

Canadian excellence, global recognition: Canada's 2019 winners of major international research awards



**Universities
Canada.**

Meet international award winners from previous years at: www.univcan.ca/globalexcellence



Celebrating Canadian curiosity

Canada's 2019 winners of international awards



Foreword by Dr. Donna Strickland

Professor in the department of physics and astronomy at the University of Waterloo
Nobel Laureate in Physics (2018)

I am thrilled to be part of a publication that celebrates the successes of Canada's research community. As we marvel at 2019's stellar research accomplishments, let's make this an opportunity to spark a much-needed conversation on the importance of cultivating curiosity and a spirit of discovery.

Growing up with an electrical engineer and English teacher for parents, talk around the dinner table often revolved around science, education or both. My parents always encouraged me to ask questions – nurturing an inquisitiveness that would drive my scientific career. I wish everyone had that opportunity and encouragement.

Creativity and innovation thrive when people are encouraged to ask questions for their own sake. The value of this approach to life, and research, is exemplified by the 2019 international research award winners and is something I've experienced throughout my own career.

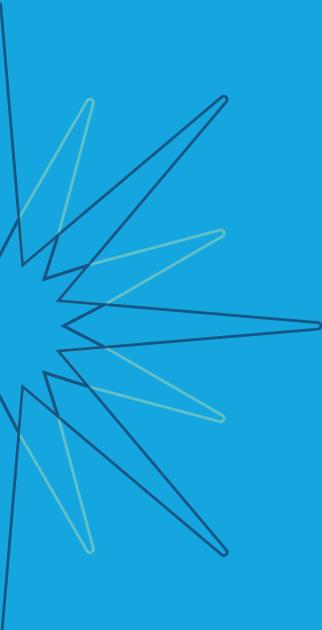
My early research was fuelled by my fascination with the relationship between light and matter. I could never have imagined that it would lead to industrial and medical applications for lasers, let alone the Nobel Prize in Physics.

Encouraging curiosity and science literacy is crucial to building a brighter future and equipping Canada's next generation of researchers and innovators to tackle challenges and harness opportunities we have yet to even imagine.

When we make science and research across disciplines more accessible, we open minds to the wonders of our world and increase evidence-based discussion and decision making – from conversations around the dinner table to public policy debates.

I hope the researchers featured in this year's publication will inspire Canadians to ask more questions, dig deeper and share what they've learned as widely as possible. An endlessly fascinating world awaits.

Canadian excellence, global recognition



Celebrating Canada's 2019 winners of major international research awards

At a time of rapid social and technological change, Canadian researchers, artists and innovators are tackling some of the world's most pressing challenges and intriguing questions.

The 14 award winners profiled in this publication show the breadth of Canadian talent garnering recognition at home and abroad. While their subject matter is wide-ranging – from exploring brain circuitry through the retina, to studying the first-ever images of a black hole, to shedding new light on real-world socio-political challenges through literature – they have all played an important role in advancing our collective knowledge and connecting Canada with the world.

Some are recognized for legendary discoveries and creations that have become building blocks for future generations. Others are in the midst of flourishing careers with a distinguished list of accomplishments to their names. Still others are just beginning to leave their mark, earning recognition and prestigious fellowships as rising stars in their fields.

Many among the “class of 2019” also reflect the collaborative aspects of research, art and innovation – combining knowledge and efforts across borders and disciplines.

We are proud to celebrate the tremendous achievements of this year’s winners. May they inspire this and future generations on their quest for greater knowledge and connection with the world around them.

Table of contents

7	Margaret Atwood The Booker Prize for Fiction	14	Mark Jurdjevic <i>Glendon College, York University</i> Guggenheim Fellowship
8	Yoshua Bengio <i>Université de Montréal</i> ACM A.M. Turing Award	15	Arjun Krishnaswamy <i>McGill University</i> Sloan Research Fellowship
9	Yang Cai <i>Yale University</i> Sloan Research Fellowship	16	Christine Muschik <i>The University of Waterloo</i> Sloan Research Fellowship
10	Simon Caron-Huot <i>McGill University</i> New Horizons in Physics Prize	17	Aaron Reinke <i>University of Toronto</i> Sloan Research Fellowship
11	Jessica Eaton Guggenheim Fellowship	18	Kendrick Smith <i>Perimeter Institute for Theoretical Physics</i> New Horizons in Physics Prize
12	Stephanie Green <i>University of Alberta</i> Sloan Research Fellowship	19	Pedro Vieira <i>Perimeter Institute for Theoretical Physics</i> New Horizons in Physics Prize
13	Geoffrey E. Hinton <i>University of Toronto</i> ACM A.M. Turing Award	20	The Event Horizon Telescope Collaboration Breakthrough Prize in Fundamental Physics

Margaret Atwood

Harnessing the power of literature for socio-political critique

The Booker Prize for Fiction

Internationally-renowned author, poet and literary critic Margaret Atwood was awarded the 2019 Booker Prize for Fiction, one of the most prestigious literary awards in the world, for her highly anticipated dystopian novel *The Testaments* – a sequel to her critically-acclaimed 1985 novel *The Handmaid's Tale*.

