“The support from Fields enabled me to expand and strengthen my network of collaborations both within my field and in adjacent areas. We uncovered several points of intersection in our research, enhancing the synergy between our respective areas of expertise. These interactions proved to be highly fruitful, productive and, in some ways, unexpected.”

Adriano Festa, Associate Professor, DISMA Politecnico di Torino
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message from the Chair</td>
<td>2</td>
</tr>
<tr>
<td>Message from the Director</td>
<td>4</td>
</tr>
<tr>
<td>Thematic and Focus Programs</td>
<td>6</td>
</tr>
<tr>
<td>General Scientific Activity</td>
<td>10</td>
</tr>
<tr>
<td>Research Centres and Initiatives</td>
<td>14</td>
</tr>
<tr>
<td>Fields Institute Fellows</td>
<td>24</td>
</tr>
<tr>
<td>Fellowships</td>
<td>26</td>
</tr>
<tr>
<td>Visitorships</td>
<td>27</td>
</tr>
<tr>
<td>Prizes and Awards</td>
<td>29</td>
</tr>
<tr>
<td>Equity, Diversity and Inclusion at Fields</td>
<td>30</td>
</tr>
<tr>
<td>Donors</td>
<td>31</td>
</tr>
<tr>
<td>Board of Directors</td>
<td>32</td>
</tr>
<tr>
<td>Members of the Corporation</td>
<td>33</td>
</tr>
<tr>
<td>Administration</td>
<td>35</td>
</tr>
<tr>
<td>Summarized Financial Statements</td>
<td>36</td>
</tr>
</tbody>
</table>
A familiar word in public discourse is “challenges”. The challenges in the scientific and public realms are many and diverse. At Fields we view challenges as giving rise to responsibilities and opportunities. Responsibilities for the Institute to respond in a manner that strengthens the mathematical sciences community and opportunities for the mathematical sciences community to respond to the needs of our wider communities.

Over the past several years, with the assistance of its Strategy Committee and the Institute’s staff, the Board has adopted a long-term strategic plan that I have discussed in previous editions of this letter. The plan has four pillars: core mathematics programs, Academy, Multiplier and MAGIC. Each of these pillars addresses the challenges and opportunities of today.

Our core mathematics programs remain just that: the core of our activities and our principal raison d'être. For over 30 years, the Institute has brought the best minds in the mathematical sciences together at our home in Toronto, and at our Principal Sponsoring Universities across Canada, to explore the limits of our knowledge in a vast range of areas of mathematics, pure and applied (if those terms still denote a useful distinction), expand those limits, and set the agenda for future work in those areas. In conjunction, we have provided access to this exciting activity to postdocs, graduate students and undergraduates. Our core mathematics programs are the key to our recognition as a global leader in advanced mathematics and its dissemination to the next generation of mathematical scientists.

Academy, Multiplier and MAGIC build on the operational and area expertise developed through organizing and presenting our core programs. In his report further on, our Director, Kumar Murty, surveys developments in these programs. I urge you to read his commentary.

Against that background, I want to mention two other important areas of strategic development driven by – and responding to – the needs of the wider communities of which the Institute forms part.

Over the course of many years, the Institute has been steadily establishing Centres in several fields aimed at bringing power and creativity of the mathematical sciences community to bear on Canada’s and the world’s critical public needs. These interdisciplinary Centres cut across departmental lines, attracting participation and funding from across academic, industrial, and governmental divides. The Institute now has five functioning centres, namely the Centre for Financial Industries, the Centre for Mathematical Medicine, the Centre for Mathematical Education, the Centre for Sustainable Development and the Fields-NRC Collaboration Centre. You will find the details of these Centres (inside this report) interesting reading.

A similar milestone has been our Mathematics for Public Health (MfPH) initiative, which played a crucial role in the development and execution of Canada’s policy during the recent pandemic. I am pleased to report that there are currently 16 projects underway, all ably steered by a principal investigator and team of talented researchers who are committed to improving Canada’s preparedness in the face of public health crises. We are looking forward to integrating this work into our core programming, building on the momentum already established.

The second important area of strategic development is the Institute’s international outlook. Mathematics is practised globally and providing opportunities for Canadian mathematical scientists at programs abroad has proved very fruitful. The Institute now has collaborations with multiple research institutions worldwide.

MESSAGE FROM THE CHAIR

Philip Siller

Sustainable Development and the Fields-NRC Collaboration Centre. You will find the details of these Centres (inside this report) interesting reading.

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Prof. Murty has a special aptitude for assessing the suitability of these relationships for the Institute’s stated goals and we expect this effort to be a permanent feature of the Institute’s activities in the future.

Finally, I want to recognize that Prof. Murty’s term as Director wraps up at the end of June this year. Collaborating with our outstanding Deputy Director, Prof. Deirdre Haskell, Prof. Murty’s tenure has been marked by exceptional growth in the Institute’s vision and programs and in the quality of management of the organization, all while weathering one of the most challenging times in the Institute’s history. His steady leadership not only saw us through but responded to the opportunities for excellence presented during the past four years. We are grateful to Prof. Murty for his leadership in these accomplishments.
MESSAGE FROM THE DIRECTOR

Forward from the Fields Medal

This year 2024 holds a special significance, first to the Fields Institute and the Canadian mathematical community, and second to me personally.

For the Fields Institute, named after Prof. John Charles Fields, it represents the centenary of the first International Congress of Mathematicians ever held in Canada and organized by Prof. Fields.

The Institute plans to observe this centenary with a series of events during the year. The scientific focus will be a symposium entitled “Forward from the Fields Medal” to take place the week of August 12, 2024 at the Institute. With over 13 scientific sessions covering a broad range of mathematical themes, the symposium will be a time for mathematicians from Canada and around the world to reflect on the state of the art in our subject and to think about its future.

In addition to the scientific events, we will also have some public-facing events that will highlight the way mathematics manifests itself outside the academic realm. The full list of events in the celebration of 2024 will be announced shortly on the Fields Institute website. Be sure to look for it.

This year also holds significance for me personally, as it will mark the end of my five-year term as Director. When I began my term in 2019, I could hardly have imagined the challenges and opportunities that lay ahead of us. Thanks to the cooperation and support of our staff, our community, and our Board, the Institute has grown in many ways. Most importantly, we now have a broader scientific base from which to launch our activities. In addition to our core thematic and focus programs, we now have new training programs in Fields Academy, new collaborative research in Fields MAGIC, and new vehicles to commercialize mathematical innovation through Fields Multiplier.

While we will continue to strengthen and develop this wider base, I think the big new opportunity in the next few years is for Fields to step onto the world stage. We are already in discussion with about a dozen countries to enter into new collaboration initiatives. Some of these take the form of appointing joint postdoctoral fellows, while others envisage a physical presence of the Fields Institute in various geographies. In Europe, we are building on our existing partnership with France to collaborate also with Spain, Italy and Germany. We are also looking at training opportunities in several former Soviet republics. We are looking at research and training opportunities in India and China. We are entering into research collaboration with United Arab Emirates and Kenya. And the list goes on.

In addition to these institutional partnerships, we have also started a new way for individuals to participate in the Fields adventure. As of this year, it is now possible to become a “Friend of Fields.” We plan to build special events for this community, which will include professional and lay people alike. We will use it as a platform to
help everyone understand the ubiquity, the power, the beauty of mathematics, and how in our complicated world, which is being challenged in so many different ways, mathematics offers a formidable tool to solve big problems.

A hundred years ago, John Charles Fields had the idea to help reunite a fractured world through mathematics. This involved finding a neutral, welcoming place to invite mathematicians to convene, interact, create and collaborate. He also wanted to find a way to recognize the mathematical contributions of young people. While both of these objectives are a constant work in progress, this year affords us the opportunity to take stock of how much has been achieved since then.

