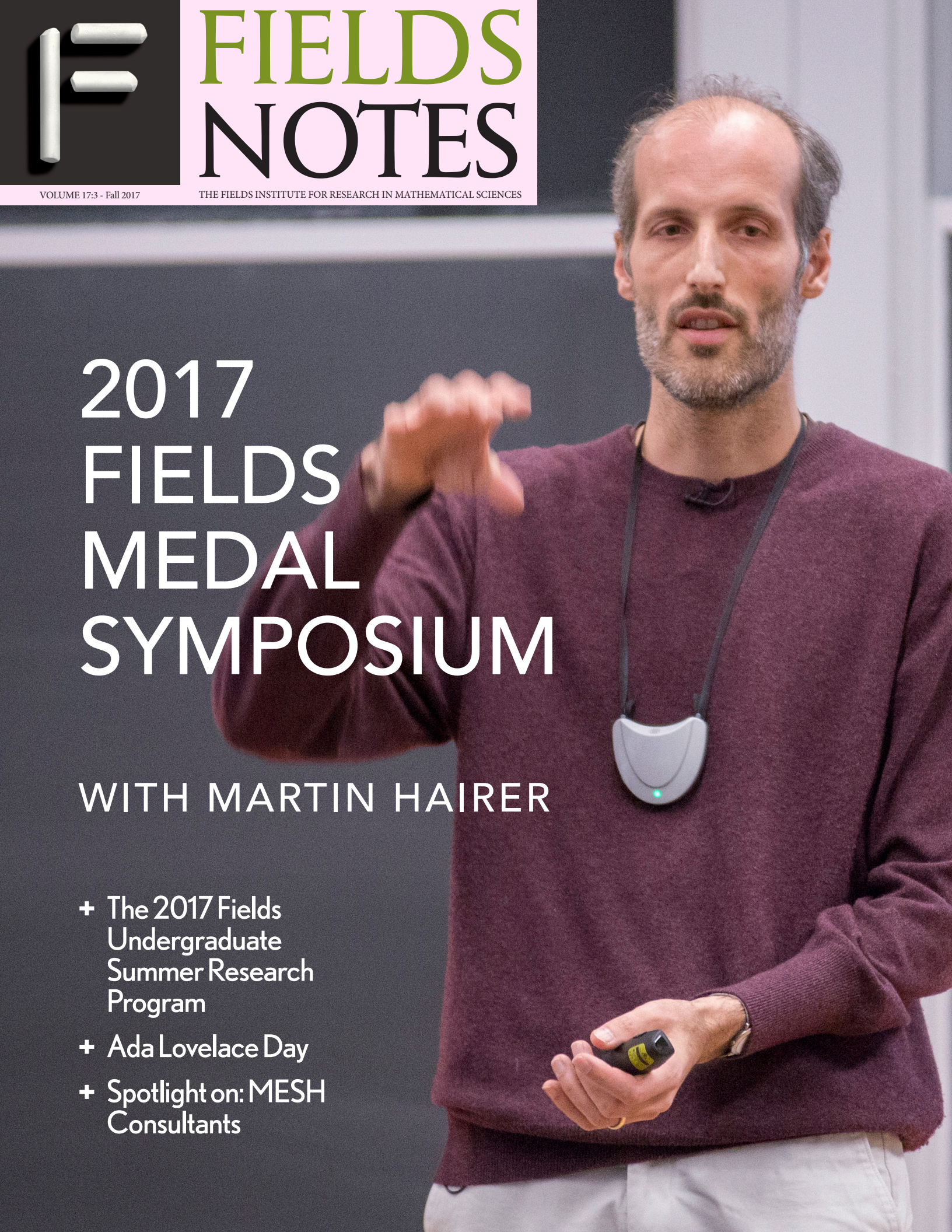
FIELDS NOTES

VOLUME 17:3 - Fall 2017

THE FIELDS INSTITUTE FOR RESEARCH IN MATHEMATICAL SCIENCES



2017 FIELDS MEDAL SYMPOSIUM

WITH MARTIN HAIRER

+ The 2017 Fields Undergraduate Summer Research Program
+ Ada Lovelace Day
+ Spotlight on: MESH Consultants

FIELDS NOTES

VOLUME 17:3 - Fall 2017

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In every issue

Message from the Director

That's one of the great things about the Fields Institute – one day you're talking to the winner of one of the most prestigious prizes in mathematics, the next you're chatting with an aspiring young undergraduate.

This issue of Fields Notes features two major events from somewhat opposite sides of the spectrum. First there is the 2017 Fields Medal Symposium – an exciting 4-day event featuring the work of Martin Hairer (Fields Medal 2014). The Symposium opened with a packed public lecture by Martin, hosted at MaRS Discovery District, and continued with a top-notch scientific program and student night.

Next, we feature the 2017 Fields Undergraduate Summer Program (FUSRP), our largest ever, with 33 students from around the world working on ten exciting group projects. There was a nice writeup in the Globe and Mail (Sept 22, 2017) by science writer Ivan Semeniuk: "Where the Fields program has excelled is in matching elite students with one another and with the right mentors and research problems. The result provides an early taste of mathematics at a professional level that few non-mathematicians ever get to see or know." Meet four of the participants in this issue and hear their perspective on mathematics and working at Fields.

That's one of the great things about the Fields Institute – one day you're talking to the winner of one of the most prestigious prizes in mathematics, the next you're chatting with an aspiring young undergraduate.

Additionally, Fields hosted its first Ada Lovelace Day celebration in collaboration with Ryerson University. An excellent talk on the mathematics of genomes by Professor Lila Kari preceded a panel discussion on equity and diversity in mathematics.

We've also had some changes here at the Institute. Matheus Grasselli is the new Director of the Centre for Financial Industries taking over from Dan Rosen. We're also happy to announce the renewal of our partnership with the Perimeter Institute in supporting the African Institute for Mathematical Sciences Next Einstein Initiative and the launch of a new partnership with the DMZ at Ryerson.

As our 25th Anniversary year draws to a close, I want to thank everyone who took part in the celebrations. Wishing you happy holidays and a wonderful start to 2018.

Ian Hambleton
Director

News

Fields and Perimeter Support the African Institute for Mathematical Sciences Next Einstein Initiative

A new partnership between the Fields Institute, the Perimeter Institute, and the African Institute for Mathematical Sciences Next Einstein Initiative will provide post-doctoral fellowships and increased research opportunities for African scientists.

THE FIELDS AND PERIMETER INSTITUTES are pleased to announce a new partnership with the African Institute for Mathematical Sciences Next Einstein Initiative (AIMS-NEI). The new agreement includes renewal of the Fields-Perimeter Africa Postdoctoral Fellowship program for an additional five years, as well as increased opportunities for AIMS-NEI students and researchers to participate in the variety of programs offered by Fields Institute.

Launched in 2012, the Fields-Perimeter Africa Postdoctoral Fellowships provide the opportunity for recent PhD graduates who are African nationals working in areas of mathematical sciences or fundamental theoretical physics to spend one year at either of the two Canadian Institutes. The goal is to support the careers of young researchers who are committed to advance science in Africa.

The program is administered in partnership with the AIMS-NEI, a pan-African network of centers for post-graduate training, research, and public engagement in the mathematical sciences.

"So far, our partnership has succeeded beyond any initial hopes," said Neil Turok, Director of the Perimeter Institute. "The Fields-Perimeter Fellowship has attracted excellent candidates, distinguished not only by the quality of their science but also by their commitment to create opportunities for others. There is an abundance of youthful talent in Africa. Everything we can do today to hasten its development will bear great fruits for Africa and for science, in the future."

Turok specifically mentioned Praise Adeyemo (Fields-Perimeter Postdoctoral Fellow 2016-17) who recently organized the CIMPA School in Algebraic Geometry in Nigeria, and Prince Osei (Fields-Perimeter Postdoctoral Fellow 2015-16) who will be moving to Rwanda next month as the project developer for Quantum Leap Africa.

In addition to the Fellowship, Fields is also supporting the AIMS-NEI For Excellence program – a collaborative program to provide the most promising minds in Africa training and other opportunities to excel in STEM disciplines.

"It is a privilege to provide opportunities for promising young African researchers," said Ian Hambleton, Director of the Fields Institute. "The postdoctoral fellows from the last four years have been truly superb and have shared with us, not only their scientific abilities, but also their diverse perspectives. The next five years are sure to be exciting and productive." ❖

Matheus Grasselli takes over as Director of the Fields Centre for Financial Industries

The Centre is the focal point for Fields activities in quantitative finance.

THE FIELDS INSTITUTE is pleased to announce the appointment of Professor Matheus Grasselli as Director of the Fields Centre for Financial Industries (CFI) for a 3-year term, effective September 1, 2017. Grasselli takes over from Dan Rosen, who has led the Centre since its establishment in 2015.