Released more than 30 years after *The Handmaid's Tale*, *The Testaments* follows the story of three drastically different women who reside in the Republic of Gilead, a futuristic, theocratic and totalitarian society in which women are stripped of their rights and agency. Exploring themes of class, subjugation, resistance and freedom, *The Testaments* is “a savage and beautiful novel that speaks to us today with conviction and power,” according to Booker judges.

Margaret Atwood began writing at the age of six, and by 16 she had committed to pursue writing as a career. She received her bachelor of arts from Victoria College at the University of Toronto, followed by her master's degree at Radcliffe College in Cambridge, Massachusetts. She also studied at Harvard University from 1962 to 1963 and from 1965 to 1967. She has taught English literature at a number of universities and colleges in both Canada and the United States.



Throughout her career, Ms. Atwood has written more than 50 books of fiction, poetry and critical essays and received more than 50 awards for her work, including the Governor General's Award in 1966 and 1985, the Giller Prize in 1996, the Italian Premio Mondello in 1997 and the PEN USA Lifetime Achievement Award. This achievement marks the second time Ms. Atwood has received the prestigious Booker Prize for her work, after first winning it in 2000 for her novel *The Blind Assassin*.

The Booker Prize is the leading literary award in the English-speaking world, and has brought recognition, reward and readership to outstanding fiction for over five decades. Each year, the prize is awarded to what is, in the opinion of the judges, the best novel of the year written in English and published in the UK and Ireland. It is a prize that transforms the winner's career.



Yoshua Bengio, a professor of computer science at Université de Montréal, was one of three winners of the 2018 ACM A.M. Turing Award. Announced and awarded in June 2019, the prize recognized Dr. Bengio and the other winners for their conceptual and engineering breakthroughs that have made deep neural networks a critical component of computing.

Dr. Bengio's work in the 1980s and 1990s laid the groundwork for the development of the deep learning field in the 2000s. Since 2010, his papers on generative deep learning have revolutionized applications of artificial intelligence in machine translation and for generating synthetic images and sounds. As the author or co-author of three books and some 500 papers, Dr. Bengio was the computer scientist with the most new citations in the world in 2018.

Dr. Bengio began his university studies at McGill in 1982, culminating in a PhD in computer science in 1991. Postdoctoral studies followed at the Massachusetts Institute of Technology and Bell Labs. Since 1993, Dr. Bengio has been a professor in the department of computer science and operational research at

Yoshua Bengio

A pioneer in deep learning

Université de Montréal
ACM A.M. Turing Award

Université de Montréal. In addition to holding the Canada Research Chair in Statistical Learning Algorithms, he is also the founder and scientific director of the Quebec Institute of Artificial Intelligence (Mila), the world's largest university-based research group in deep learning. He is also the scientific director of the Montreal-based Institute for Data Valorization (IVADO).

Among recent awards, Dr. Bengio was made an Officer of the Order of Canada and a Fellow of the Royal Society of Canada in 2017. That same year, he received the Prix Marie-Victorin and was named Scientist of the Year by Radio-Canada. In 2018, he received the 50th Anniversary Medal from Quebec's Ministère des Relations internationales et de la Francophonie. He has also been awarded a 2019 Killam prize.

The ACM A.M. Turing Award, the most prestigious technical award offered by the Association for Computing Machinery (ACM), is given for major contributions of lasting importance to computing. Often called the “Nobel Prize of Computing,” the ACM A.M. Turing Award carries a \$1 million prize. It is named for Alan M. Turing, the British mathematician who articulated the mathematical foundation and limits of computing.

Yang Cai

Combining computation and game theory

Yale University
Sloan Research Fellowship

Yang Cai, now an associate professor at Yale University, received a Sloan Fellowship in Computer Science for his promising research while at McGill University in the areas of algorithmic game theory, learning and statistics and online algorithms.