In 2024, the new activities of the Fields Institute open yet another dimension of opportunity for everyone – young, old and in between – to participate in this ongoing mathematical adventure. As I wrap up my time here at Fields, grateful for the opportunity to have played a small role in the story of the Institute, I will be watching with happiness as the next generation of ideas develop and bloom.
THEMATIC PROGRAM ON SET THEORETIC METHODS IN ALGEBRA, DYNAMICS AND GEOMETRY  JANUARY 1 - JUNE 30, 2023

ORGANIZING COMMITTEE

Michael Hrušák
Universidad Nacional Autónoma de México

Kathryn Mann
Cornell University

Justin Moore
Cornell University

Stevo Todorcević
University of Toronto

SUMMARY

The idea for this program grew out of the realization that there were several new applications of set theory and logic to subject matter outside of its traditional orbit. A program was organized to bring together experts from outside the field, as well as those inside the field with a record of interacting with other areas.

The program aimed to foster interactions between emerging connections in set theory, the fields of algebra, dynamics, geometry and topology. This goal seems to have been achieved, especially through the first workshop, which concerned large-scale geometry of transformation groups and "big" mapping class groups in particular, the big mapping class groups reading seminar, and the mini-workshop on homological algebra. Many of the set theorists with knowledge of and connections to Peter Scholze’s “condensed mathematics” were longterm participants in the program and helped others in the program access this subject.

There was also success in the more generic sense through a great deal of sustained research activity and collaboration throughout the program, with many collaborative groups often involving junior mathematicians, students and postdocs in particular. The graduate courses and large level of student participation seemed to benefit the students and postdocs greatly. We also felt fortunate to have one of the rising stars in big mapping class groups, George Domat, and descriptive set theory, Forte Shinko, as Fields postdocs.

BY THE NUMBERS

SET THEORETIC METHODS IN ALGEBRA, DYNAMICS AND GEOMETRY

- 9 ACTIVITIES
- 679 PARTICIPANTS
- 37 COUNTRIES

NONSmoOTH RIEMANNIAN AND LORENTZIAN GEOMETRY

- 11 ACTIVITIES
- 1295 PARTICIPANTS
- 34 COUNTRIES

THE FIELDS INSTITUTE
The Thematic Program on Nonsmooth Riemannian and Lorentzian Geometry was considered among the most successful to take place at Fields. Robert McCann notes that it was the most fruitful thematic semester he has ever been involved in, both as an organizer and participant. The program was notable for many reasons, including a record number of postdocs, the excitement it generated in the community, and the scientific, network and career opportunities it provided for many of its participants. It also established a bridge between several researchers at the Fields Institute's Principal Sponsoring Universities, including McMaster, Waterloo, University of Toronto and University of Alberta.

The idea for the program emerged from conversations between several of the mathematicians who wound up on the organizing and scientific committees. Part of the impetus was to create an opportunity for leading international experts in curvature dimension conditions, such as Nicola Gigli and Karl-Theodor Sturm, to come to Toronto for long-term visits. There was motivation to explore the recently broached prospect of extending their approach from the Riemannian to the more physically relevant Lorentzian setting. This required a broader scope for the organizing and scientific committees in an attempt to bridge these two areas, and fit perfectly into the Fields Institute's work to expand connections to local universities and demand a better job of addressing equity, diversity and inclusion (EDI) efforts in our recruitment process. As a result, Waterloo mathematical physicist Ghazal Geshnizjani was brought on board as an organizer, a decision that had a transformative effect on the program through her valuable contributions and strong network of women and BIPOC scientists.

The program was aided by the Fields Institute's decision to extend four postdocs from half a year to a full-year position. McCann notes that these postdocs were among the best he's ever attracted to Toronto, and their post-program track record supports his claim. Five of the postdocs accepted multiyear appointments at Canadian universities, one received a tenure track position in Europe as a result of connections made here, and there are numerous papers and collaborations in the works between participants. One notable outcome is a preprint that identifies infinitesimal Minkowskianity and gives a nonsmooth d’Alembert comparison theory, which is expected to be the first step toward a nonsmooth version of the Lorentzian splitting theorem.

Additional highlights include the large number of senior and mid-career visitors the program attracted to Toronto, which allowed the program to host three extremely successful weeklong workshops where in-person registration approached room capacity. Two of these included Bruce Kleiner's workshop on rigid vs flexible mappings and Stephen Hawking protegee Fay Dowker's lecture series on Causal Set Theory. Another important component of the program was the Wednesday afternoon hybrid seminar series, which paired a senior researcher with a junior researcher each week.
The 2022 Fields Medal Symposium honoured Akshay Venkatesh. Dr. Venkatesh was awarded the Fields Medal in 2018 “for his synthesis of analytic number theory, homogeneous dynamics, topology and representation theory, which has resolved long-standing problems in areas such as the equidistribution of arithmetic objects.”

The Institute for Advanced Study (IAS) professor is primarily known as a number theorist with an ability to pick up complex topics and develop deep insights that can be applied to other areas of mathematics. This intellectual flexibility has allowed Dr. Venkatesh to flow through multiple domains – from number field extensions to dynamical systems and representation theory. As a result, he has developed a reputation as one of math’s “great connectors.”

True to form, Dr. Venkatesh asked to do things at this Symposium a little differently. Rather than a program dedicated only to his work, he preferred an opportunity for speakers from diverse fields to address the influx of new perspectives on the nature of research and of proof. Given the evolving technological landscape we are living in, it was a topic very much of the moment and one that acknowledges the inextricable relationship between research and its context.

The 2022 Fields Medal Symposium took place in hybrid form, inviting participants to chime in online, or come in person to the Fields Institute for the first time since 2019.

For his Public Opening talk, Dr. Venkatesh chose to speak about “Glimpses from entropy’s lens”. The event was held in person at the Isabel Bader Theatre on the University of Toronto campus. At the door, staff handed attendees a balloon before ushering them to their seats. This unusual prop would make perfect sense at the top of Dr. Venkatesh’s talk, when he encouraged the audience to participate in an experiment first posed in an early 19th century letter by British experimental philosopher, John Gough. Gough’s investigations into the properties of natural rubber led to the first description of the heat that gets released when rubber is stretched quickly. He noticed that after the stretched rubber heats up, it contracts, which is the reverse of what normally happens to materials when they’re heated. This experiment later influenced physicist James Joule, who discovered the relationship of heat to mechanical work and for whom the joule unit of energy is named.

This fun, interactive experiment was a great lead-in to Dr. Venkatesh’s exploration of entropy, a subject he chose because it interests him personally. While his talk was for a general audience, the hallmarks of his intellectual scope were evident. Not every mathematician can speak about physics so clearly and find the natural links to their own areas of research. The fact that Dr. Venkatesh can pull this off, and that he chose to speak about this topic at a Symposium traditionally designed to honour Fields Medal-winning work, indicates a curious mind that loves to explore the boundaries of its own knowledge. Attendees later commented that they appreciated the opportunity to hear someone of Dr. Venkatesh’s level speak on a topic they could follow without advanced mathematics training.

“People always say there is no universal mathematician nowadays because it is too difficult, but [Venkatesh’s mind] can think about anything.”

Emmanuel Kowalski,
Swiss Federal Institute of Technology Zurich
DIGNITARIES:
The Honourable Scott Ryan
High Commissioner of Australia
Nalini Joshi
Vice President of the International Mathematical Union (IMU)

STUDENT NIGHT
We were pleased to host the first Student Night since 2019. This popular, sold-out event offered high school students and undergraduates the opportunity to interact with a Fields medallist and working mathematician.

Dr. Venkatesh spent several hours chatting with attendees over pizza, gamely answering questions and offering advice, inspiration and direction.

