor Razvan C. Fetecau



In August, PIMS welcomed Professor Razvan C. Fetecau as the new Site Director at Simon Fraser University. A professor within the Department of Mathematics at SFU, Prof. Fetecau's primary research is in the

general area of nonlinear differential equations with particular interests in mathematical models for self-collective and swarming behavior. He has been actively involved in various PIMS activities for more than 10 years. PIMS is grateful to Professor Weiran Sun, whose work as Simon Fraser University's Site Director has been commendable.

## PIMS Action on Climate Thematic Summer (PIMS-ACTS)

PIMS designated the 2023 summer as the **Action on Climate Thematic Summer (PIMS-ACTS)**. The program helmed several events that took place during this time, with a particular focus on the ongoing climate emergency. The role of mathematics in understanding the challenges faced and finding solutions was highlighted. These events spanned several areas of the PIMS mandate and included events such as: *FACTS Public Panel on Climate Change*; *Math to Power Industry 2023 (M2PI 2023)*; *PIMS CRG Summer School on Forecasting and Mathematical Modeling for Renewable Energy* and; *Workshop on Forecasting and Mathematical Modeling for Renewable Energy*.

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.

### Kantorovich Initiative: 2023 - 2026

The Kantorovich Initiative is dedicated towards research and dissemination of modern mathematics of optimal transport towards a wide audience of researchers, students, industry, policy makers and the general public. Recent key events include the 2022 PIMS-IFDS-NSF Summer School on Optimal Transport, and an upcoming 2024 summer workshop called Women in Optimal Transport.

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.

### 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 focus is 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, which encode arithmetic information and have connections with a host of other mathematical fields, including algebraic number theory, harmonic analysis, probability and representation 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.

### Forecasting and Mathematical Modeling for Renewable Energy: 2023-2026

Wind and solar energy are expected to be the primary sources of electricity in the future. Both wind and solar power are stochastic and intermittent as they are weather driven. The main purpose of this CRG is to develop meso, submeso and micro scale forecast methods for wind and solar power and create quantitative tools to support a wide range of decision-making problems related to wind and solar power systems and their integration to the power grid and electricity markets.

# 2023 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

### Site Director: Dr. Anthony Quas



UVic has strongly benefited from the CNRS connection: Tahar Boulmezaouad, a Professor from Versailles, spent 6 months at UVic in 2023; Boualem Khouider was awarded a Poste Rouge (a 3 month visit to France). Three PIMS Postdocs were at UVic during the current year: Natalie Behague, Kesav Krishnan and Kristyna Zemkova. Adam Monahan (Assoc. Dean Science and Earth Sciences) and Slim Ibrahim are leaders of a CRG in Mathematical Modeling for Renewable Energy; Ryan Budney is a leader of a CRG on Novel Techniques in Low Dimension: Floer Homology, representation theory and algebraic topology. PIMS has supported workshops on statistics and combinatorics this year, and is currently supporting 5 seminar series, including the Mathematics of Ethical Decision Making, hosted in Computer Science.

## UNIVERSITY OF BRITISH COLUMBIA

### Site Director: Dr. Brian Marcus



In 2023, the UBC PIMS site, both Vancouver and Okanagan, hosted a wide variety of activities, from almost every category of PIMS supported scientific events. This included seminars, workshops, postdoctoral fellows, collaborative research groups, and distinguished visitors. One highlight consisted of two intertwined events, a workshop on Forecasting and Mathematical Modelling for Renewable Energy and a public panel on Tackling Climate Change and the Just Transition to Renewable Energy. These events were two components of the PIMS Action on Climate Thematic Summer (PIMS ACTS), a whirlwind of activity, that also included a Summer School on Renewable Energy at the University of Calgary and climate-themed projects in the annual Math to Power Industry (M2PI) workshop. The workshop brought together practitioners from mathematics, statistics, computer science, engineering, atmospheric sciences, and economics to showcase a wide spectrum

of quantitative research problems to support the design and operation of wind and solar power systems and their integration to the power grid and electricity markets. Presentations covered a broad range of space and time scales, from individual wind turbine scale to provincial scale and from minutes to years. The public panel, which was jointly sponsored by the French embassy, was attended by about 150 people from the workshop, UBC community and the general public. It featured an afternoon of short talks by each of five eminent Canadian and French leaders representing climate science, renewable energy, economics, public policy, and Indigenous affairs. This was followed by an evening public panel discussion moderated by CBC journalist Laura Lynch and concluded with a highly interactive and exciting session for the public to meet the panelists.

## SIMON FRASER UNIVERSITY

### Site Director: Dr. Razvan C. Fetecau



In 2023 SFU continued to hold the four seminars previously supported by PIMS: Discrete Mathematics Seminar, Operation Research

Seminar, Number Theory and Algebraic Geometry Seminar, and Applied and Computational Mathematics Seminar. The latter has recently been renamed in fact Mathematics of Computation, Application and Data (MOCAD) Seminar. SFU also hosted several PIMS-supported conferences and meetings: Coast Combinatorics Conference, Canadian Western Algebraic Geometry Symposium, and West Coast Optimization Meeting. During 2023 we had four PIMS postdoctoral fellows at SFU. On the Education side, PIMS supported the Changing the Culture conference, the Community Data Science program and SFU Math camps. Other activities and events supported by PIMS include the Women in Mathematics Day (May 12) and Vancouver Datajam. Faculty at SFU offered several PIMS network wide graduate courses (The Mathematics of Evolution, and Computer Algebra).