Dr. Cai's interests lie in theoretical computer science and its relationship with economics, probability, learning and statistics. For example, the design of revenue-optimal auctions is a central problem in both economics and computer science. Dr. Cai's research provides characterizations of the optimal auctions, as well as algorithms that can compute them in multi-item multi-bidder settings, resolving a long-standing problem since the 1980s.



Following his BA in computer science from Peking University, Dr. Cai earned a PhD in electrical engineering and computer science from the Massachusetts Institute of Technology. His doctoral thesis was recognized by the George M. Sprowls dissertation award and the SIGecom dissertation award. Post-doctoral work followed at the University of California, Berkeley. Dr. Cai joined McGill University's department of computer science as an assistant professor in 2014 and was named a William Dawson Scholar at McGill in 2016.

The Sloan Research Fellowships are given annually to early-career scientists and scholars whose achievements and potential identify them as rising stars and influential leaders. They are one of the oldest awards conferred by the Alfred P. Sloan Foundation, a philanthropic, not-for-profit grant-making institution based in New York City. The foundation makes grants in support of original research and education in science, technology, engineering, mathematics and economic performance. In 2019, the amount of the award was \$70,000.



Simon Caron-Huot, a Canada Research Chair in High-Energy Physics and assistant professor at McGill University, was one of three Canadian academics awarded the New Horizons in Physics Prize for “profound contributions to the understanding of quantum field theory.”

Dr. Caron-Huot’s interests lie in high-energy particle theory, a branch of physics that studies the nature of particles constituting matter and radiation. In particular, by studying scattering amplitudes in quantum chromodynamics, he aims to develop new on-shell techniques to simplify and enable new calculations. He is also interested in the N=4 super Yang-Mills model, which could become the first exactly solved field theory in four dimensions. The techniques he develops harness the surprising power of general principles – relativity and quantum mechanics – to break difficult quantitative calculations into simpler building blocks.

Simon Caron-Huot

Investigating the building blocks of nature

*McGill University
New Horizons in Physics Prize*

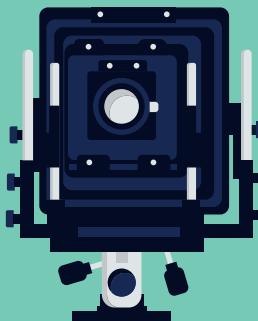
Following undergraduate studies in physics at Université Laval, Dr. Caron-Huot earned his PhD in physics from McGill University in 2009, where he studied hot and dense systems, including the quark-gluon plasma. He pursued post-doctoral work at the Institute for Advanced Study at Princeton between 2009-2014 and at the Niels Bohr Institute in 2012-2016 before joining the McGill University department of physics as an assistant professor.

The New Horizons in Physics Prize is awarded by the Breakthrough Prize Foundation to promising junior researchers who have already produced important work. Each year, the foundation awards up to three prizes of \$100,000. The prize is funded by a grant from the Milner Foundation.

Jessica Eaton

Investigating the essence of photography

Guggenheim Fellowship



Jessica Eaton, a Montreal-based photographer, has received a Guggenheim Fellowship to pursue her interest in the limits and potential of photography.

Ms. Eaton's photographs investigate components of the photographic process, such as light, colour and time to challenge human perception. With support from the fellowship, Ms. Eaton will build on earlier research into the reproduction and creation of colour, exploring the possibilities of the photographic print. A new body of work – tentatively entitled *Pure Pigment and Precious Metals* – may involve colour carbon prints, silvers, platinum, dye transfer and perhaps even daguerreotypes or holograms.

Jessica Eaton received her bachelor of fine arts degree in photography from Emily Carr University of Art + Design in 2006. Her work has been showcased across North America and Europe, including in the 2017 Canadian Biennial at the National Gallery of Canada, *Under Construction: New Positions in American Photography* at Foam Fotografiemuseum Amsterdam in 2014, and the Quebec Triennial 2011 in Montreal.

Eaton's work is held in many significant museum collections, including the National Gallery of Canada, Musée d'art contemporain de Montréal, and The Art Gallery of Ontario. She was a recipient of the Hyères Photography Jury Grand Prize in 2012 and the Talents 2011 Award from Foam International Photography Magazine. She was also longlisted for the Sobey Art Award in 2016 and the Aimia | AGO Photography Prize in 2013.

Since its establishment in 1925, the John Simon Guggenheim Memorial Foundation has granted more than \$360 million in Fellowships to more than 18,000 individuals, among whom are scores of Nobel laureates, Fields Medalists, poets laureate, members of the various national academies, and winners of the Pulitzer Prize, ACM A.M. Turing Award, National Book Award and other significant, internationally recognized honours.



