



The Perimeter Institute for Theoretical Physics

Final Evaluation Report

KPMG LLP

June 7, 2016

Contents

Executive Summary	1
1 Introduction	6
1.1 The Study	6
1.2 Evaluation Issues	6
1.3 Perimeter Institute for Theoretical Physics – Profile	7
1.4 Goals and objectives	8
1.5 Institute operations	9
1.5.1 Research	9
1.5.2 Research positions	9
1.5.3 Research Programs	10
1.5.4 Research Training	11
1.5.5 Educational Outreach	12
1.6 Resources	13
2 Methodologies	14
2.1 Scientific Advisory Committee Interviews	14
2.2 Surveys	14
2.3 Advancement/Supporter Interviews	16
2.4 Document and Performance Data Review	17
3 Issue 1: What does Perimeter add to physics capability in Canada?	18
4 Issue 2: To what extent have Perimeter researchers produced and disseminated world class, leading edge research results?	24
5 Issue 3: To what extent has Perimeter contributed to the exchange of research knowledge and results?	29
6 Issue 4: Has Perimeter Institute been successful in attracting the interest of and recruiting researchers and research students of the highest international calibre?	33



June, 2016

7	Issue 5: Has Perimeter Institute created a world-class outreach program of high quality that:	41
7.1	a) Helps teachers to be better prepared to teach science and physics?	41
7.2	b) Encourages teachers, students, and the general public to increase their knowledge and gain a deeper level of interest and appreciation for the value of science and physics?	46
8	Issue 6: To what extent has Perimeter established a high quality research environment?	57
9	Issue 7: Has Perimeter Institute helped to position Canada as a world leader in theoretical physics research?	62
10	Issue 8: Are Perimeter's activities the most economic and efficient means of making progress towards intended outcomes?	66

This report has been prepared by KPMG LLP ("KPMG") for the Perimeter Institute for Theoretical Physics ("Client") pursuant to the terms of our engagement agreement with Client dated May, 2015 (the "Engagement Agreement"). KPMG neither warrants nor represents that the information contained in this report is accurate, complete, sufficient or appropriate for use by any person or entity other than Client or for any purpose other than set out in the Engagement Agreement. This report may not be relied upon by any person or entity other than Client, and KPMG hereby expressly disclaims any and all responsibility or liability to any person or entity other than Client in connection with their use of this report.

© 2016 KPMG and the KPMG logo are registered trademarks of KPMG International, a Swiss entity



June, 2016

Executive Summary

Background and Objectives

Located in Waterloo, Ontario, the Perimeter Institute for Theoretical Physics (Perimeter, or PI) was founded in 1999 through major philanthropic investments and subsequent public-private partnerships with the federal and Ontario governments. Perimeter's purpose is to create an independent, resident-based world-leading centre for foundational theoretical physics research, training and outreach, fostering excellence and stimulating major scientific breakthroughs. Research is Perimeter's first pillar, through a dynamic atmosphere allowing resident and visiting researchers to focus on profound issues in several sub-disciplines of basic research. The graduate training of young scientists is the second pillar of PI's mandate. The third PI pillar is the provision of an educational outreach program, focusing on high school students, teachers and the general public across Canada, along with select international engagements and resource sharing.

Perimeter is required to have an independent evaluation conducted in accordance with its funding agreement with Innovation, Science and Economic Development Canada (ISED). The evaluation was scoped to address the evaluation elements outlined by Treasury Board related to performance (seven questions) and relevance (one question). The evaluation utilized Perimeter's Performance Measurement Strategy as the framework for the evaluation design, with purposeful allowance for comparison, contrast and assessment of changes in results from Perimeter's first evaluation conducted in 2011. The evaluation covers the period from April 1, 2012 to July 31, 2017 (in accordance with the funding agreement). As the funding agreement required a report to be submitted to the Minister of ISED by July 2016, the scope of the evaluation covered the time period from April 1, 2012 to May 31, 2016.

The evaluation was conducted using four key methodologies, including: (1) document and performance data review; (2) web-based surveys of PI researchers, trainees, partner institutions, high school teachers, and the general public involved with PI outreach; (3) telephone interviews with a sample of donor ("advancement/supporter") organizations; and (4) interviews with eight of the nine members of PI's Scientific Advisory Committee (SAC).

Summary of Overall Findings

PI has achieved great success against its mandate and mission, is viewed very positively by all respondents groups, and is making significant impacts on both science and society. Results in many areas have improved compared to the 2011 evaluation results. Perimeter has successfully positioned Canada as a world leader in theoretical physics research, and its influence on Canada's reputation in foundational theoretical physics is significantly higher than just five years ago. Perimeter has attracted a high calibre of researchers – both senior



June, 2016

faculty, Distinguished Visiting Research Chairs, visitors and postdoctoral fellows – at the top of their fields, and against competition from top institutions world-wide.

Perimeter's educational programming is widely used and is found to be highly useful for high school teachers, with its materials generally considered to be better than from other sources, and students having greatly benefitted from the learning experiences. The general public reports increased knowledge and interest in physics and science because of Perimeter. Of considerable interest is that donors report that PI is having even broader societal impacts than it may have originally intended, in terms of attracting young people with fewer opportunities into science, technology, engineering, or math (STEM) careers.

Key findings by each evaluation questions are summarized below.

1) PI's contribution to Canadian physics capability

Overall, all respondent groups report that Perimeter has significantly added to Canadian capability in foundational theoretical physics. Researchers report that Perimeter has made Canadian research capacity, on average, better to much better in all fields that PI addresses – and the impacts are stronger than was seen in 2011. PI's Affiliate Member and Associate Faculty programs were also found by partners to be greatly effective.

The SAC was also extremely positive about Perimeter's contribution to Canadian capability, noting that when the world theoretical physics community thinks "Canada" they now think "Perimeter", in large part due to PI's creation of strong groups of investigators. Donors are also attracted by PI's uniqueness and focus on promoting long-term scientific research innovation and education.

2) Production and dissemination of world-class research

Overall, Perimeter produces many research papers of very high quality, published in top ranking scientific journals. Perimeter researchers (since inception) have produced over 3,460 papers (1,432 during the evaluation timeframe), appearing in over 170 journals, which have attracted over 115,000 citations. The Institute actively fosters dissemination through a very wide variety of vehicles: peer review journals, Perimeter Institute Recorded Seminar Archive (PIRSA), research collaborations, and its highly regarded outreach and education initiatives.

SAC interview respondents rated the PI fields in which they had the highest expertise as having, on average, work with a scientific importance at or near "world-leading." Researchers noted that PI encourages dissemination over and above "the norm." Perimeter's in-person and on-line access and conduct of seminars, workshops, and colloquia are especially highly regarded.

3) PI contribution to exchange of research knowledge

Overall, Perimeter was noted by all respondents to be very actively and successfully engaged in the exchange of scientific knowledge. About one-third of PI researcher respondents are actively connected with large scale experimental and observational initiatives in Canada and world-wide. Researchers are also actively involved in interactions with each other, and with Perimeter workshops, seminars, colloquia, and conferences.

Partner institutions rate PI's Associate Faculty and Affiliate Member programs as being highly effective in promoting interaction with their institutions, and both were seen as more effective now than in 2011. These programs increase the partners' recruitment abilities.

4) Attraction and retention

Overall, Perimeter is having a significant effect on recruitment to Canada of top quality faculty members and postdoctoral fellows, as well as having knock-on effects for other Canadian universities. Perimeter researchers have received close to 50 awards and scientific honours from 2011 – 2015, including many prestigious awards, such as the Rutherford Medal of the Royal Society of Canada, Gribov Medal of the European Physical Society, and Herzberg Medal of the Canadian Association of Physicists.

SAC respondents rated the calibre of PI researchers in the field they knew best as "at the top of their field," unanimously stating that Perimeter successfully competes for top senior "stars" and "giants," as well as for outstanding postdoctoral fellows against the very best institutes world-wide. All donor respondents also commented very positively on PI's ability to attract top faculty members and postdoctoral fellows, noting that this helps local and Canadian universities recruit talent.

Researchers, trainees and partner institutions all rated Perimeter as providing a high level of research training, with most PI trainees intending to pursue an academic research career and this being more likely – and more likely to be successful – because of exposure to Perimeter.

5) Outreach

High school teachers make high use of Perimeter teaching materials, consistent with the 2011 evaluation results. The Perimeter materials are viewed as being reliable, trustworthy, well-planned, and engaging, while addressing topics that are more cutting-edge than can easily be developed independently, as well as addressing topics of practical importance. The PI materials have an exceptionally broad reach, with potential reach of 12,500 teachers and 750,000 students using this material each year based on an extrapolation of survey results.

Perimeter is also very well regarded with respect to its more general outreach activities and materials. The general public is very positive about the impacts of PI's outreach initiatives on their interest in theoretical physics and science in general. In addition, PI outreach and



June, 2016

communications are consistently found to be credible, of high quality, addressing leading-edge topics, inspirational, and relevant to daily and community life. In addition, the evaluation data suggest that PI has a positive effect on student decisions to engage in a STEM career for at least some students.

6) Research environment

Overall, researchers are extremely positive about Perimeter's research environment, with 94% believing it fosters and supports cutting edge research from a great extent to a very great extent, and three-quarters believing it does so better or much better than other top-ranked international institutions. Key factors supporting this are freedom and time to pursue novel research, funding, and access to many research activities.

7) Canada's position as a world leader

Overall, Perimeter has had a significant impact on Canada's reputation in foundational theoretical physics. It is recognized as a true world-leading institution by stakeholders, and has been ranked second in theoretical physics world-wide in the Max Planck Society's study "Mapping Research Excellence". These findings are consistent with the 2015 independent SAC report that noted that "Perimeter Institute has established itself beyond doubt as a top international player in theoretical physics and contributes significantly to Canada's visibility in fundamental and potentially transformative research." Perimeter is now considered to be "the default" when international researchers think about Canadian foundational theoretical physics. The researcher survey respondents agreed, stating that Perimeter has made Canada's reputation in Perimeter's specific fields better to much better than it was previously, and provided higher ratings of Canada's reputation than in the 2011 evaluation.

8) Economy and efficiency

Perimeter is roughly equally funded by government (53.5%) and private (46.5%) sources. For every dollar invested by the federal government, Perimeter has been able to leverage \$2.56 of other funding, demonstrating economy through its ability to leverage other funding sources. Perimeter is recognized by its donors as having strong leadership, clear vision, and well managed programs, all contributing to the efficiency with which it conducts its operations. In addition, several respondents noted that PI helps create social and community impacts (both Canadian and international) well beyond its central goals, and hoped these could be leveraged and scaled up – for example through increased partnerships and accessible resources for high schools, universities, and the general public.

Recommendations for Improvement

Overall, the evaluation results demonstrated Perimeter's effectiveness in achieving performance results and its ongoing relevance. While no significant areas for improvement were identified through the evaluation, two areas for management's consideration were identified in the interest of continuous improvement.

1. **Maintain and possibly increase partnerships for outreach and education.** The results of the evaluation suggest that Perimeter is having considerable success in increasing the general public interest and appreciation for physics and science. There appears to be opportunity for Perimeter to continue to extend these activities – likely through external partnerships, so as to not dilute its central mission – in order to create even broader societal benefits. In particular, for youth, women, and the disadvantaged, and in certain regions, where career opportunities are often slim in the STEM fields. Attracting youths into these fields can in turn create more community income, stability, and safety. Perimeter's education and outreach materials are perceived to be highly compelling, to the extent that STEM careers may appear to be viable options for such individuals. Through the evaluation, several donors encouraged Perimeter to continue to widely distribute its education and outreach materials, provide easy access, and continue to establish and maintain partnerships to develop and deliver such materials which are seen to be of significant (if indirect) value to delivering societal benefit.¹ Such efforts fit well with Perimeter's efforts to increase general scientific literacy, e.g., in Africa and South America, and could also explicitly address the point of having scientific literacy at all – to ultimately benefit society.
2. **Investigate the undergraduate programs.** While overall, researchers rated the ability of Perimeter to attract top undergraduate students to work with its postdoctoral fellows as being, on average, between moderate and great, this was the lowest of the ratings regarding attraction of various categories of researchers, and the average rating was somewhat lower than in 2011. It is worth considering whether there is any underlying issue in this area, and, if so, whether it can be addressed through additional management action. While it is acknowledged that this is a very small program, and is not a major focus of the Institute, the results in this area stand out somewhat amongst the other very positive ones and may be useful for management to consider in more depth moving forward.

¹ Not all donors would be fully aware of the extent of Perimeter's current global reach and distribution of its education and outreach materials.



June, 2016

1 Introduction

Perimeter is required to have an independent evaluation conducted in accordance with its funding agreement with Innovation, Science and Economic Development Canada (ISED). The evaluation plan was developed in the fall of 2015 and received approval from Perimeter's Senior Management team and Finance Committee.