## UNIVERSITY OF CALGARY

### Site Director: Dr. Wenyuan Liao



During the year 2023, the University of Calgary continued our strong and diverse program, featuring many

high-profile PIMS activities. The 18th Richard & Louise Guy Lecture Series was given by Doris Schattschneider, Professor Emerita of Mathematics at Moravian University in Bethlehem. The 3rd PIMS-supported Math to Power Industry (M2PI) workshop, led by Dr. Kristine Bauer, was held during Summer 2023 (July 10-28, 2023). The 2023 Math Attack Summer Camp for Girls (organized by Lauren DeDieu, the recipient of the 2023 PIMS Education Prize, and Sean Graves) 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. Calgary also hosted the 10-day PIMS CRG summer school on Forecasting and Mathematical Modelling for Renewable Energy, which was organized by Dr. Deniz Sezer. In 2023, we welcomed Gregory Knapp, a PIMS PDF working with Dang Khoa Nguyen. PIMS Calgary continued to support prizes in Mathematics at the Calgary Youth Sciences Fair, which was held on April 22, 2023. The University of Calgary also hosted several PIMS-supported seminar series: Geometric Analysis Seminar organized by Dr. Tracey Balehowsky, Algebra & Number Theory Seminar organized by Dr. Dang Khoa Nguyen, and Biostats Seminar organized by Dr. Qingrun Zhang.



## UNIVERSITY OF ALBERTA

### Site Director: Dr. Thomas Hillen

The University of Alberta had the opportunity to benefit greatly from PIMS support during 2023. We have been able to support 7 PIMS postdocs, who work in very different areas of mathematics, and contribute significantly to our research. PIMS funds were also instrumental to host a series of conferences such as the Alberta Mathematics Dialogue at Mount Royal College, the 4th International Conference on Dynamics of Differential Equations at the Fields Institute in Toronto and the Conference on Hodge Theory, Mirror Symmetry, and Physics of Calabi-Yau Moduli in Heidelberg, Germany. Through PIMS support we were able to invite 4 leading experts to the Mathematical and Statistical Sciences Colloquium, 4 visiting speakers to the Mathematical Biology Seminar Series, and one distinguished speaker as part of the Kantorovich Initiative. PIMS educational activities are also an important part of our activities in 2023. We welcomed a new PIMS Educational Coordinator - Trevor Pasanen, and we

thank Sean Graves for his many years of service as the previous PIMS Educational Coordinator. PIMS educational activities include the James Math Circle Tutor in the Decima Robinson Support Centre, targeted primarily at keen junior high school students, the Undergraduate Student Outreach Event, geared toward undergraduate students associated with the Department of Mathematical and Statistical Sciences, the 2023 Alberta Graduate Mathematics and Statistics Conference held at the Barrier Lake Field Station in Kananaskis, and the 2023 MathBio Graduate Student Retreat at Pigeon Lake.

## UNIVERSITY OF LETHBRIDGE

### Site Director: Dr. Nathan Ng



This year there were Distinguished Speaker talks by Youness Lamzouri (IECL), Steven Rayan (U. Sask), Marni Mishna (SFU), Wenyuan Liao (Calgary), and Yu-Ru Liu (Waterloo).

In March we held a Math Fair for the community which attracted many children and their parents (organizers: Archibald, Ng). On May 12 Lethbridge hosted the Celebration of Women in Math event (organizer: Kadiri). This event included wonderful talks by Laleh Behjat (Calgary) and Kristine Bauer (Calgary) and a panel discussion on "Challenges for international mathematicians." There were active weekly hybrid seminars: Number Theory and Combinatorics Seminar (organizers: Baril-Boudreau, Elma) and the CRG L-functions seminar (organizers: Benli, Cicek, Elma). Alberta Number Theory Days (co-organizer Benli) and the Alberta-Montana Combinatorics and Algorithms Day (co-organizer: Kharaghani) took place at BIRS. In December there was the high school outreach event Math Attack. The current PIMS PDFs are Kubra Benli, Felix Baril Boudreau, and Abbas Maarefparvar. Lethbridge faculty, postdocs, and students have been actively involved in events associated with the CRGs, Movement and Symmetry in Graphs and L-functions in Analytic Number Theory.



## UNIVERSITY OF SASKATCHEWAN

### Site Director: Dr. Chris Soteris

The University of Saskatchewan hosted 3 PIMS Postdocs during 2023, three seminar series, three VXML projects, a Data Science Bootcamp, one Network-wide graduate class,

and several CRG related activities. The PIMS Geometry, Algebra and Physics (GAP) seminars, which are delivered in a hybrid format through the USask hub, featured 7 exciting talks in 2023 by a diverse range of speakers, including postdocs and faculty based both regionally and internationally. A Distinguished PIMS Applied Mathematics Seminar was given on Friday, September 22, 2023 by Mohammad Akbar from University of Texas at Dallas; the seminar was dedicated to the connections between continuous symmetries and the theory of general relativity and brought together a large interdisciplinary group of students and faculty. Associated with the PIMS Network-wide graduate class on Statistical Machine Learning for Data Science, in November 2023, three high-profile speakers gave public lectures at the cutting-edge of research in this area. The Data Science Bootcamp held in summer 2023 was a major educational event with 67 students and professionals registered; participants were exposed to some core areas of data science, including real data analysis and hands-on training in software. The PIMS Collaborative Research Group (CRG) in Quantum Topology and its Applications (quanTA) continues 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. This has led to coverage in venues such as *The Globe and Mail* and *Scientific American* (which featured the work of USask-based quanTA faculty member Steven Rayan in December 2023 for the second time in two years). The CRG continues to drive multi-site events, including a symposium on applied quantum computing for human healthcare held at the USask hub in November with 85 registered participants from across the Prairies. We also highlight that CRG-affiliated students and postdocs convened at the USask hub for a pair of quanTA Junior Workshops, held in June and July respectively. The UofS is now a hub in the newly approved CRG Structure-Preserving Discretizations and their Applications. The CRG will commence April 1, 2024 and run until March 31, 2027. In addition, Li Xing co-organized two PIMS sponsored conferences: Recent Research Progress in Advanced Statistical Methods, Squamish, Canada, Feb 17-20, 2023 and Statistics Data Science Conference, Kelowna, Canada, Jun 2-5, 2023. Students and faculty from USask also participated in PIMS Math to Power Industry (M2PI) - July 10 to 31, 2023.