Stephanie Green, an assistant professor in the department of biological sciences at the University of Alberta, was awarded a Sloan Research Fellowship to pursue her work on biodiversity change in aquatic ecosystems.

Dr. Green investigates how disturbances, like biological invasion, climate change and over-exploitation, alter the distribution and abundance of marine and freshwater species. Her research combines field experiments, behavioural observations and simulation modeling to evaluate how interactions between species are altered by disturbance, and its consequences for ecosystem structure and function.

Dr. Green's research produces predictive modelling tools that are used to identify management actions and solutions that are most likely to conserve and restore aquatic populations. Her lab applies this approach to a range of ecological issues, including setting targets for population control of invasive species, designing coral reef habitat restoration and predicting the effects of a changing ocean climate on the distribution of fisheries species.

Stephanie Green

Developing ecological forecasting tools to conserve biodiversity

*University of Alberta
Sloan Research Fellowship*

In 2013, following an undergraduate degree in ecology and environmental biology at The University of British Columbia, Dr. Green completed her doctoral studies in the department of biological sciences at Simon Fraser University. In 2016, following three years as a David H. Smith Conservation Research Fellow at Oregon State University, she was named a Banting Fellow at the Center for Ocean Solutions at Stanford University. Dr. Green joined the faculty of science at the University of Alberta in 2018.

The Sloan Research Fellowships are given annually to early-career scientists and scholars whose achievements and potential identify them as rising stars and influential leaders. They are one of the oldest awards conferred by the Alfred P. Sloan Foundation, a philanthropic, not-for-profit grant-making institution based in New York City. The foundation makes grants in support of original research and education in science, technology, engineering, mathematics and economic performance. In 2019, the amount of the award was \$70,000.

Geoffrey E. Hinton

The godfather of the deep learning revolution

*University of Toronto
ACM A.M. Turing Award*

Geoffrey Hinton, a professor at the University of Toronto who is often referred to as the godfather of deep learning, was one of three winners of the 2018 ACM A.M. Turing Award. Announced and awarded in June 2019, the prize recognized Dr. Hinton and the other winners for their conceptual and engineering breakthroughs that have made deep neural networks a critical component of computing.

Dr. Hinton aims to discover learning procedures that are efficient at finding complex structure in large, high-dimensional datasets. His contributions to neural network research include Boltzmann machines, distributed representations, time-delay neural nets, mixtures of experts, variational learning, products of experts, deep belief nets and capsule networks. His research group in Toronto has made major breakthroughs in deep learning that have revolutionized speech recognition and object classification.

Following an undergraduate degree in experimental psychology from the University of Cambridge in 1970, Dr. Hinton earned his PhD in artificial intelligence from the University of Edinburgh in 1978. After teaching at Carnegie-Mellon University for five years, he became a fellow of the Canadian Institute for Advanced Research (CIFAR) and moved to the department of computer science at the University of Toronto. He later spent three years setting up the Gatsby Computational



Neuroscience Unit at University College London before returning to the University of Toronto in 2001. From 2004 to 2013, Dr. Hinton also directed the CIFAR-funded Neural Computation and Adaptive Perception program (now the Learning in Machines & Brains research program).

Dr. Hinton is now an emeritus distinguished professor and a fellow of the Royal Society, the Royal Society of Canada, and the Association for the Advancement of Artificial Intelligence. Since 2013, he has been working halftime for the Google Brain team and now directs their research group in Toronto. He is also the chief scientific adviser of the Vector Institute.

Dr. Hinton has received honorary doctorates from the University of Edinburgh, the University of Sussex and the University of Sherbrooke. Among Dr. Hinton's honours, he was awarded the first David E. Rumelhart prize in 2001 and the NSERC Herzberg Gold Medal in 2010, which is Canada's top award in Science and Engineering.

The ACM A.M. Turing Award, the most prestigious technical award offered by the Association for Computing Machinery (ACM), is given for major contributions of lasting importance to computing. Often called the “Nobel Prize of Computing,” the ACM A.M. Turing Award carries a \$1 million prize. It is named for Alan M. Turing, the British mathematician who articulated the mathematical foundation and limits of computing.



Mark Jurdjevic, a professor of early modern European history at York University's Glendon Campus, has been awarded a Guggenheim Fellowship to explore friendship networks shared between Niccolò Machiavelli and Francesco Guicciardini. He will examine how their correspondence and epistolary debates informed the realist turn in late Renaissance historical and political writing.