1.1 The Study

The Perimeter evaluation covers the period from April 1, 2012 to July 31, 2017 aligning with the terms of its current funding agreement. As the funding agreement required a report to be submitted to the Minister of ISED by July 2016, the scope of the evaluation covered the time period from April 1, 2012 to May 31, 2016. The evaluation utilized the Performance Measurement Strategy developed by Perimeter (and approved by ISED) as the framework for the evaluation design, with purposeful allowance for comparison, contrast and assessment of changes in results from Perimeter's first evaluation conducted in 2011.

The purpose of the evaluation is twofold:

- Provide concrete information to Perimeter's Board of Directors, stakeholders, funders and senior management on progress towards objectives, achievements, opportunities and challenges that will help Perimeter moving forward.
- Provide accountability to ISED in support of the Perimeter funding agreement.

1.2 Evaluation Issues

The Perimeter evaluation was scoped to address the evaluation elements outlined by Treasury Board related mainly to performance and with one question on relevance. The key evaluation questions addressed are:

1. What does Perimeter add to physics capability in Canada?
2. To what extent have Perimeter researchers produced and disseminated world class, leading edge research results?
3. To what extent has Perimeter contributed to the exchange of research knowledge and results?
4. Has Perimeter Institute been successful in attracting the interest of and recruiting researchers and research students of the highest international calibre?
5. Has Perimeter Institute created a world-class outreach program of high quality that:
 - a) Helps teachers to be better prepared to teach science and physics?

June, 2016

- b) Encourages teachers, students, and the general public to increase their knowledge and gain a deeper level of interest and appreciation for the value of science and physics?
- 6. To what extent has Perimeter established a high quality research environment?
- 7. Has Perimeter Institute helped to position Canada as a world leader in theoretical physics research?
- 8. Are Perimeter's activities the most economic and efficient means of making progress towards intended outcomes?

1.3 Perimeter Institute for Theoretical Physics – Profile

Located in Waterloo, Ontario, Perimeter Institute for Theoretical Physics was founded in 1999 through significant philanthropic investments and subsequent public-private partnerships with the federal and Ontario governments with the purpose of creating an independent, resident-based research institute devoted to foundational issues in theoretical physics.

Perimeter Institute's mission is to create and sustain the world's leading centre for foundational theoretical physics research, training and outreach, fostering excellence and stimulating major scientific breakthroughs.

Perimeter's resident-based research operations began in 2001 and, tied to growth, moved into a custom-built 55,000 square foot facility in 2004. In the fall of 2011, the Institute completed a significant expansion, the Stephen Hawking Centre, which increased the size of the facility to 120,000 square feet. Perimeter can now accommodate over 250 scientists and research trainees.

Research is the first pillar of Perimeter's mandate, with the Institute providing a dynamic atmosphere of scientific interaction in order that resident and visiting researchers can focus on profound issues in several overlapping sub-disciplines of basic research. Perimeter strongly encourages interactions amongst researchers with different scientific orientations and specializations, developing a culture where both orthodox and more speculative approaches are pursued simultaneously in a highly cooperative manner.

In addition, the Institute works to collaborate constructively with the surrounding academic community, in particular by co-recruiting, fostering joint-hires, and creating educational research opportunities for graduate students. The training of young scientists is, in fact, the second pillar of the Institute's mandate.

The third pillar of the Institute's mandate is the provision of an educational outreach program which conveys the wonder and mystery of the universe and the importance of theoretical physics. Efforts focus on high school students, teachers and the general public across Canada, along with select international engagements and resource sharing.



June, 2016

1.4 Goals and objectives

Perimeter Institute aims to vault Canada to a leading position at the frontier of modern science and brand the nation as a world leader in basic research in physics. As stated in the Institute's most current Corporate Plan (2012-13) the Institute's vision is:

To create the world's foremost centre for foundational theoretical physics, uniting public and private partners, and the world's best scientific minds, in a shared enterprise to achieve breakthroughs that will transform our future.

Perimeter serves as a focal point for all relevant members of the Canadian theoretical physics community and beyond. The Institute has identified ten key objectives in support of achieving its vision:

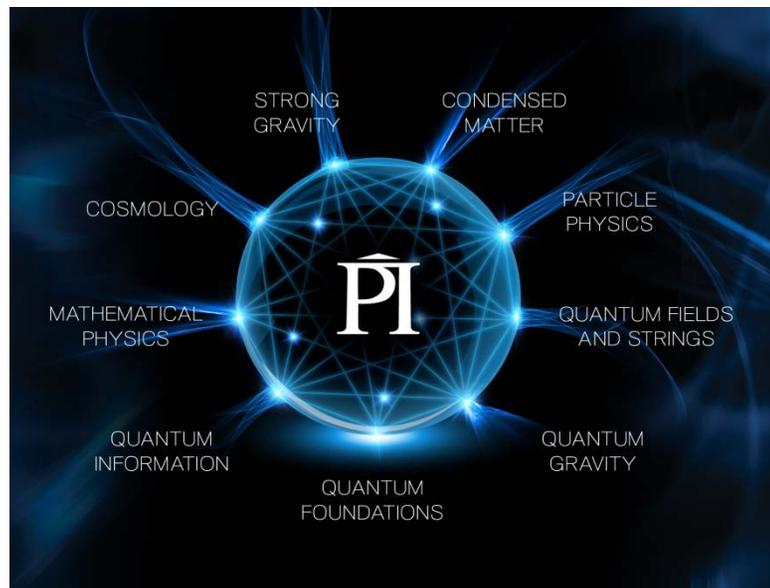
1. To deliver world **-class research discoveries**
2. To become the research home of a critical mass of the world's leading theoretical physicists
3. To generate a flow **-through of the most promising talent**
4. To become the second 'research home' for many of the world's outstanding theorists
5. To act as a hub for a network of theoretical physics and math centres around the world
6. To increase Perimeter's role as Canada's focal point for foundational physics research
7. To host timely, focused conferences, workshops, seminars, and courses
8. To engage in high impact outreach
9. To create the world's best environment and infrastructure for theoretical physics research, training, and outreach
10. To continue to build on Perimeter's highly successful public/private partnership funding model

June, 2016

1.5 Institute operations

1.5.1 Research

Perimeter Institute focuses on nine fields of study to create critical mass and scientific breakthroughs in basic physics research in Canada. Scientists at Perimeter pursue challenging programs in:



1.5.2 7.1.1 Research positions

Faculty

Perimeter attracts and recruits top talent who demonstrate proven research excellence, leadership and cutting-edge scientific activity. Faculty can be divided into two different categories: tenured and tenure-track.

Perimeter Research Chairs

The Perimeter Research Chairs program is designed to attract world-leading researchers to Perimeter and Canada. The program provides for chairs to be named after scientists whose insights defined modern physics, such as: Isaac Newton, James Clerk Maxwell, Albert Einstein, Niels Bohr and Paul Dirac. The goal of the program is to bring outstanding talent to Perimeter to complement existing strengths.

Associate Faculty

The Associate Faculty Program at Perimeter is designed to enable the Institute to partner with similarly focused research universities throughout Canada to jointly recruit



June, 2016

international-calibre scientists to their facilities with an associated residence commitment at Perimeter.

Postdoctoral Fellows

The Postdoctoral Fellows (PDF) program provides a highly supportive environment in which postdoctoral researchers can pursue novel, ambitious lines of research with additional enhancements to training provided by the Institute. PDF positions are normally for a period of three years, however select senior positions offer a five year term.

Affiliate Member

Affiliate Members are Faculty members at Canadian Universities who are invited to be regularly involved in the Institute's research activities.

1.5.3 Research Programs

The Distinguished Visiting Research Chairs Program

Perimeter's Distinguished Visiting Research Chairs (DVRCs) are world-leading scientists who visit Perimeter for extended periods to do research and collaborate. DVRCs are appointed for three-year terms, while retaining permanent positions at their home institutions. DVRCs span a range of expertise, greatly enhancing Perimeter's research environment. The DVRC program is also used as a recruitment tool for senior faculty members.

The Visiting Fellows Program

The Visiting Fellows program aims to bring accomplished junior researchers to the Institute on a regular basis. Visiting Fellows span a wide range of expertise, are appointed for three to five year terms, and maintain their positions at other institutions while going to the Institute for extended research visits of up to six months each year.

Visitor Program

Perimeter Institute's active visitor program enables its resident scientists to work intensively with collaborators. Coming to Perimeter, meanwhile, gives visiting scientists the time and space required for the intense, sustained work with collaborators that is often required to 'crack' tough problems. The program is also an aid to recruitment, giving potential recruits an opportunity to experience the Institute. There are over 1,000 visiting scientists attending Perimeter every year.

Conference and Workshop Program

Perimeter offers all of its researchers, including PDFs and Distinguished Visiting Research Chairs, the opportunity to propose and organize conferences and workshops. The program is flexible and responsive, prioritizing topics with high potential for significant outcomes.



June, 2016

Seminar Program

Perimeter enhances its research environment through an active seminar program, inviting top scientists – including Distinguished Visiting Research Chairs, Visiting Fellows and prospective faculty recruits – to share their latest research spanning all of Perimeter’s identified focus areas. The majority of seminars, colloquia, courses and workshops are recorded and made available online to students and scientists around the world via the Perimeter Institute Recorded Seminar Archive, Perimeter RSA (pirsa.org).

Partnerships

Partnership development within Canada and abroad works to solidify the Institute as a global hub of research, while opening up opportunities for Perimeter’s researchers.

Below are some of the partnerships in place:

- TRIUMF, Canada’s particle research facility
- ATLAS experimental collaboration at the University of Toronto
- Institute for Quantum Computing (IQC) at the University of Waterloo.
- International Centre for Theoretical Physics (ICTP)
- Centre for Theoretical Cosmology (CTC) at Cambridge
- the Centro de Fisica do Porto in Portugal
- International Centre for Theoretical Physics – South American Institute for Fundamental Research (ICTP - SAIFR)
- Laser Interferometer Gravitational Wave Observatory (LIGO)
- Eight Canadian universities with whom PI partners with joint hires

1.5.4 Research Training

Perimeter Scholars International Masters Program

The Institute houses and operates Perimeter Scholars International (PSI) which is a one-year Master’s program offered in partnership with the University of Waterloo. PSI attracts applications from top undergraduate physics and mathematics students from around the world to spend a year immersed in theoretical physics taught by top lecturers from Perimeter and other leading universities and laboratories. Students are fully supported and are guided in their studies by six PhD-level PSI Fellows along with graduate teaching assistants. As part of their program, they undertake a short research project which is



June, 2016

supervised by Perimeter faculty and PDFs or by faculty from nearby universities. PSI provides a pool of high quality PhD candidates for Perimeter Faculty and Associate Faculty as well as top educational institutions in Canada and around the world.

PhD Students

The Institute maintains a large and active graduate program at the PhD level. Although Perimeter is not a degree-granting institution, its faculty are adjunct professors with full supervisory rights at surrounding universities, while Associate Faculty have full supervisory rights at their academic institutions. Students of Perimeter Faculty and resident students of Associate Faculty benefit from enhanced financial support and access to Perimeter facilities, and they participate fully in the research of the Institute.

Visiting Graduate Fellows

The Visiting Graduate Fellows program brings advanced PhD students from around the world to spend three months to a year at the Institute, enabling them to join Perimeter's research community and interact with leading researchers. The program is utilized as a recruitment tool for Perimeter PDFs.

Undergraduate Student Program

This program brings exceptional (6 – 10) Canadian and international undergraduates to the Institute to complete two to four month summer research projects with Perimeter PDFs, who gain mentorship experience in the process.

1.5.5 Educational Outreach

Perimeter outreach programs are designed to increase scientific literacy across Canada by sharing the power of theoretical physics with general audiences, developing youth for the field, and supporting a network of high school educators with in-class resources. The Institute also reaches out globally by taking part in high level international gatherings, offering outreach expertise to others and by making most Perimeter programming on modern physics available online. Examples of general audience activities include: the *Perimeter Public Lecture Series*, the animated *Adventures of Alice and Bob in Wonderland*, Perimeter's *YouTube* channel, *Facebook* community, the *Slices of Pi* digital content, *The Quantum Tamers* broadcast documentary, science themed events like the *BrainSTEM: Your Future is Now* festival, as well as ongoing media interviews on a variety of science topics.

Activities in support of youth and educators include: the *EinsteinPlus Teacher Camp*, the *Perimeter Teacher Network Workshops*, *Perimeter Inspirations* and *Explorations* in-class modules, *Physica Phantastica* on-location presentations and the *International Summer School for Young Physicists*.

