



2018/19 Annual Report Supplement

Covering the Objectives, Activities, and Finances
for the period of August 1, 2018, to July 31, 2019

Submitted by: Robert C. Myers, Director
To: The Hon. Navdeep Bains, Canadian Minister of Innovation, Science, and Industry

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Objective 1: Achieve breakthroughs in our understanding of the universe

Summary of Achievements

- Advanced fundamental research through 459 high-calibre papers¹
- Since inception, Perimeter researchers have produced more than 5,792 papers appearing in 218 journals, which have earned 289,613 citations to date, attesting to the importance and long-term impact of Perimeter research²
- 17 major national and international honours

Highlights

For detailed descriptions of several research highlights for the past year, refer to **pages 6-15** of the Annual Report.

For a list of honours, awards, and major grants received by Perimeter researchers, including details on the Breakthrough and New Horizons prizes, refer to **pages 18-19** of the Annual Report.

Supplementary Information (beyond the Annual Report Contents)

Grants

In 2018/19, eight Perimeter scientists were awarded Discovery Grants totalling \$2,267,500 (over terms of five years) from the Natural Sciences and Engineering Research Council of Canada (NSERC) to support graduate students.

- Stavros Niarchos Foundation Aristarchus Chair Asimina Arvanitaki: \$380,000 (\$52,000/year over five years, plus a Discovery Accelerator Supplement of \$40,000/year over three years)
- Faculty member William East: \$177,500 (\$33,000/year over five years, plus a \$12,500 Discovery Launch Supplement)
- Krembil Galileo Galilei Chair Davide Gaiotto: \$385,000 (\$77,000/year over five years)
- Faculty member Jaume Gomis: \$290,000 (\$58,000/year over five years)
- Faculty member Yin-Chen He: \$207,500 (\$39,000/year over five years, plus a \$12,500 Discovery Launch Supplement)
- Director and BMO Financial Group Isaac Newton Chair Robert Myers: \$365,000 (\$73,000/year over five years)
- Associate Faculty member Will Percival: \$305,000 (\$61,000/year over five years)

¹ This reflects the one-year period from August 1, 2018, to July 31, 2019. Each publication has been counted only once, regardless of how many Perimeter researchers collaborated on it.

² This data comes from Google Scholar, Research Gate, INSPIRES, ads (Harvard astrophysics data system), APS, and others.

- Associate Faculty member Daniel Siegel: \$157,500 (\$29,000/year over five years, plus a \$12,500 Discovery Launch Supplement)

Three Perimeter scientists were awarded grants totalling \$117,191 from the Foundational Questions Institute (FQXi):

- Faculty member Lucien Hardy, \$55,680
- Associate Faculty member Matthew Johnson, \$9,825
- Postdoctoral researcher Ana Belen Sainz, \$51,673

Two Perimeter faculty were awarded grants totalling \$60,000 as part of their fellowships with the Canadian Institute for Advanced Research (CIFAR):

- Kendrick Smith, \$30,000
- Guifre Vidal, \$30,000

Objective 2: Create the world's strongest community of theoretical physics researchers

Summary of Achievements

- Appointed Robert Myers as the new Director of Perimeter Institute
- Attracted major investments, including a \$10 million commitment from the Riddell Family Charitable Foundation in support of the Clay Riddell Centre for Quantum Matter
- Welcomed Chong Wang as a full-time faculty member, bringing the total to 24
- Welcomed Debbie Leung, Christine Muschik, and Daniel Siegel as new associate faculty members, bringing the total to 21
- Launched several initiatives aimed at increasing equity, diversity, and inclusion

Highlights

For details on the appointment of Robert Myers as Director, refer to **page 20** of the Annual Report.

For details on Perimeter Research Chairs, faculty, and associate faculty, including profiles of new faculty hire Chong Wang and new associate faculty hires Debbie Leung, Christine Muschik, and Daniel Siegel, refer to **pages 20-21** of the Annual Report.

For complete faculty and associate faculty bios, refer to **pages 49-56** of the Annual Report.

For more information on 2018/19 equity, diversity, and inclusion initiatives, refer to **pages 16-17** of the Annual Report.