**UNIVERSITY OF REGINA**  
**Site Director: Dr. Allen Herman**

In 2023 the University of Regina held five PIMS Distinguished Lecture events: [Feb. 10: Emily Riehl (Johns Hopkins U.)-virtual, Sept. 15: Jiguo Cao (SFU)-in person, Sept. 22: Jacob Tsimmerman (U. of Toronto)-virtual, Oct. 6: Colva Roney-Dougal (U. of St. Andrews)-virtual, Oct. 22: Ben Williams (UBC)-in person]; hosted two PIMS-supported conferences: [May 27-28: 2023 Western Canada Linear Algebra Meeting; June 7-11: 2023 Canadian Mathematics Education Study Group Meeting]; and was home to three PIMS Postdoctoral Fellows. PIMS also advertised our weekly seminars in Topology during Winter 2023 and Topology and Geometry during Fall 2023. University of Regina researchers also participated in the PIMS-supported Prairie Mathematics Colloquium and the ongoing activities of the active PIMS CRG in Movement and Symmetry of Graphs. The University of Regina played host to the first in-person meeting of the PIMS Board since 2019, which took place on April 12 and 13 of 2023 at our historic College Avenue Campus in downtown Regina. The PIMS Board Meeting led to the highlight of the year for PIMS at Regina, with our local affiliated institution First Nations University of Canada (FNUC) signing an MOU to join PIMS as an Affiliate Member Institution in July 2023.



**UNIVERSITY OF MANITOBA**  
**Site Director: Dr. Stéphanie Portet**

In 2023, PIMS partly supported two international conferences held in Winnipeg. The 6th edition of the Conference on Computational and Mathematical Population Dynamics (CMPD6), organized by J. Arino, K.-L. Liao and S. Portet, had about 100 participants and featured 102 talks from May 23 to 27. The Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM2023) had 327 participants and accommodated 260 talks, 3 poster sessions and 2 problem sessions. This conference was jointly organized by R. Craigen, K. Gunderson and B. Li from the University of Manitoba and S. Dueck, O. Oellermann and N. Rampersad from the University of Winnipeg. This meeting was immediately followed by the 2023 Movement & Symmetry in Graphs Research

Retreat organized by K. Gunderson at the University of Manitoba on 9-10 June. This workshop was supported by PIMS as part of the Movement & Symmetry in Graphs Collaborative Research Group. PIMS also supported the online 05c050 seminar about graphs and matrices, held twice a month. This seminar is organized by S. Kirkland and H. Monterde (University of Manitoba). Additionally, PIMS partly supported the following symposia: the Canadian Abstract Harmonic Analysis Symposium, partly organized by Y. Zhang at the Université de Saint Boniface (Winnipeg) on June 15-16, 2023; the 2023 North America Machine Learning Optimization and Statistics Symposium, partly organized by L. Wang (University of Manitoba) at SFU from June 23 to 25; and the CRM Conference on Orderable Groups, organized by A. Clay (University of Manitoba) and S. Boyer (UQAM), held in Montreal from April 24 to May 5.



**UNIVERSITY OF WASHINGTON**  
**Site Director: Dr. Jayadev Athreya**

PIMS activities at UW continued to expand and gather momentum as we increased in-person (and hybrid) activities in 2023. PIMS continues to support the UW Mathematics Colloquium, and several seminar series across the mathematical sciences, including the new interdisciplinary Distinguished Seminar in Optimization and Data. Via support from the Simons Foundation, PIMS is supporting several high-quality postdoctoral researchers in mathematics, statistics, and applied mathematics. The Kantorovich Initiative (KI) on Optimal Transport and its applications has grown from being a PIMS CRG to being the first PIMS Research Network, and UW is one of the primary sites. KI has a huge amount of activity, including distinguished visitors from across the world, a PIMS Network Wide course co-taught by Soumik Pal and Young-Heon Kim (UBC) attended by students across the world, an Optimal Transport and Econometrics workshop with over 50 participants and an industry panel with Amazon. We also would like to congratulate UW-PIMS-Simons postdoc Nabarun Deb, who was part of KI, who has joined the University of Chicago Booth School of Business as a faculty member.