ORGANIZING COMMITTEE
Kevin Buzzard
Imperial College London
Maia Fraser
University of Ottawa
Michael Harris
Columbia University
Alma Steingart
Columbia University

SCIENTIFIC PROGRAM

SCHEDULE
Monday, October 17, 2022
Opening Remarks
Kumar Murty
The Fields Institute; University of Toronto
Akshay Venkatesh
Institute for Advanced Studies
Michael Harris
Columbia University
Abstract Formalities
Johan Commelin
Albert Ludwigs University of Freiburg
Prospects for AI Systems That Can Form Concepts and Abstractions
Melanie Mitchell
Santa Fe Institute
Towards General and Robust AI at Scale
Irina Rish
Université de Montréal; Mila
Public Opening of the Fields Medal Symposium

Tuesday, October 18, 2022
What can the working mathematician expect from deep learning?
Geordie Williamson,
University of Sydney
Is mathematical interest just a matter of taste?
Timothy Gowers
Collège de France
What makes a proof acceptable?
Andrew Granville
Université de Montréal
How I became seduced by univalent foundations
Emily Riehl
Johns Hopkins University

Wednesday, October 19, 2022
Varieties of Mathematical Understanding
Jeremy Avigad
Carnegie Mellon University
Tacit knowledge and partial automation in mathematics
Rodrigo Ochigame
Leiden University
Closing Remarks
Kumar Murty, The Fields Institute; University of Toronto

If you or your organization would like to contribute to the Fields Medal Symposium, please contact development@fields.utoronto.ca or visit our website www.fields.utoronto.ca/about/fundraising.

The Public Opening was recorded and the full video is available on our YouTube channel.
The Scientific Program was streamed live and also recorded for later viewing on our YouTube channel.
WORKSHOPS AND CONFERENCES

Mutations: From Cluster Algebras to Representation Theory
July 4-8, 2022

FUSRP 2022
July 4-August 30, 2022

International Congress of Mathematicians – Selected Lectures
July 6, 2022

Spec(Q)
July 6-8, 2022

Séminaire de mathématiques supérieures on Floer Homotopy Theory
July 11-22, 2022

2022 Canadian Undergraduate Mathematics Conference
July 13-17, 2022

Workshop on Differential Privacy and Statistical Data Analysis
July 25-29, 2022

Workshop on Mathematical Ecology: Modelling Epidemics
August 10-11, 2022

Workshop on Modelling Population Dynamics in Ecology, Environment and Epidemiology
August 15-19, 2022

Workshop on Symmetric Spaces, Their Generalizations and Special Functions
August 18-21, 2022

34th Canadian Conference on Computational Geometry (CCC2G 2022)
August 25-27, 2022

Conference on Quantum Information and Quantum Control IX
August 29-September 2, 2022

Fields-CFI Workshop on the Mathematics and Statistics of Anti-Money Laundering
September 9, 2022

Workshop on Geometry of Spaces with Upper and Lower Curvature Bounds
September 12-16, 2022

Monetary Policy and Income and Wealth Inequality
September 15-16, 2022

Fields-CFI Workshop on Impacts of Climate Change on Economics, Finance and Insurance
September 19-23, 2022

Summer School in Computational Neuroscience at Western University
September 19-23, 2022

MathEd Forum: September 2022
September 24, 2022

Third Symposium on Machine Learning and Dynamical Systems
September 26-30, 2022

Workshop on Mathematical Relativity, Scalar Curvature and Synthetic Lorentzian Geometry
October 3-7, 2022

Workshop on Quantum Computing and Operations Research
October 13-14, 2022

2022 Fields Medal Symposium: Akshay Venkatesh
October 17-19, 2022

Fields-CFI Bootcamp on Machine Learning for Finance
October 20-21, 2022

Mathematics for Public Health Festival (MfPHest)
October 26-28, 2022

MathEd Forum: October 2022
October 29, 2022

Panelists during What the Numbers Say: Inflation in the Nation. Transcript available on our website.
Applied Analysis Day
November 4, 2022

How I Became a Quant
November 10, 2022

The Second Canadian Geometry & Topology Seminar (CGTS)
November 11-13, 2022

Workshop on Aspects of Ricci Curvature Bonds
November 14-18, 2022

LGBTQ+Math Day
November 18, 2022

MathEd Forum: November 2022
November 26, 2022

Math in Motion... Girls in Gear!
November 26, 2022

Workshop on Advances in Mathematical Ecology
December 6-7, 2022

Workshop on Recent Advances in Optimization
December 6-7, 2022

Workshop on Lie Groups, Singular Spaces and Higher Structures
January 9-13, 2023

Workshop on the Geometry and Dynamics of Groups of Transformations
January 16-20, 2023

Combinatorial Algebra meets Algebraic Combinatorics (CAAC):
20th Annual Meeting
January 20-22, 2023

MIPH Workshop on Early Warning Systems for Emerging and Re-emerging Diseases
January 23-25, 2023

MathEd Forum: January 2023
January 28, 2023

Virtual Workshop II for Women in Commutative Algebra and Algebraic Geometry
February 4-5, 2023

Workshop on Machine Learning for Investor Modelling
February 16-17, 2023

MathEd Forum: February 2023
February 25, 2023

Workshop on Borel and Measurable Combinatorics in Algebra and Dynamics
March 20-24, 2023

Workshop on the Applications of Topology to Quantum Theory and Behavioural Economics
March 23-24, 2023

MathEd Forum: March 2023
March 25, 2023

6th Conference on Financial Econometrics and Risk Management
April 20-21, 2023

Coding, Computational Modelling and Equity in Mathematics Education
April 27-29, 2023

Beyond Endoscopy Mini Conference
April 27-28, 2023

Math Horizons 2023
April 28, 2023

MathEd Forum: April 2023
April 29, 2023

Fields-WICI Math for Complex Climate Challenges Workshop
May 1-4, 2023

9th Meeting on Systems and Control Theory
May 3-5, 2023

Workshop on Smart Cities, Energy and Sustainability
May 5, 2023
WORKSHOPS AND CONFERENCES

Learning and Teaching Mathematics Today: Cognitive Science, Technological and Semiotic Perspectives
May 11, 2023

Ontario Combinatorics Workshop
May 12-13, 2023

Workshop on Recent Advances in Continuum Theory, Dimension Theory, Dynamical Systems and Applications of Topology
May 15-19, 2023

Workshop on Lefschetz Properties in Algebra, Geometry, Topology and Combinatorics
May 15-19, 2023

Canadian Operator Symposium 2023 (COsy 2023)
May 22-26, 2023

18th Workshop on Algorithms and Models for Web Graphs
May 23-26, 2023

Computational and Mathematical Population Dynamics 6
May 23-27, 2023

Fields-CFI Workshop on Quantitative Methods for Wealth Management
May 29-31, 2023

Miniworkshop on set-theoretic methods in module theory and homological algebra
May 29-June 2, 2023

Workshop on the Frontiers of Set Theory
June 5-9, 2023

Advances in Representation Theory of Algebras
June 12-16, 2023

FUSRP 2023
June 12-August 9, 2023

Canadian Abstract Harmonic Analysis Symposium 2023
June 15-16, 2023

Séminaire de Mathématiques Supérieures on Periodic and Ergodic Spectral Problems
June 19-30, 2023

Canadian Undergraduate Mathematics Conference 2023
June 19-23, 2023

2023 Fields Institute Annual General Meeting
June 22, 2023

Women in Operator Algebras III
June 25-30, 2023

Full house for the Conference on Quantum Information and Quantum Computing IX.