Grasselli is currently a Professor of Financial Mathematics working with the PhiMac group in the Department of Mathematics and Statisticsat McMaster University, and previously served as the Fields Institute Deputy Director from 2012-2016.

As Deputy Director, Grasselli was directly involved in the creation of the CFI, and is excited to take on this new role and lead the Centre in new directions.

"Quantitative Finance is experiencing a renewal in terms of topics, techniques, and scope. This includes new areas in data analytics, blockchain technologies and other FinTech related topics. It will be exciting to see the Fields Institute develop a leadership role in this new landscape just as it did in the initial stages of financial mathematics."

Grasselli has been consistently involved with Institute activities since his arrival to Canada in 2001, including organizing a major thematic program in 2010.

"As a lead organizer of the thematic program on Quantitative Finance in 2010, I saw the convergence of world experts to Toronto and the tremendous boost it gave to research in the area, not to mention the impact on the career of young researchers, postdocs, and graduate students," says Grasselli, who became a Fields Institute Fellow earlier this year.

He believes it's important to participate in Fields programs, to ensure they continue to make a lasting impression on the community.

"I've experienced the impact that Fields has on the mathematical community, but none of that could be achieved without the active participation of local academics, who are the soul of the Institute." ❖

The Fields Institute and Ryerson DMZ Collaboration Set to Take Mathematical Startups to the Next Level

Collaboration will provide startup incubation and employment opportunities.

THE FIELDS INSTITUTE AND THE DMZ at Ryerson University – the number one university-based incubator in North America – are excited to announce a new collaboration to further entrepreneurship in the mathematical sciences.

The partnership aims to provide improved support for promising startups in the mathematical sciences as well as employment and partnership opportunities for students. This will also include quality startup referrals, potential partnerships, and invitations to events and workshops for member startups.

The Fields Institute is one of the premier mathematical research institutes in Canada providing a stimulating environment for mathematical innovation and education. Since 1999, Fields has fostered startup companies that commercialize mathematical ideas, giving them access to the physical, intellectual, and logistical resources of the Institute. Graduates of the Fields startup program include the Toronto-based asset management firm Sigma Analysis and Management, R2 Financial Technologies, Synchrony Consulting Services, and QWeMA (Quantitative Wealth Management Analytics) Group. Currently, start-up incubation

is managed through the Fields Commercial and Industrial Mathematics Program.

"We're very excited by the potential of this new relationship with the DMZ," says Fields Deputy Director Huaxiong Huang. "The Fields Commercial and Industrial Mathematics Program is always looking for new partnerships to expose our students to industry challenges. As the leading tech incubator in North America, the DMZ can give our students valuable exposure to the development of cutting-edge technology and starting new enterprises. In turn, Fields can provide mathematical expertise and refer promising new startups in the mathematical space."

Founded in 2010, the DMZ is the leading business incubator for tech startups in Canada. The DMZ helps startups grow great businesses by connecting them with customers, capital, coaches and a community of innovators to help them scale globally.

"At the DMZ, we're actively looking to connect Canadian entrepreneurs with business opportunities to help them further tap into industry and market expertise," said Abdullah Snobar, executive director of the DMZ at Ryerson University. "We look forward to welcoming the Fields Institute as a partner that will help us capitalize on the breadth of Canadian innovations in mathematical sciences." ❖

Fields Board Member Named Canada's Chief Science Advisor

Prime Minister Justin Trudeau announced the appointment of Dr. Mona Nemer in Ottawa last month.

ONE OF FIELDS NEWEST BOARD MEMBERS, Dr. Mona Nemer, was appointed as Canada's Chief Science Advisor, following an open, transparent, and merit-based selection process. The new role is part of the government's commitment to support scientists and strengthen the role of science in government.

"We have taken great strides to fulfill our promise to restore science as a pillar of government decision-making," said Prime Minister Justin Trudeau. "Today, we took another big step forward by announcing Dr. Mona Nemer as our Chief Science Advisor. Dr. Nemer brings a wealth of expertise to the role. Her advice will be invaluable and inform decisions made at the highest levels. I look forward to working with her to promote a culture of scientific excellence in Canada."

Dr. Nemer is a renowned health researcher and an accomplished senior academic leader, including more than ten years as the Vice-President, Research at the University of Ottawa.

As Chief Science Advisor, Dr. Nemer will provide impartial scientific advice to the Prime Minister and the Minister of

Science. She will also ensure that government science remains open and freely accessible to Canadians.

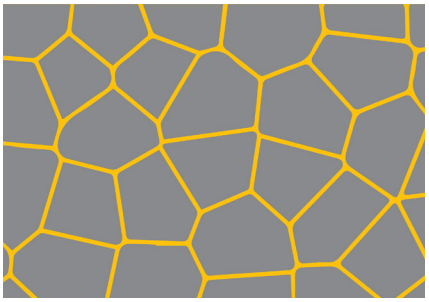
"I am honoured and excited to be Canada's Chief Science Advisor," said Dr. Nemer. "I am very pleased to be representing Canadian science and research – work that plays a crucial role in protecting and improving the lives of people everywhere." ❖

Calendar

THEMATIC PROGRAM

Emerging Challenges in Mathematical Biology

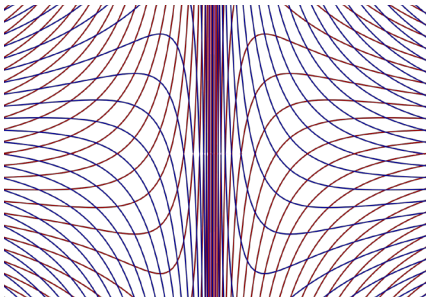
January to June, 2018



FOCUS PROGRAM

Nanoscale Systems and Coupled Phenomena

April 1 – May 31, 2018



FOCUS PROGRAM

Poisson Geometry and Physics

June 1 – July 31, 2018

WORKSHOPS AND CONFERENCES

Connections Between Complex, Harmonic, and Stochastic Analysis January 10 - 12, 2018 The Fields Institute

Hatchery Accelerator Weekend January 19 - 20, 2018 The Fields Institute

Combinatorial Algebra meets Algebraic Combinatorics January 26 - 28, 2018 McMaster University

Semaine d'Étude Maths-Entreprises (SEME) January 29 to February 2, 2018 Université Lille 1

CMM-Fields-Inria Workshop on Mathematics for Medicine January 31 to February 2, 2018 The Fields Institute

Software For Data Science Workshop: High Performance Computing in the Cloud – Numerical Simulation and Data Analysis February 5 - 6, 2018 The Fields Institute

High Intensity Focused Ultrasound: Mathematical Modeling and Clinical Applications March 7 - 9, 2018 The Fields Institute

1st Canadian Geometry and Topology Seminar March 14 - 16, 2018 The Fields Institute

Workshop on Algebraic Varieties, Hodge Theory and Motives March 19 - 22, 2018 The Fields Institute

Workshop on Immersed Lagrangian Cobordisms April 6 - 9, 2018 University of Ottawa

4th Conference on Financial Economics and Risk Management April 19 - 20, 2018 The Fields Institute

First Year University Mathematics Across Canada: Facts, Community and Vision April 27 - 29, 2018 The Fields Institute

Workshop on Robust Geometric Algorithms for Computational Fabrication April 30 to May 4, 2018 The Fields Institute

Taylor Model Workshop May 8 - 11, 2018 The Fields Institute

BioMath Days 2018 May 14 - 16, 2018 University of Ottawa

SPECIAL LECTURES

Coxeter Lecture Series: Henri Berestycki March 6 - 8, 2018 The Fields Institute

Keyfitz Lecture in Mathematics and the Social Sciences: Jane Menken April 12, 2018 The Fields Institute

Fields-Institute of Biomaterials and Biomedical Engineering (IBBME) Distinguished Speaker Series May 7, 2018 The Fields Institute

Life at Fields

GROW: Workshop on Graph Classes, Optimization, and Width Parameters

A list of open problems presented at GROW 2017 is posted on the workshop website.

MANY PRACTICAL PROBLEMS in applied computer science can be modelled by a mathematical structure called a graph or network. Most of these problems, often expressed in an optimization framework – find the largest complete subgraph, find the shortest spanning tour, find the minimum partition into independent sets – are intractable in the sense that it is very unlikely that a polynomial time algorithm exists. A large fraction of theoretical computer science research deals with such complexity issues. Intractability properties such as NP-hardness necessitate novel theoretical and practical advances – such as determining some underlying structure in the data – to find efficient, heuristic solutions to real world problems.