Supplementary Information (beyond the Annual Report Contents)

Perimeter Institute has an ongoing comprehensive attraction and retention strategy, including the following:

- Comprehensive ongoing support for researchers' families, including career support to partners, assistance accessing social services and childcare, and social gatherings to help them build a support network and become established in the local community
- Numerous ongoing wellness and social activities for resident researchers and staff, contributing to a positive work environment

New attraction and retention initiatives in 2018/19:

- Director of People and Culture Sheri Keffer was certified as a Regulated Canadian Immigration Consultant

Equity, diversity, and inclusion initiatives beyond those included in the Annual Report:

- Established 42 Degrees, a group that provides information and support and organizes events for LGBTQ+ people and their allies
- Held workshops on equitable and respectful communication for researchers and senior leadership

Objective 3: Attract and develop the next generation of brilliant minds

Summary of Achievements

- Welcomed 19 new postdoctoral researchers for a total of 63.
- Provided ongoing training for 58 PhD students in residence and 25 associate PhDs
- Perimeter PhD students include four Vanier Canada Graduate Scholars and one NSERC Gilles Brassard Doctoral Prize winner
- Successfully ran the Perimeter Scholars International (PSI) master's program for 33 students; in 10 years, 310 students have completed the PSI program. The program continues to be very popular; only seven percent of the 500-plus applicants for 2018/19 received an offer, and more than 94 percent accepted, a rate higher than virtually all top international institutions.
- Started a new summer school program for undergraduates, and welcomed 20 students
- Welcomed 46 Visiting Graduate Fellows to the Institute

Highlights

For a description of Perimeter's postdoctoral researcher program and a profile of postdoctoral researcher Béatrice Bonga, refer to **page 28** of the Annual Report. For a complete list of postdoctoral researchers, refer to **page 57** of the Annual Report.

For a description of Perimeter's PhD program and a profile of PhD student Anna Golubeva, refer to **page 29** of the Annual Report. For a complete list of PhD students, refer to **page 59** of the Annual Report.

For a description of PSI and details on its 10-year anniversary, refer to **page 30** of the Annual Report. For a complete list of PSI faculty and students, refer to **pages 58-59** of the Annual Report.

For a description of the Visiting Graduate Fellows program refer to **page 28** of the Annual Report.

Objective 4: Attract outstanding visiting scientists

Summary of Achievements

- Appointed five leading scientists as a Distinguished Visiting Research Chairs (DVRCs), and renewed six more, bringing the total to 44
- Appointed eight accomplished researchers as Visiting Fellows and renewed four more, bringing the total to 51
- Welcomed six early-career researchers as Simons Emmy Noether Fellows, including Christine Muschik, who has now been hired as an associate faculty member at Perimeter
- Held 11 conferences and workshops, attended by 620 scientists from around the world
- Presented 315 scientific talks, seminars, and colloquia
- Hosted 512 visiting scientists including DVRCs, Visiting Fellows, Visiting Researchers, Affiliates, scientific collaborators, Simons Emmy Noether Fellows, and more

Highlights

For a description of the DVRC program, refer to **page 22** of the Annual Report. For a full list of DVRCs, refer to **page 58** of the Annual Report.

For a description of visitor and affiliate programs, including a profile of Visiting Researcher Oliver Schlotterer, refer to **page 23** of the Annual Report. For a full list of Visiting Fellows, refer to **page 23** of this supplement.

For details on the Simons Emmy Noether Fellows program, including its place in Perimeter's broader Emmy Noether Initiatives, refer to **pages 16-17** of the Annual Report. For a full list Simons Emmy Noether Fellows, refer to **page 22** of this supplement.

For details on Perimeter's conferences, workshops, seminars, and colloquia, refer to **pages 24-25** of the Annual Report. For a full list of conferences **see page 60** of the Annual Report.

Objective 5: Act as Canada’s hub for foundational physics research

Summary of Achievements

- Created the Perimeter Institute Quantum Intelligence Lab (PIQuIL) as a research centre and training hub for future leaders at the intersections of artificial intelligence and quantum systems, led by Associate Faculty member Roger Melko
- In partnership with, and jointly funded by, the National Research Council (NRC), created four new postdoctoral fellowships and two new graduate fellowships
- Continued to work closely with all relevant partners to foster the Quantum Valley ecosystem
- Deepened ties with experimental and observational centres in Canada and abroad
- Jointly appointed three associate faculty members with the University of Waterloo and the University of Guelph (see Objective 2)
- Partnered with the University of Waterloo to hold the PSI master’s program and involved faculty from Canadian universities as lecturers (see Objective 3)
- Appointed two new Affiliate researchers and renewed 32 more
- Sponsored 12 off-site workshops and conferences across Canada, from New Brunswick to British Columbia
- In partnership with the University of Waterloo, the Waterloo Global Science Initiative developed and distributed the *Generation SDG Blueprint*, outlining recommendations from the 2018 Summit tied to effective Canadian implementation of the United Nations’ Sustainable Development Goals

Highlights

For more information about PIQuIL, refer to **page 13** of the Annual Report, and to the supplemental information below.