The Institute has created a special program called Global Outreach in order to help catalyze the growth of scientific centres of excellence around the world. The current focus is the African Institute for Mathematical Sciences-Next Einstein Initiative (AIMS-NEI), a pan-

June, 2016

African initiative to establish a network of centres providing advanced mathematical and scientific education to exceptional African graduates. Perimeter administrators share organizational strategy and best practices with AIMS-NEI staff, while Perimeter researchers and trainees provide scientific knowledge among students as tutors and lecturers. Four AIMS graduates have entered the PSI program.

1.6 Resources

Perimeter Institute exists through a cooperative public-private approach to investment that provides for ongoing operations while, at the same time, safeguards future opportunities.

The allocation of funding received by the Institute since inception is detailed as follows:

Funding Type	From inception to 2011	2012	2013	2014	2015	2016	Total	Percentage of Total
Innovation, Science and Economic Development Canada	48,990,000	4,344,000	16,667,000	3,333,000	10,000,000	6,666,667	90,000,667	18.14%
Other Federal	40,379,000	1,456,000	1,944,000	2,417,000	2,168,000	642,000	49,006,000	9.88%
Provincial	83,093,000	8,706,000	5,270,000	13,808,000	10,628,000	5,095,000	126,600,000	25.51%
Private Donations	213,167,000	1,142,000	909,000	761,000	2,690,000	4,816,000	223,485,000	45.04%
Private Foundations	627,000	317,000	1,153,000	1,210,000	1,578,000	642,000	5,527,000	1.11%
Private Sector Sponsorships	580,000	326,500	200,000	122,000	248,000	100,000	1,576,500	0.32%
Total Funding	386,836,000	16,291,500	26,143,000	21,651,000	27,312,000	17,961,667	496,195,167	100%



June, 2016

2 Methodologies

2.1 Scientific Advisory Committee Interviews

In late 2015, Perimeter's Scientific Advisory Committee (international, independent experts) performed a scientific review of Perimeter.² To supplement these findings for the purpose of this evaluation, eight of the nine SAC members were interviewed by telephone, using customized interview guides prepared for each respondent. These guides incorporated quotes from the SAC report that were considered to be of key relevance to the evaluation by the evaluation team, with respondents asked to confirm these views, as well as some more general evaluation questions.

2.2 Surveys

Five web surveys were conducted over an approximate six week period from the end of March 2016 through to the beginning of May 2016. The following respondent groups were surveyed:

- **Perimeter Researchers:** Web-based surveys were provided to a census of Perimeter Researchers, including full-time Faculty, Associate Faculty, Affiliate Members, Visiting Researchers, and PDFs. Perimeter developed the census listing of all researchers to be used in the evaluation. The number of responses received to the researcher survey was 85 out of 296 possible respondents, providing a response rate of 29%.
- **Trainees:** A web-based survey was conducted of Perimeter trainees, including past and present PDFs, graduate students and Perimeter Scholars International (PSI) attendees. Perimeter developed the list of trainees to be included in the survey. The number of responses received to the trainee survey was 81 out of 386 possible respondents, providing a response rate of 21%.
- **Partner Institutions:** This group consisted of representatives of universities involved in some way in partnering with Perimeter through formal agreements supporting Associate Faculty or possible faculty/researcher hiring or other programming. The Partner survey distribution list was compiled by Perimeter and consisted of 13 possible respondents. The number of responses received to the Partner survey was 8 out of 13 possible respondents, providing a response rate of 62%.
- **High School Teachers:** Perimeter used a census of high school teacher contacts contained within its database(s) to distribute a web-based survey on behalf of KPMG. (This was administered by Perimeter due to restrictions on privacy and the sharing of personal information held by Perimeter on potential respondents.) Perimeter sent a

² Scientific Review of the Perimeter Institute for Theoretical Physics 2015. Scientific Advisory Committee. 13 January 2016.



June, 2016

mass e-mail to teachers who participated in Einstein Plus workshops, on-location workshops, Teachers Network, and workshops presented by the Teachers Network. These individuals were directed to a secure KPMG web-server to complete the survey. All survey responses went directly to KPMG and individual survey responses were not shared with Perimeter.

The survey distribution consisted of the following:

High School Teacher Mailing	#
Number of possible contacts	5,749
Emails delivered	5,675
Email bounce backs (invalid email addresses)	74
Total number of email messages opened	2,187
Total number of click throughs to survey link	577

Response rates for the teachers survey are calculated in two different ways:

Method	Distribution	Responses received	Response rate
Number of responses based on email messages opened	2,187	260	12%
Number of responses based on number of click throughs to survey link	577	260	45%

- General Public:** Similarly, Perimeter used its contact databases to distribute a web-based survey on behalf of KPMG to a census of general public respondents who had participated in a Perimeter event, such as the Public lecture series. As with the survey sent to the High School Teachers, the same considerations for privacy legislation were respected. In this case as well, Perimeter sent a mass e-mail directing general public respondents to a secure KPMG web server to complete the survey. All survey responses went directly to KPMG and individual survey responses were not shared with Perimeter.

The survey distribution consisted of:

General Public Mailing	#
Number of possible contacts	11,827
Emails delivered	11,769
Email bounce backs (invalid email addresses)	58
Total number of email messages opened	5,522
Total number of click throughs to survey link	1,367



June, 2016

Response rates for the general public survey are calculated in two different ways:

Method	Distribution	Responses received	Response rate
Number of responses based on email messages opened	5,522	1,031	19%
Number of responses based on number of click throughs to survey link	1,367	1,031	75%

The majority of teacher and general public respondents did not participate in the previous evaluation in 2011. Therefore, the survey results for the current evaluation consist largely of a new audience which allowed the analysis to review consistency or divergence in responses.

2.3 Advancement/Supporter Interviews

Telephone interviews were conducted with a sample of private sector companies, private foundations and individual donors supporting or partnering with Perimeter. This stakeholder group was targeted due to the significant growth in the number of donors since the last evaluation in 2011. In addition, this stakeholder group holds a mostly external – and mainly non-scientific – perspective, and is outside of Perimeter’s direct research community. The list of potential interviewees was provided by Perimeter based on those who are most familiar with Perimeter’s operations and objectives at a high level.

Additionally, interviews were conducted with organizations that leverage Perimeter’s educational resources. These organizations were either public institutions or other research institutes that leveraged/used the Perimeter material within the period covered by the evaluation.

A target of 5-8 interviews was set for the donor and outreach interviews, with 13 interviews actually completed.

These stakeholder groups were asked questions in the following topic areas:

- Assessment of product effectiveness
- Assessment of Perimeter’s influence
- Assessment of increased interest and appreciation for the value of science and physics (general public)
- What attracted the organization to Perimeter
- Importance of the partnership
- How the partnership has affected the organization
- Key benefits of the partnership to the organization



June, 2016

2.4 Document and Performance Data Review

Documents and performance data were reviewed, mainly in support of the evaluation questions related to performance. These included Perimeter’s strategic documents (such as its annual reports and strategic plan), and performance data held by Perimeter in relation to its education and outreach activities, including client satisfaction surveys and conference reports. The document review was also used to form the profile description of Perimeter.

3 Issue 1: What does Perimeter add to physics capability in Canada?

3.1 Key Findings

- Overall, Perimeter has significantly added to Canadian capability in foundational theoretical physics. This effect was reported consistently by all respondent groups, and in all Perimeter scientific areas.
- Researchers report that Perimeter has made Canadian research capacity, on average, better to much better in all fields that Perimeter addresses – and the impacts are stronger than was seen in 2011. Of interest is that Perimeter affiliation has increased the quality of many aspects of the respondents' own research, including its novelty, collaborations, and multidisciplinaryity.
- Perimeter's Affiliate Member and Associate Faculty programs were found to be effective to a great extent by partners. Further, partner institutions note these programs are, on average, of very great benefit to their organizations, particularly with respect to the recruitment of research leaders, PDFs, and graduate students.
- The Perimeter SAC was extremely positive about Perimeter's contribution to Canadian capability, both in their independent 2015 review report, and in the interview program conducted for this evaluation. SAC interviewees noted that when the world physics community thinks of "Canada" they now think of "Perimeter." They further noted that prior to Perimeter there was a handful of strong individual researchers scattered across Canada, whereas Perimeter has created strong groups of investigators now.
- Every donor organization contacted through this evaluation noted that their attraction to Perimeter was the Institute's uniqueness and focus on promoting long-term scientific research innovation and education. Half the respondents spontaneously commented that Perimeter is putting Canada on the global map as a leader of innovative scientific research, and they want to be part of supporting this effort.

3.2 Analysis

The SAC interviewees identified that Perimeter has had a large impact on Canadian theoretical physics capability, noting a very significant increase compared to the pre-Perimeter time. SAC interviewees implicitly rated Canada's capability as "good" prior to Perimeter's creation, changing to "world class" now. The main effect noted was that there are now strong Canadian groups in the Perimeter scientific disciplines, not just a few isolated individuals amongst a few Canadian universities. Thus, when the world physics community thinks of "Canada" they now think of "Perimeter." A few

June, 2016

representative comments from the SAC 2015 Independent Report (all from different Perimeter areas) include:

- “pivotal contributions”
- “excellent standing”
- “an example of Perimeter at its best”
- “since the last SAC review in 2011 [this field] at Perimeter has really flourished”
- “a leader from the start. . . Notable for its efforts at the most exciting new frontiers of the field”

A key finding from the SAC interviews is that respondents unanimously stated Perimeter can successfully compete for top faculty and PDFs against the very best institutes world-wide.

The SAC believe that even other Canadian institutions benefit, as Perimeter is “larger than it looks” because of its outstanding Affiliate Member and DVRC programs.

The SAC interview results are supported by the results of the researcher survey. According to the results of the researcher survey, Perimeter activities have made research capacity, on average, better to much better in many fields, quite a bit above what was observed in 2011 as shown in Exhibit 1.

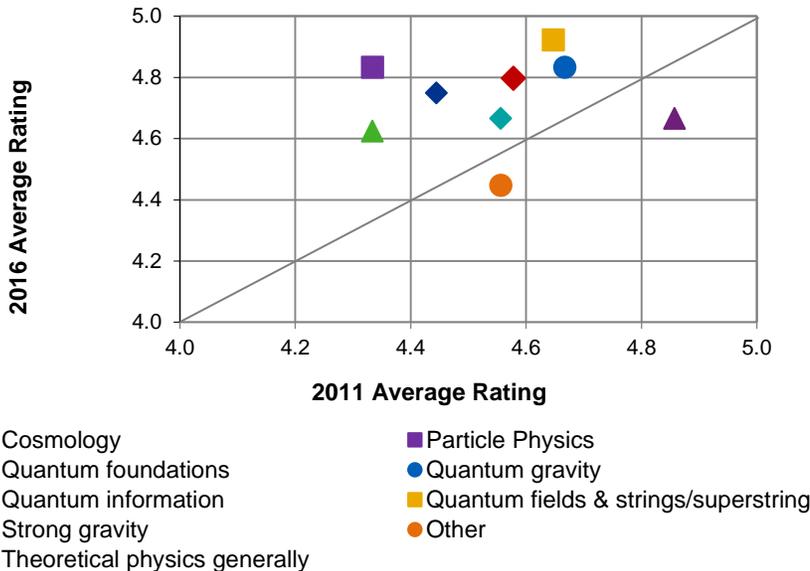


Staggering . . . Perimeter is the envy of everyone – they are competing with the very best. Harvard and Princeton are fighting with Perimeter for these [individuals].

SAC Interviewee

June, 2016

Exhibit 1
Extent to which Perimeter has affected capacity in certain fields of physics – Researchers



*Other category includes mathematical physics and condensed matter.

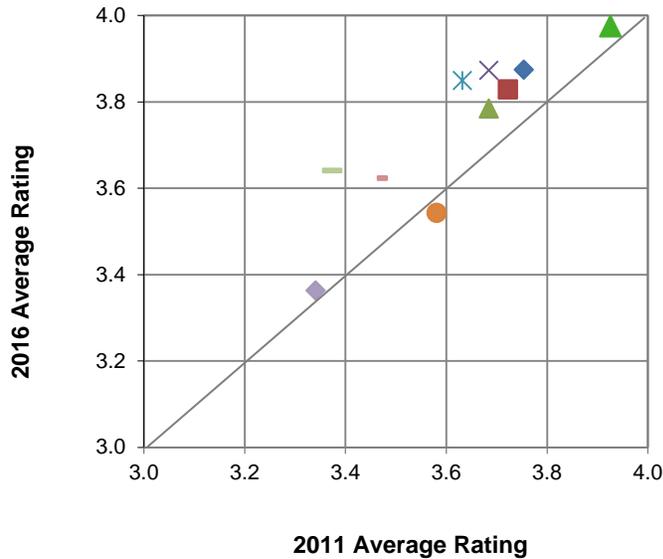
Additionally, researchers rate their affiliation with Perimeter as having an impact on their own research and training programs.