The first GROW (Workshop on Graph Classes, Optimization, and Width Parameters) was held in Barcelona, Spain in 2001 as a conference of mathematicians and computer scientists engaged in cutting-edge research in the area of discrete optimization algorithms on graphs. At the second GROW in Prague, Czech Republic, in 2005, it was agreed that the workshop would become a biennial event. This year's event was held at the Fields Institute in Toronto.

As with other GROW workshops, GROW 2017 had both invited (Bruno Courcelle, Zdenek Dvorak, and Anna Lubiw) and contributed talks as well as problem solving or discussion sessions. Thus, the researchers had a forum to share and discuss interesting and important applications, problems, and solution methods, which inevitably resulted in the establishment of many new research collaborations. This is especially rewarding for young scientists.

After each workshop, full versions of selected papers are invited to a special issue of the journal Discrete Applied Mathematics. Andrzej Proskurowski will be the Editor in Chief of the DAM issue associated with GROW 2017. It has been an important tradition, and an indication of the interest among research groups in the themes of our workshops, that some open problems discussed during the workshop are often solved in subsequent special issues.

GROW 2017 also greatly benefited from the serendipitous Tuesday, October 12th timing of Dr. Robert Tarjan's lecture on "Concurrent Disjoint Set Union" as part of U of T's Department of Computer Science Distinguished Lecture Series.

From the beginning, GROW has been run as an academic, grassroots directed event with no affiliation with any formal organization. Furthermore, the workshop is invitation only with considerable emphasis spent on identifying new junior colleagues interested in the GROW areas. Through GROW, we hope to unite theory and practice by demonstrating how graph-theoretic concepts can be applied to various areas in computer science, and by extracting new application-motivated problems. ❖

— Derek G. Corneil

FOCUS PROGRAM

Multi-scale Modelling of Wave Structures in Tissues

From August 28 to October 6, 2017, theoretical and experimental researchers in the areas of mathematical modelling, neuroscience, and biophysics gathered at the Fields Institute to develop new ideas and perspectives that can radically push forward the understanding of wave structures in the brain.

The program included three one-week long workshops, namely Wave Transport of Ionic Species, Waves in Neural Media, and Uncertainty Quantification (UQ) and Parameter estimation: High Dimensional Manifolds, which included a mixture of interesting seminars and lively discussions. The first workshop contained very valuable interactions between mathematicians and engineers with substantial cross-fertilisation of ideas. The second workshop benefitted substantially from the participation of K.C. Brennan, a clinician specialising in brain phenomena associated with migraines, and a number of extremely promising discussions arose from his talk. The third workshop contained a set of lectures from Pierre Gremauld along with seminars and research discussions.

There was also a Lecture Series on Mathematical and Computational Techniques for Life Sciences whose aim was to train graduate students and young researchers in the relevant modelling skills. The series was given by Tim David who provided the participating students and postdocs with a comprehensive background in the mathematical modelling of biological systems.

The program attracted a diverse mix of participants from a wide range of backgrounds including mathematicians, clinicians, experimentalists, physicists and engineers. Of the 43 participants, eight were graduate students, seven were postdoctoral researchers, and 11 identified as female. In addition participants were based in ten different countries including two students of Maori heritage all the way from New Zealand.

A number of promising new collaborations and research directions arose as a direct result of this program, including understanding how uncertainty quantification can be applied to models related to calcium propagation, consistently homogenising the equations for neural ion transport, developing a theory for ionic transport within a cell that is subjected to ion transport across its membrane, and developing a theory to explain calcium oscillations that have been observed in the experiments of one of the participants.

We believe that the program was particularly useful for students and young researchers. They all participated very actively in the Lecture Series on Mathematical and Computational Techniques for Life Sciences and gained valuable experience in both modelling and computational techniques. In summary, the program was very successful and we hope to run a short follow-up meeting in approximately two years time. ❖

— Tim David, Sivabal Sivaloganathan, Jonathan Wylie

FOCUS PROGRAM

Nonlinear Dispersive Partial Differential Equations and Inverse Scattering

From July 31 to August 23, 2017, the Fields Institute Focus Program on Nonlinear Dispersive Partial Differential Equations and Inverse scattering brought together specialists in completely integrable systems, inverse scattering, and partial differential equations.

The centerpiece of the program was the series of three Coxeter lectures delivered by Percy Deift. Deift began his lectures by describing the structure underlying the integrability of the defocusing nonlinear Schrödinger equation, and after a tour through other topics ranging from Hamiltonian systems to random matrix theory, he concluded his lectures by proposing a working definition of what it means for a problem to be integrable. The lectures drew a large audience including researchers in nearby areas, graduate students, and researchers in tangentially-related areas.

The Focus Program began with one-week a summer school for graduate students and early career researchers which developed important background material and described the landscape of integrable systems techniques in dispersive partial differential equations. Some lecturers also emphasized new phenomena and applications. Examples include the lectures of Walter Craig on interacting vortices and the presentation of Patrick Gérard on the integrability of the cubic Szegö equation and the growth of high Sobolev norms in its solutions. One researcher wrote afterwards:

“I found it to be a very beneficial meeting. My grad students were also very happy with the summer school. Several times now I have started explaining something to them, but they tell me they already know how to do it from the summer school.”

During the following two weeks, invited lecturers painted a compelling picture of current research on completely integrable and PDE techniques in dispersive nonlinear waves. Highlights of the first workshop week included lectures by Daniel Tataru and Rowan Killip on derived conserved quantities for the KdV and NLS equations to initial data in rough Sobolev spaces, dramatically increasing the reach of completely integrable methods. In the second week, Adrian Nachman announced a dramatic and far-reaching extension of the solution of the Cauchy problem for the defocusing Davey-Stewartson II equation, joint with his student Idan Regev and Daniel Tataru. Their work combines inverse scattering techniques with deep results in harmonic analysis including new fractional integral estimates and new L^2-boundedness theorems for pseudo differential operators. Both these results and many others presented at the conference underscore the timeliness of its subject and the importance of bringing researchers in these communities together.

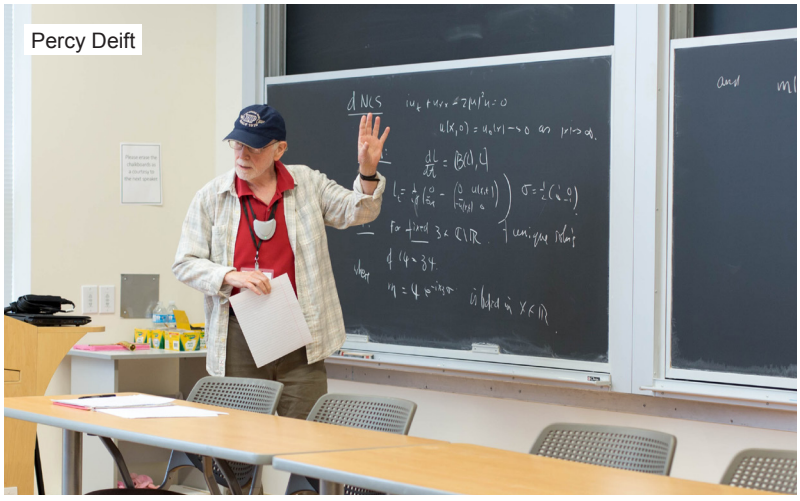
Participants of the Summer School

Finally, the poster presentations allowed graduate students and junior researchers to discuss their work with others and gather useful feedback. As an example, postdoc Deniz Bilman presented a poster on a new approach to the initial-value problem for the focusing nonlinear Schrödinger equation that drew many comments and allowed Bilman to learn first-hand from others working in the field, such as Gino Biondini, Percy Deift, Ken McLaughlin, and Barbara Prinari.

A number of participants initiated new collaborations or advanced international collaborations already in progress.

- Olga Assainova (graduate student), Christian Klein, Ken McLaughlin, and Peter Miller made progress that led to a paper analyzing the reflection coefficient for the defocusing Davey-Stewartson-II equation in the semiclassical limit. This paper was submitted just recently for publication.
- A group including Joel Klipfel (graduate student), Peter Perry, Allen Wu, and Peter Miller made progress in initiating a study of the inverse-scattering transform for the intermediate long-wave equation.
- Robert Buckingham, Robert Jenkins, and Peter Miller made progress in understanding a family of three-sheeted genus-zero Riemann surfaces underlying certain exact solutions of the three-wave resonant interaction equations. These solutions appear naturally in an asymptotic context during the interaction of monochromatic waves.
- David Smith and Deniz Bilman made progress on a collaborative project on interface problems for the nonlinear Schrödinger equation, with Deniz Bilman, and a project on the Massive Thirring Model with Robert Buckingham.
- Mark Hoefer and Michelle Maiden (graduate student) have begun a collaboration with Gino Biondini, initiated at Fields and due to interactions there. ❖

— Peter Miller, Peter Perry, Jean-Claude Saut, Catherine Sulem


Percy Deift

Spotlight


Tomei and Gibson

THE FIELDS Research Fellowship program was launched in 2017 as a way to bring high-calibre mathematicians to the Institute for a period of full-time "research in residence". Professor Carlos Tomei was one of the first Fields Research Fellows, staying at the Institute from July 2 to August 10, 2017 to work with Professor Peter Gibson from York University.