For a list of sponsored off-site workshops and conferences, see **page 60** of the Annual Report.

Supplementary Information (beyond the Annual Report Contents)

Perimeter Institute Quantum Intelligence Lab (PIQuIL)

With partners in academia, industry, and government, PIQuIL, launched in 2018/19, is an innovative venture aimed at leveraging Perimeter’s many ties and world-class talent to conduct unique, multidisciplinary research at the intersection of machine learning (ML) and quantum systems.

Physicists are in a unique position to harness ML for fundamental research. In addition, their deep knowledge of the foundations of statistical and quantum physics is already catalyzing technology transfer back to research in industry applications of artificial intelligence (AI). As such, physicists are in high demand in AI in both research and industry.

In light of this, PIQuIL was launched 2018/19 with a twofold mission:

- Conduct unique, world-leading research at the intersection of AI and quantum systems
- Train PhD and postdoctoral level talent in AI and physics research, producing a steady stream of young researchers who redefine theoretical physics and AI, integrating scientific discovery and progressing industry in transformative ways

Researchers at PIQuIL come from a mix of academia, government, and industry and co-exist in a unique research space designed to foster cross-disciplinary collaboration. Quantum computing start-up 1Qbit has located five research staff at PIQuIL to take advantage of research synergies (with more expected in the coming year).

Located in the Communtech Data Hub, a five-minute walk from Perimeter, PIQuIL aims to work in collaboration with AI centres and experts in Montreal, Ottawa, Sherbrooke, Toronto, Edmonton, and Vancouver.

PIQuIL promotes the free exchange of scientific ideas, algorithms, and open source computer codes. Participating scientists and trainees are permitted to manage their own intellectual property. Partners are free to use and adopt ideas, technology, and other properties conceived and developed at PIQuIL to further research or for-profit products and services. Software developed under the scientific direction of the lab will generally be licensed as open source (e.g., Apache 2.0).

Partnerships and collaborative efforts

Perimeter continues to strengthen Canadian networks in physics research through collaborative efforts at the regional, provincial, and national level. The Institute's Centre for the Universe has ties to several national partner institutions, as well as to major collaborative experimental and observational efforts, such as the Canadian Hydrogen Intensity Mapping Experiment (CHIME).

A partnership forged in 2018 between Perimeter and the NRC has created four new co-funded postdoctoral fellowships and two graduate fellowships – all with three-year terms – in two exciting frontier areas: radio astrophysics and quantum intelligence.

- In the area of radio astrophysics, three postdoctoral fellowships: one based at Perimeter and two based at the NRC's Dominion Radio Astrophysical Observatory, the site of the CHIME radio telescope
- In the area of quantum intelligence, one doctoral fellowship, located at PIQuIL
- In the area of quantum intelligence, two graduate fellowships based at the NRC's Security and Disruptive Technologies Research Centre in Ottawa, with research privileges at Perimeter

Other national partnerships include those with SNOLAB; TRIUMF; the Fields Institute for Research in Mathematical Sciences at the University of Toronto; and the recently established Arthur B. McDonald

Canadian Astroparticle Physics Research Institute, a national research network of 13 Canadian partners dedicated to understanding dark matter and neutrino science.

In addition to numerous informal collaborations, Perimeter has formal agreements with institutions around the world,³ and will continue to partner with other leading Canadian, theoretical, experimental, and observational centres (see below).

Catalyst for Quantum Valley



Perimeter continued to work with key partners in Waterloo Region's Quantum Valley to ensure Canada remains at the forefront of international efforts to create new quantum industries. These industries will in turn spark major job and value creation.

Quantum Valley partners include those in the surrounding academic community (including the Institute for Quantum Computing (IQC), the Waterloo Global Science Initiative, and the Waterloo Institute of Nanotechnology), the region's vibrant start-up community (including Communtech and Universal Quantum Devices), and venture capitalists (such as Quantum Valley Investments).