As shown in Exhibit 2, according to researchers, their affiliation with Perimeter has made many elements of their research programs better, with the greatest impact in the following four areas:

- Novelty and potential of theories and theoretical approaches.
- The recruitment of higher quality students and PDFs.
- The quality of the collaborations they are undertaking.
- The mix of disciplines and fields addressed in their research.

June, 2016

Exhibit 2
Researchers view of how affiliation with Perimeter has affected their own research, training and/or outreach programs.



- 2011 Average Rating**
- ▲ The novelty and potential of your theories and theoretical approaches
 - ◆ The recruitment of higher quality students and postdoctoral fellows
 - The quality of your research, publications, and presentations
 - ▲ The number of collaborations you are undertaking
 - × The quality of collaborations you are undertaking
 - ✱ The mix of disciplines and fields you are addressing in your research
 - The approach to general outreach (e.g., to the general public)
 - The quantity of your research, publications, and presentations
 - The novelty and potential of your experimental and observational predictions (or those of your collaborators, experimentalists who are testing your theories, etc.)
 - ◆ The approach to dealing with high school teachers and students

Perimeter has impacted most components of a researcher’s research program for between half to two-thirds of researcher survey respondents (depending on which particular aspect of their program), with improvement ratings of much better for approximately 10% - 20% of all identified factors compared to the 2011 evaluation. These findings are consistent with

June, 2016

the results of the 2011 researcher survey, with the areas of quality of collaboration and mix of disciplines and fields being addressed in research being influenced slightly more than previously.

- Across all factors, approximately one-third of respondents report their research programs are about the same.
- There has been less impact on general outreach, and on dealings with high school teachers and students. However, these aspects are still rated, on average, as being somewhat better because of Perimeter.

Through the Partner survey, the Affiliate Member and Associate Faculty programs are identified as being effective mechanisms to interact with Perimeter to at least a great extent as shown in Exhibit 3.

Exhibit 3

Extent to which the mechanisms employed by Perimeter to promote interactions with Partners institutions are seen as effective by Partners

	Not at all	Minor extent	Moderate extent	Great extent	Very great extent	Don't know / not applicable	Total (n)	Mean
	1	2	3	4	5	0	2016	2016
Associate PI faculty	0%	0%	13%	13%	63%	13%	8	4.6
Affiliate PI faculty	0%	0%	38%	13%	38%	13%	8	4.0
Visiting PI faculty	25%	13%	13%	38%	0%	13%	8	2.7

Partner institutions identify the Associate Faculty and Affiliate Member partnership arrangements with Perimeter as being of very great benefit to their institutions. The attraction of greater quality candidates and appointments were identified as likely not being possible without the partnership with Perimeter by many respondents. These partnership arrangements are noted to be strengthened by the personal relationships held with Perimeter faculty members and the open access to senior management within Perimeter.

“Enabled an appointment that otherwise would not have been possible.”
 “Attracted candidates of greater strength than would have applied otherwise.”
Partner Survey Respondent

Access to higher quality graduate students and higher quality PDFs was also mentioned most frequently as benefits to partner institutions as a result of their partnership with Perimeter.

All 13 respondents in the donor interviews noted that what attracted them to Perimeter was Perimeter's uniqueness and focus on promoting scientific research innovation and education. Half the interviewees commented that they believe Perimeter is putting Canada on the global map as a leader of innovative scientific research, and they want to be part of



June, 2016

supporting this effort. This question was not specifically asked, but these comments were consistently provided spontaneously by the respondents.

Of interest is that donors are not supporting Perimeter to primarily obtain benefits for their own organizations. Instead, they believe their support is a long-term investment that fosters Canadian research and innovation. Respondents reported it was well recognized that such impacts were long-term, but this fit well with their own organization's mandates.

Further, these investments and Perimeter's success are widely seen by donors to increase the visibility of the Kitchener-Waterloo region, in turn attracting investments from abroad into the region.

4 Issue 2: To what extent have Perimeter researchers produced and disseminated world class, leading edge research results?

4.1 Key Findings

- The 2015 SAC independent report notes that Perimeter researchers (since inception) have produced over 3,460 papers (1,432 during the evaluation timeframe), appearing in over 170 journals, which have attracted over 115,000 citations to date. Many key scientific achievements are discussed in that report as being of very high interest and importance world-wide. There were no criticisms of Perimeter’s science or dissemination in the SAC report.
- The Institute actively fosters dissemination through a wide variety of vehicles, including peer review journals and also through research collaborations and through its outreach and education initiatives for other researchers, other countries, teachers, high school students, and the general public.
- Researchers report that Perimeter encourages dissemination over and above “the norm” from a moderate to very great extent, and these activities have been successful from a moderate to very great extent. Perimeter’s in-person and on-line access and conduct of seminars, workshops, and colloquia are particularly highly regarded.
- The SAC interviewees rated the fields in which Perimeter had the highest expertise as having, on average, work with a scientific importance that was near “world-leading.” Perimeter was said to rank among the top four or five institutions world-wide within each specific discipline. Of interest is that some SAC interviewees commented positively on Perimeter’s strategies; e.g., explicitly building capability within individual groups, consciously building high capability within narrow sub-fields in areas too large to build broad capability, and presciently splitting Quantum Foundations from Quantum Information, and Cosmology from Strong Gravity.

4.2 Analysis

As reported in the 2015 SAC independent report, Perimeter researchers (since inception) have produced over 3,460 papers appearing in over 170 journals, which have attracted over 115,000 citations to date. This includes 1,432 published papers during the evaluation timeframe.³

³ 2015 Report to the Perimeter Institute Scientific Advisory Committee, for the period August 2011 to October 2015.

June, 2016

Publications are present in high ranking journals⁴, a number of which are open access journals promoting wide dissemination. Examples include:

- The Astrophysical Journal
- Physics Letters B, Particle Physics, Nuclear Physics and Cosmology
- Journal of High Energy Physics
- Journal of Parallel and Distributed Computing
- Journal of Magnetic Resonance
- Journal of Applied Physics

The 2015 SAC independent report makes mention of many scientific achievements. Some representative comments (all from different Perimeter areas) include:

- “A researcher now at Perimeter has made major contributions to [this topic], whose implications are potentially enormous.”
- “[this area] is one of the most active interfaces between pure mathematics and physics at the moment.”
- “Partly due to the interdisciplinary nature of its research, Perimeter is the place where new applications of [this field to other related ones] can come to fruition.”
- “Many influential new ideas have been conceived and developed here.”
- “[this area is] small but very, very strong.”
- “They have made and continue to make important contributions.”
- “Perimeter’s leading effort in this area is further enhanced by a recently launched research initiative.”

During the SAC interviews, respondents were asked to rate the importance of Perimeter’s bodies of research as a whole, using the scale shown below:

1	2	3	4	5
Not at all important	Of minor importance (e.g., incremental increases in understanding or applicability)	Of moderate importance (e.g., supporting the continued advance of knowledge and understanding, but not as novel as the categories to the right)	Of great importance (e.g., more profound or testable understanding of existing theories, or new approaches, or new linkages among theories that allow wider application)	World leading (e.g., ground-breaking, revolutionary, or transformative).

⁴ For example, the Journal of High Energy Physics is the top ranked journal with Thomson Reuters Journal Citation Reports (Impact Factor 6.111 , 2014).

June, 2016

The findings were overall very high:

- Average ratings of areas by experts in those areas = 4.7
- Average ratings of all areas by all SAC interviewees = 4.3

Five of the six areas rated by experts in a specific field were rated as “world leading”. Of note is that some respondents implied or said explicitly that they would reserve a rating of 5.0 for work such as that by Einstein or Schrödinger. Many specific examples of scientific achievements were given, from all Perimeter areas, and with many individual Perimeter researchers cited. A minor exception was mathematical physics, with the rationale being it is too new. One SAC respondent also commented that Perimeter does special cutting edge work, not mainstream research, even in relatively traditional theoretical fields. Two representative comments from the SAC interviews include:

Compared to other institutions, there are many good places, perhaps 4-5 world-wide in [this field], tops. Perimeter is one of them.

Each time you look at a paper in front line journals, you see a reference to these two Perimeter people, who’ve been pushing this field for over 10 years. Their creativity has just gone up over time.

One respondent also stated that Perimeter does not insist its faculty and PDFs worry about their number of publications, but instead encourages them to push their imaginations to extremes.

Some SAC interviewees also commented on Perimeter’s scientific strategy in various fields. In particular, Perimeter’s conscious efforts to grow and nurture specific scientific areas was viewed very positively. As another example, some fields (e.g., particle physics) cover a broad number of subjects, for which recruiting young talent is difficult and highly competitive. An SAC interviewee commented that:

So one strategy is to have a narrow focus, and group people with this narrow focus together – this is what Perimeter has done, very successfully⁵.

Of additional interest is Perimeter’s separation of Quantum Foundations (QF) from Quantum Information (QI), which is not the case at most comparable institutes. Several respondents commented that this is now seen as a prescient decision, as recent positive QI experimental results give further credibility to the QF field. In the fairly recent past, this was seen as somewhat of a career “dead end.”

⁵ This kind of comment was made about two separate Perimeter areas.



June, 2016

Because Perimeter has started with both QI and QF, it's the ideal place for this synergy to happen – and the results are spreading to other areas as well. Perimeter is at the forefront of this distribution, and these people all meet in the same building.

The Perimeter Institute has been visionary and world-leading in recognizing and promoting Quantum Foundations as an independent research area

A similar effect was seen with Perimeter's separation of cosmology and strong gravity:

At Perimeter, in previous years cosmology and strong gravity were the same group. They were clearly related, but . . . Perimeter separated out strong gravity. . . This turned out to be a timely and important move. . . with LIGO's⁶ first discovery of gravitational waves.

In this case, a SAC interviewee noted that Perimeter started the strong gravity effort. This now positions Perimeter well to take advantage of the groundbreaking LIGO discovery, and the quality of theorists will undoubtedly improve as they attract even more outstanding people.

Results from the surveys indicate all respondent groups view Perimeter as encouraging more research dissemination activity (compared to typical academic activities), with most rating Perimeter as encouraging this additional dissemination to a great extent. As demonstrated in Exhibit 4, Perimeter has encouraged dissemination over and above "the norm" from a moderate to very great extent, on average, and these activities have been successful to a moderate to very great extent. The highest rated activities are in-person and on-line access and conduct of seminars, workshops, and colloquia.

⁶ LIGO is the Laser Interferometer Gravitational-Wave Observatory operated by Caltech and MIT, responsible for the recent (September 2015) confirmation of the detection of gravitational waves, a breakthrough observation in physics.

June, 2016

Exhibit 4

Extent to which Perimeter has encouraged additional research dissemination activity, and the extent to which those activities have been successful

Activities	PI encourages these activities	2011 comparison	PI is successful at these activities	2011 comparison
Conduct of scientific seminars, workshops, colloquia, conferences, etc.	Great extent (4.4)	+	Great extent (4.4)	+
Online access to such seminars, workshops, colloquia, and conferences	Very great extent (4.6)	+	Very great extent (4.6)	+
Scientific exchange programs	Great extent (4.0)	neutral	Great extent (4.0)	neutral
Availability of non-traditional research-based learning activities (e.g., PSI, WinterSchool)	Great extent (4.3)	N/A	Great extent (4.3)	N/A
Engagement with national and international experimental programs	Moderate extent (3.3)	Neutral	Moderate extent (3.4)	neutral

5 Issue 3: To what extent has Perimeter contributed to the exchange of research knowledge and results?

5.1 Key Findings

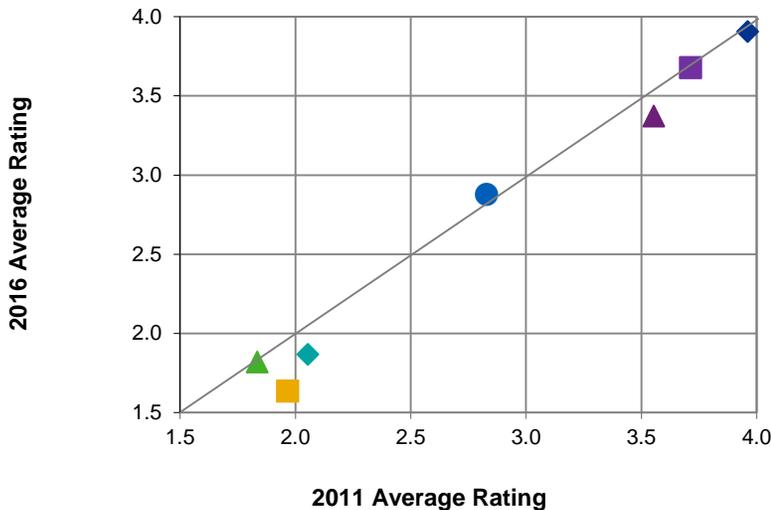
- Overall, Perimeter was viewed by all respondents to be very actively and successfully engaged in the exchange of scientific knowledge. Perimeter researchers are also actively connected with many large scale experimental and observational initiatives in Canada and world-wide.
- Researcher survey respondents are actively involved to a great extent in interactions with other Perimeter researchers, and also with Perimeter workshops, seminars, colloquia, and conferences. Interactions with other international scientists, facilitated through Perimeter, are also taking place to a great extent. However, similar to the 2011 evaluation, researchers reported less frequent interactions with Perimeter’s education and outreach programs.
- One-third of researcher survey respondents reported that they are connected to experimentalists, observationalists, and scientific exchange partnerships, with these being of moderate importance to their research.
- Partner institutions rate Perimeter’s Associate Faculty and Affiliate Member programs as being highly effective, and both are viewed as more effective now than in 2011. These programs also increase the partner’s recruitment ability. However, the Visiting Perimeter faculty program was seen as being only of minor effectiveness for the partners in promoting interactions with their institutions.
- SAC interview respondents were asked only about the connections between Perimeter theorists and experimental and observational physicists – most commented that Perimeter fosters such connections at an institute/corporate level somewhat more than what is routine for a given field.