Tomei is a Full Professor in the Department of Mathematics at the Pontifical Catholic University of Rio de Janeiro in Brazil. His mathematical interests lie in analysis, with frequent interlacing of theoretical and computational aspects. He has been working with Gibson intermittently for ten years, and it was finally time for Tomei to reciprocate Gibson's visits to Rio.

"The visit to the Fields was such a wonderful opportunity. Everything was motivating: meeting old friends and making new ones, hours alternating walks and blackboard sessions."

As an extra bonus, the last three weeks of Tomei's stay coincided with a series of events related to subjects very close to his heart, culminating in the Coxeter Lectures given by Percy Deift, Tomei's former PhD supervisor and a constant inspiration.

"The six weeks we spent together at the Fields were very fruitful: we made progress on all fronts and Peter [Gibson] was the perfect host." ❖

— Malgosia Ip

Navigating stock market crashes in the Brexit-Trump era

THE FIELDS CENTRE FOR FINANCIAL INDUSTRIES arranged for Bill Ziemba to give a public lecture on Wednesday September 20, 2017 at the Fields Institute. Dr. Ziemba is Professor Emeritus at the Sauder School of Business at UBC, and is currently a Distinguished Visiting Research Associate at the London School of Economics.

Titled "Navigating stock market crashes in the Brexit-Trump era", the talk centred on work (joint with Sebastian Lleo and Mikhail Zhitlukin) that forms the basis for his recent book "Stock market crashes: big and small and what to do about them". In particular, they try to understand stock price bubbles, and have developed a risk measure aimed at predicting crashes in the stock market. Dr. Ziemba described how this risk measure would have performed in a number of recent market downturns, and compared it to the predictive tools that have already been developed by others. Being a public lecture, the talk didn't dwell on technical details. Instead, it shared interesting stories about Dr. Ziemba's many years spent as both an academic and a money manager, along with anecdotes about the colorful and outspoken friends and colleagues he has worked with (or in opposition to) over that time. ❖

— Tom Salisbury

New Frontiers in Complex Dynamics: From One to Several Variables

THE WORKSHOP ON NEW FRONTIERS in Complex Dynamics: From One to Several Variables brought together a vibrant community of researchers in the field, with many younger mathematicians, graduate students, and postdocs in attendance. Sixty-six mathematicians registered, and some of the lectures were attended by more than seventy people!

The workshop opened with a comprehensive talk from Misha Lyubich on dissipative complex Hénon maps. These maps can be viewed as perturbations of one-dimensional quadratic polynomials, and understanding the similarities and differences between the one- and two-dimensional cases has led much of the recent development of the field. In his talk, Lyubich overviewed several themes in this area that have been advanced in recent years. Over the course of the conference, these themes were expanded upon by many speakers.

In contrast to dissipative Hénon maps, the dynamics of conservative Hénon maps is quite mysterious, since one-dimensional intuition mostly does not apply. Eric Bedford gave an overview of some of the beautiful puzzles awaiting in this area which led to a lively discussion during the conference, and will without a doubt lead to much future work.

One of the highlights of the workshop was a talk by 1962 Fields medallist, Wolf and Abel prize winner, John Milnor, about his work in progress with Araceli Bonifant. They study a moduli space of projective isomorphism classes of algebraic curves in the projective plane, but have to deal with the difficulty that the action of the automorphism group of P2 on the appropriate space of curves is not proper.

On Tuesday evening, the participants had the pleasure of witnessing the stunning spectacle of the sunset over the Toronto skyline, as seen from the Kajama, a traditional 165 foot three-mast schooner. Many fond memories were made during the workshop, and, without a doubt, many new mathematical breakthroughs will follow from this activity. ❖

— Michael Yampolsky

Check the Fields Youtube channel for a video interview with John Milnor.

Narrating Neuroscience

ON OCTOBER 20, SCIENCE and art enthusiasts gathered at the Fields Institute for a discussion on the role of storytelling and art in communicating complex and often abstract concepts in neuroscience. The four speakers each presented their perspective on neuroscience communication, painting a diverse and multifaceted picture. Art can help explain neuroscience concepts and sometimes, neuroscience can even dictate art.

Matteo Farinella, PhD, Presidential Scholar in Society and Neuroscience – Columbia University

Matteo Farinella had two passions in his life, neuroscience research and comics. He never once considered that the two could be combined. That is, until a post-doc named Hana Ros joined his lab. She saw the potential, and what started out as an inside joke between the two of them soon became a beautifully illustrated story called Neurocomic. Supported by the Wellcome Trust, Neurocomic is a graphic novel journey through the human brain.

Farinella's goal was not to try and write a textbook in comic form – good textbooks with beautiful illustrations already exist. Rather, he wanted to focus on the narrative component. In his story, the main character gets trapped inside a brain and must learn about it to find his way out.

Shelley Wall, AOCAD, MSc, PhD – Assistant professor, Biomedical Communications Graduate Program and Department of Biology, UTM

Shelley Wall is a certified medical illustrator with a PhD in literature and a Masters in biomedical communication. Maybe it was this combination of qualifications that drew her to comics about medicine.

Similarly to Farinella, Wall's work focusses on the narrative component, but rather than purely educational, Wall is interested in more of a memoir-style comic where patients and caregivers share their personal experiences. When someone is diagnosed with a serious neurodegenerative disease, they are rarely interested in the mechanism or history behind the condition; they want to know what kind of treatment they can get, how long they have, and what effect this will have on their family.

Alfonso Fasano, MD, PhD, Associate Professor – University of Toronto Clinician Investigator – Krembil Research Institute Movement Disorders Centre – Toronto Western Hospital

Fasano's presentation was unique, in that it didn't focus on using art to communicate neuroscience, but rather on how neuroscience, more specifically brain disorders, can affect art.

Fasano showed examples of artists diagnosed with Parkinson's and how their art changed before and after diagnosis, and also after starting a medication regimen. He also explained that patients on Parkinson's medication can sometimes develop a condition called punding, where they are compelled to perform a task, seemingly a form of art, over and over again.

Tahani Baakdhah, MD, MSc, PhD candidate – University of Toronto

Baakdhah's presentation was different not because of the topic, but because of the medium. Baakdhah is the talent behind Knit-A-Neuron Toronto, where she teaches participants how to crochet various types of brain and retinal cells using homemade patterns. You may have seen her colourful and cuddly creations on Instagram or Twitter.

Baakdhah, who is completing her PhD in retinal stem cell biology at the University of Toronto, says she loves how engaged people become at these types of events. ❖

— Malgosia Ip

2017 Fields Medal Symposium

WITH MARTIN HAIRER

"Math seems to be exceptional in the sense that people do tend to get recognition at a young age."

"You're married to a Fields Medallist."

That's the text Xue-Mei Li, then a Professor of mathematics at the University of Warwick, received one cold February day. Her husband, Martin Hairer, had just gotten a phonecall saying that he'd won the 2014 Fields Medal for his outstanding contributions to the theory of stochastic partial differential equations.

Along with the Abel Prize, the Fields Medal is considered the most prestigious prize that a mathematician can receive – not bad for someone who finished high school not intending to study mathematics at all.

Hairer began his undergraduate career at the Université de Genève studying physics, but quickly realized that he didn't like the lab work, and was instead attracted to the more rigorous, theoretical side of the subject. He completed his PhD in 2001 under Jean-Pierre Eckmann, a mathematical physicist at the Université de Genève and a pioneer of chaos theory and social network analysis. It took just thirteen years from the day of his doctoral dissertation to that pivotal phonecall.

"Math seems to be exceptional in the sense that people do tend to get recognition at a young age," says Hairer. "You don't need so many resources, the lab, the manpower. In math when you're a PhD student or a postdoc you do pure research almost 100% of your time, so you can go much further and faster."

And rewarding young, promising researchers is part of the mandate of the Fields Medal, which is only awarded to mathematicians under the age of 40. Compare this to the average age of Nobel Prize laureates, which stands at 67 years across all categories and 56 years for physics prizes.

Perhaps this is one of the reasons Hairer's favourite part of the 2017 Fields Medal Symposium, at which he was the guest of honour, was the student night, where 150 high school and undergraduate students met with him over pizza and pop to discuss probability theory.

"Afterwards there was a whole bunch of them that, sort of, pinned me to the board and they were very interested," laughs Hairer.