The field of quantum condensed matter is crucial to the development of quantum technologies and presents a significant strategic opportunity for Perimeter to build on existing strengths. This year, in addition to creating PIQuIL (see above), the Institute appointed several new experts in quantum information and condensed matter. These included Faculty member Chong Wang and Associate Faculty members Debbie Leung and Christine Muschik (see Objective 2). Visiting Fellows who visited Perimeter

³ Formal partnerships include those with African Institute for Mathematical Sciences – Next Einstein Initiative; Canadian Institute for Theoretical Astrophysics; Centro de Fisica do Porto; Fields Institute for Research in Mathematical Sciences; International Centre for Theoretical Physics; Institute of Mathematical Sciences, Chennai; Institute for Quantum Optics and Quantum Information; Institute for Quantum Studies at Chapman University; Scuola Internazionale Superiore di Studi Avanzati; SNOLAB; South American Institute for Fundamental Research; and TRIUMF.

in 2018/19 and are directly related to this field include Juan Carrasquilla, Tarun Grover, Matthew Leifer, Thomas Vidick, Chenjie Wang, and Gil Young Cho.

Engagement with Experimental and Observational Centres

Experiment is the ultimate test of all theory. Recognizing this, Perimeter helped catalyze the creation of the Institute for Quantum Computing in 2002, and it continues to be Perimeter's closest experimental partner today. IQC is led by Interim Director Kevin Resch, a Perimeter Affiliate, and Deputy Director, Research, David Cory, an associate faculty member at Perimeter. Many more Perimeter researchers are cross-appointed at IQC.⁴

In 2018/19, Perimeter continued to strengthen ties to experimental and observational centres around the world. These include the Event Horizon Telescope (EHT), the Square Kilometre Array (SKA), the Laser Interferometer Gravitational-Wave Observatory (LIGO), and CHIME. The Institute's many ties to international experimental efforts include the following:

- The Institute has formal partnership agreements with SNOLAB, an underground science laboratory specializing in neutrino and dark matter physics, and TRIUMF, Canada's particle accelerator centre.
- Associate Faculty member Will Percival is a senior member of the Extended Baryon Oscillation Spectroscopic Survey (eBOSS), which seeks to precisely measure the expansion history of the universe; the Dark Energy Spectroscopic Instrument (DESI), which aims to measure the effect of dark energy on the expansion of the universe; and the Euclid experiment of the European Space Agency, which hopes to map the geometry of the dark universe.
- Delaney Family John Archibald Wheeler Chair Avery Broderick is a leader in the EHT collaboration, which produced the world's first image of a black hole's event horizon. He is also one of several Perimeter researchers associated with the Institute's EHT Initiative, which is building a team of faculty members, postdoctoral researchers, and graduate students to conduct leading-edge analysis of astrophysical data collected by the EHT. Faculty Chair Luis Lehner and Faculty member Guifre Vidal are also involved.
- Daniel Family James Peebles Chair Kendrick Smith works on several experimental collaborations including CHIME, the Simons Observatory, and the Hydrogen Intensity and Real-time Analysis eXperiment (HIRAX).
- Perimeter is a collaborating institution in the Simons Observatory, with Kendrick Smith, Associate Faculty member Matthew Johnson, and several postdoctoral researchers and students involved.
- Stavros Niarchos Foundation Aristarchus Chair Asimina Arvanitaki is part of the ARIADNE (Axion Resonant InterAction Detection Experiment) collaboration, which is looking for axion mediated

⁴ Associate Faculty members Raymond Laflamme and Michele Mosca were founding members of IQC and continue to be jointly appointed there, as are Associate Faculty members Debbie Leung, Christine Muschik, and Jon Yard, and postdoctoral researchers Anurag Anshu, Dave Touchette, Fereshteh Rajabi, and Aleksander Kubica. Perimeter and IQC share many affiliates and students as well.

interactions in matter. She has proposed new searches for the dark matter component of the universe using atomic clocks, molecules, and resonant mass detectors. She has also proposed how astrophysical black holes, such as those detected at advanced LIGO, can diagnose the presence of new particles through the effect of superradiance.

Lastly, Perimeter connects with experiment through its conference program, and several conferences in 2018/19 revolved around experimental findings and challenges.⁵

Affiliate Researchers Program

Perimeter's Affiliate program unites the Canadian physics community by providing researchers from more than 25 research centres across the country with the opportunity for regular collaboration visits. In 2018/19, the Institute appointed two new Affiliates (Eric DeGiuli of Ryerson University and Francesca Vidotto of the University of Western Ontario) and renewed 32 more, bringing the total number of Perimeter Affiliate researchers to 113.