Dr. Jurdjevic's research focuses on the Italian Renaissance, Machiavelli and Florentine political and intellectual history. It explores the social history of ideas and the process by which debates between intellectuals catalyze larger historical developments. Dr. Jurdjevic chose Renaissance Florence as an ideal setting to consider the impact of ideas on social and political life, as its inhabitants produced texts that enable detailed reconstructions of universal questions about democratic life.

Dr. Jurdjevic has written two books that consider these questions. *Guardians of Republicanism: The Valori Family in the Florentine Renaissance* was published in 2008 and *A Great and Wretched City: Promise and Failure in*

Mark Jurdjevic

Exploring political thought of the late Italian Renaissance

*York University
Guggenheim Fellowship*

Machiavelli's Florentine Political Thought was released in 2014. He has also co-edited several books, including *Florentine Political Writings from Petrarch to Machiavelli* in 2019. His new book, which is the subject of his Guggenheim Fellowship, will be entitled *Desperation's Remedies: Machiavelli and Guicciardini's Debate about Freedom and Florentine Republicanism*.

Following undergraduate and graduate work in history at the University of Toronto, Dr. Jurdjevic earned his PhD in history from Northwestern University in 2002. He joined the department of history at Glendon College, York University in 2009. He has also taught at the University of Ottawa and the University of Toronto, as well as at Yale University as a Mellon postdoctoral fellow at the Whitney Humanities Center.

Since its establishment in 1925, the John Simon Guggenheim Memorial Foundation has granted more than \$360 million in Fellowships to over 18,000 individuals, among whom are scores of Nobel laureates, Fields Medalists, poets laureate, members of the various national academies, and winners of the Pulitzer Prize, ACM A.M. Turing Award, National Book Award, and other significant, internationally recognized honours.

Arjun Krishnaswamy

Understanding the inner workings of the brain

*McGill University
Sloan Research Fellowship*

Arjun Krishnaswamy, an assistant professor in the department of physiology at McGill University's faculty of medicine, was awarded a Sloan Fellowship. The award, which recognizes promising early-career researchers, will help his lab pursue studies in neural circuitry.

Dr. Krishnaswamy seeks to understand how neurons form the complex circuits that underlie our mental abilities. He studies this problem in the retina, a thin sheet of neural tissue at the back of the eye that contains several neural circuits arranged in parallel, each attuned to detect a unique visual feature such as motion. Greater understanding of how these circuits assemble and how their wiring patterns support feature computations could yield insights into the workings of the brain, including how to treat neurological disease when circuits malfunction.



A member of the Cell Information Systems group at McGill's Life Sciences Complex, Dr. Krishnaswamy joined the university's faculty in 2017 following postdoctoral research at the Center for Brain Science at Harvard University. He earned his PhD from McGill University in 2009 after completing a graduate degree in physiology in the faculty of medicine. He received a bachelor of science from McGill in 2003.

The Sloan Research Fellowships are given annually to early-career scientists and scholars whose achievements and potential identify them as rising stars and influential leaders. They are one of the oldest awards conferred by the Alfred P. Sloan Foundation, a philanthropic, not-for-profit grant-making institution based in New York City. The foundation makes grants in support of original research and education in science, technology, engineering, mathematics and economic performance. In 2019, the amount of the award was \$70,000.



Christine Muschik, an assistant professor at the University of Waterloo, received a Sloan Fellowship in recognition for her research in quantum physics, which could eventually lead to greater understanding of high-energy physics – including the physics of the early universe.

Through the development of novel tools, Dr. Muschik explores and engineers interactions between light and matter. The tools, which focus on quantum networks and quantum simulations of models from high-energy physics, have applications in the field of quantum information science. Ultimately, she hopes to tackle problems related to heavy ion collisions in particle accelerators, matter at extreme densities and the physics of the early universe.

Christine Muschik

Investigating interactions between light and matter

University of Waterloo
Sloan Research Fellowship

Dr. Muschik completed both undergraduate and postgraduate studies at the Max Planck Institute for Quantum Optics in Germany, earning a PhD in 2011. Her theoretical research in quantum optics led to a postdoctoral fellowship at the Institute of Photonic Sciences in Barcelona, followed by further research at the Institute for Quantum Optics and Quantum Information in Austria. In 2017, Dr. Muschik joined the Institute for Quantum Computing and the department of physics and astronomy at the University of Waterloo. She is also an Emmy Noether Fellow and affiliate at the Perimeter Institute for Theoretical Physics.

The Sloan Research Fellowships are given annually to early-career scientists and scholars whose achievements and potential identify them as rising stars and influential leaders. They are one of the oldest awards conferred by the Alfred P. Sloan Foundation, a philanthropic, not-for-profit grant-making institution based in New York City. The foundation makes grants in support of original research and education in science, technology, engineering, mathematics and economic performance. In 2019, the amount of the award was \$70,000.