# 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.

## 2023 Postdocs

Benjamin Anderson-Sackaney\* (USaskatchewan)  
Eugene Bilokopytov (UAlberta)  
Sarah Dijols (UBC)  
Samuel van Fleet\* (UWashington)  
Himanshu Gupta (URegina)  
Daniel Kessler\* (UWashington)

Jakwang Kim (UBC)  
Gregory Knapp (UCalgary)  
Kesav Krishnan (UVictoria)  
Poornendu Kumar (UManitoba)  
Yanwen Luo (SFU)  
Abbas Maarefparvar (ULethbridge)  
Konstantinos Mamis\* (UWashington)

Paul Péringuey (UBC)  
Anastassiya Semenova\* (UWashington)  
Lucas Teyssier\* (UBC)  
Canon Sun (UAlberta)

**\*PIMS-Simons PDF**

## 2023 PIMS Postdocs\*

\*in alphabetical order



## Featured Postdoctoral Fellow: Lucas Teyssier

*PIMS-CNRS-Simons Postdoctoral Researcher at the University of British Columbia*

Lucas Teyssier is a **PIMS-CNRS-Simons** Postdoctoral researcher at the University of British Columbia under the sponsorship of Prof. Jonathan Hermon. He completed his PhD at the Universität Wien, Vienna, under the supervision of Prof. Nathanaël Berestycki. While in Vienna, Teyssier and Berestycki worked with Hermon to prove a significant result about the universality of fluctuations of the cover time on vertex-transitive graphs. The three continue to collaborate in this area. Teyssier holds both the CNRS and Simons awards at PIMS. The CNRS Postdoctoral fellowship is targeted to applicants who are French or who have completed their Ph.D. degree in France, while the Simons Fellowship recognizes top postdoctoral researchers at PIMS member institutions.

Lucas Teyssier has harbored a fascination for numbers since his childhood, where he would engage in mental computations for the sheer enjoyment of it. This early affinity for mathematics deepened during his studies in Lyon, where he delved into arithmetics, group theory, and Fourier analysis. Uncertain about which branch to specialize in during his time at École normale supérieure – PSL (ENS), Lucas eventually pursued a Master 2 in Probability in Paris, France. It was there that he stumbled upon the intriguing realm of card mixing in a course on mixing times, taught by Justin Salez ( Université Paris-Dauphine & PSL), who later became his master thesis advisor. Simultaneously, Lucas had the opportunity to explore Philippe Biane's course on the representation theory of the symmetric group, providing a perfect blend of concrete problems intertwined with beautiful mathematics involving Fourier analysis, group theory, and combinatorics.

During his PhD in Vienna, under the guidance of Nathanaël Berestycki, Lucas collaborated with Jonathan Hermon on the study of cover times of graphs, resulting in a notable discovery about the universality of fluctuations in the cover time on vertex-transitive graphs. This fruitful collaboration with Jonathan extended into a mentorship, leading Lucas to

Vancouver for his postdoctoral studies. Lucas Teyssier's research revolves around probability and combinatorics. One of his primary focuses is the study of the representation theory



of the symmetric group and its combinatorics to establish precise results on card mixing problems, particularly on conjugacy invariant random walks on the symmetric group. A more recent area of interest involves characterizing the behavior of cover times on vertex-transitive graphs, in collaboration with his PIMS mentor, Jonathan Hermon

(University of British Columbia). This newer avenue incorporates more probabilistic techniques and draws on geometric group theory.

Extracurricular activities also play a significant role in Lucas's life, providing a source of well-being and additional energy for his mathematical pursuits. Currently engaged in karate and ballroom dancing, he actively participates in UBC clubs dedicated to these activities.

Reflecting on his university experience, Lucas expresses positivity about the club system, emphasizing the convenience of having excellent clubs directly on campus. Additionally, he expresses satisfaction with his office at PIMS, appreciating the conducive working conditions it provides.

In terms of future research, Lucas is motivated to continue collaborating with Jonathan Hermon and Omer Angel. While currently wrapping up another project, he acknowledges a slightly less active period in terms of new projects. However, he now eagerly anticipates the upcoming motivational challenge of teaching lectures in front of large classes in the upcoming semester.

Research talks from PIMS Postdocs can be found on [www.mathtube.org](http://www.mathtube.org).

# PIMS Action on Climate Thematic Summer

Several events took place in the summer of 2023 which PIMS designated as the **PIMS Action on Climate Thematic Summer (PIMS-ACTS)**. This green-themed strategic initiative was helmed by PIMS, with support from government institutions, organizations (the Embassy of France in Canada, UBC Faculty of Science, the Pacific Institute for Climate Solutions [PICS], and UBC Connects), and individual stakeholders. The series of events were organized with the aim of stimulating practical solutions from the mathematical sciences for the climate challenges we face.

## Workshop on Forecasting and Mathematical Modeling for Renewable Energy



Participants at the Workshop on Forecasting and Mathematical Modeling for Renewable Energy. Left to Right: Workshop participant, Nina Effenberger (University of Tubingen); Participants attending a coffee break on Day 1 of the workshop; Workshop participants with research poster, Mackenzie Meni (Florida Institute of Technology) and Tianxia Jia (UCalgary); Maryam Mahmoudi Gharai (UCalgary); Several workshop participants on the final day of the workshop.

## FACTS Panel on Climate Change



Participants at the FACTS Panel on Climate Change. Left to Right: Panelists at the FACTS Panel on Climate Change (sitting left to right: René Aïd, Gael Giraud, Laura Lynch, Seth Klein and Andrew Weaver. On Conference call: Judith Sayers); Panel attendees observing the FACTS panel; FACTS Panel organizer, Brian Marcus; UBC Dean of Science, Meigan Aronson; Attendees, coffee break; PIMS Director, Özgür Yılmaz; Attendees, coffee break; Scientific and Higher Education Attachée, French Embassy in Canada, Géraldine Le-Scornet; Panel speakers.



# PIMS Action on Climate Thematic Summer

## Mathematics Meets Climate Crisis: PIMS' Approach to Sustainability.

Amid the approaching climate crisis, Canadian entities, including the Pacific Institute for the Mathematical Sciences (PIMS), are actively working towards a sustainable future. PIMS, a consortium of western Canadian universities and the University of Washington centered at UBC, has led initiatives uniting researchers in mathematical sciences, collaborating across disciplines to comprehend the complexities of climate change and develop sustainable solutions, including renewable energy alternatives.