Dr. Sharmistha Mishra delivered the 2023 Keyfitz Lecture in Mathematics and the Social Sciences
SEMINAR SERIES

Blockchain Research Seminar Series
Fields Analysis Working Group
Fields Postdoc Colloquium
Fields Trips
Low Regularity Physics and Geometry Seminar
Matroids - Combinatorics, Algebra and Geometry Seminar
MIFPH Next Generation Seminar Series
Seminar on Mathematical Models and Data Science
Algebraic Combinatorics Seminar
Applied Mathematics Colloquium
ArtSci Salon
Ask a Mathematician
Centre for Mathematical Medicine Seminar
Colloquium on Mathematics for Public Health
Fields Number Theory Seminar
GANITA Seminar
Geometric Analysis Colloquium
Geometric Structures Laboratory
Geometry and Model Theory Seminar
Machine Learning Advances and Applications Seminar
Operator Algebra Seminar
Quantitative Finance Seminar
Quantum Information Seminar
Set Theory Seminar
Simons Distinguished Visitor Seminar: Alex Lubotzky
Toronto Probability Seminar

SPECIAL AND PUBLIC LECTURES

Distinguished Lecture Series:
Bruce Kleiner
September 12-16, 2022

Truth Values: One Girl’s Romp Through MIT’s Male Math Maze
September 15-17; 20-22, 2022

Margaret Sinclair Memorial Award Lecture: John Mighton
September 24, 2022

Coxeter Lecture Series: Fay Dowker
October 3-7, 2022

2022-2023 Fields-Carleton Distinguished Lecture Series:
Leon Glass
October 13, 2022

Public Opening of the 2022 Fields Medal Symposium
October 17, 2022

Student Night of the 2022 Fields Medal Symposium
October 18, 2022

2021 CRM-Fields-PIMS Prize Lecture: Andrew Granville
October 20, 2022

Keyfitz Lecture in Mathematics and Social Sciences: Sharmistha Mishra
February 16, 2023

Distinguished Lecture Series:
Stevan Todorčević
March 15-17, 2023

Western Mathematics Exposition Competition
March 31, 2023

CRM-Fields-PIMS Prize Lecture: Christian Genest
April 20, 2023

What the Numbers Say: Calculating Climate Change
May 18, 2023

Coxeter Lecture Series: Maryanthe Malliaris
May 30-June 1, 2023

Reveal of the Fields Institute Wieringa Wall
June 29, 2023

An exciting addition to the Fields building took place this summer, thanks to the installation of a Wieringa Wall in our main seminar room. The project was a labour of love by University of Toronto Architecture student, Ross J. Cocks (pictured here), and includes nearly 10,000 individually cut tiles that create a 3D projection of a Penrose Tiling. Unveiled in June, the wall took over 3,200 hours to complete and acts as an acoustic scattering surface, which lowers the reverberation time of the room. We hope you come by in person to experience it yourself!
Since 2015, the Centre for Financial Industries has served as the focal point for the Institute’s leadership in quantitative finance, providing visibility for the expertise of its members, facilitating corporate collaboration, and enabling the rapid mobilization of resources.

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University of Waterloo

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SS&C Algorithmics  
Mathieu Rosenbaum  
Ecole Polytechnique  
Dan Rosen  
d1g1t Inc.

**SUMMARY**
Individual membership is drawn from a vibrant community of financial industry professionals, faculty and postdoctoral fellows from the Institute’s Principal Sponsoring Universities (PSUs), and scientists with close ties to us. The Centre provides unique benefits for corporate members, including the option to propose and organize scientific activities at the Institute with exclusive access to the results; participation in the Centre’s working groups, roundtables, webinars and seminars; recruitment opportunities; and networking opportunities among the corporate membership.

**EVENTS**

**WORKSHOPS AND CONFERENCES**
Fields-CFI Workshop on the Mathematics and Statistics of Anti-Money Laundering  
September 9, 2022

Fields-CFI Workshop on Impacts of Climate Change on Economics, Finance and Insurance  
September 19-22, 2022

Fields-CFI Bootcamp on Machine Learning for Finance  
October 20-21, 2022

How I Became a Quant – Toronto  
November 10, 2022

**SEMINARS**
Fields-CFI Workshop on Quantitative Methods for Wealth Management  
May 29-31, 2023

When finance workshop participants say "cheese" for the camera, they’re thinking of the slang word for money.
The Centre for Mathematical Medicine (CMM) connects researchers from medical and mathematical disciplines and provides the only environment of its kind in Canada for interdisciplinary ventures and initiatives. It operates independently of the Mathematics for Public Health (MfPH) network.

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James Drake  
SickKids Hospital  
Siv Sivaloganathan  
The Fields Institute and University of Waterloo

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The Fields Institute and University of Waterloo  
Frances Skinner  
University of Toronto  
Wei Xu  
Princess Margaret Cancer Centre

**EVENTS**

Untangling Fronts and Waves in Dementia  
Alain Goriely (University of Oxford)  
September 16, 2022

Evolutionary modelling of cancer  
Natalia Komarova (University of California, Irvine)  
October 28, 2022

Microstructure-informed in silico modelling of the human brain  
Silvia Budday (Friedrich-Alexander-Universität Erlangen-Nürnberg)  
November 18, 2022

Modelling Collective Cell Migration  
Philip Maini (University of Oxford)  
December 9, 2022

Generalized Cable Theory and Impedance of the Neural Tissue  
Claude Bedard (French National Centre for Scientific Research (at Gif-sur-Yvette, College de France)  
February 21, 2023

Predicting subject traits from brain dynamics during unconstrained cognition  
Diego Viduarre Henche (Aarhus University)  
March 24, 2023

Mechanistic mathematical modelling of the within-host response: from chemotherapy to COVID-19  
Suzan Farhang-Sardroodi (University of Manitoba)  
April 10, 2023

Bubbles and Droplets: looking through the lens of curiosity  
Zhao Pan (University of Waterloo)  
May 26, 2023
The Centre for Mathematics Education (CME) is devoted to transformative research in mathematics education and, by extension, education in science, technology, and engineering.

**DIRECTORS**
- Miroslav Lovric
  McMaster University
- Dragana Martinovic
  University of Windsor

**STEERING COMMITTEE**
- George Gadanidis
  Western University
- Kathy Kubota-Zarivnij
  Toronto Catholic District School Board
- Judy Mendaglio
- John Mighton
  The Fields Institute
- David A. Talbot
  The Epiphany Society
- Peter Taylor
  Queen’s University
- Walter Whiteley
  York University

**EVENTS**

**ACTIVITIES**

**MathEd Forum:** Open monthly meetings (during the school year) on themes related to K-12 mathematics education.

**Fields Cognitive Science Network:** A scholarly community that conducts an empirical study of mathematics and how it is learned.

**Math Circles:** Activities for middle school and high school students

**Mathematics Knowledge Network:** Connecting math education communities across Ontario. Visit their website to learn more.

**SPECIAL LECTURES AND AWARDS**

The Margaret Sinclair Memorial Award: This annual award recognizes an educator in Canada who has demonstrated innovation and excellence in promoting mathematics education at the elementary, secondary, college or university level.

The 2023 recipient of the Margaret Sinclair Memorial award was **Dr. Lynda Colgan**, Professor Emerita, Faculty of Education, Queen’s University. She is currently the Executive Director, Education and Development of Science Rendezvous and is working on a number of research, resource-creation, and teacher-education projects, funded by the National Sciences and Engineering Research Council of Canada (NSERC), the Social Sciences & Humanities Research Council (SSHRC), and the Mathematics Knowledge Network (MKN).

The Margaret Sinclair Memorial Award Lecture was given by the previous year’s winner, **Dr. John Mighton** (JUMP Math) and was delivered on September 25, 2023.
FIELDS ACADEMY

Established in 2020 as part of a broadening vision for the future, Fields Academy encompasses the training components of the Fields Institute. Programs that fall under the Academy umbrella focus on teaching and training, with levels that range from K-12 all the way up to highly specialized postgraduate courses.

**ASK A MATHEMATICIAN**

The Ask a Mathematician program brings a mathematician virtually into Grades 4-10 classrooms for a one-hour visit. During the visit, the mathematician will speak about their field of research, some of the real-world applications of their work, and provide students with a chance to ask questions.

**TOPICS**
- Cryptography
- Math in Nature
- Analytical Thinking
- Visualizing 4D Space
- Mathematical Modelling
- Operations and Fractions

**ELEMENTARY EDUCATOR PROGRAM**

Launched in 2022 as a pilot program, the Elementary Math Educator Program is designed to help elementary teachers and teacher candidates boost their math skills. Program resources are developed by an Ontario-certified teacher with a Ph.D in Mathematics Education, and in collaboration with math researchers and educators from across Canada.

**TOPICS**
- Mathematical Modelling
- Financial Literacy
- Games and Coding
- Proofs and Logic
- Operations and Fractions

**SHARED GRADUATE COURSES**

The Shared Graduate Courses program aims to amplify Canadian graduate-level mathematics by making more courses available to qualified students. Instructors are invited, with the approval of their Department Chairs, to submit their course proposals. Courses are selected through an Advisory Committee from existing classes offered at the Fields Institute's PSUs.