Aaron Reinke

Unlocking the mysteries of a one-cell parasite

*University of Toronto
Sloan Research Fellowship*

Aaron Reinke, an assistant professor of molecular genetics at the University of Toronto, was awarded a Sloan Fellowship in computational and evolutionary molecular biology.

By investigating how parasites interact with their hosts, Dr. Reinke aims to shed light on how pathogens evolve. His lab focuses on microsporidia, a common, one-cell parasite related to fungi. Microsporidia can infect nearly every species on the planet, causing disease and even death in humans with weakened immune systems. Through their research, Dr. Reinke and his team hope to better understand how microsporidia successfully infect and proliferate inside of their hosts – and become one step closer to finding a preventative solution.



Dr. Reinke earned his PhD from the Massachusetts Institute of Technology in 2012. During postdoctoral work at the University of California San Diego, he developed a system to see the proteins that microsporidia put into host cells. Building on this research, he set up a lab at the University of Toronto in 2017, using worms as a model to understand infection and immunity in other animals. This, in turn, may generate insight into environmental effects that are passed down from generation to generation, including in humans.

The Sloan Research Fellowships are given annually to early-career scientists and scholars whose achievements and potential identify them as rising stars and influential leaders. They are one of the oldest awards conferred by the Alfred P. Sloan Foundation, a philanthropic, not-for-profit grant-making institution based in New York City. The foundation makes grants in support of original research and education in science, technology, engineering, mathematics and economic performance. In 2019, the amount of the award was \$70,000.



Kendrick Smith was one of three academics awarded the New Horizons in Physics Prize "for the development of novel techniques to extract fundamental physics from astronomical data." Dr. Smith holds the Daniel Family P. James E. Peebles Chair in Theoretical Physics at the Perimeter Institute for Theoretical Physics in Waterloo.

As a "data-oriented" cosmologist, Dr. Smith mixes theoretical physics, phenomenology, computational physics, statistics and data analysis. He has been part of several large experiments, including on cosmic microwave background (CMB) – sometimes called the oldest light in the universe. Indeed, Dr. Smith is best known for data analysis and phenomenology that led to the first detection of gravitational lensing in CMB satellites. More recently, he joined the Canadian Hydrogen Intensity Mapping Experiment, a new experiment in British Columbia that aims to measure the radio sky with more sensitivity than previous all-sky surveys.

Kendrick Smith

Astronomical advances in fundamental physics

Perimeter Institute for Theoretical Physics
New Horizons in Physics Prize

Following a PhD in pure mathematics at the University of Michigan in 2000, Dr. Smith pursued a career as a software developer. However, his hobby of reading physics textbooks led to a second PhD in early universe cosmology from the University of Chicago in 2007. Dr. Smith pursued postdoctoral work at the University of Cambridge and Princeton University before joining the faculty of the Perimeter Institute.

Among previous awards, Dr. Smith was named a fellow in the CIFAR program Gravity & the Extreme Universe in 2019. As a member of Wilkinson Microwave Anisotropy Probe Science Team, he was also co-awarded the Breakthrough Prize in Fundamental Physics in 2018 and the Gruber Cosmology Prize in 2012.

The New Horizons in Physics Prize is awarded by the Breakthrough Prize Foundation to promising junior researchers who have already produced important work. Each year, the foundation awards up to three prizes of \$100,000. The prize is funded by a grant from the Milner Foundation.

Pedro Vieira

Advancing our knowledge of quantum field theory

Perimeter Institute for Theoretical Physics
New Horizons in Physics Prize

Pedro Vieira, who holds the Clay Riddell Paul Dirac Chair at the Perimeter Institute for Theoretical Physics in Waterloo, was one of three Canadian academics awarded the New Horizons in Physics Prize for “profound contributions to the understanding of quantum field theory.”

Dr. Vieira’s main research aims at developing new techniques for studying quantum field theories and string theories at finite coupling. String theory attempts to group the four known fundamental interactions – gravitation, electromagnetism, strong nuclear force and weak nuclear force – into a single theory. He studies a special massless supersymmetric quantum field theory known as N=4 SYM. If the theory can be solved, it could provide valuable lessons about the foundations



of quantum field theory and string theory. In a complementary approach, Dr. Vieira also tries to carve out the space of all massive quantum theories by asking more general questions.