The student night was just one of the evening events during the four-day Symposium, which was co-organized by Eckmann, Massimiliano Gubinelli (University of Bonn), Dmitry Panchenko (University of Toronto), Jeremy Quastel (University of Toronto), and Gigliola Staffilani (MIT). On the first night, a crowd of 250 gathered in the MaRS auditorium for the public opening, where Martin spoke about "Taming Infinities". One of the applications of Hairer's Fields Medal work is in so-called renormalization procedures that allow mathematicians and physicists to derive meaning from equations containing quantities of interest that appear to be infinite.

During the day, up to 200 researchers, graduate students, and postdocs filled the largest Fields seminar room to hear from world experts in stochastic PDEs and statistical physics. Among the presenters was Sylvia Serfaty, a Professor at the Courant Institute of Mathematical Sciences at NYU, who has known Hairer since grad school.

Since the time when they were students together, Hairer notes that his particular subfield of math has changed a lot – the kinds of questions people ask and the tools they have to answer those questions are very different and will no doubt continue to evolve. In his new position at Imperial College London, Hairer will certainly be one of the people pushing the field ever further. ❖

— Malgosia Ip

Fields Undergraduate Summer

The 2017 Fields Undergraduate Summer Research Program was our biggest ever, with 33 students from around the world working on 10 projects and exploring a wide range of mathematics.

Brian

Brian Morris is a declared math major who just finished his first year at Stanford, but you might find him reading more than math books – he plans to declare a second major in comparative literature next year. At Fields, Brian worked on Project 5: determining the local dimensions of self-similar measures with overlap, supervised by Kevin Hare and Kathryn Hare (no relation) from the University of Waterloo. Due to unforeseen issues, his project partner was unable to make it, but that doesn't mean Brian spent the summer alone. In fact, his favourite part of the program was meeting all the other undergrads who were "both as interested in math as [he was] and also normal, chill people that like to do fun things."

"Math is in every place – in biology, in mechanics, in physics, in whatever you want – math is there."

Magdalen

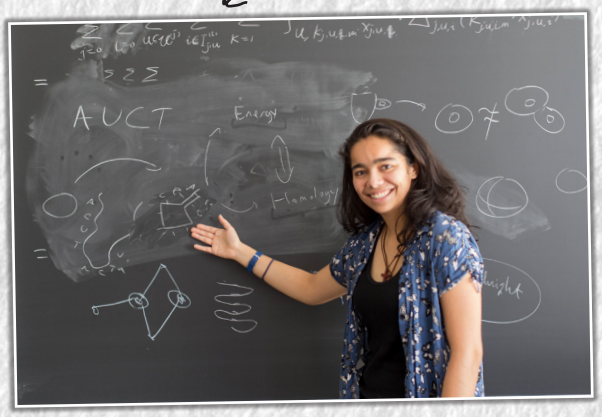
Up until grade 10, **Magdalen Dobson** thought she would study philosophy, but then, she discovered grade 11 calculus. "I started reading through my textbook and reading the proofs of all the theorems and I realized that the logic and reasoning that I struggled with in philosophy is much more prevalent in theoretical math. I think that's what made me decide to study it". She is now pursuing her undergraduate degree in pure math at MIT. At Fields, Dobson and her group were trying to find a less computationally intensive alternative to Marked Branching Diffusion for calculating value adjustments on derivatives. The work was supervised by a team from Scotiabank.

Got to see some Rogers Cup tennis from the VIP box courtesy of the Dean of Science and President's Office at York University!

Research Program

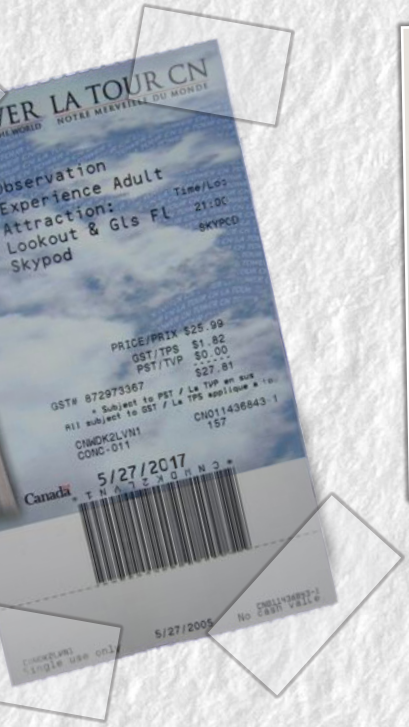
FUSRP in the Globe and Mail!
https://goo.gl/dLUjED

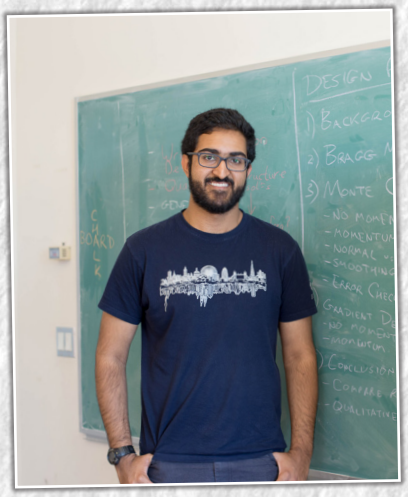
Astrid



Astrid Olave came to Fields all the way from Colombia, where she studies at the International University of Colombia in Bogota. Olave has been good at math for as long as she can remember, but it was in University that she really fell in love. “Math is in every place – in biology, in mechanics, in physics, in whatever you want – math is there.” At Fields, Olave worked on combinatorial optimization with Professor Konstantinos Georgiou from Ryerson University, where, not being used to the late summer sunsets, she sometimes worked till well into the night. Her favourite part of being at Fields was the ability to focus on research and to see the connections between applied mathematics and industry.

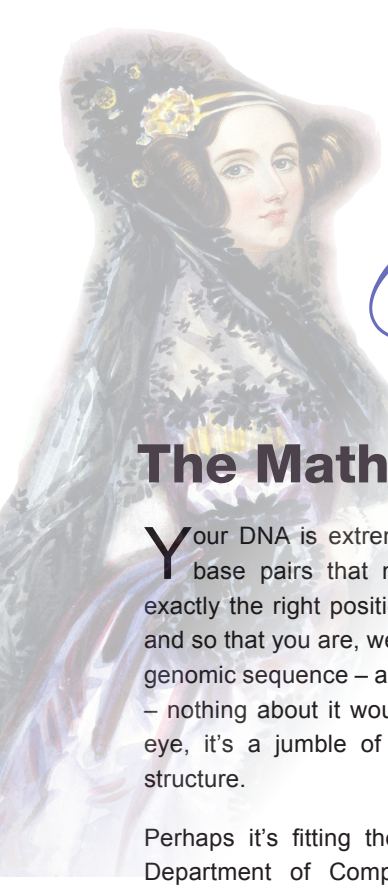
The whole group





Asad

Asad Chaudhary was one of the oldest undergraduates in the program this year – having just finished his undergraduate degree in mathematics at Imperial College London he is all set to start his PhD at Oxford in the fall. Chaudhary’s main area of interest is partial different equations (PDEs). “The thing that drew me to PDEs was this interplay between analysis and geometry,” he explains. As part of Project 2, Chaudhary studied sound propagation through laminated structures, either attempting to design a structure with certain acoustic properties, or determining the make-up of a structure given an input sound and the resulting echo. The project was supervised by Peter Gibson from York University. For Chaudhary the FUSRP offered a fresh perspective. “Everybody has different backgrounds: there are things that I’ve learned that others haven’t and things the others learned that I haven’t. And even if you learned the same things you may have been taught in different ways.”



Ada Lovelace Day

The Mathematics of Genomes

Your DNA is extremely organized. Each of the 3-billion base pairs that make up your genome is placed in exactly the right position so that everything works properly, and so that you are, well, you. But if you were to look at your genomic sequence – all 3 billion bases laid out in front of you – nothing about it would seem organized. To the untrained eye, it's a jumble of letters with no discernible order or structure.

Perhaps it's fitting then, that **Lila Kari**, Professor in the Department of Computer Science at the University of Waterloo, used chaos game theory to represent genomic sequences.

The premise is simple: begin with a single point at the centre of a square where each corner represents one of the DNA bases, A, C, T, or G. The next point is then determined by the midpoint of the line connecting the first point and the corner matching the next letter in the sequence. The third point is the midpoint of the line from that point to the corner matching the next letter, and so on.

Suddenly, when faced with these visual representations of the genome, the underlying structure and organization becomes clear. Patterns emerge that are very different from species to species. With a simple mathematical manipulation, the genome can be transformed into something quantifiable.