Sharing graduate-level courses helps solve the problem of small enrollment in highly specialized courses within a single university. This way, more students can attend the course, increasing its impact and helping strengthen networks in specialty areas across different Canadian institutions. Moreover, the Shared Graduate Courses help defray administrative costs by eliminating the unnecessary duplication of resources.

The Shared Graduate Courses continue to be a huge success in drawing students from universities across Canada to participate in classes outside their home school. Of the 500 students who registered in the past year, our data reveals that 60% of students signed up for courses outside their home university.
### FALL 2022 SEMESTER

<table>
<thead>
<tr>
<th>University</th>
<th>Instructor</th>
<th>Course</th>
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<tbody>
<tr>
<td>Carleton University</td>
<td>Sanjeena Dang</td>
<td>Statistical Methods for Big Genomic Data</td>
</tr>
<tr>
<td>Queen’s University</td>
<td>Gregory Smith</td>
<td>Computational Homological Algebra</td>
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<tr>
<td>Queen’s University</td>
<td>Brad Rodgers</td>
<td>Random Matrix Theory on the Classical Compact Groups</td>
</tr>
<tr>
<td>University of Toronto</td>
<td>Stevo Todorcevic</td>
<td>Topics in Set Theory: Homogenous Structures, Topological Dynamics of Their Automorphism Groups and the Corresponding Ramsey Index Theory</td>
</tr>
<tr>
<td>Toronto Metropolitan University</td>
<td>Pawel Pralat</td>
<td>Probabilistic Method and Random Graphs</td>
</tr>
<tr>
<td>Queen’s University</td>
<td>Gregory Smith</td>
<td>Computational Homological Algebra</td>
</tr>
<tr>
<td>University of Waterloo</td>
<td>Spiro Karigiannis</td>
<td>Topics in Geometry and Topology: A Second Course in Riemannian Geometry</td>
</tr>
<tr>
<td>University of Saskatchewan</td>
<td>Nathaniel Osgood</td>
<td>Agent-Based &amp; Individual-Based Modelling: Theory and Praxis (MfPH)</td>
</tr>
<tr>
<td>York University</td>
<td>Jianhong Wu</td>
<td>Advanced Topics in Infectious Disease Dynamics Modelling (MfPH)</td>
</tr>
<tr>
<td>OMNI-RÉUNIS</td>
<td>Julien Arino, Marina Freire-Gormaly, Woldegebriel Assefa Woldegerima, Katie Clow, Rebecca Tyson</td>
<td>One Health Modelling for Emerging Infectious Diseases, Part I (MfPH)</td>
</tr>
</tbody>
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### WINTER 2023 SEMESTER

<table>
<thead>
<tr>
<th>University</th>
<th>Instructor</th>
<th>Course</th>
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<tbody>
<tr>
<td>McMaster University</td>
<td>Ben Bolker</td>
<td>Statistical Learning</td>
</tr>
<tr>
<td>University of Ottawa</td>
<td>Aaron Tikuisis</td>
<td>Introduction to Operator Algebras</td>
</tr>
<tr>
<td>University of Toronto</td>
<td>James Arthur</td>
<td>Automorphic Forms and Representation Theory: An Introduction to the Langlands Program</td>
</tr>
<tr>
<td>Western University</td>
<td>Lyle Muller, Marieke Mur</td>
<td>Neural Networks</td>
</tr>
<tr>
<td>York University</td>
<td>Mario Roy</td>
<td>Countable-State Thermodynamic Formalism and Its Application to Conformal Graph-Directed Markov Systems (CGDMSs)</td>
</tr>
<tr>
<td>OMNI-RÉUNIS</td>
<td>Julien Arino, Marina Freire-Gormaly, Woldegebriel Assefa Woldegerima, Katie Clow, Rebecca Tyson</td>
<td>One Health Modelling for Emerging Infectious Diseases, Part II (MfPH)</td>
</tr>
</tbody>
</table>
**MILESTONE**

On April 10, James Arthur (University of Toronto) gave his final graduate course through the Fields Academy Shared Graduate Program. His Automorphic Forms and Representation Theory was an introduction to the Langlands Program, of which he is one of the world’s experts.

Arthur will devote himself to proving the Langlands Program conjectures, but he will be dearly missed as a teacher. In honour of his retirement, we published a career retrospective in our Spring/Summer 2023 edition of Fields Notes and posted video recordings of his full course on our YouTube channel.

**CYBER CONNEXION**

Launched in late 2020, Cyber Connexion works with top industry experts to upskill diverse talent with foundational quantitative competencies to be job-ready, and helps connect them to in-demand roles in industry. The program involves ongoing engagement with industry and subject matter experts to develop and update curriculum informed by industry skills gaps; an eight-week full-time intensive course with integrated technical and soft skills training along with industry showcases, presentations and live demos, followed by active job-search support.

This year, Cyber Connexion introduced a 12-week part-time cohort for students who are currently working full-time or enrolled in full-time studies. This allowed Fields to run three successful cohorts, with graduates now populating the Canadian job market. Our virtual information sessions also saw a major spike in attendance, with over 800 people registering for our events.

**INDUSTRY JOBS PATHWAY**

Fields Academy supports industry by providing a direct pipeline of talented math graduates into key roles at top companies across the country. Our Industry Jobs Pathway stream creates a bridge between academia and industry with the assurance of Fields Institute academic standards.
FIELDS UNDERGRADUATE SUMMER RESEARCH PROGRAM (FUSRP)

Each summer, the Fields Institute invites a competitive group of students from across the globe to work on research projects under the guidance of mentors from our Principal Sponsoring Universities, Affiliate Universities, visiting scientists and industry partners.

During this rich mathematical experience, 31 students from around the world benefited from hands-on problem solving and connected with fellow collaborators and friends. Together, they worked in groups of up to five students on one of eight carefully selected projects. Supervisors and academic advisors reported that this cohort was among the most exceptional in the program’s 13 years, with promising results presented at the end of the summer.

ATTENDANCE, DEMOGRAPHICS AND GEOGRAPHY

HIGHLIGHTS:

DATES: JUNE 12 - AUGUST 9, 2023

8 Projects:

- On Field Extensions of Archimedean Local Fields and Local Langlands Correspondence
- Active Human-Centric Evaluations in NLP Interpretability
- Statistical and Machine Learning and Applications
- Spectral Graph Invariants and Random Walks on Graphs
- Bootstrapping the Eigenvalues of Discrete Hyperbolic Surfaces
- Random Multiplicative Functions over Function Fields
- Spectral-Spatial Tissue Boundary Detection in Biomedical Hyperspectral Images
- Physiological Feature Extraction Using Facial Video Data

“...I found it really interesting when talking with participants from more pure mathematics. As well, talking with people and realizing how similar our experiences were despite coming from different cultures was very cool.”

James Zhu, FUSRP 2023 alum
The Centre for Sustainable Development brings together research activity in areas such as smart villages, smart communities, climate risk, Environmental, Social & Governance (ESG), investing and other themes related to sustainability. The Centre draws on the mathematical strength of the Fields community as well as partnerships with a diverse collection of organizations who are involved and interested in the sustainability problem overall.

Potential activities include regular seminars, workshops, conferences, summer schools, short and long thematic programs, graduate courses, mini-courses, public lectures and outreach events all organized around the theme of sustainability.

The Centre also aims to grow a research network to collect a community around the subject of Mathematics for Climate Change (MfCC).

Membership is open to faculty from Principal Sponsoring Universities, Principal Sponsoring Institutions, Affiliate Universities and Corporate Affiliates with recognized contributions to the area of sustainable development, as well as to regular participants in Fields Institute activities that relate to the Centre’s activities.

New industrial and commercial partners with an interest in sustainability are encouraged engage with the Centre and to become Corporate Members of the Fields Institute.