### Harnessing Math for Addressing the Grand Challenges of Humanity.

Özgür Yilmaz, the PIMS Director and a professor of mathematics at UBC, emphasizes this sentiment: "Mathematics has a profound role in understanding and addressing the grand challenges humanity is facing. For example, using mathematical modeling, we can predict the spread of infectious diseases and design efficient strategies to control them. With advanced statistical techniques, we can analyze social inequality and propose informed policy interventions. Now, in this climate crisis, we need mathematics more than ever, in order to understand the complex dynamics of our planet and guide our way to a sustainable future."

### PIMS Action on Climate Thematic Summer (ACTS) 2023.

In a timely move, PIMS recently engaged in a suite of activities, designated as the "PIMS Action on Climate Thematic Summer" or PIMS ACTS, in the summer of 2023. Building upon foundations laid in a 2019 PIMS technical workshop on renewable energy, PIMS ACTS consisted of a two-week summer school on renewable energy for graduate students, a program of green-themed industrial projects for graduate students and postdoctoral fellows, a second technical workshop on renewable energy, and a public panel on climate change jointly organized by PIMS and the French Embassy in Vancouver. Most of these activities were spearheaded by a PIMS Collaborative Research Group, an intense three-year collaboration among researchers in renewable energy primarily from the Universities of Calgary and Victoria, led by University of Calgary professor Deniz Sezer.

Brian Marcus, a professor of mathematics and the PIMS UBC Site Director, was one of the lead organizers for both the 2019 and 2023 workshops. He said, "A major difference between the 2019 workshop and

its 2023 counterpart was a shift in their focus. While the former covered an extremely broad array of renewable energy technologies, the latter focused on wind energy, solar energy, forecasting and economics." Furthermore, the recent workshop was more student-oriented with, "nearly half of the participants being students, many of whom were graduates of the summer school organized as part of the PIMS ACTS activities," he adds.

### French-Ameri-Can Climate Talks (FACTS).

The public panel on "Tackling Climate Change and the Just Transition to Renewable Energy" stood out among the myriad of activities of PIMS ACTS. This event, co-hosted by PIMS and other organizations (as listed on page 14), was organized as part of a series of French-Ameri-Can Climate Talks (FACTS) that have been held throughout North America in the past decade.

The FACTS event, which was attended by more than 120 people, consisted of three sessions: a three-hour session of individual talks by each of the panelists, followed by a two-hour panel discussion, and a one-hour "Meet the panelists" session. All sessions were open to the general public, the UBC community, and attendees of the technical workshop on renewable energy. The event was an opportunity for everyone to learn about and engage in a wide variety of issues in climate change.

The panelists included prominent Canadian and French scientists and activists representing climate science, renewable energy, economics, public policy, and Indigenous affairs. Specifically, the panelists were:

- **René Aïd:** Professor of Economics, University of Paris-Dauphine, former Deputy-Director of EDF Research Energy Finance, Co-founder and former Director of the Finance for Energy Markets Research Initiative.

- **Gaël Giraud:** Founder and Professor, Georgetown University Environmental Justice Program, former chief economist of the French Development Agency, CNRS research director, and Jesuit priest.
- **Seth Klein:** Public policy researcher, author, Team Lead with the Climate Emergency Unit, and founding director of BC office of the Canadian Centre for Policy Alternatives.
- **Judith Sayers:** President of the Nuu-chah-nulth Tribal Council, lawyer, renewable energy leader, Chancellor of Vancouver Island University, member of Order of Canada.
- **Andrew Weaver:** Professor of Earth Sciences, University of Victoria, UN Intergovernmental Panel on Climate Change (IPCC) lead author, former BC

MLA, and former leader of BC Green Party.

The central aspect of the FACTS event was a panel discussion skillfully moderated by Laura Lynch, CBC journalist and host of the show "What on Earth." Covering diverse topics like individual versus governmental actions, carbon sequestration methods, youth engagement, and the role of the fossil fuel industry in transitioning to renewable energy, the discussion delved into the political, technological, and societal aspects of climate change. Despite acknowledging the urgency of the situation, the predominant message from the panel was one of hope, drawing parallels with historical successes such as mobilizing for World War II, challenging the tobacco lobby, and achieving human space travel..

### Panel Titles and Key Takeaways: FACTS.

**René Aïd:** *More electricity demand response for less carbon emissions.*

Wind and solar energy encounter intermittency, with capacity variations during low sunlight or wind periods. Mitigation involves battery storage and an "action-demand" response, fostering consumer participation through distributed control, incentives, and information signal transmission within the electrical system. Efficiency assessments can be made using advanced mathematical models.

**Gaël Giraud:** *Macroeconomics and climate.*

Recent research questions the efficacy of traditional macroeconomic models in the context of climate change. Complexity economies, using two-dimensional nonlinear equations, precisely model system evolution, including the wage-employment relationship. Adding factors like the balance of private and public debt in three-dimensional equations enables a coupling between economic and climate models, illustrated by projections of lethal temperature-humidity combinations in various climate change scenarios.

**Seth Klein:** *Mobilizing Canada for the climate emergency.*

The clear evidence of climate change, notably through severe weather events like forest fires, calls for solutions with broad public backing. The main obstacle is the political will of leaders to implement these solutions, despite the perceived

challenge. Drawing from historical examples like World War II and the Covid-19 pandemic, six markers of true emergency action include substantial financial commitment, creating new institutions, transitioning to mandatory measures, transparent crisis communication, inclusivity, and acknowledging Indigenous rights in responsible resource stewardship.