⁵ These included Wide Field Astronomy in Canada (Oct. 10-12, 2018); CHIME-FRB Collaboration Meeting (Nov. 26-27, 2018); Quantum Matter Day (Nov. 13, 2018); PI CITA Day 2019 (Apr. 2, 2019); Quantum Matter: Emergence & Entanglement 3 (Apr. 22-26, 2019); Many-Body States and Dynamics Workshop II (June 13, 2019); and Machine Learning for Quantum Design (July 8-12, 2019).

Objective 6: Catalyze the emergence of top centres for math and physics globally

Summary of Achievements

- Provided continued expertise in support of both the African Institute for Mathematical Sciences – Next Einstein Initiative (AIMS-NEI) and the South American Institute for Fundamental Research (SAIFR)
- Continued sharing Perimeter’s expertise in educational outreach internationally, engaging partners including the European Organization for Nuclear Research (CERN) and the Laser Interferometer Gravitational-Wave Observatory (LIGO)
- Continued translating Perimeter’s educational resources into Portuguese and helping SAIFR build a teacher network in Brazil, allowing for a vastly greater impact in South America

Highlights

For information about Perimeter’s impact on Brazilian educators, see **page 34** of the Annual Report.

Supplementary Information (beyond the Annual Report Contents)

South American Institute for Fundamental Research

Since 2015, Perimeter has partnered with SAIFR, an emerging centre of excellence in theoretical physics located at São Paulo State University in Brazil. The two institutes have a great deal in common, including several research areas of focus and active visitor and conference programs.

In 2018/19, Perimeter continued to leverage the expertise of its research and administrative staff to assist with SAIFR’s growth.

- Pedro Vieira, the Clay Riddell Paul Dirac Chair in Theoretical Physics at Perimeter Institute, continues to spend up to six months per year in Brazil, helping to develop SAIFR, while Faculty Chair Luis Lehner serves on SAIFR’s Scientific Council
- Perimeter’s Outreach team continues to assist SAIFR in developing its own outreach efforts, including providing 23 teacher training workshops in 2018/19

African Institute for Mathematical Sciences

AIMS was founded in Cape Town, South Africa, in 2003 by Perimeter Director Emeritus Neil Turok and is now a globally recognized centre of excellence for postgraduate education and research. There are now six centres of excellence across Africa: Cameroon, Ghana, Rwanda, Senegal, South Africa, and Tanzania.

- In 2018/19, Perimeter staff assisted in writing a successful grant proposal to the Government of Canada that resulted in over \$13 million in funding for AIMS.

Objective 7: Share the transformative power of theoretical physics

Summary of Achievements

- Facilitated 10.9 million student interactions through educational programs and resources, bringing the total to more than 52 million to date
- Hosted the 17th International Summer School for Young Physicists (ISSYP)
- Delivered 153 workshops to 5,132 educators across Canada and abroad. Perimeter's Teacher Network has reached 31,181 educators since 2006
- Hosted the Inspiring Future Women in Science conference for 174 Canadian high school students
- Presented nine engaging public lectures and panels to capacity audiences on site and a global audience of more than 546,000 via webcasts and media partnerships
- Continued the Institute's science communications efforts with more than 7 million YouTube video views in total since 2009, and continued growth across all social media channels
- Won two Prix d'Excellence awards for outstanding achievements in communications and publications from the Canadian Council for the Advancement of Education

Highlights

For information on Perimeter's educational outreach efforts, including ISSYP, the EinsteinPlus Teachers' Camp, the Inspiring Future Women in Science conference, educational resources, and the Power of Ideas Tour, refer to **pages 34-35** of the Annual Report.

For information on public outreach efforts, including the Perimeter Public Lecture Series, cultural events, science communication, digital media outreach, and media coverage, refer to **pages 36-37** of the Annual Report.

Supplementary Information (beyond the Annual Report Contents)

A key part of our outreach mandate is to expose the public to the power of physics. In keeping with that mandate, we continue to explore new, innovative ways to showcase Perimeter Institute and Canada to the world. This year, Perimeter was a production and marketing partner (along with CERN, the National Science Foundation, and other partners) on *Secrets of the Universe*, an IMAX documentary that explores cutting-edge science experiments. It premiered in 2019 at the Smithsonian National Air and Space Museum in Washington, DC. Perimeter appears in the film, inspiring families and youth in across Canada and around the world.

Viewership of Perimeter's public lectures and other events on YouTube increased 77 percent over the previous year. Perimeter's YouTube channel has almost 65,000 subscribers – 50 percent growth in just one year – and more than 7 million total views since launching in 2009.