**STEERING COMMITTEE**

- **Luis Seco (Chair)**  
  University of Toronto

- **Daniel Gottschald**  
  CEO TUM-Heilbronn GmbH

- **Peter Leuwen**  
  Director Munk School, University of Toronto

- **Juan Du**  
  Dean of Architecture, University of Toronto

- **Matt Davison**  
  Dean of Science, Western University

- **John Baez**  
  Professor of Mathematics, University of California, Riverside

- **Nathaniel Osgood**  
  Dean of Science, Associate Professor of Computer Science, University of Saskatchewan

**EVENT SPOTLIGHT**

**FIELDS-WICI MATH FOR COMPLEX CLIMATE CHALLENGES WORKSHOP**

**MAY 1 - 4, 2023**

**LOCATION:** UNIVERSITY OF WATERLOO

Building on two successful Fields Mathematics for Climate Change (MfCC) workshops held last year, the Fields Institute partnered with the Waterloo Institute for Complexity and Innovation (WICI) to organize a hybrid four-day workshop titled “Math for complex climate challenges” at the University of Waterloo. The workshop brought together climate researchers and applied mathematicians to identify major Canadian climate policy and research challenges for which additional state-of-the-art and emerging mathematical methods would add value—in short, to match mathematicians with skills and interest and climate researchers with applied problems. Recordings of the workshop are available on the Fields YouTube channel.
FIELDS MULTIPLIER

Fields Multiplier is an initiative that can help innovative businesses develop, validate and bring to market disruptive innovations powered by mathematics. The Multiplier team creates collaborations between businesses, academia and other partners to accelerate the commercialization process for math-based start-ups.

After a competitive application process, Multiplier selects then works with the chosen companies to provide funding, networking opportunities and hands-on support. Over the past three years, it has supported several of these start-ups in their early stages and has started to chart real momentum in their path to commercial success.

STRATOTEGIC INC.

Stratotegic Inc. is the brainchild of Jeremy Henderson, a London, Ontario-based entrepreneur who spent over two decades as a military pilot in the Canadian Air Force. After leaving the military in 2019, Henderson consolidated his niche expertise in coordinating global air force operations through Stratotegic Inc., with the goal of assisting high-altitude platform station (HAPS) companies with flight and air traffic control coordination on a global scale.

Henderson visualized methods to improve on networks of autonomous high-altitude balloons. He would build upon proven concepts of stratospheric communications that were limited by imprecise navigation of winds. If you can develop an AI system that comprehensively understands stratospheric winds, then you have essentially harnessed the wind. The balloons arrange and keep themselves physically situated above an area where high-speed internet is required for a temporary amount of time, like after an earthquake that knocks out all power, or a war zone where the means of communication have been compromised. The AI algorithms can also be used to manage the position of drones or underwater devices.

Henderson partnered with Martin Guay, a Professor of Mathematics and Engineering at Queen’s University. Guay connected him with Fields, where he learned about the emerging Multiplier program. Linking up with Fields, where Stratotegic could tap into our vast network of mathematicians and academic partners, made sense from a research perspective. For the industry side, Multiplier principals, Donna Shukaris and Martin Croteau, have helped advise on everything from securing intellectual property protection for the company’s control system to structuring relationships with international partners.

At present, Stratotegic is testing prototypes and forging international partnerships in the US and Europe. In the fall of 2023, they started a major multi-year government project that pertains to QKD quantum communications and at the same time are currently undergoing an initial investment round aimed at gathering the necessary funds to take the company’s development to a commercial level. The funding effort has already garnered considerable attention from investors.

Each Multiplier project involves a partnership between an academic research team and a company sponsor. The first two projects are well underway and will receive their official public launch shortly. A third project is currently ramping up.

FINANCIAL WELLNESS LAB

The Financial Wellness team at Western University developed an AI-based wellness tool for Retired Registered Savings Plans (RRSPs) that can help recalibrate the HR retirement savings plan process for Canadians. The tool, which forms part of a broader package of services that large benefits companies can offer to employers, streamlines the onboarding process to help employees make optimized, rapid and informed decisions about their financial future. The Lab joined forces with Aligned Capital Partners (ACP) and Fields Multiplier to build the prototype and take the finished product to market. ACP is now in the process of integrating the application into their back office and will launch later this year.

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The Mathematics for Public Health (MfPH) program was established to develop a national network of infectious disease modellers and public health policymakers that can rapidly respond to public health emergencies. It was established in April 2021 thanks to a $3M grant from NSERC/EIDM and is set to wind down in April 2024. The initiative has built on the work done by the Mathematical Modelling of COVID-19 Task Force, which Fields organized in February 2020 to advise the provincial government on pandemic-related decisions.

Over the past three years, MfPH has drawn over 70 members who are leaders in their respective fields to join our network. Network members work in teams on a series of 16 projects with a focus on epidemiology, mathematical modelling and public health policy.

As a commitment to the future of healthcare, MfPH also established the Next Generation group for early career scholars, junior modellers and epidemiologists interested in the modelling of infectious disease and other public health threats. The group meets for seminars and provides an inclusive online space for presentations by guest speakers, a journal club and opportunities for members to present work in a supportive environment.

“...I joined the Fields Institute in January 2023 after receiving an offer to contribute to Mathematics for Public Health (MfPH). It was a great opportunity for me to collaborate with a team of outstanding mathematicians from various global universities. The MfPH network had significantly contributed to pandemic crisis modelling and problem solving over the past three years.

Beyond my specific responsibilities and tasks in the project, I had the privilege of meeting great mathematicians during my time at Fields. Attending workshops and seminars in areas of mathematics related to my research greatly enriched my understanding of modelling techniques. Fields offers a warm, active, supportive and highly productive scientific atmosphere. It attracts top-tier and brilliant mathematicians worldwide, making a conducive environment for cutting-edge research across diverse scientific domains.

Mortaza Baky Haskuee, Mathematics for Public Health (MfPH) postdoctoral fellow

NETWORK STATS:
70 Highly Qualified Personnel from across Canada
50% Male
50% Female
40 Graduate Students
30 Postdoctoral Fellows

HIGHLIGHTS:
• 150+ papers published
• 39 colloquia presentations
• 45 Next Generation Seminar Series presentations
• 6 MfPH Shared Graduate Courses

NOTABLE RESEARCH PROJECTS:
• Advancement of early warning systems and forecasting (Combine new data sources Seroprevalence, Wastewater, Viral Genomics/phylodynamics)
• Advancement of integrative models (public health & economic health)
• Social and behavioural models (role of trust, public reaction to NPI and vaccine policies, systematic social inequalities)
• Role of AI
FIELDS INSTITUTE FELLOWS 2023

The designation of Fields Institute Fellow is awarded annually to a select group of people in recognition of their outstanding contribution to the Institute and within the Canadian mathematical community. It is a lifetime appointment. In 2022, we celebrated 20 years of Fellowship by appointing the following new members.

AYMAN CHIT

Ayman Chit currently serves as a Vice President at Sanofi Vaccines, a leading pharmaceutical company. He also holds the position of Assistant Professor at the University of Toronto’s Leslie Dan Faculty of Pharmacy. With extensive expertise in the field, Chit leads teams of researchers and medical experts at Sanofi, driving the development of vaccines that align with global healthcare needs. At the University of Toronto, Chit actively collaborates with faculty members on research and teaching. Additionally, he plays a vital role in mentoring and advising graduate students, nurturing the next generation of scientific leaders and innovators.

Chit’s primary research focus revolves around vaccine development and assessment. He is particularly interested in understanding the impact and burden of infectious diseases, and how to develop and deploy vaccines to counter this burden. Furthermore, his research extends to the study of the economics and administration of healthcare systems and the economics of drug and vaccine development and use.

RICHARD KENYON

Richard Kenyon is the Erastus L. DeForest Professor of Mathematics at Yale University. His central mathematical contributions are in statistical mechanics and geometric probability. He established the first rigorous results on the dimer model, opening the door to recent spectacular advances in the Schramm–Loewner evolution theory. In most recent work, he introduced new homotopic invariants of random structures on graphs, establishing an unforeseen connection between probability and representation theory.