**Judith Sayers:** *First Nations leadership in clean energy and climate action..*

Remote First Nations face disproportionate climate impacts, including forest fires and power outages due to their location at transmission line ends. Despite historical exclusion from mainstream energy decisions, they show leadership in developing renewable solutions, contributing \$6 billion to the economy and creating over 10,000 jobs. Integrating Indigenous laws, protocols, and knowledge in decision-making processes is crucial for effective and inclusive policies

**Andrew Weaver:** *Privilege, agency, and the climate scientist's role in the global warming debate..*

Record-high temperatures underscore the urgent need for climate action, hindered by short-term political thinking. Achieving the 2050 target of zero fossil emissions and negative technological emissions is vital to combat species extinction and geopolitical instability, necessitating investments in negative emission technology and behavior change through market instruments. Optimism lies in supporting progressive policies, advocacy, and personal leadership in choices and behavior.

## 2023 Prizes & Awards

### CRM-Fields-PIMS Prize Christian Genest, McGill University

Professor Christian Genest of McGill University was awarded the 2023 CRM-Fields-PIMS Prize. As one of the leading statisticians in Canada whose work has had dual impact on

both theory and real-world applications, Professor Genest is best known for his contributions to multivariate analysis, and was a pioneer in the expansive use of copula models in science. Together with a few close collaborators, he combined nonparametric methods and the asymptotic theory of empirical processes to design a broad array of rank-based inference tools for building, selecting, fitting, and validating stochastic models within this class.

### PIMS-Europe Fellowship Award Habiba Kadiri, University of Lethbridge

Dr. Habiba Kadiri from the University of Lethbridge is the recipient of this award in 2023. The prize champions

a mutual exchange of knowledge and talent while encouraging cross-ocean research on the frontline of the Mathematical Sciences. Dr. Kadiri will visit the Institut de Mathématiques de Marseille, Aix Marseille Université for a three-month research visit to work with Prof. Olivier Ramaré.

### PIMS Education Prize Lauren DeDieu, University of Calgary

Dr. Lauren DeDieu, Associate Professor (Teaching) in the Department of Mathematics and Statistics at the University of Calgary, is an exceptional instructor with an immeasurable impact on the mathematical sciences community. Having been involved with math outreach activities at the university and beyond for several years, Dr. DeDieu is particularly interested in programs that encourage girls to pursue their passion in mathematics, and works to instill a sense of belonging in the mathematical community.

### CAIMS PIMS Early Career Winner Adam Stinchcombe, University of Toronto

Prof. Adam Stinchcombe of the University of Toronto is awarded the 2023 CAIMS/PIMS Early Career Award in recognition of his contributions to high-performance computational methods for studying partial differential equations with applications in biology.

## PIMS Collaborations

PIMS has developed a global reach by entering into associations with several international research organizations. 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.

### 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. Since 2007 PIMS has awarded more than 25 PIMS - CNRS Postdoctoral scholarships.

Together with our partners, PIMS has developed various programs to help foster collaboration between mathematical scientists across our institutes. These include the **PIMS/BIRS - Team Up!** program, the **PIMS Institutional Exchange Program**, launched in 2022, and more recently, the **PIMS-ICMS Collaboration**.

### PIMS/BIRS Team Up!

The PIMS/BIRS Team Up! program provides opportunities for in-person collaboration to teams of mathematical scientists, targeting researchers who are traditionally underrepresented in the mathematical sciences.

### PIMS Institutes Exchange Program

The PIMS Institutes Exchange Program aims to reduce the carbon footprint of travel for research purposes by maximizing the scientific impact of each visit. Inspired by the Simons Oberwolfach Visiting Professor Program, PIMS+X builds agreements between partner American, Indian and French Mathematical Institutes, allowing scholars to extend existing visits to include nearby universities or institutes, facilitating additional scientific collaboration. Partner institutes include the **Institute for Computational and Experimental Mathematics (ICERM)**, the **Centre International de Rencontres Mathématiques (CIRM)**, the **International Centre for Theoretical Sciences (ICTS)**, the **Institut Henri Poincaré (IHP)**, and the **Institute for Mathematical and Statistical Innovation (IMSI)**.

### PIMS - ICMS MOU

Following an established connection at the 2022 Pacific Rim Mathematical Congress (PRIMA), PIMS along with the International Centre for Mathematical Sciences (ICMS) in Edinburgh, UK recently signed a memorandum of understanding. The aim of the MOU is to promote collaboration between the two institutes. A recent focal point of the agreement is an upcoming co-hosted hybrid format event called "Land and Sea: Mathematics of the Climate Crisis, to be held on March 18, 2024.



# PIMS Online Programs



## Network-wide Colloquium Series

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 2023-24 speakers, whose talks are listed below.