5.2 Analysis

The researcher survey results indicate there are three areas where Perimeter researchers are actively involved in activities that support research knowledge exchange. Researchers report being actively involved to a great extent in interactions with other Perimeter researchers, and a great extent of involvement with Perimeter workshops, seminars, colloquia, and conferences. Interactions with other international scientists, facilitated through Perimeter, are also taking place to a great extent. The 2011 evaluation results also identified the greatest extent of activity in the same three areas as shown in Exhibit 5.

June, 2016

Exhibit 5
Extent to which researchers are actively involved in activities that support research knowledge exchange⁷



- ◆ Interactions with other PI researchers
- Involvement with PI workshops, seminars, colloquia, conferences, etc.
- ▲ Interactions with other international scientists, facilitated through PI
- Interactions with other scientists within Canada, facilitated through PI
- ◆ Training programs (e.g., EinsteinPlus, the Teachers Network, PSI)
- Other Outreach programs
- ▲ MOUs with universities

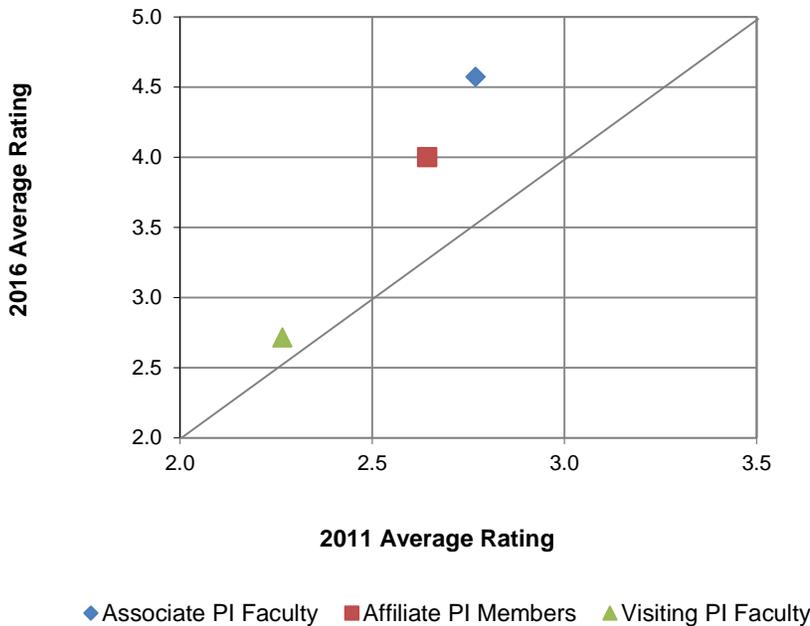
Similar to the 2011 results, researchers indicate less involvement with education, outreach, and memoranda of understanding (MOUs) with other universities.

Partners rated the mechanisms used by Perimeter to promote interactions with their institutions, as illustrated in Exhibit 6. These partners rated the mechanisms for Associate Faculty and Affiliate Members as being effective to a great extent, though Visiting Perimeter faculty was rated as being effective to a minor extent in promoting interactions with their institutions. However, the ratings provided by the partners for the 2016 evaluation are consistently higher than those provided by university Department Heads in 2011.

⁷ Note that the Perimeter Scholars International (PSI) program is an intensive Masters level program, while EinsteinPlus and the Teachers' Network are for high school teachers.

June, 2016

Exhibit 6
Extent to which Perimeter has effective mechanisms for promoting interactions with collaborating institutions



Partners also noted “spin-off” impacts for their institution from their association with Perimeter, particularly regarding access to higher quality PDFs and graduate students, as shown in Exhibit 7.

Exhibit 7
Other impacts for the Perimeter collaborating institutions

	Frequency of mention	
	2016	2011
Access to higher quality postdoctoral fellows	5	7
Access to higher quality graduate students	5	5
Increased research funding opportunities	4	2
Increased enrollment in some physics programs as a result of having a PI Affiliate researcher within your institution	1	3
Other (please specify)	2	4
None of the above	2	8

Other impacts noted by partners included:

- Increased access to quality outreach material; and
- Enhanced attraction of researchers at both the senior and junior level.

Perimeter Institute has identified a number of experimental and observational connections contributing to the exchange of research knowledge and results. These efforts include connections to the Large Hadron Collider at CERN (LHC), the Event Horizon Telescope (EHT), the Laser Interferometric Gravitational-Wave Observatory, the Planck satellite, and the Square Kilometre Array (SKA). At the same time, the Institute’s scientists work with leading Canadian experiments – such as SNOLAB and the Canadian Hydrogen Intensity Mapping Experiment (CHIME) – by helping to lead the planning, interpretation, and analysis of data.⁸

SAC interviewees were asked about connections between Perimeter theorists and experimental and observational physicists as one measure of the exchange of research results across fields. Four of the five SAC interviewees who

It was a bold decision [for Perimeter] to become involved with experiments.
SAC Interviewee

In fact that is part of Lazaridis’ vision: theoretical work unhampered by immediate applications, but maintaining contact with groups who are more application-minded.
SAC Interviewee

commented on this believe that Perimeter views such interactions somewhat more favourably⁹ at an institute/corporate level than is usual; i.e., more than what is routine for a given field, with Perimeter theorists helping to understand mathematically what is experimentally observed. The respondents commented that these connections may position Perimeter to be slightly more ready to capitalize on new data and discoveries as a result, while cautioning that this should not in any way be seen to

suggest that Perimeter should become directly involved with short-term, strictly practical applications.

These SAC interviewees commented on the fact that interactions with experiments/observations that are stimulated and positively regarded is important and can lead to future growth in this direction. One commented that the alternative was to have a strictly mathematically focused institute, which was not considered to be a good path forward.

Perimeter researchers (32%) do identify as engaging with experimentalists, observationalists and having scientific exchange partnerships. Slightly more, 48%, indicate they have engaged with experimentalists, observationalists and scientific exchange partnerships prior to their affiliation with Perimeter. In terms of importance to Perimeter researchers, these types of scientific exchanges were rated of moderate importance to their own research.

⁸ The Perimeter Institute for Theoretical Physics, 2014/15 Annual Report to Canada’s Department of Innovation, Science, and Economic Development covering the Objectives, Activities, and Finances for the period August 1, 2014 to July 31, 2015 and Statement of Objectives for Next Year and the Future, pages 52-53.

⁹ Such interactions have historically been relatively common in fields such as cosmology and more recently in quantum information, but less so in other areas.

6 Issue 4: Has Perimeter Institute been successful in attracting the interest of and recruiting researchers and research students of the highest international calibre?

6.1 Key Findings

- Overall, Perimeter is having a significant effect on recruitment to Canada of top quality faculty members and PDFs – especially to Perimeter itself, but also with knock-on effects for other Canadian universities. Of crucial importance is that Perimeter can compete for research “stars” and “giants” with the best institutes in the world.
- Perimeter researchers have received close to 50 awards and scientific honours over the period 2011 – 2015. Many of these represent highly prestigious awards, e.g., Rutherford Medal of the Royal Society of Canada, Gribov Medal of the European Physical Society, Herzberg Medal of the Canadian Association of Physicists.
- The independent 2015 SAC report discussed many high quality Perimeter faculty members and PDFs by name, noting many instances of Perimeter being able to attract the very best people across the Perimeter disciplines.
- SAC interview respondents unanimously stated that Perimeter can successfully compete for top senior “stars” as well as outstanding PDFs against the very best institutes world-wide.
- Partner institutions and researcher survey respondents both viewed Perimeter as being highly successful in attracting high calibre researchers.
- The SAC interview respondents also noted that Perimeter has changed the Canadian theoretical physics environment from one of a handful of top people scattered across the country, to several strong groups at Perimeter. These groups are essentially larger than they appear, being bolstered by a high number of top-flight PDFs (many of whom compete on the international stage) and through its Affiliate Member and DVRC programs.
- Many of Perimeter’s PDFs go on to very good research positions after leaving Perimeter. SAC interviewees considered this to be a key impact.
- Two issues were raised by the SAC. First, Perimeter has lost, or is about to lose, some key people. However, no concerns were raised that Perimeter could not find top quality replacements. Second, a small number of PDFs feel somewhat isolated within the very independent Perimeter culture.
- All donor respondents commented very positively on Perimeter's ability to attract top faculty members and PDFs facilitating world-class international physicists collaborating with Waterloo and Canada. They further noted that this helps local and Canadian

June, 2016

universities in their recruitment as well. Such impacts fit with the aspirations of donor organizations to develop human capital.

- Several donors also commented that Perimeter is helping the general public - and especially high school students and young women - in recognizing the appeal and importance of science, technology, engineering, or math fields, in turn increasing their career opportunities.
- Researchers, trainees and partner institutions all rated Perimeter as providing a high level of research training. Most Perimeter trainees intend to pursue an academic research career, with this being more likely - and more likely to be successful - because of exposure to Perimeter.

6.2 Analysis

Perimeter researchers have received close to 50 awards and scientific honours over the period 2011 – 2015¹⁰. In particular, many Faculty members have been recognized in their respective fields for the quality and significance of their research achievements. Examples include:

- (2011) Faculty member awarded the Rutherford Medal of the Royal Society of Canada.
- (2011) Faculty member awarded the prestigious Gribov Medal by the European Physical Society.
- (2012) The 2012 Best Paper Prize, given by the Institute of Physics and the Editorial Board of Journal of Physics A, was awarded to a Faculty member and Senior PDF.
- (2012) Faculty member won the Canadian Association of Physicists 2012 Herzberg Medal, recognizing outstanding achievements by a physicist early in their career.
- (2013) Associate Faculty member was awarded the International Union of Pure and Applied Physics Young Scientist Prize in Computational Physics by the Council on Computational Physics.
- (2014) Associate Faculty member was named to the Canada Research Chair in Computational Quantum Many-Body Physics (Tier 2).
- (2014) Associate Graduate Student was named one of “Canada’s future leaders of 2014” by Maclean’s magazine.
- (2014) Faculty member was elected as a Fellow of the Royal Society of Canada.

¹⁰ 2015 Report to the Perimeter Institute Scientific Advisory Committee, Covering the Institute’s Research, Training and Outreach Activities for the period August, 2011 to October, 2015. Submitted by: Neil Turok, Director

June, 2016

- (2015) Faculty member was ranked 22nd on Prospect Magazine's "World Thinkers 2015" list.
- (2015-present) Faculty member named to the Scientific Council of the International Centre for Theoretical Physics - South American Institute for Fundamental Research (ICTP-SAIFR) centre in Brazil.

Perimeter's 2014 and 2015 annual reports document a number of Perimeter researchers being named to the "World's Most Influential Scientific Minds" list by Thomson Reuters¹¹:

- 2015 – Faculty member Robert Myers and Distinguished Visiting Research Chair Juan Ignacio Ciria.
- 2014 – Faculty Chair Robert Myers; Subir Sachdev, the James Clerk Maxwell Chair in Theoretical Physics at Perimeter Institute (Visiting); and Distinguished Visiting Research Chairs Lance Dixon and Dam Thanh Son.