Objective 8: Continue to strengthen Perimeter’s visionary public-private partnership

Summary of Achievements

- Continued five-year, \$50 million funding agreements with both the Government of Ontario and the Government of Canada
- Secured \$21 million in new private sector commitments, passing the halfway mark of a major \$100 million fundraising campaign, with \$52 million in commitments to date. Multi-year agreements include:
 - \$10 million from the Riddell Family Charitable Foundation in support of the Clay Riddell Centre for Quantum Matter
 - \$8 million from the Krembil Foundation in support of the Galileo Galilei Chair and the William Rowan Hamilton Chair
 - \$2 million from Gluskin Sheff + Associates in support of the Gluskin Sheff / Onex Freeman Dyson Chair
- Continued support of Emmy Noether Initiatives, which support women and girls in physics, through the Emmy Noether Council and the Emmy Noether Circle

Highlights

For details about Perimeter’s public-private partnership, including major successes in 2018/19, refer to **pages 38-39** of the Annual Report. This includes a list of donors who have made cumulative gifts of more than \$100,000 since 2014, the membership list of the Perimeter Institute Leadership Council, and a story about the impact of the Delaney Family Foundation’s support of researcher Avery Broderick.

For a list of Emmy Noether Council members, as well as details about the Institute’s Emmy Noether Initiatives, see **pages 16-17** of the Annual Report.

For a full list of public and private supporters, refer to **pages 40-41** of the Annual Report.

Governance

For Perimeter's governance structure, including all members of the Board of Directors and the Scientific Advisory Committee, refer to **pages 42-43** of the Annual Report.

Biographies of Board members can be found at [*perimeterinstitute.ca/people/board-directors*](https://perimeterinstitute.ca/people/board-directors).

More information about the Scientific Advisory Committee members can be found at [*perimeterinstitute.ca/people/scientific-advisory-committee*](https://perimeterinstitute.ca/people/scientific-advisory-committee).

Performance Evaluation Strategy

Scientific

Perimeter Institute uses an array of performance monitoring and evaluation policies, systems, and processes (both internal and external) that are re-evaluated and updated on a regular basis. These mechanisms to measure outcomes, results, and impact include:

Performance Monitoring – Internal

- Annual reports on research activity submitted to the Institute’s Director by all faculty and associate faculty members for evaluation
- Annual performance reviews of all staff
- Ongoing monitoring of publication and citation records
- Post-conference reports and evaluation
- Visitor research activity reports and ongoing tracking of all output
- Regular updates and monitoring of progress of all scientific programs
- Mid-term researcher performance reviews
- Postdoctoral researcher mentorship program
- Monitoring of postdoctoral researchers’ post-Perimeter placement success
- Monitoring of researchers’ international presence and impact through collaborations and invitations to lecture
- Internal review and evaluation of all outreach programs and products

Performance Monitoring – External

- Regular reporting to the international Scientific Advisory Committee, with subsequent performance assessment and recommendations
- Review of tenured faculty hires and promotions by the Scientific Advisory Committee
- Peer review of publications
- Annual audit of financial statements by an independent auditor
- Other performance audits and reviews in accordance with grant agreements
- External review and evaluation of all outreach programs and products

Investment Strategy

Public-Private Partnership

Perimeter Institute exists through a cooperative and highly successful funding model that provides for ongoing operations while, at the same time, safeguarding future opportunities.

Public partners contribute to research, training, and outreach activities and, in keeping with individual grant requirements, receive ongoing updates, reports, and yearly audited financial statements as required to ensure value for money while remaining aware of the Institute's research productivity and outreach impact.