## 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 semesters, 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 offered between Jan 1, 2023 and Dec 31, 2023 included the following:

- Gaussian and Empirical Process Theory for High Dimensional Statistics: Alexander Giessing (University of Washington) and Jiahua Chen (University of British Columbia)
- Nanoscale Modelling and Simulations: Alireza Nojeh. (University of British Columbia)
- Lie Groups: Structure and Representation Theory: Lior Silberman (University of British Columbia)
- Analytic Number Theory II: Greg Martin (University of British Columbia)
- Methods for Multivariate Data: Kevin J. Keen (University of Northern British Columbia)
- Stochastic Differential Equations: Yaozhong Hu (University of Alberta)
- Geometry and Mechanics: Rouslan Krechetnikov (University of Alberta)
- Algebraic Topology: Martin Frankland (University of Regina)
- The Mathematics of Evolution: Ailene MacPherson (Simon Fraser University)
- Computer Algebra: Michael Monagan (Simon Fraser University)
- Formalization of Mathematics: Adam Topaz (University of Alberta)
- Linear Algebra and Matrix Analysis: Julien Arino (University of Manitoba)
- Moments of L-functions: Alia Hamieh (University of Northern British Columbia)
- Optimal Transport + Gradient Flows: Soumik Pal (University of Washington) and Young-Heon Kim (University of British Columbia)
- Spectral Methods for PDEs: Shaun Lui & Mikael Slevinsky (University of Manitoba)
- Statistical Machine Learning for Data Science: Li Xing (University of Saskatchewan)

- September 21, 2023 - Understanding arithmetic and geometry through cutting and pasting: Ravi Vakil, Stanford University
- October 19, 2023 - Surface sums and Yang-Mills gauge theory: Scott Sheffield, Massachusetts Institute of Technology
- November 16, 2023 - SALSA, PICANTE y VERDE: Machine Learning attacks on LWE with small sparse secrets: Kristin Lauter, META

### Winter 2024 speakers:

- January 25, 2024 - Wilfrid Gangbo, University of California, Los Angeles
- February 29, 2024 - Sarah Koch, Michigan State University

## Digital Collaborations

### PIMS Virtual Experimental Mathematics Lab (VXML)

The PIMS Virtual Experimental Mathematics Lab (VXML) brings together faculty & postdocs with graduate and undergraduate students from across the PIMS network to work on challenging and exciting research mathematics questions. The 2022-2023 projects included research into applications of topology to the study of DNA and RNA, topological data analysis, p-adic groups, and mathematical models of cognitive function. Ongoing 2023-2024 projects include deep dives into graph theory and statistical methods for analyzing microbiome data.

### PIMS First Year Interest Groups (FYIG)

The PIMS First Year Interest Groups (FYIG) Program brings together early career researchers to study active research topics in the mathematical sciences. Each First Year Interest Group is led by a PIMS postdoctoral fellow, and centers on an accessible subject for beginning graduate students. The PDF will lead a small reading group (up to 4 students) of early year (1st and 2nd year MSc or PhD) graduate students on books or papers that inspired them. Current FYIGs include groups focusing on Modelling Ecological Population Dynamics, on Diophantine Approximation, Partial Differential Equations, and interactions between Linear Algebra and Combinatorics.



## Math to Power Industry (M2PI)

PIMS and our partners have offered the Math to Power Industry (M2PI) workshop every summer for the past three 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.

This year's edition of the popular M2PI program had **action on climate** as its primary focus. M2PI is an ongoing PIMS program which seeks to prepare graduate students and postdoctoral fellows in the mathematical and statistical sciences with the industry skills necessary for success in their careers.

Hosted online and in-person, the 2023 green-themed M2PI workshop included problems on clean energy, clean tech, problems related to climate change and other problems in the realm of climate resilience.

Several teams of problem solvers, academics and industry professionals came together to work on demonstrating the power of the mathematical sciences in advancing solutions to problems that are valuable to Canada's economy. Our 2023 industry partners were: **Awesense, Cenovus Energy, Innovatree Carbon Group, IOTO, Multiverse Computing and the Noth Coast Skeena First Nations Stewardship Society.**

Thank you to our sponsors:



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.

## Science Rendezvous: May 13

Science Rendezvous is a FREE festival that takes science, technology, engineering, art, and math (STEAM) research and innovation out of the lab and onto the street. Returning in-person this year at the UBC Point Grey campus, the Canadian national science festival had an exciting program line up of hands-on activities, demos, and tours, from robotics and programming, to biochemistry and molecular biology demos, and fun math activities.

## Changing the Culture: May 19

The annual Changing the Culture conference resumed in-person this year! Mathematicians, educators and school teachers from all levels are working together to discuss narrowing gaps between mathematicians and teachers of mathematics. This year's panel discussion focused on the well-debated educational topic, "Should We Teach Geometry in Schools?", and its role in applied and computational mathematics. Changing the Culture has been held every year, either in person or online, at SFU Harbour Centre in Vancouver.

## Girls Excel in Math Summer Camp: August

The 2023 Girls Excel in Math Summer Camp was held at the University of Calgary from Wednesday, August 9th to Friday, August 11th. Open to students who identify as girls and who are currently in grades 6 - 9, the camp aims to encourage girls to pursue their passion for mathematics and make connections with peers who share similar interests. Throughout the week, students engaged in mathematical sessions that explored topics such as fractals, game theory, origami, and graph theory.



Photo credit: Kevin Allen

## Mathemalchemy: April - October

Mathemalchemy is a unique and collaborative art exhibit exploring the beauty of mathematics. Running between April and October, 2023, the art and science exhibit is created and mainly supported by mathematician Ingrid Daubechies (Duke University) and artist Dominique Ehrmann. Both art and math illuminate and describe our world, and have the power to inspire our imaginations. This installation invited you to let go of preconceptions or classroom experiences about art or math, and to explore with an open mind.



## PIMS events and activities to look forward to in 2024 include:

### February 29 - March 1: France-Western Canada Workshop on Ocean and Polar Sciences

This collaborative workshop will focus on the role of mathematical sciences in the ocean and polar sciences fields. Co-organized by PIMS, the Centre National de la Recherche Scientifique (CNRS), and the Consulate General of France in Vancouver, the workshop will host prominent scientists from Western Canada and France.