In addition, the 2015 SAC independent report made many mentions of the high quality of Perimeter faculty and PDFs, with representative comments (all from different Perimeter fields) such as:

- "The group [of faculty members] has an excellent international scientific reputation."
- "[This individual] is a highly versatile and original researcher."
- "[This group] is small but excellent. Its researchers follow highly original and creative paths." "Perimeter attracts good PDFs who go on to good positions elsewhere."
- "The senior faculty member is an outstanding young mathematician, whom the Institute managed to attract in competition with other world-leading institutions, a feat it should be congratulated on."
- "[This group's] researchers at the Perimeter Institute are world leaders in the area." "Perimeter continues to attract excellent young people, PhDs and PDFs."
- "A small, excellent group that generates plenty of impact and visibility globally." "Perimeter continues to attract some of the very best PDFs."
- "The group has an excellent international scientific reputation."
- "The group is very strong, and in our view will be able to continue its prominent role even if the focus of the field changes."
- "The [faculty] group at Perimeter has positioned itself extremely well." "Perimeter has been able to recruit top PDFs in competition with leading, better-established institutions in the field."

¹¹ These studies analyze years of citation data to identify scientists whose publications ranked in the top one percent most-cited in their fields, thereby having the greatest impact on the future direction of those fields.

June, 2016

The SAC interview respondents were also asked to rate the quality of Perimeter faculty members during the evaluation’s interview component, using the rating scale shown below:

1	2	3	4	5
Low calibre	Moderate calibre	High calibre	Very high calibre	At the top of their field

The results were:

- Average ratings of faculty members, by experts in those areas = 4.9
- Average ratings of faculty members in all areas by all SAC interviewees = 4.4

As for the ratings of the importance of Perimeter research, all six Perimeter groups were rated by experts in that specific field as “at the top of their field.”

For smaller groups, the rating of the individuals may be somewhat higher than that of their corresponding group, simply because even if there were one or two really strong people, the group might be too small to be a “powerhouse.” There were two key findings here. The first is that Perimeter can absolutely compete against the best institutes in the world for the very top people, both senior “stars” as well as exceptionally promising PDFs in the “race for junior faculty,” where Perimeter is said to be on the “front line.” Several examples were given by SAC interviewees of Perimeter attracting such top individuals

Perimeter brought in, as visitors, really well-known people – everyone important in the field was at Perimeter at some time.
SAC Interviewee

from other world-leading institutes, and many specific individual faculty members were commented on very positively by SAC interviewees – no examples of relatively weaker individuals were provided. Further both the DVRC and Affiliate Member programs were commented upon very positively; the former said to attract the very top people in the world (by contrast, most comparable institutes were said to mainly focus on visiting faculty from nearby universities), while the latter is “brilliant.”

That international draw of Perimeter for students, PDFs, and faculty, this is unique to pull this off.
SAC Interviewee

The second major effect at the “people level” is that, prior to Perimeter, Canada’s reputation in theoretical physics was based on the reputation of a few individuals, whereas now groups have been brought together by Perimeter. Since Perimeter is very successful competing with other institutions, these very strong people at the top bring others with them.

These effects are also true at the PDF level. Many of the SAC interviewees commented that Perimeter PDFs are very strong, compete well on the international stage, and contribute significantly to the strength and reputation of their Perimeter research group. Perimeter is essentially much larger than it seems at first glance because of this effect, coupled with the strong Associates, Affiliates, and DVRC programs.



June, 2016

Further, Perimeter is a significant boon to the future careers of its PDFs, many of whom go on to very good positions afterwards¹². This was considered by a number of SAC interviewees to be quite striking, and essentially the best recommendation that Perimeter can have:

Perimeter has attracted top PDFs, it's a sort of home for them as they looked for job positions. Perimeter was really instrumental in their career – all of my students spent at least a month there. It catalyzed discussions with many top people; a dramatic impact for them.

This young group generates a lot of impact and visibility, many are outstanding people. In this sense Perimeter's is the MOST important group in this area world-wide.

Some threats to individual Perimeter groups were noted due to the loss of a few key stars, but SAC interviewees noted that Perimeter is well aware of this challenge, and is actively pursuing top level replacements, some of whom are seen to be “giants,” while others are younger researchers, sometimes at the PDF level. No SAC respondent expressed any concern that Perimeter could not find top quality replacements, and all the replacement candidates mentioned were very well regarded by respondents.

One difficulty was mentioned in the 2015 independent SAC report regarding PDFs: that those few who were not as confident as others, or with their own ideas to run with, could feel a little isolated within the very independent Perimeter culture. The committee recommended somewhat more interaction with faculty members in those cases.

Additionally, all donor interviewees noted that Perimeter has helped attract talent. It is perhaps significant that, even at the arms-length nature of these donor organizations, the quality of Perimeter people is recognized. Respondents noted not only that Perimeter had a unique ability to attract world-class talent to the Institute, but also to help regional and Canadian universities conduct recruitment (in part because of the Affiliates and Associates programs), and to collaborate with local universities. It was noted that world-class physicists are associated with Waterloo and Canada even though they have roots elsewhere. It was also commented that Perimeter's PDFs could go anywhere in the world and it really says something that they come to Perimeter.

Several of the donors associated with science or technology organizations noted that their own organizations care deeply about developing human capital and like to tap into the local talent pool of students and researchers. Perimeter was also said to have a significant “people impact” in two areas not directly associated with its core mandate, but that are potentially of considerable societal significance. The first is that Perimeter is proactive in

¹² The 2015 independent SAC report notes that nearly half of the PDFs who finished their appointments at Perimeter during the 2011-2015 timeframe have already obtained faculty positions – an almost unheard of percentage in foundational theoretical physics.

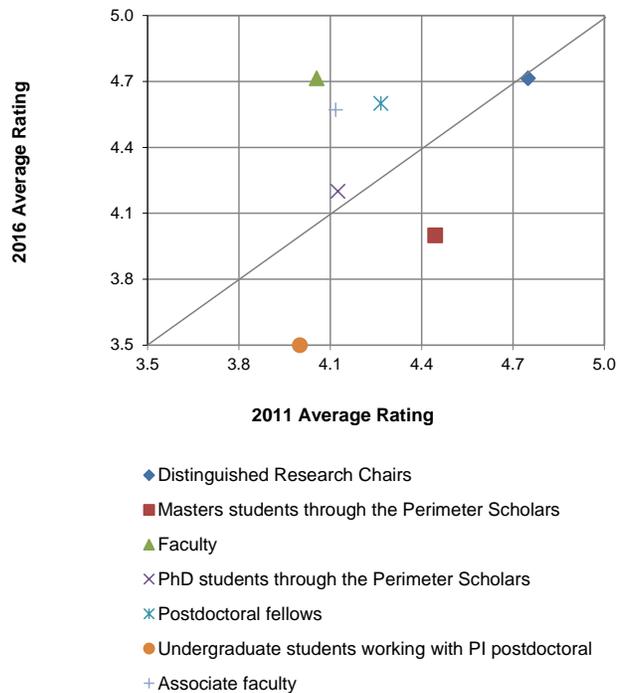
June, 2016

attracting and supporting women in the science, technology, engineering, and mathematics disciplines, an area respondents noted as being traditionally less well-served for women in Canada. The second is that Perimeter is seen to have – or potentially have – important impacts in attracting young people in general into the STEM fields, which in turn can have significant benefits for areas where youths traditionally have few career options and poor life prospects in general.

Associate Faculty Partner institutions identified Perimeter as being successful in the attraction of high caliber researchers from a great to very great extent as shown in Exhibit 8. This is higher in most areas compared to 2011, with the exception of undergraduate students which was rated as moderate¹³.

DVRCs, Faculty, PDFs and Associate Faculty are the highest rated by Partners with the last three categories receiving significantly higher ratings than 2011.

Exhibit 8
Extent to which Perimeter has attracted researchers of the highest international caliber – Partner survey respondents



¹³ Most Associate Faculty Partners selected “Don’t Know/Not applicable” for their rating of undergraduate students working with Perimeter PDFs.



June, 2016

Researchers also identify that Perimeter has had success to a great extent in the attraction of top talent (Exhibit 9), with PDFs receiving the highest rating, supporting the views of the SAC interviewees noted earlier. Of note is that in all areas, the mean result has increased from 2011.

While the undergraduate students working with Perimeter PDFs is again the category with a lower rating, most researcher survey respondents selected “Don’t know/not applicable” for this category. Researcher survey respondents that did provide a lower rating for undergraduate students consisted of an Affiliate and an Associate rating “not at all,” two Affiliates rating “to a minor extent,” and a mix of Faculty, Associate Faculty, DVRC, PDFs and Affiliate Members rating to a “moderate extent.” While the average rating falls between moderate and great, a positive response, it may be useful for Perimeter to further explore these perceptions, particularly with PDFs.

Exhibit 9

The extent Perimeter has been successful in attracting top talent – Researcher survey

Researchers	Not at all	Minor extent	Moderate extent	Great extent	Very great extent	Don't know / not applicable	Total (n)		Mean		
	1	2	3	4	5	0	2016	2011	2016	2011	
Attraction of top talent											
Postdoctoral researchers to PI			11%	40%	41%	8%	83	101	4.3	4.2	
Faculty members (Full Time)		4%	10%	42%	40%	5%	83	100	4.2	4.0	
Faculty member (Part Time) i.e., Associate Members	1%	2%	7%	46%	33%	11%	83	100	4.2	4.0	
Masters students through the Perimeter Scholars		2%	10%	27%	26%	35%	82	101	4.2	3.8	
PhD students through the Perimeter Scholars	2%	4%	14%	35%	15%	31%	81	101	3.8	3.7	
Undergraduate students working with PI postdoctoral	2%	2%	13%	16%	5%	61%	82	100	3.5	3.3	

Researchers, trainees and partner institutions all rated Perimeter as providing high level research training to a great extent (Exhibit 10). The highest rated training mechanism was exposure to theories and issues in related fields. The results of the Researcher, Trainee and Partner surveys have been aggregated in this table. The mean results are very much the same across the three different groups, with partners providing slightly higher average ratings and researchers providing slightly lower average ratings.¹⁴

¹⁴ This is not surprising as the Researchers are somewhat self-rating.



June, 2016

Exhibit 10
Extent to which Perimeter has provided high level research training – Aggregate
Researchers, Trainees and Partner responses

	Not at all	Minor extent	Moderate extent	Great extent	Very great extent	Don't know / not applicable	Total (n)		Mean	
	1	2	3	4	5	0	2016	2011	2016	2011
Exposure to theories and issues in related fields	1%	2%	9%	29%	54%	6%	170	125	4.4	4.1
Supervision by top researcher(s)	1%	2%	11%	34%	48%	5%	170	126	4.3	3.8
Interactions with other top researchers in your field	1%	2%	12%	30%	48%	7%	169	126	4.3	4.1
Overall quality of training	1%	1%	12%	37%	44%	5%	169	126	4.3	3.9
Interactions with other top researchers in related fields	2%	4%	14%	34%	38%	8%	169	125	4.1	4.0

Trainees responding to the survey identified a higher likelihood they will pursue a PhD or PDF because of Perimeter. Most trainees identify it is likely they will pursue an academic research career following their studies and believe their affiliation with Perimeter will positively influence:

- the number of offers they will likely receive
- a higher quality and prestige of the institutions making offers.
- the likelihood they will have the ability to pursue their main research interests

6.3 Potential Area for Improvement

Exhibit 8 shows that researchers rated the ability of Perimeter to attract top undergraduate students to work with its PDFs as being, on average, between moderate and great. While a positive response, this was the lowest of the ratings regarding attraction of various categories of researchers, and the average rating was somewhat lower than in 2011. It is worth considering whether there is any underlying issue in this area, and, if so, whether it can be addressed through additional management action. There are at least two possibilities: (1) there is some minor difficulty with how Perimeter identifies and attracts undergraduates; or (2) conducting high level theoretical research is simply beyond the ability of even the most talented undergraduates (e.g., due lack of highly advanced mathematical knowledge) which may imply further thought is necessary as to how these students can assist the PDFs in a meaningful way. While it is acknowledged that this is very small program, the results in this area stand out somewhat amongst the other very positive ones and may be useful for management to consider in more depth moving forward.

7 Issue 5: Has Perimeter Institute created a world-class outreach program of high quality that:

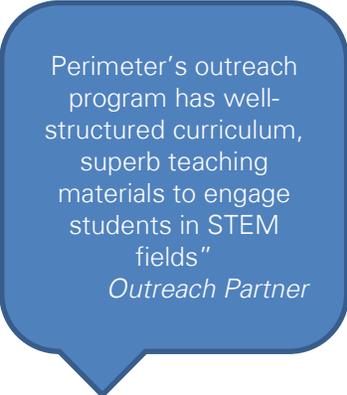
7.1 a) Helps teachers to be better prepared to teach science and physics?