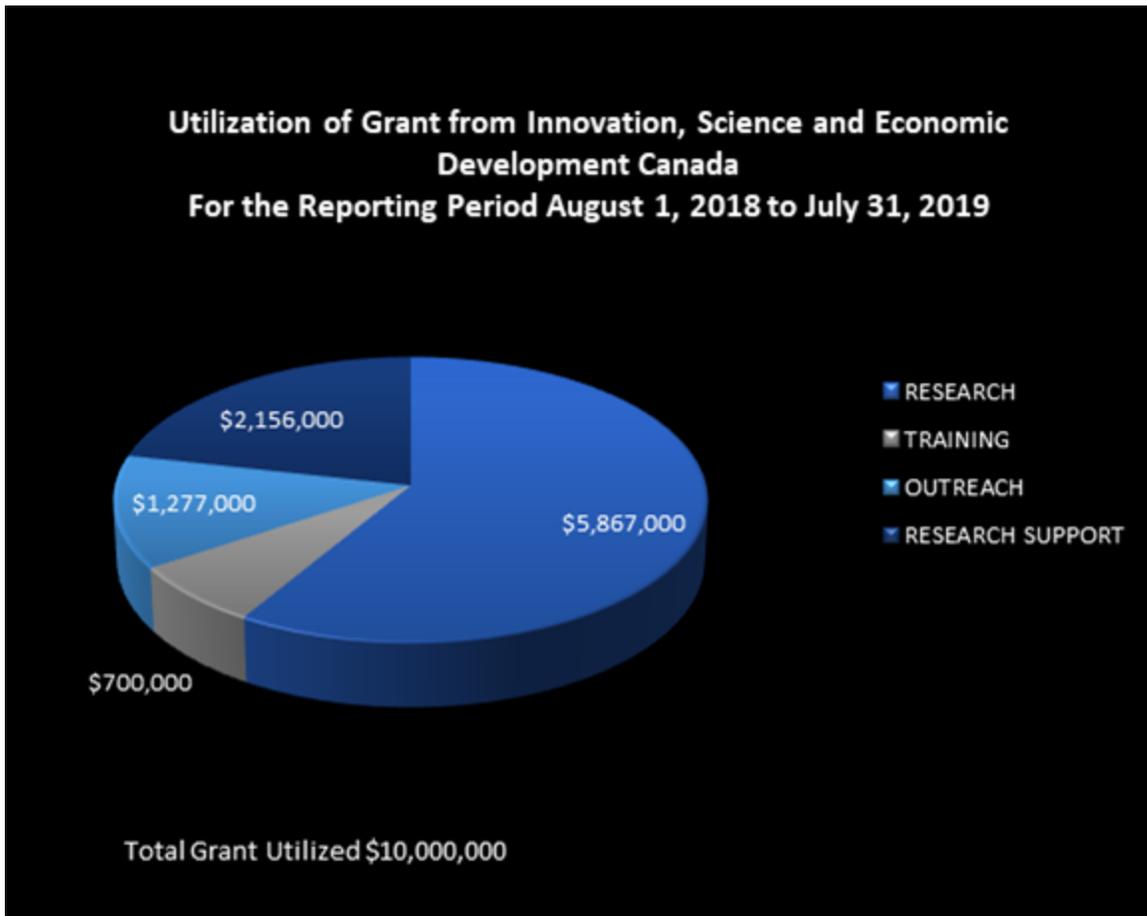
Private funds from a growing donor base are used to fund research, training, and outreach activities, while a portion is protected in an endowment that ensures the strongest possible long-term financial health of the Institute.

Perimeter Institute continues to be an innovative example of how government and philanthropists can unite in a common quest to secure the transformative potential of scientific research in Canada.

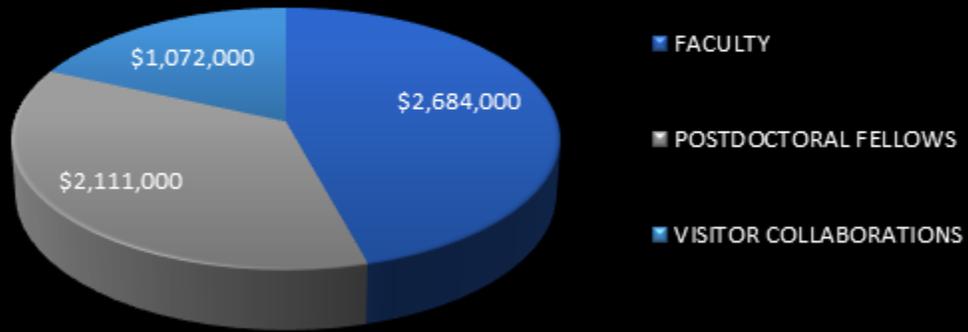
Overview of Financial Statements, Expenditures, and Investment Strategy

For Perimeter's summary of operating costs and details about its income, financial position, and long-term plan, refer to **pages 44-45** of the Annual Report. For the Institute's audited financial statements and the report of the auditor on the audited financial statements, refer to **pages 46-48** of the Annual Report.

Expenditure of Innovation, Science, and Economic Development Canada Grant



**Research Supported Expenditures By Category
For the Reporting Period August 1, 2018 to July 31, 2019**



Total Research Expenditures \$5,867,000

Statement of Objectives for 2019/20

Perimeter Institute is on track to achieve its paramount long-term goal: to create and sustain the world's leading centre for foundational theoretical physics research, training, and educational outreach. To build on the Institute's momentum, Perimeter has established a set of strategic objectives to guide its continued development. The advancement of the Institute's core mission will continue to inform every facet of its research, training, and outreach efforts.