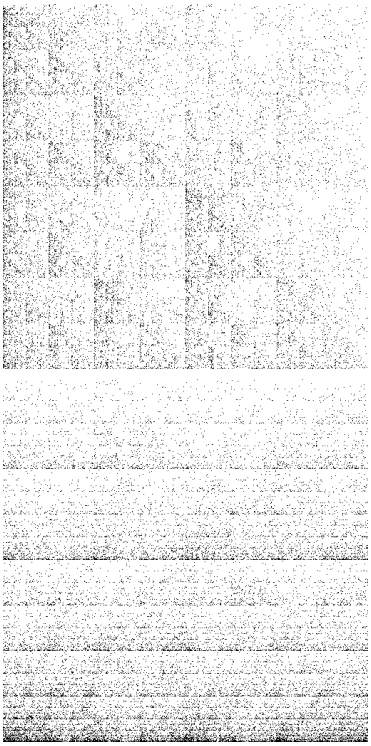
By computing the "image distance" between each graphical genome representation and then employing multi-dimensional scaling, Kari is transforming the tree of life into the map of life, with each DNA sequence represented as a single point in 3D space and the spatial proximity between any two points reflecting their degree of similarity.

When Kari's group performed this comparison for more than 3,100 complete mitochondrial genomes, known phyla and subphyla (mammals, amphibians, reptiles, etc.) clustered together in non-overlapping subsets with very few exceptions, and agreed remarkably well with classical phylogenetic trees. What gave Kari goosebumps is that species that crept over the boundaries often still appeared logically placed, like species of fish with primitive lungs that slid into the amphibian cluster.

"This method captured the fact that they have common characteristics and you are really unable to untangle them," says Kari. It also determined that the modern human is most closely related to the chimp and furthest from the cucumber.

The beauty of this approach is that it doesn't rely on direct comparisons of specific genes that may or may not exist in all organisms. The image distance employed, the Structural Dissimilarity Index (DSSIM), implicitly compares the occurrences of oligomers of length nine in DNA sequences, without reference to what those sequences are or which organism genome they were taken from.

"It can be a computer-generated sequence that makes no sense whatsoever or alien DNA from outer space. I don't care, bring it on," laughs Kari.



Chaos game theory representation of the miochondrial genome of the human (top) and red algae (bottom).

What's even more astonishing, is that the classification still works with non-contiguous pieces of each DNA sequence.

"The genome is a little bit like a book in many volumes. It's a language, like English. So this [method] captures something like word frequency. You can notice that you have the word 'the' occurring very frequently whether you take the whole volume or whether you take a sentence here or a sentence there."

This is especially exciting given that most sequencing results actually come in separate chunks, which are then fit together using other algorithms. With this method, you wouldn't even need to do that part before classification could begin.

"We developed a quantitative, universal mathematical method that is able to tell the relationship between species. This is not to be understated." ❖

— Malgosia Ip

PROF. LILA KARI ON GENDER EQUITY IN MATHEMATICS

"I am 100% sure that this is a cultural, artificial construct, because I come from a country where it doesn't exist. I did my PhD in Romania where computer science was in the Department of Mathematics and 2/3 of all the students were girls. So when I hear that someone points out, 'oh it's biological', I just laugh them away.

I've tried to think very hard in hindsight, what it was that made me study math – I never thought it would be a problem. Nobody implied to us in any way whatsoever at any stage of development that girls should not be able to do math."

The Panel

"Don't put a woman on a committee.. Make her the president. Put women in positions of power, not supporting roles." — Almut Burchard

"There have to be proactive approaches to hiring... with the tenure system, change happens very slowly." — Anthony Bonato

"Quotas are not going to work.. maybe "blind" hiring practises are one way to reduce bias." — Kathleen Miao

The Ada Lovelace Day panel

Finding the Statistical Rules of Blood Regeneration

On September 26, as part of the Fields Centre for Mathematical Medicine Seminar Series, Professor **Sidhartha Goyal** from the University of Toronto presented a phenomenological model of blood regeneration to explain how 100 billion new blood cells are made every day from a much smaller pool of blood stem cells.

Using data from a primate experiment that tracked the offspring of blood stem cell clones over time, Goyal studied the clone size distribution, or how much each initial stem cell contributes to the final blood pool. Two interesting results emerged: first, the distribution was very broad, with some clones contributing as much as 10% of the blood and others contributing very little; second, the size distribution remained constant even as the various clones ebbed and surged in numbers.

"The stability is in this distribution rather than the individual actors," says Goyal.

To explain results such as these, the idea of cellular heterogeneity has taken centre stage in blood research – is there some fundamental cell-level difference that determines which clone will overtake the others?

Using a simple, three-compartment model of stem cells, progenitor cells, and somatic cells, Goyal found that, in fact, the same broad distributions can be reproduced without any differences in the starting population of blood stem cells. That is, the results obtained in the primate experiment could be explained purely by chance.

"The truth is probably somewhere in the middle," he explains, with some clone success due to cell-specific differences and some due to chance."

But if chance is a major driver as Goyal's results suggest, then the model makes some interesting predictions that could have profound implications in the treatment of blood diseases like leukemia. Currently leukemia is treated with chemotherapy and bone marrow transplant in order to rid the body of the defective blood stem cell pool and replace it with a healthy one. But if the presence of a large number of cancerous blood cells is not due to their superiority over other normal cells, but simply because of statistical probability, then perhaps the defective cells can be replaced in a different way. Goyal reasons that if the clone size distribution could be reset and allowed to broaden again, the results may be different, with the cancerous clone now contributing very little to the blood pool. This could be done, Goyal suggests, by adding growth factors, increasing the differentiation and proliferation rate of all clones and transiently evening the playing field.

"This model allowed us to generate a new hypothesis, which right now is completely counterintuitive to anybody who thinks about these things. That is the real reason to do math models in my mind."

"This model allowed us to generate a new hypothesis, which right now is completely counterintuitive to anybody who thinks about these things. That is the real reason to do math models in my mind – that's the real contribution."

Goyal is now looking for collaborators to test these predictions either in vitro or in animal models. The results could change the way we think about treating blood cancers. ❖

— Malgosia Ip

Distinguished Lecture Series in Statistical Sciences: Raymond Carroll

ON OCT 4 AND 5, 2017, **Raymond James Carroll,** professor of Statistics at Texas A&M University, gave two public lectures for the Distinguished Lectures Series in Statistical Sciences. Professor Carroll's many areas of methodological research cover a wide range of application fields, including radiation and nutritional epidemiology, molecular biology, genomics and many others.

In his first lecture, Professor Carroll took the audience on a journey to understand how to measure dietary intakes in a population and how to relate such measures to mortality and chronic diseases. In animal experiments, different dietary patterns show that, for example, a fish oil enhanced diet is protective against colon cancer, DNA damage, deleterious gene expression and more compared to a corn oil enhanced diet. In humans, the statistical questions are much more difficult, because it is impossible, in current practice, to measure an individual's long-term average dietary intake across multiple foods and nutrients. This statistical issue, along with the media focus on dietary "magic bullets" has resulted in massive confusion, and sometimes silly conclusions. Professor Carroll emphasized that focusing on dietary patterns, instead of magic bullets, leads to far more robust statistical conclusions.

In his second lecture, Professor Carroll discussed statistical methods for efficient analysis of case-control studies of gene-environment interactions using a retrospective likelihood framework that exploits the natural assumption of gene-environment independence in the underlying population.

More than one hundred researchers and students attended the two lectures and the questions of diet, health, statistics, and mathematics lingered in the minds of audience members long after the lectures. ❖

— Xin Gao

2016-2017 York-Fields Math Circle

The York-Fields Math Circle is an outreach and enrichment program that brings together mathematicians and high school students from across the GTA. The Math Circle is headed by Dr. Varvara Nika, a York graduate, along with Dr. Corina Georgescu, a TCDSB high school teacher, and Stefana Penelea and Robert Jordan, graduate students in the MA for Mathematics Teachers program at York.

Last year the York-Fields Math Circle attracted 40 Grade 11/12 students.Students explored several advanced topics in the area of number theory, real analysis, cryptography, graph theory, geometry, trigonometry, sequences and series, vectors and linear algebra, probability, advanced counting techniques and problem solving strategies.

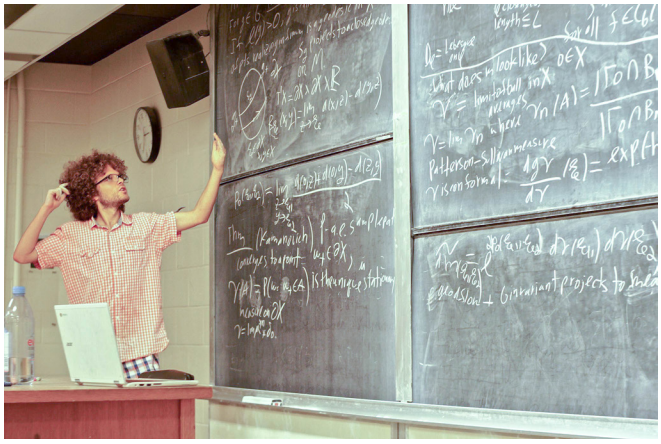
This year, the Math Circle was honored by a distinguished guest speaker, Professor Frank Sottile from the Department of Mathematics at Texas University, who spoke about "The Shape of Space". The presentation focused on how mathematicians manage to make sense of higher-dimensional spaces and related this to the recent proof of the Poincare conjecture that won one of the Clay Institute's Millennium Prizes.