Following an undergraduate degree at the University of Porto, Dr. Vieira pursued graduate work at the École normale supérieure in Paris where he earned his PhD in physics in 2008. He joined the faculty of the Perimeter Institute in 2009. Dr. Vieira was previously awarded a Sloan Fellowship and the Gribov Medal in 2015.

The New Horizons in Physics Prize is awarded by the Breakthrough Prize Foundation to promising junior researchers who have already produced important work. Each year, the foundation awards up to three prizes of \$100,000. The prize is funded by a grant from the Milner Foundation.



In April 2019, the Event Horizon Telescope collaboration – a global network of 347 researchers at 60 institutions in 20 countries around the world – unveiled the first-ever image of a supermassive black hole, making headlines worldwide. This breakthrough discovery earned the 2020 Breakthrough Prize in Fundamental Physics, one of the field's most prestigious prizes. Among these 347 researchers were 11 Canadian scientists from McGill University, the Canadian Institute for Theoretical Astrophysics at the University of Toronto, the Perimeter Institute for Theoretical Physics and the Canadian Nuclear Association.

By strategically positioning and synchronizing eight sensitive radio telescopes in Antarctica, Chile, Mexico, Hawaii, Arizona and Spain, the international team of researchers created a virtual telescope as large as the Earth, with unprecedented power. This allowed researchers to target and capture a photo of the supermassive black hole at the center of the

The Event Horizon Telescope Collaboration

Making history with an Earth-shattering image

Breakthrough Prize in Fundamental Physics

Messier 87 galaxy in the Virgo constellation, which matched expectations of Einstein's theory of gravity: a bright ring marking the point where light orbits the black hole, surrounding a dark region where light cannot escape the black hole's gravitational pull.

This historic discovery also underlines the importance of international research collaboration in uncovering the greatest mysteries in our universe.

The Breakthrough Prize in Fundamental Physics was founded in 2012 by Yuri Milner to recognize researchers around the world who have made profound contributions to human knowledge. It is open to all physicists – theoretical, mathematical, experimental – working on the deepest mysteries of the universe. Valued at \$3 million, the Breakthrough Prize is one of the most prestigious and generous prizes in the world.

Canadian Recipients of the 2020 Breakthrough Prize

John Barrett

Canadian Nuclear Association

Avery Broderick

Perimeter Institute for Theoretical Physics

Boris Georgiev

Perimeter Institute for Theoretical Physics

Daryl Haggard

McGill University

Britton Jeter

Perimeter Institute for Theoretical Physics

Mansour Karami

Perimeter Institute for Theoretical Physics

Chun-chong Ni

Perimeter Institute for Theoretical Physics

Ue-Li Pen

Canadian Institute for Theoretical
Astrophysics, University of Toronto

Jorge A. Preciado López

Perimeter Institute for Theoretical Physics

Hung-Yi Pu

Perimeter Institute for Theoretical Physics

Paul Tiebe

Perimeter Institute for Theoretical Physics



Universities Canada member institutions

Acadia University	HEC Montréal	NSCAD University	Université de Sherbrooke
University of Alberta	Huron University College	OCAD University	Simon Fraser University
Algoma University	Institut national de la recherche scientifique	Ontario Tech University	St. Francis Xavier University
Athabasca University	University of King's College	University of Ottawa	St. Jerome's University
Bishop's University	The King's University	Polytechnique Montréal	University of St. Michael's College
Brandon University	King's University College at Western University	University of Prince Edward Island	St. Paul's College
Brescia University College	Kwantlen Polytechnic University	Université du Québec à Chicoutimi	St. Thomas More College
The University of British Columbia	Lakehead University	Université du Québec à Montréal	St. Thomas University
Brock University	Laurentian University	Université du Québec à Rimouski	University of Sudbury
University of Calgary	Université Laval	Université du Québec à Trois-Rivières	Université TÉLUQ
Campion College	University of Lethbridge	Université du Québec en Abitibi-Témiscamingue	Thompson Rivers University
Canadian Mennonite University	Luther College	Université du Québec en Outaouais	University of Toronto
Cape Breton University	MacEwan University	Queen's University	Trent University
Carleton University	University of Manitoba	Redeemer University College	University of Trinity College
Concordia University	McGill University	University of Regina	Trinity Western University
Concordia University of Edmonton	McMaster University	Royal Military College of Canada	Vancouver Island University
Dalhousie University	Memorial University of Newfoundland	Royal Roads University	University of Victoria
École de technologie supérieure	Université de Moncton	Ryerson University	Victoria University
École nationale d'administration publique	Université de Montréal	Saint Mary's University	University of Waterloo
Emily Carr University of Art + Design	Mount Allison University	Université de Saint-Boniface	Western University
First Nations University of Canada	Mount Royal University	Université Sainte-Anne	Wilfrid Laurier University
University of the Fraser Valley	Mount Saint Vincent University	University of Saskatchewan	University of Windsor
University of Guelph	University of New Brunswick		The University of Winnipeg
	Nipissing University		York University
	University of Northern British Columbia		