7.1.1 Key Findings

- High school teachers make high use of Perimeter teaching materials, and intend to keep doing so in the future. Teachers report the Perimeter materials are reliable, trustworthy, well-planned, and engaging, while addressing topics of practical importance to their audience that are more cutting-edge than can easily be developed independently.
- The Perimeter materials have an exceptionally broad reach: on average, each teacher shares the Perimeter material with five other teachers - by extrapolation of the data provided by the survey respondents only, a potential of 12,500 teachers and 750,000 students having access to this material each year.
- Outreach partners noted that Perimeter has a strong education and outreach program to the general public and younger generation, with robust educational materials that encourage the younger generation's participation in STEM fields.

7.1.2 Analysis

The results from the survey of high school teachers are positive and indicative of the influence and reach the Perimeter education and outreach program is having on this particular audience, and by implication, an audience of high school students as well. Exhibit 11 shows 61% of all teachers who have obtained Perimeter material have used the Perimeter products to at least a great extent¹⁵ in the delivery of their curriculum. Similarly, 76% have found the Perimeter products to be useful at least to a great extent and 63% identified they intend to use the Perimeter educational materials to at least a great extent in the future.

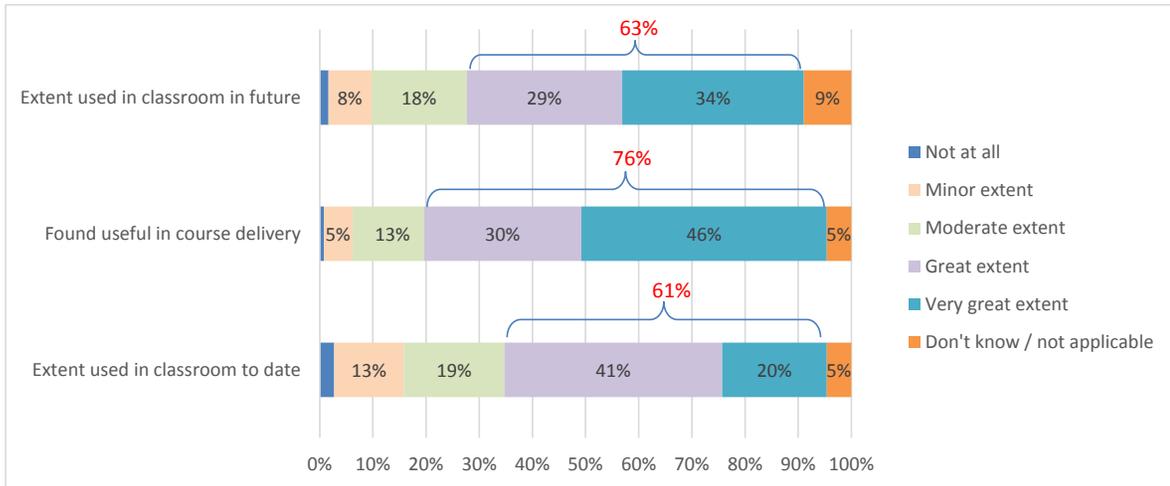


Perimeter's outreach program has well-structured curriculum, superb teaching materials to engage students in STEM fields"
Outreach Partner

¹⁵ Defined as utilizing 1-3 educational activities.

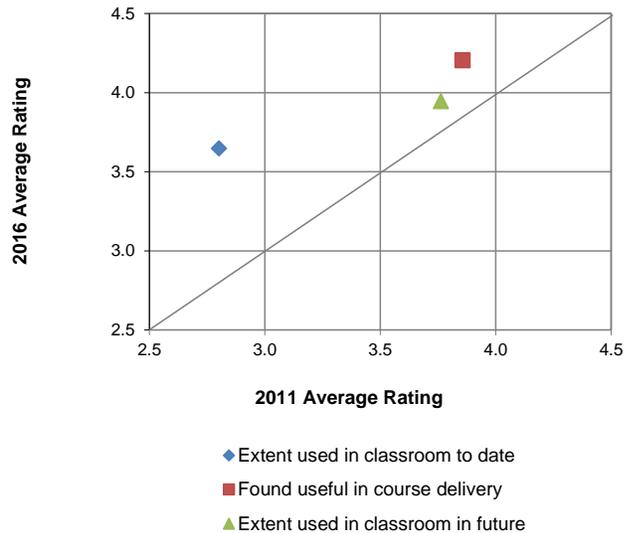
June, 2016

Exhibit 11
Teachers use of Perimeter educational materials



This usage rate, for this group of teachers, is consistent with the results from the 2011 evaluation data as shown in Exhibit 12.

Exhibit 12
Extent to which Perimeter outreach material has been used, is seen as useful, and will be used in the future as reported by high school teachers – comparison to 2011 evaluation data



June, 2016

Teachers identified that the delivery of modern science or careers lessons in their course(s) would be affected to a moderate extent if the materials developed/delivered by Perimeter were not available at all.

Some teachers indicated that, in the absence of Perimeter's materials, they would have to undertake other activities or develop their own lessons, however the material would not cover the same cutting edge topics, would be less engaging, and it would take more time for them to conduct the research to create new lessons.

Even where teachers indicate they have strong backgrounds in modern physics, they still indicate the Perimeter materials add good reference to concepts, provide greater accuracy and make teaching more interesting.

Additionally, a number of teachers identified the impact of Perimeter on their own learning being such that they are able to better deliver the material.

Outreach partner interviewees also identified that Perimeter has a strong education and outreach program to the general public and younger generation, with robust educational materials:

Perimeter is a highly valuable resource to obtain the latest physics education material that can be brought back to their local communities and classrooms.

Encourages younger generation to pursue careers in science, technology, engineering, and math fields

The following representative quotes made by high school teachers responding to the survey demonstrate the value and usefulness of the Perimeter outreach products to this audience:

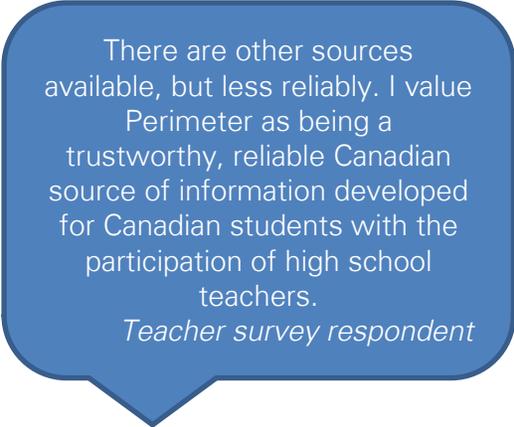
"The Perimeter resources are a welcome addition to a teachers' lesson arsenal. The hands-on approach is a welcome one within the modern physics classroom."

"The usefulness of [Perimeter] material is unprecedented. Few resources are provided to physics teachers that are specifically targeted at the high school level, and provide up to date, and engaging content. "

"The materials have been very useful for extending the scope of the curriculum. They not only teach about high level physics, but they also set up ideas and concepts about the nature of physics as a subject in itself."

"One of very few trusted resources that are suitable for high school."

"Accurate, dependable information from a credible institution "



There are other sources available, but less reliably. I value Perimeter as being a trustworthy, reliable Canadian source of information developed for Canadian students with the participation of high school teachers.

Teacher survey respondent



June, 2016

“The materials are well planned for classroom use and very engaging to students, with practical application. ”

High school teachers (76%) identified a wide range (low of one to high of 1,400) of the number of other teachers they are sharing the Perimeter educational materials with since incorporating it into their curriculums. The resulting estimate is that each teacher is sharing material with potentially five other teachers (median number). Additionally, 70% have encouraged other teachers to attend Perimeter’s teacher-oriented learning events or access Perimeter’s educational resources. The most frequently mentioned resource recommended to other teachers was the Einstein Plus program. However, a significant number of teachers recommended all of Perimeter’s resources including videos, web resources and DVD kits.

The evaluation teacher’s survey findings are consistent with client feedback surveys Perimeter has undertaken following its own outreach/educational events. For example, results of surveys conducted in support of EinsteinPlus programing delivered in 2011, 2012, 2014 and 2015 indicate:

- The majority of teachers rated the material as being applicable to their classrooms.
- The level of difficulty of the topics covered during the program was appropriate.
- Overall review of the program was highly regarded.

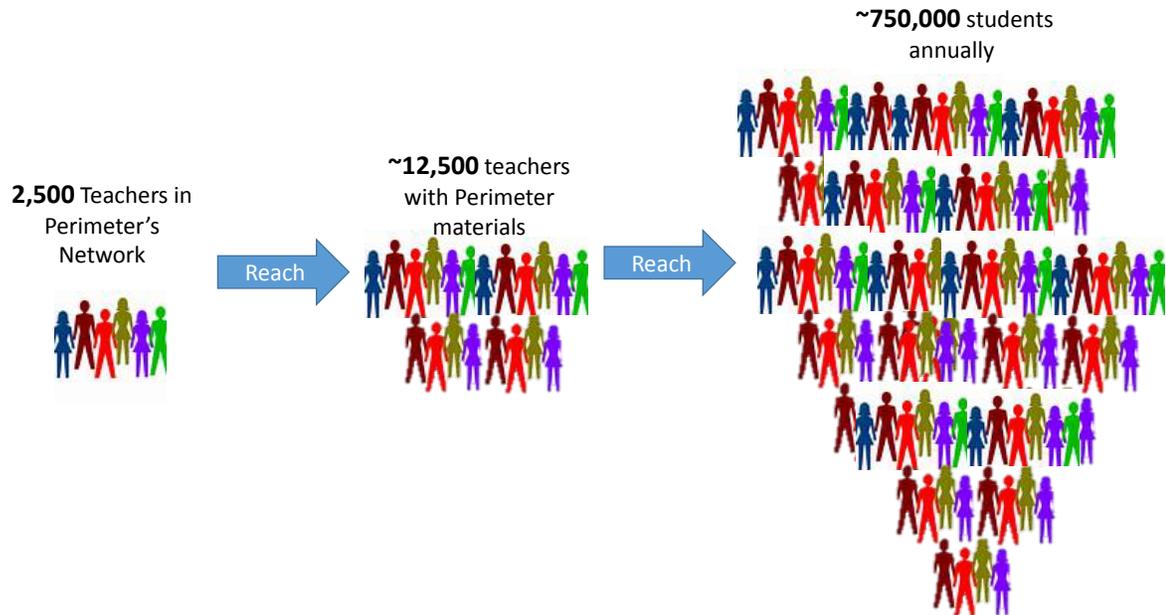
Client feedback collected at the Association for Science Education (ASE) 2015 Conference on four sessions delivered by Perimeter was also positive. Participants indicated a high likelihood they would incorporate aspects of the ASE -delivered sessions into their classroom practice.

Utilizing Perimeter’s total network of teachers (2,500) who have attended a Perimeter educator workshop, an estimate of the number of teachers and students reached by Perimeter educational materials can be made. The median number of other teachers reached per teacher responding to the survey is five. The median number of students reached per teacher responding to the survey is 50. Extrapolating these figures places Perimeter’s potential reach to an overall total of 12,500 teachers to date and then a potential total of 750,000 students annually (Exhibit 13).¹⁶

¹⁶ These figures should be used with care, as we cannot verify whether all teachers reported multi-year or per year data (although per year data was requested), how many years were reported, or if they were reporting for themselves or numbers that would be part of a larger teacher’s network where multiple sets of students would have been included.

June, 2016

Exhibit 13 Estimated reach of Perimeter's educational materials¹⁷



Looking at the effect Perimeter outreach material has had on teachers (Exhibit 14), teachers indicated Perimeter materials have enabled their course delivery in various aspect by at least a great extent.

¹⁷ Median number (midpoint of the frequency of distribution) of other teachers reached by teachers responding to survey = 5 (range 1 to 1,400)

Median number (midpoint of the frequency of distribution) of students reached by teachers responding to survey = 50 (range 0 to 1,000)

High level extrapolation: teachers to teachers = $2,500 \times 5 = 12,500$; teachers to students = $(2,500 + 12,500) \times 50 = 750,000$

Exhibit 14
Extent to which Perimeter’s educational materials enable teacher’s delivery of science lessons

	Not at all	To some extent	To a moderate extent	To a great extent	To a very great extent	Don't know or not applicable	Mean	
	1	2	3	4	5		#	(n)
Clearly explain the goals of the material	0.8%	3.6%	13.6%	39.6%	34.8%	7.6%	4.1	231
Deliver your lesson in an orgnaized manner	1.6%	4.8%	17.7%	32.7%	33.1%	10.1%	4.0	223
Provide good examples and illustrations	0.4%	2.8%	5.6%	30.5%	55.4%	5.2%	4.5	236
Challenge your own understanding	0.8%	6.0%	15.3%	30.1%	42.2%	5.6%	4.1	235
Enrich your own creative approach	0.8%	5.7%	12.6%	33.2%	42.1%	5.7%	4.2	233
Actively engage students	0.8%	4.0%	10.8%	38.6%	36.9%	8.8%	4.2	227

7.2 b) Encourages teachers, students, and the general public to increase their knowledge and gain a deeper level of interest and appreciation for the value of science and physics?