JAVAD MASHREGHI

“Javad Mashreghi is a Canadian mathematician and author working in the fields of functional analysis, operator theory and complex analysis. In particular, he is known for his contributions to analytic function spaces and operators acting on them. Mashreghi was the 35th President of the Canadian Mathematical Society (CMS), is a Lifetime Fellow of CMS, and works as Professeur Titulaire at Université Laval. He is immensely involved in various aspects of North America’s mathematical community, having served on numerous editorials, administrative and selection committees across Canada and the U.S. (CMS, AMS, Fields Institute, CRM, NSERC, NSF). He is the Editor-In-Chief of the Canadian Mathematical Bulletin (2020–2025) and Concrete Operators (2018–2022), and an Associate Editor of the Proceedings of The American Mathematical Society (2020–2024). More recently, he became a Canada Research Chair in function spaces and a Fulbright Research Chair at Vanderbilt University.
MESSOUD EFENDIEV

Messoud Efendiev is a world-renowned mathematical-biologist, leading scientist at the Helmoth Research Centre in Munich, member of the editorial boards of 10 international scientific periodicals, editor-in-chief of the International Journal of Biomathematics and Biostatistics, and author of over 160 scientific works and eight scientific monographs. He was James D. Murray distinguished professor at the University of Waterloo, York University, University of Toronto and Fields Institute, and is currently a distinguished professor at Western Caspian University.

SYLVIA SERFATY

Sylvia Serfaty is Silver Professor at the Courant Institute of Mathematical Sciences of New York University. Prior to this she has been Professor at the Université Pierre et Marie Curie (currently Sorbonne Université) at the Laboratoire Jacques-Louis Lions, and has held various appointments at the Courant Institute of NYU. She earned her BS and MS in Mathematics from the École Normale Supérieure in Paris in 1995, and her PhD from Université Paris Sud in 1999.

She works in calculus of variations, nonlinear partial differential equations, and mathematical physics. A large part of her work has focused on analyzing vortices in the Ginzburg-Landau model of superconductivity and on the statistical mechanics of systems of points with Coulomb-type repulsion.

She was the recipient of the European Mathematical Society prize in 2004, the Henri Poincaré prize in 2012 and the Mergier-Bourdeix Prize of the Académie des Sciences de Paris in 2013, and was a plenary speaker at the International Congress of Mathematicians in 2018. She was also named a Simons investigator in 2018 and elected to the American Academy of Arts and Sciences in 2019.

CHRISTIAN GENEST

Christian Genest a professor in the Department of Mathematics and Statistics at McGill University, where he holds a Canada Research Chair. He is one of the leading statisticians in Canada, whose work has had dual impact on both theory and real-world applications. He 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. Additionally, Genest has contributed to group decision making, prioritization techniques, multivariate extreme-value theory and, most recently, to space-time modelling of rare events in environmental science.

He is a recipient of the Statistical Society of Canada’s Gold Medal for Research and was elected a Fellow of the Royal Society of Canada in 2015. Recently, Genest was awarded the 2023 CRM-Fields-PIMS Prize.
FELLOWSHIPS AND VISITORSHIPS

**FIELDS RESEARCH FELLOWSHIP**
Mathematical scientists from the Fields Institute’s Principal Sponsoring Universities (PSUs) may either apply for themselves or nominate another mathematical scientist for the Fields Research Fellowship, a one-to-three-month period of residence for the purpose of mathematical collaboration.

Leonid Berlyand, Pennsylvania State University  
Laura Escobar Vega, Washington State University in St. Louis  
Vikraman Balaji, Mathematical Institute, Chennai  
Andrea Macrina, University College London  
Stefano Morra, Université Paris 8  
John K. Nicholson, Imperial College London

**FIELDS POSTDOCTORAL FELLOWSHIP**
Nicholas Sharp  
University of California, Santa Barbara  
Siegfried Van Hille  
KU Leuven  
Wenzhe Yang  
Stanford University  
Xuanlong Fu  
University of Toronto  
Pablo Andujar Guerrero  
Purdue University  
Cale Rankin  
University of Toronto  
Sharmila Gunasekaran  
University of Alberta  
Mathias Braun  
Institut für Angewandte Mathematik  
César Corral Rojas  
York University  
Jikang Wang  
Rutgers University

**FIELDS-AIMS-PERIMETER POSTDOCTORAL FELLOWSHIP**
Gael Yomgne Diebou  
University of Bonn

**DIRECTORS’ RESEARCH FUND**
Debanjana Kundu  
University of Toronto  
Payman Eskandari  
University of Toronto  
Armin Jamshidpey  
University of Toronto
**FIELDS-ONTARIO POSTDOCTORAL FELLOWSHIP**

The Fields-Ontario Postdoctoral Fellowships are two-year positions involving one semester at Fields, typically during a major Thematic Program, and three semesters at a Principal Sponsoring University. Fellows are nominated by Thematic Program organizers or interested supervisors.

- Adele Padgett
  McMaster University

- Krzysztof Jan Ciosmak
  University of Toronto

- Angel Martinez Martinez
  University of Toronto Mississauga

**DEPUTY DIRECTORS’ RESEARCH FUND**

- Siegfried Van Hille
  KU Leuven

- Alexi Block Gorman
  Ohio State University

**DEAN’S DISTINGUISHED VISITING PROFESSORSHIP**

The Dean’s Distinguished Visiting Professorship (DDVP) is a joint program of the Fields Institute and select Principal Sponsoring Universities. The DDVP program exists to enhance the research environment by bringing leading international researchers in the mathematical sciences to the Fields Institute to be in residence for a term. Agreements have been in place with the University of Toronto since 2007 and with McMaster University since 2021. Starting in 2022 there are two DDVPs annually, one with the University of Toronto, one with McMaster University.

**UNIVERSITY OF TORONTO DEAN’S DISTINGUISHED VISITING PROFESSOR**

- Slawomir Solecki
  Cornell University

**McMASTER UNIVERSITY DEAN’S DISTINGUISHED VISITING PROFESSOR**

- Nicola Gigli
  SISSA Trieste

Check the Fields Institute website for rolling opportunities to visit us in person for short-term or long-term research posts.
PRIZES AND AWARDS

CRM-FIELDS-PIMS PRIZE

The CRM-Fields-PIMS prize is the premier Canadian award for research achievements in the mathematical sciences. It is awarded jointly by the three largest Canadian mathematics institutes: the Centre de Recherches Mathématiques (CRM) in Montreal, the Fields Institute in Toronto, and the Pacific Institute for the Mathematical Sciences (PIMS) in Vancouver. The winner's research should have been conducted primarily in Canada or in affiliation with a Canadian university. The main selection criterion is outstanding contribution to the advancement of research.

The 2023 CRM-Fields PIMS Prize was awarded to Christian Genest, Professor, Department of Mathematics and Statistics, McGill University. Prof. Christian Genest is one of the leading statisticians in Canada, whose work has had a dual impact on both theory and real-world applications. He 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. Additionally, Prof. Genest has contributed to group decision-making, prioritization techniques, multivariate extreme-value theory and, most recently, to space-time modeling of rare events in environmental science.

CAIMS-FIELDS INDUSTRIAL PRIZE

The CAIMS-Fields annual industrial mathematics prize is to be awarded to a researcher in recognition of exceptional research in any branch of industrial mathematics, interpreted broadly. The nominee's research should have been conducted primarily in Canada.

The 2022 CAIMS-Fields Industrial Prize was awarded to Sivabal Sivaloganathan, Professor, Department of Applied Mathematics, University of Waterloo. Prof. Sivaloganathan has made significant contributions in several areas of applied mathematics and is a leader in the field of mathematical medicine. He has established productive collaborations with leading clinicians at some of the top research hospitals in Canada and was the founding Director of the Centre for Mathematical Medicine at the Fields Institute.

MARGARET SINCLAIR MEMORIAL AWARD

The Margaret Sinclair Memorial Award recognizes an educator in Canada who has demonstrated innovation and excellence in promoting mathematics education at the elementary, secondary, college or university level. This annual award is administered by the Fields Institute and the recipient is expected to deliver a lecture during a selected MathEd Forum within the calendar year.