From June 3rd to June 4th 2017, the York Math Circle team participated at the 2017 American Regions Mathematics League (ARML) competition in Pennsylvania, USA. This was the first time that York University sent their own team to the ARML competition. Although our team competed with only 13 students compared to the 15 that other teams had, we came 43rd among 140 teams. The strongest showing of our team was the power round questions in which our team scored 39 out 50. In the spirit of competition, the Math Circle students composed their own song, and wore red and white t-shirts. ❖

— Varvara Nika

In the Field

Dynamics in Number Theory and Geometry



The Conference on Dynamics in Number Theory and Geometry was the first Fields funded event in Dynamics at Queen's University in Kingston, Ontario. Our main goal was to give starting and early-career mathematicians the opportunity to meet with leaders in the field, as well as initiate new projects and collaborations, thus fostering a more inclusive network for the next generation of dynamicists.

We gathered about 50 people from 8 countries, including 28 graduate students and postdocs. Of the 19 talks, 15 were delivered by promising junior mathematicians.

The scientific activities in this conference covered a wide range of topics, including homogenous dynamics, Diophantine geometry, partially hyperbolic systems, translation surfaces, and Teichmüller theory. We were able to bring together two groups of scientists working in adjacent areas: those working on application of dynamics to Number Theory, and those working on dynamical systems of geometrical origin. Several themes appeared transversally in many presentations; for instance the connection between Farey fractions, homogeneous flows, and Diophantine approximation. Another common theme was rigidity and flexibility within different families of dynamical systems.

The week-long conference opened with "Farey statistics and applications" by Florin Boca (UIUC) who surveyed the connections between the statistical features of point processes of number-theoretical origin and ergodic theory, with emphasis on recent developments and open problems. Aaron Brown's (University of Chicago) talk "Groups acting on surfaces" aimed at presenting a unified theory of rigidity which would include the acclaimed results of Eskin-Mirzakhani-Mohammadi, Benoist-Quint, Brown-Rodriguez Hertz-Wang and his recent work on the Zimmer conjecture with Fisher and Hurtado. The talk "On the local Hölder exponent of the entropy function" by Giulio Tiozzo (University of Toronto) advertised a novel question about Holder exponent of functions of dynamical nature.

A special lecture was delivered by Damien Roy (University of Ottawa) on his acclaimed work on "Parametric geometry of numbers". Professor Roy, a leading number theorist, brought this new topic of research to our dynamically-minded participants. The conference also featured an afternoon without presentations, in which many participants broke up into small groups to discuss some details of the presentations and start new projects.

This event was sponsored by the Fields Institute, the Department of Mathematics and Statistics of Queen's University, and the Vice-Principal (Research) of Queen's University. ❖

— Francesco Cellarosi

Stochastic Processes and Their Applications

The Fields Workshop on Stochastic Processes and Their Applications was held at Carleton University from August 9-11, 2017 under the joint sponsorship of Fields Institute and the School of Mathematics and Statistics of Carleton University.

The three-day event featured by two 1.5-hour tutorials, 11 fifty minute invited talks, and 7 thirty-minute short talks given by graduate students. These talks covered a wide range of topics, including Markov processes, queueing networks, stochastic control and filtering, mean field models, stochastic simulations, finance, among others. The materials of the two tutorials were carefully designed to benefit both graduate students and researchers. David McDonald of University of Ottawa presented his tutorial on Yaglom limits, which are concerned with an appropriately defined limiting distribution for an absorbing Markov chain. The second tutorial was delivered by Opher Baron of University of Toronto on queueing and Makov chain decomposition (QMCD). The 11 fifty-minute invited talks covered a diverse range of topics related to probability, stochastic processes, and applications.

The event was very successful in bringing together nearly 40 participants and it provided an important forum where researchers and students in the field could meet to encourage on-going research, discuss work-in-progress, and motivate new initiatives. ❖

— Yiqiang Zhao

Workshop on Operator Systems in Quantum Information

The Workshop on Operator Systems in Quantum Information was held from August 14 to 17, 2017 at the University of Guelph. There were approximately 40 participants, with roughly half from the surrounding region and half drawn from around the world. Sponsorship was welcomed from the Fields Institute, the Institute for Quantum Computing at the University of Waterloo, and the Perimeter Institute.

The purpose of the workshop was to stimulate interaction between researchers with different backgrounds, who are broadly interested in the theoretical development of operator systems and their applications to quantum information. The participants were encouraged to discuss recent developments, modern techniques, as well as the challenges in their respective research programs. The topics ranged from recent theoretical developments such as operator system tensor products and their connection with Connes' Embedding Problem, to modern applications in non-local games, quantum correlations, zero-error quantum channel capacities, quantum error correction, and quantum local operations and classical communication.

Building on the format used at a similar workshop last year, of which several participants spoke positively and claimed generated new collaborations, the organizers ensured that significant time for scientific discussions was included in the daily schedule. Early indications suggest that once again, plenty of “work” was accomplished at this workshop as well.

Participants enjoyed pleasant summer weather in Guelph, with several exploring the university campus and old downtown area. The organizers were delighted to host this workshop and are grateful to all participants for their contributions to the program and discussions, and to the sponsors for their support. ❖

— Jason Crann and David Kribs

Spotlight

Daniel Hambleton and Elissa Ross

MESH CONSULTANTS

Elissa Ross and Daniel Hambleton, the two person team behind MESH Consultants, may have never met if it wasn't for the Fields Institute.

Ross was a postdoctoral fellow at the time, organizing a workshop at the Fields Institute on geometry and applications to 3D models, which Hambleton, who was just getting his fledgling consulting company off the ground, spontaneously decided to attend. And the rest was history. After working remotely on a contract basis, Ross soon became a full-time member of the team, applying her mathematical knowledge to problems in architecture, advanced manufacturing, geology, and even art.

MESH is a geometry consulting company, providing mathematical expertise to a variety of digital design problems.

"A lot of the traditional construction approaches have patterns," explains Hambleton. "If your building falls into the kind of pattern that the glazing manufacturer is used to, then you're good to go. But what designers always try and do is push the limits, and as soon as they do that they come up against these manufacturing constraints."

That's where MESH comes in. Using custom-built software called IOGRAM (iogram.ca), their aim is to make the design and construction of more complicated objects cheaper and more efficient. If you've ever walked by the Lassonde Engineering building at York University with its cloud-like façade, you've seen the results of MESH's work.

Hambleton started out working at large engineering firms, but found that he couldn't explore as much as he wanted to.

"I thought there could be a deeper role for applying math to the design industry."

And being part of Fields incubation program has been crucial in making that happen. In order to offer mathematical development services, Ross and Hambleton have to stay on top of the research in their respective fields – something that is very difficult to do outside of academia.

"Fields was the perfect blend between a space where I could run a business but also get access to journals, people and conferences," says Hambleton.

Recently, Ross was working on a novel method for applying thickness to a design surface, when she realized she was coming up to some challenges outside of her own mathematical expertise. So she walked down the hall and knocked on the door of someone who could help. This led to an 8-month NSERC Engage grant where Xiulei Cao, a postdoctoral fellow at York University co-supervised by Professors Huaxiong Huang and Michael Chen, worked with MESH to advance their techniques.

"That's the amazing thing about Fields – those sorts of moments." ❖

— Malgosia Ip

@FieldsInstitute

Our favourite tweets from the last four months

Just because...

Enjoying a visit to the @FieldsInstitute to do some mathematics!

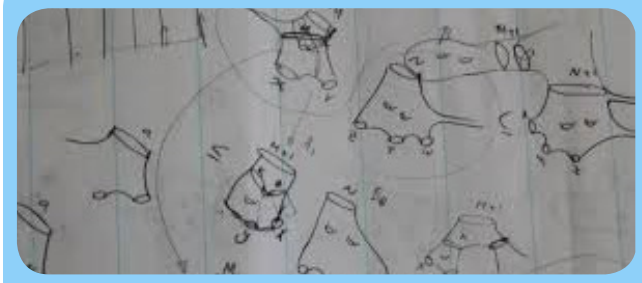
- Alejandro Adem, @alejandroadem

Just before Jason Lotay's public lecture: Adventures in the 7th Dimenstion

.@FieldsInstitute lecture about to start. Dear 18 year old self-you now go to math lectures for entertainment.