- Objective 1: **Achieve breakthroughs in our understanding of the universe**, drawing insights from and contributing to the whole spectrum of theoretical physics, focusing strategically on research areas that offer the greatest opportunity for major discoveries.
- Objective 2: **Create the world's strongest community of theoretical physics researchers** by continuing to attract and retain top international talent and providing them with unparalleled infrastructure and support to help maximize productivity.
- Objective 3: **Attract and develop the next generation of brilliant minds** by providing exceptional graduate students and postdoctoral researchers with the training and support to develop the powerful, widely applicable skills that will fuel successful individual careers and the knowledge economy more broadly.
- Objective 4: **Attract outstanding visiting scientists** by holding timely, focused conferences, workshops, and seminars on cutting-edge topics and facilitating a constant flow of eminent and emerging physicists for both short-term and extended collaboration visits.
- Objective 5: **Serve as Canada's premier hub for foundational physics research**, strengthening connections with institutions across the country and enabling frontier research, high-quality training, and public engagement.
- Objective 6: **Raise Canada's profile as a global leader in fundamental physics research**, through strategic international partnerships, by providing access to excellence for vast new pools of scientific talent, and by sharing knowledge and expertise internationally.
- Objective 7: **Share the transformative power of theoretical physics** across Canada and around the world, inspiring a new generation of scientific explorers through high-impact educational outreach, while engaging the general public with the wonder and excitement of basic physics research.
- Objective 8: **Continue to strengthen Perimeter's partnerships with the public and private sectors** by demonstrating excellent return on investment, securing sustained funding from government partners, and expanding the Institute's private sector support base.

APPENDIX

Simons Emmy Noether Fellows

Simons Emmy Noether Fellows are appointed for one full year, and have full research and visiting privileges for three additional years. The following are the current Fellows, with their years of appointment:

2018/19:

Valentina Forini, City University of London
Ling-Yan (Janet) Hung, Center for Quantum Control, Fudan University
Karen Livesey, University of Colorado – Colorado Springs
Christine Muschik, University of Waterloo
Phiala Shanahan, Massachusetts Institute of Technology
Sherry Suyu, Max Planck Institute for Astrophysics

2017/18:

Olalla Castro Alvaredo, City University of London
Emanuela Dimastrogiovanni, Case Western Reserve University
Paula Mellado, Adolfo Ibáñez University
Yaping Yang, University of Melbourne

2016/17:

Céline Boehm, Durham University
Radja Boughezal, Argonne National Laboratory
Gemma de las Cuevas, University of Innsbruck
Mairi Sakellariadou, King's College London
Didina Serban, Institut de physique théorique – CEA Saclay
Sumati Surya, Raman Research Institute
Bei Zeng, University of Guelph

2015/16:

Fiona Burnell, University of Minnesota
Orit Davidovich, Northwestern University
Barbara Drossel, Technische Universität Darmstadt
Katarzyna Rejzner, University of York
Rachel Rosen, Columbia University
Sarah Shandera, Pennsylvania State University

Visiting Fellows

Haipeng An, Tsinghua University
Jonathan Barrett, University of Oxford
Joseph Ben Geloun, Laboratoire d'informatique de Paris Nord
Eugenio Bianchi, Pennsylvania State University
Céline Boehm, University of Sydney
Joseph Bramante, Queen's University
Fernando Brandao, California Institute of Technology
Simon Caron-Huot, McGill University
Juan Carrasquilla, Vector Institute for Artificial Intelligence
Giulio Chiribella, University of Hong Kong
David Curtin, University of Toronto
Bartek Czech, University of Tsinghua, Institute for Advanced Study
Claudia de Rham, Imperial College London
Fay Dowker, Imperial College London
Sergei Dubovsky, New York University
Astrid Eichhorn, University of Southern Denmark
Glen Evenbly, Georgia Institute of Technology
Jerome Gauntlett, Imperial College London
Ruth Gregory, Durham University
Tarun Grover, University of California – San Diego
Razvan Gurau, CPT Centre de Physique Théorique de l'École Polytechnique
Jutho Haegeman, Universiteit Gent
Hal Haggard, Bard College
Daniel Halpern-Leistner, Cornell University
Chad Hanna, Pennsylvania State University
Gilbert Holder, University of Illinois at Urbana-Champaign
Daniel Holz, University of Chicago
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