The 2023 Margaret Sinclair Memorial Award was given to Lynda Colgan, Professor Emerita, Faculty of Education, Queen's University and Executive Director, Education and Development of Science Rendezvous. Her research has focused on supporting early career mathematics teachers, involving parents as partners in mathematics teaching and learning and alternate images of mathematics curriculum. Her creative projects have resulted in the development of a children's television show, The Prime Radicals and an award-winning children's non-fiction book, Mathemagic.

2022-2023 ANNUAL REPORT
Fields is committed to creating a more equitable environment for mathematics research. We have been engaged in the work to outline and formalize efforts to improve equity, diversity and inclusion (EDI) at the Institute since 2021, with the creation of an EDI Advisory Committee. This Committee is comprised of selected staff members as well as members of the mathematics community outside of Fields to improve representation.

Since then, Fields has updated our registration system to employ a personal portal for users, including a voluntary, self-reporting user profile with demographic information with the intention to improve representation in our programming, funding and employment opportunities.

Fields has also stipulated to program organizers that there must be adequate or appropriate attempts to invite women as speakers and participants. These requirements have been added to our application forms. For those who still request assistance, we have developed a living document with suggestions on how to best execute these goals. In addition, our Principal Sponsoring Universities (PSUs) must support up to two postdoctoral fellows from underrepresented groups.

On the digital front, Fields has recently created AODA compliant landing pages on our website, which are designed to be easier to read and translate by screen readers. This helps visually impaired visitors access our information more easily. We plan to migrate the entire website to this new design over the next 1-2 years.

Statistically, Fields continued to see an improvement in the gender distribution of some of our programs. The latest Fields Undergraduate Research Program (FUSRP) had a near-even proportion of male-identifying (15) and female-identifying (14) participants, with two participants identifying as non-binary. Our Distinguished Lecture Series saw equal improvement with 50% men and 50% women giving talks in the 2022-2023 academic year. We also achieved a 50/50 split of men and women on our Board of Directors and Administrative Staff.
DONORS

The Fields Institute is grateful to our donors. The Director, Deputy Director and Board of Directors of the Institute wish to express their profound appreciation to the donors, whose generous support through various fundraising campaigns helps carry forward our work. Donations are registered for the fiscal year from April 1, 2022 to March 31, 2023.

FIELDS MEDAL SYMPOSIUM
Bronze-Level Sponsor
($25,000 to $99,000)
Professor George Elliott
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Up to $1,000
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THE MARGARET SINCLAIR MEMORIAL AWARD
$500 to $999
Mr. James Doyle

$200 to $499
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Mrs. Mary Stevenson
Anonymous (1)

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Aqueduck Foundation – Paul Selick Foundation

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Prof. Kenneth Davidson
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Mrs. Elaine S. Riehm
(in honour of Barth Pollack)

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(pd for Howard Goodman)
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Anonymous (1)
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Abdelfetah Ali
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Head of Operations

Jordana Feldman
Senior Writer

Alice Kim
Executive Assistant to the Directorate

Tara Popovic
Communications Officer

Miriam Schoeman
Fields Liaison

ADMINISTRATION
JULY 2022–JUNE 2023

2022-2023 ANNUAL REPORT
35
The Fields Institute is an independent charitable organization. The volunteer Board of Directors is responsible for financial and operational oversight of the Institute and for appointing the Scientific Advisory Panel, which provides scientific oversight to Fields Institute programs.

The Board of Directors is elected by the Members of Corporation. These Members come primarily from the Principal Sponsoring Universities, Principal Sponsoring Corporations, Affiliate Universities and Corporate Affiliates of the Fields Institute. Members of Corporation approve auditors who then conduct a yearly, independent review of the Institute’s finances and operational practices.

The complete audited financial statements are available by request (by email to: inquiries@fields.utoronto.ca), or may be downloaded from the Fields Institute website (www.fieldsinstitute.ca).

What follows is an unaudited summary of the audited financial statements.

Fields Institute Charitable Number: #896011459 RR0001
The impact of the ongoing COVID-19 pandemic is reflected in The Fields Institute’s 2021-22 Finances, both in revenues and expenses.

**REVENUES:**
The Institute's operating grants from the Ontario Ministry of Colleges and Universities and from the Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Institute Support fund are the major operating grants of the Institute. Along with support from sponsoring universities, grants from the National Science Foundation, the Simons Foundation, Canadian Institutes for Health Research (CIHR), Social Sciences and Humanities Research Council (SSHRC), NSERC as part of the Emerging Infectious Diseases Modelling (EIDM) and revenue relating to developing and delivering a cybersecurity training program make up the bulk of the Institute's revenues.

Total revenue for 2022-23 was $9.009 million, up 24% from 2021-22.

**EXPENSES:**
As the pandemic continued to ease and people returned to the Institute, expenses to support the increase in on-site researchers and in-person activities, including many rescheduled programs, rose dramatically compared to 2021-22. Activity relating to newer revenue sources, including the EIDM grant, Simons grants and the cybersecurity training program also contributed to the increase in spending as these programs continued to mature. Total expenses for 2022-23 were $9.195 million, up 39% from 2021-22.

### REVENUES 2022-23
**CAD $9.009 MILLION**

- **FEDERAL GRANTS** $3,394
- **PROVINCIAL GRANTS** $2,128
- **SPONSORING UNIVERSITIES & CORPORATIONS** $1,072
- **OTHER SCIENTIFIC GRANTS** $1,206
- **DONATIONS/OTHER** $1,209

*Amounts are in thousands of dollars.

### EXPENSES 2022-23
**CAD $9.195 MILLION**

- **SCIENTIFIC PROGRAMS** $3,768
- **ADMINISTRATION & DIRECTORATE** $1,792
- **LEASE/OPERATING COSTS** $1,207
- **THEMATIC PROGRAMS** $973
- **SCIENTIFIC SUPPORT** $1,455

*Amounts are in thousands of dollars.*
# Fields Institute for Research in Mathematical Sciences
## Summarized Statement of Operations

**Year Ending 31 March**

<table>
<thead>
<tr>
<th></th>
<th>2022-23 CAD$’000</th>
<th>2021-22 CAD$’000</th>
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<td>Provincial Grants</td>
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<td>Ministry of Colleges &amp; Universities</td>
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<td>Math Knowledge Network</td>
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<td>Centre for Qualitative Analysis &amp; Modelling</td>
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<td>Mathematics for Public Health</td>
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<td>Donations &amp; Other</td>
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<td><strong>EXPENSES</strong></td>
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<td>Post Doctorate Fellows’ Stipends</td>
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<td>Teaching Buyout &amp; Honoraria</td>
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<td>Lease &amp; Operating Costs</td>
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<td><strong>TOTAL EXPENSES</strong></td>
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|                        |                  |                  |
| (Deficit)/Surplus      | (186)            | 671              |
# FIELDS INSTITUTE FOR RESEARCH IN MATHEMATICAL SCIENCES
## SUMMARIZED STATEMENT OF FINANCIAL POSITION

As of 31 March 2023

<table>
<thead>
<tr>
<th></th>
<th>2023 CAD$'000</th>
<th>2022 CAD$'000</th>
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<tr>
<td><strong>ASSETS</strong></td>
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<td>Current Assets</td>
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<td>Cash &amp; Cash Equivalents</td>
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<td>Other Current Assets</td>
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<td>Capital &amp; Intangible Assets</td>
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<td><strong>TOTAL ASSETS</strong></td>
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<td><strong>LIABILITIES</strong></td>
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<tr>
<td>Current Liabilities</td>
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<td>Accounts Payable &amp; Accrued Liabilities</td>
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<td>Deferred Revenue &amp; Contributions</td>
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<td>Unrestricted Reserves</td>
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<td>Endowments</td>
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<td><strong>Total Net Assets</strong></td>
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<td><strong>TOTAL LIABILITIES AND NET ASSETS</strong></td>
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<td><strong>5,873</strong></td>
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