### March 18, 2024: "Land and Sea": Mathematics of the Climate Crisis

This upcoming March, PIMS and the International Centre for Mathematical Sciences in Edinburgh, UK will co-host a special hybrid event as part of an extended collaboration between the two mathematical institutes. The event will be addressing the problem of the climate crisis by having a global conversation on what the mathematical sciences can contribute toward its solution. Dr. Rashid Sumaila (Institute for the Oceans and Fisheries, University of British Columbia) and Prof. Emily Shuckburgh (Cambridge Zero) will both present lectures and participate in a Q&A discussion.

### April: New PIMS Research Network: Maud Menten Institute

A new PIMS Research Network (PRN), the Maud Menten Institute for the Life Sciences, will commence in April 2024. The Maud Menten Institute for the Life Sciences will provide a collaborative research platform for mathematical biologists at PIMS sites to promote interactions with life science experts and decision makers in government, industry and NGOs. The PRN Leaders are Mark Lewis (University of Victoria) and Stéphanie Portet (University of Manitoba).



### April: New Collaborative Research Group: Structure-Preserving Discretizations and their Applications

The PIMS Scientific Review Panel has approved the Collaborative Research Group: Structure-Preserving Discretizations and their Applications. This CRG will bring together research specialists in structure-preserving discretizations to share their knowledge, expertise, and current challenges in their respective fields. The CRG Leaders are: Jingwei Hu (University of Washington), Steven Ruuth (Simon Fraser University), Raymond Spiteri (University of Saskatchewan) and Andy Wan, University of California, Merced.



### June: PIMS PDF Summit

The first PIMS PDF Summit will bring together PIMS Postdoctoral Fellows from all PIMS Universities. This will give the PIMS PDF cohort to showcase their research and expand their networks, leading to new collaborations.

### June: PIMS Industry Day

Our Math to Power Industry (M2PI) graduates will get a chance to showcase their work from the workshop at an in-person event and also network with industry members.

## SEMINARS, CONFERENCES & WORKSHOPS

1 January - Ongoing	<b>Distinguished Seminars in Optimization and Data</b> University of Washington
1 January - Ongoing	<b>Mathematics of Computation, Applications and Data Seminar Series</b> Simon Fraser University
1 January - Ongoing	<b>PIMS-UBC Distinguished Colloquia</b> University of British Columbia - Vancouver
1 January - Ongoing	<b>Washington Directed Reading Program</b> University of Washington
1 January - Ongoing	<b>Statistical Data Science Seminar Series</b> University of Victoria
17 January - 17 April	<b>Emergent Research: The PIMS PDF Seminar Series</b> Network Wide - Online
25 January	<b>PIMS Network Wide Colloquium: Wilfrid Gangbo, UCLA</b> Network Wide - Online
26 - 28 January	<b>Combinatorial Algebra meets Algebraic Combinatorics</b> Montréal, Quebec
29 February	<b>PIMS Network Wide Colloquium: Sarah Koch, Michigan</b> Network Wide - Online
29 Feb - March 1	<b>France-Western Canada Workshop on Ocean and Polar Sciences</b> University of British Columbia - Vancouver
18 March	<b>"Land and Sea": Mathematics of the Climate Crisis</b> PIMS UBC & ICMS UK
22 - 24 March	<b>Alberta Number Theory Days XV</b> Banff International Research Station
3 - 4 May	<b>Alberta Mathematics Dialogue</b> University of Alberta
4 - 5 May	<b>Mathematics Quantum Frontiers</b> Banff International Research Station
17 - 19 May	<b>Women in Optimal Transport Workshop</b> University of British Columbia - Vancouver
18 - 22 May	<b>Foundational Methods in Computer Science</b> Biogeosciences Institute, Kananaskis
2 - 5 June	<b>Canadian Workshop on Information Theory</b> University of British Columbia - Vancouver
11 - 15 June	<b>NCTS-PIMS Workshop in PDE</b> Taipei
17 - 21 June	<b>Comparative Prime Number Theory Symposium</b> University of British Columbia - Vancouver

## SUMMER SCHOOLS

1- 12 July	<b>KAZUAL Summer School</b> St. Mary's College, Berkeley
1 - 19 July	<b>Summer School on Theory, Mechanisms and Hierarchical Modelling of Climate Dynamics: Clouds and Convection</b> International Center for Theoretical Physics, Trieste, Italy
14 - 28 July	<b>Summer School on Forecasting and Mathematical Modeling for Renewable Energy</b> BIRS - Okanagan

## COLLABORATIVE RESEARCH GROUPS

2020 - 2024	Novel Techniques in Low Dimension: Floer Homology, Representation Theory & Algebraic Topology
2020 - 2024	Quantum Topology and its Applications
2021 - 2024	Movement & Symmetry in Graphs
2021 - 2024	Pacific Interdisciplinary Hub on Optimal Transport
2022 - 2025	L-Functions in Analytic Number Theory
2024 - 2027	Structure-Preserving Discretizations and their Applications

## PIMS RESEARCH NETWORKS

2023 - 2026	Kantorovich Initiative
2024 - 2027	Maud Menten Institute

## INDUSTRY EVENTS

28 - 30 May	<b>Math to Power Quantum Workshop</b> University of Saskatchewan
3 - 21 July	<b>Math^Industry Workshop</b> Online

## K-12 EDUCATION EVENTS

27 April	<b>Elementary Math Contest (ELMACON)</b> University of British Columbia - Vancouver
11 May	<b>ScienceRendezvous.ca</b> PIMS Sites Canada-wide
17 May	<b>Changing the Culture</b> Simon Fraser University

For more information and updates, visit [www.pims.math.ca](http://www.pims.math.ca)



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