In recognition of our partners:

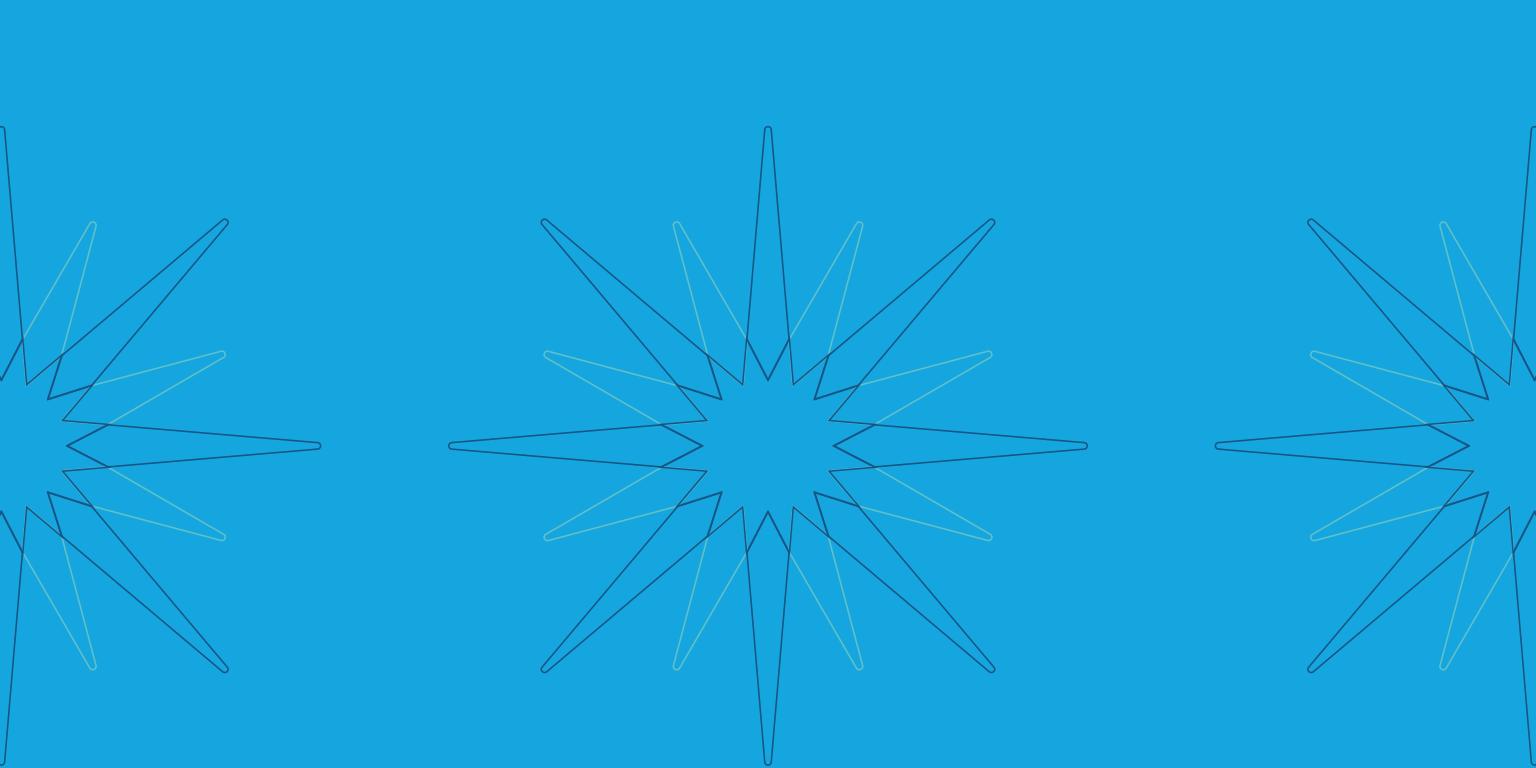


Conseil de recherches
en sciences humaines
du Canada

Social Sciences and
Humanities Research
Council of Canada



Cette publication est aussi disponible en français.



For more information:
communications@univcan.ca
613 563-1236

univcan.ca
@univcan



**Universities
Canada.**