- Matthew Oldridge, @MatthewOldridge

After the sad news of Maryam Mirzakhani's passing



Doodles by a Fields Medal winner. Goodbye Maryam Mirzakhani. @FieldsInstitute @mknrcm @ FieldsMathEd

- Judy, @judy11235813

When we posted about the origin of Friday the 13th being unlucky

It's a PRIME example of numerical discrimination.

- Jonathan D. Evenboer, @jde13X

During the Fields Medal Symposium public opening

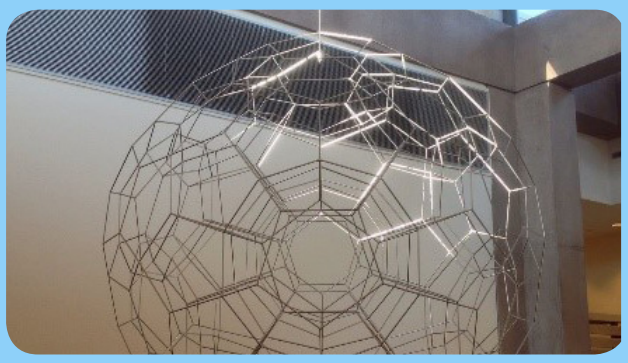
Martin Hairer giving his public talk titled "taming infinities" @ FieldsInstitute what an inspiring talk #2017FMS

- K1, @k1monfared

The Fields Institute has some intricate and beautiful artwork

At the end of the day, sunlight adorns this 120-cell displayed in the @FieldsInstitute.

- Joshua Bowman, @Thalesdisciple



During Lila Kari's talk at our Ada Lovelace Day event

@UWaterloo @FieldsInstitute Species with amphibian & reptile characteristics or fish with amphibian traits?? Molecular distance maps (MoD) capture these, weirdly cool!!

- Bhairavi Shankar, @b_muscateer

Upon encountering the ArtSci Salon guerilla display

Cool exhibit from @Thepurplelilac at @ FieldsInstitute Hope there is another #knitaneuronTO @SciCommTOsession soon.

- Elizabeth Neswald, @eneswald1

Back pages

Call for proposals, nominations, and applications

THEMATIC AND FOCUS PROGRAMS

The Fields Institute solicits proposals for a variety of programs in areas of current research interest in the mathematical sciences: (1) Major thematic programs, four-six months in length. (2) Thematic or focus programs, from one to two months in length to run concurrently with our major thematic programs; in particular, two-month summer programs of an interdisciplinary nature. Proposals or letters of intent should be submitted by March 15 or September 15, with a lead time of at least two years recommended for six-month programs.

GENERAL SCIENTIFIC ACTIVITIES

Proposals for short scientific events in the mathematical sciences should be submitted by October 15, February 15, or June 15 of each year, with a lead time of at least one year recommended. Activities supported include workshops, conferences, seminars, and summer schools.

OUTREACH PROPOSALS

The Fields Institute provides support for projects whose goal is to promote mathematical culture at all levels and bring mathematics to a wider audience. Faculty at Fields sponsoring universities or affiliates are invited to submit a proposal to the Fields Outreach Competition. There are three submission deadlines each year: February 15, June 15, and October 15. Proposals should include a detailed description of the proposed activity and the target audience. A budget indicating other sources of support is also required.

FIELDS INSTITUTE FELLOWS

To nominate someone as a Fields Fellow, please send a CV plus a letter briefly outlining why your candidate is a worthy nominee, to proposals@fields.utoronto.ca, or to:

The Director
Fields Institute
222 College Street, Second Floor
Toronto, Ontario M5T 3J1, Canada

Winners of the CRM-Fields-PIMS prize are automatically recommended for fellowship. No member of the current Fields Institute Board of Directors nor any continuing member of the Fields Institute Scientific Advisory Panel will be eligible. Nominations are encouraged from all qualified individuals, including women, members of visible minorities, and persons with disabilities.

THE DEAN'S DISTINGUISHED VISITING PROFESSORSHIP

The Dean's Distinguished Visiting Professorship is a joint program of the Fields Institute with the Faculty of Arts and Science, and the Department of Mathematics of the University of Toronto. Each year, the program brings a leading international researcher in the mathematical sciences to give a full-term course connected to a Fields Institute program, for graduate and advanced undergraduate students of the University of Toronto and other students participating in the program.

The Professorship currently provides a stipend of $50,000, and is selected by a committee representing the Fields Institute and the Department of Mathematics. Nominations can be made either to the Director of the Institute or to the Chair of the Department of Mathematics.

THE MARGARET SINCLAIR MEMORIAL

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 comprises a $5,000 prize and inscription of the winner's name on a plaque at the Fields Institute recognizing the recipients.

Candidates for the award may nominate themselves or be nominated by others.

A complete nomination packages consists of:

1. A nomination letter of no more than 1000 words demonstrating alignment with The Margaret Sinclair Memorial Award
2. A recent curriculum vitae
3. Three (3) letters from arm's length referees

Nominations for the 2018 Margaret Sinclair Memorial Award must be received electronically by the Fields Institute by December 1, 2017. Send to deputydirector@fields.utoronto.ca

Please note that nominations for the Margaret Sinclair Award will be kept under consideration for two additional years following the initial submission.

POSTDOCTORAL FELLOWSHIPS

The Fields Institute's Postdoctoral Fellowships provide for a period of research activity at the Institute during one of our thematic or focus programs. We are currently soliciting applications for Fields Postdoctoral Fellowships and Jerrold E. Marsden Postdoctoral Fellowships. Qualified candidates who will have a recent PhD (normally awarded not more than five years before tenure of the Fellowship) are encouraged to apply.

FIELDS RESEARCH FELLOWSHIP

This fellowship provides an opportunity for a period of full-time "Research in Residence" at the Fields Institute. Faculty members at our Principal Sponsoring Universities are invited to apply (e.g. for a period during a research leave from their own university), or to nominate a mathematical scientist for the purpose of collaborative research.

Fellowship holders will be provided with office space, access to all Fields facilities and activities, and an allowance for living expenses up to $3,500 for each month of full-time residence. The minimum length of residence is 1 month, and the maximum length normally 3 months. Note that faculty living in the GTA are not eligible to hold the fellowship, but may nominate external candidates for the award.

Selection of successful candidates will be made by the Directors of the Institute, in consultation with the Scientific Advisory Panel.

All application materials should be sent by e-mail to director@fields.utoronto.ca at least 3 months prior to the proposed start date. The annual application deadlines are September 15, January 15 and May 15.

FIELDS-PERIMETER AFRICA POSTDOCTORAL FELLOWSHIP

The Fields Institute for Research in Mathematical Sciences and Perimeter Institute for Theoretical Physics are inviting applications from African Nationals for a one-year Joint Postdoctoral Fellowship.

The deadline for applications to the 2018 Fields-Perimeter Africa Postdoctoral Fellowship will be November 15, 2017.

Applications are accepted through Mathjobs:

www.mathjobs.org/jobs/jobs/5691

FIELDS INCUBATOR PROPOSALS

In 1999, Fields began a program to foster start-up companies that commercialize mathematical ideas and that can benefit from the expertise at the Fields Institute. Companies are approved by the Fields Board on recommendation by the Industrial Advisory Board. The goal of the program is to enable members of the Fields community to start business ventures by giving them access to the physical, intellectual, and logistical resources of the Institute. Examples of successful Fields start-ups are Sigma Analysis and Management and R^2 Financial Technologies.

More information about this program can be obtained by contacting the Director at director@fields.utoronto.ca.

WANT TO SEE YOUR NAME IN PRINT?

Do you have a great math story to tell? Are you excited about your math research? FieldsNotes accepts contributions on a volunteer basis. Send your pitches to communications@fields.utoronto.ca.

BECOME A SUPPORTER OF THE FIELDS INSTITUTE

Mathematics provides a deep and powerful way of thinking about the world, yet it is not a static, finished subject. There are still many questions and great intellectual challenges remaining, and you can be part of the discovery.

With your support, the Fields Institute can create a more supportive, inclusive, diverse, and stimulating environment for research in the mathematical sciences. When you support Fields, you become part of the equation.

Donations are tax-deductible. For more information, please visit http://www.fields.utoronto.ca/about/fundraising or contact development@fields.utoronto.ca.

THEMATIC
PROGRAM ON

EMERGING CHALLENGES IN MATHEMATICAL BIOLOGY

JANUARY 1 TO
JUNE 30, 2018

NSERC CRSNG

Ontario

THE FIELDS INSTITUTE FOR RESEARCH IN MATHEMATICAL SCIENCES
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