7.2.1 Key Findings

- Perimeter is very well regarded with respect to its more general outreach activities and materials. The general public is positive about the impacts of Perimeter's outreach initiatives (especially Perimeter's lecture series and website resources) on their interest in theoretical physics and science in general. High school teachers report that Perimeter's material creates significant engagement and interest amongst their students, but also increases their own interest in and knowledge of physics.
- Teacher and general public survey respondents are very positive about the quality of Perimeter outreach and communications, finding them credible, of high quality and rigor, discussing leading-edge topics, and inspirational. Quality has increased somewhat over the very positive 2011 evaluation results, and for teachers the quality is better than alternative well-known sources of information.
- Data suggest, but do not prove, that Perimeter has a positive effect on deciding on a STEM career for at least some students. Perimeter's efforts appear to be often contributing factors in such decisions, with its mentoring activities (e.g., in the International Summer School for Young Physicists) being especially valuable.
- The independent 2015 SAC report and several SAC interview respondents provided high praise for Perimeter's innovative education and outreach - one called it a "hub for teacher's education."

June, 2016

- Outreach partners commented that Perimeter's outreach and education material were first rate and highly interesting for both the general public and especially for high school students. The qualities mentioned were similar to those noted by teachers and the public: cutting-edge, interesting, and engaging - far more than typical public education materials, and additionally made relevant to daily and community life.
- Several outreach partners commented that these effects were quite broad, not just in Canada but also in the US and the UK, e.g., by helping provide a central source of top quality physics teaching material, and by potentially providing new opportunities for students with otherwise poor education and career prospects - encouraging them to pursue dreams and expand aspirations.

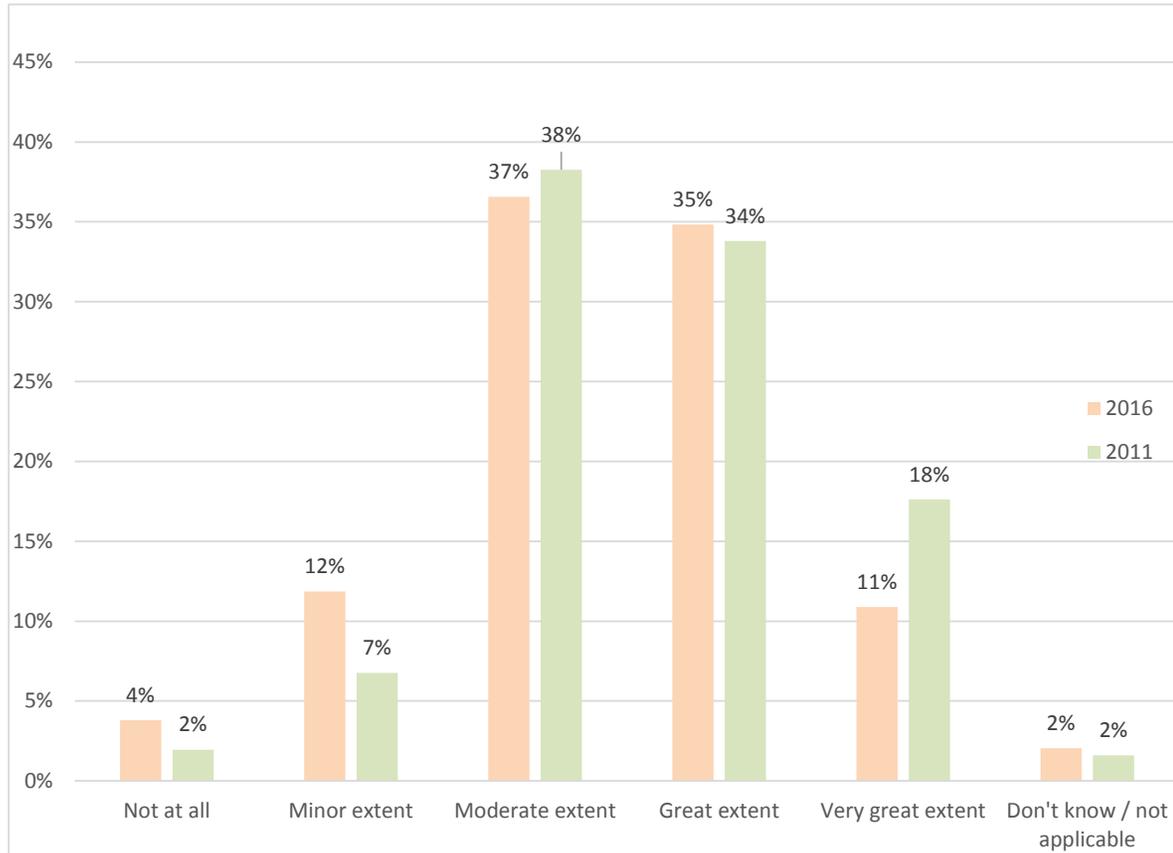
7.2.2 Analysis

The results of the general public and high school teacher's web surveys indicate Perimeter is succeeding in fulfilling its outreach objectives. Exhibit 15 shows that nearly half (46%) of general public survey respondents report their interest in theoretical physics and modern science has increased from a great to very great extent since attending or receiving communications or outreach from Perimeter Institute. This is consistent with results from 2011 as well as internal performance monitoring undertaken by Perimeter in which it was documented through Public Lecture survey data that the Lecture Series inspires attendees to find out more about the lecture topics or other science topics (100% of respondents in 2013-2014 and 95% of respondents in 2014-2015).

Teachers also indicate the Perimeter educational and outreach materials and programming have increased their interest and knowledge in science and physics (see Exhibit 17 below)

June, 2016

Exhibit 15
Perimeter’s effect on increasing the general public’s interest in theoretical physics and modern science



Additionally, the general public has sought further information from/participation with Perimeter to a moderate extent, and the majority of public survey respondents (96%) intend to engage with Perimeter’s public programming in the future. Most identified engaging with Perimeter’s public lecture series and website resources. A majority of public survey respondents (79%) identified they have encouraged other people to attend or access Perimeter’s outreach and communications programming, on average to approximately 23 other people.

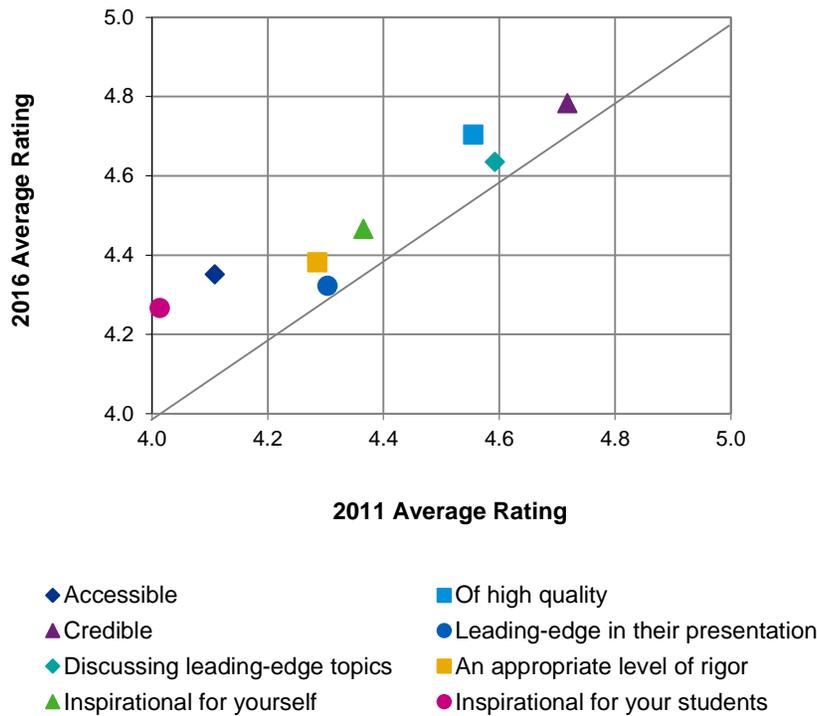
Teachers and the general public were asked to comment on the quality of Perimeter’s outreach and communications. On average, they responded very positively. Exhibit 16 demonstrates that the attributes of credibility, quality, and discussion of leading edge topics were ranked the highest, although Perimeter’s outreach and communications were also found to be inspirational to both teachers and students. In general, teacher ratings on the

quality of Perimeter materials has increased, on average, over 2011 results. The general public views Perimeter’s outreach and communications materials very positively. All qualities are rated from a great (4.0) to a very great extent (5.0) – consistent with the 2011 results. This includes the added area of “engaging content” (not shown in the chart) which received an average rating of 4.3.

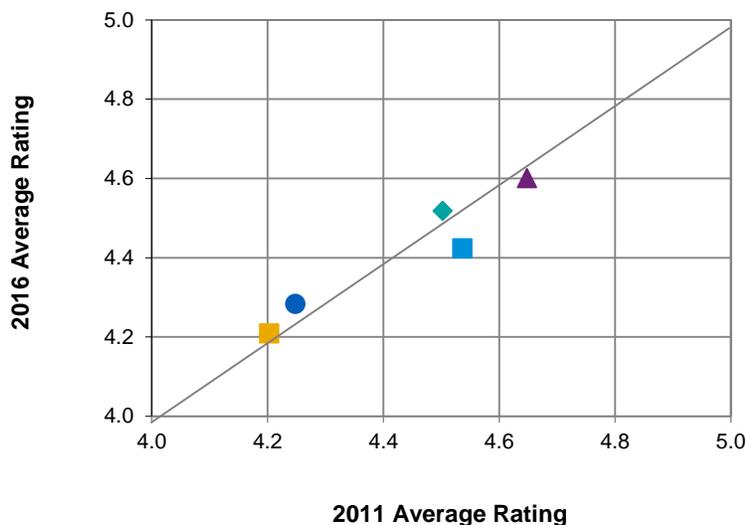
Exhibit 16

Qualities of Perimeter’s outreach and communications

Teachers Survey - Qualities of PI Materials



Public Survey - Qualities of PI Materials



- ◆ Accessible
- ▲ Credible
- ◆ Discussing leading-edge topics
- Of high quality
- Leading-edge in their presentation
- An appropriate level of rigor

The majority of teachers and the general public respondents (80%) were not aware of other potential sources for material with the same or similar attributes to what is available and delivered by Perimeter. For those aware of other sources of materials, Perimeter’s materials were found to be:

- Better, by teachers across a number of qualities, namely: overall quality, rigor, credibility, and leading edge topic selection and in presentation.
- About the same as others from the public perspective.

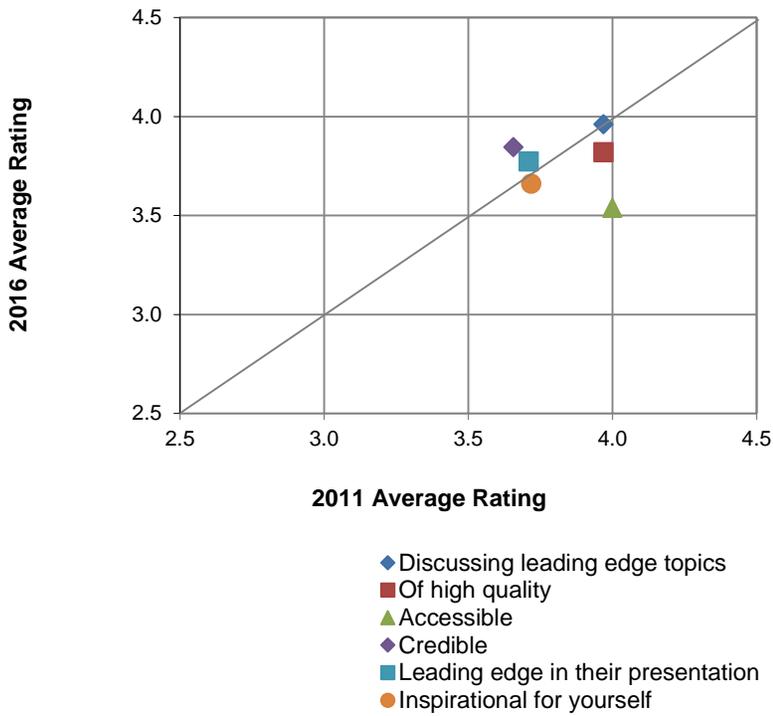
Of those teachers and general public respondents who were aware of other potential sources of material, Exhibit 17 demonstrates that, on average, respondents rated Perimeter material to be better overall. Teachers were comparing Perimeter resources to those from other sources such as: TRIUMF (UBC), PhET (Wiemann), Nova or Discovery channel, NASA, CosmoLearning, and the general Internet.

June, 2016

Exhibit 17

Comparison of Perimeter information to other potential sources of theoretical physics and modern science materials

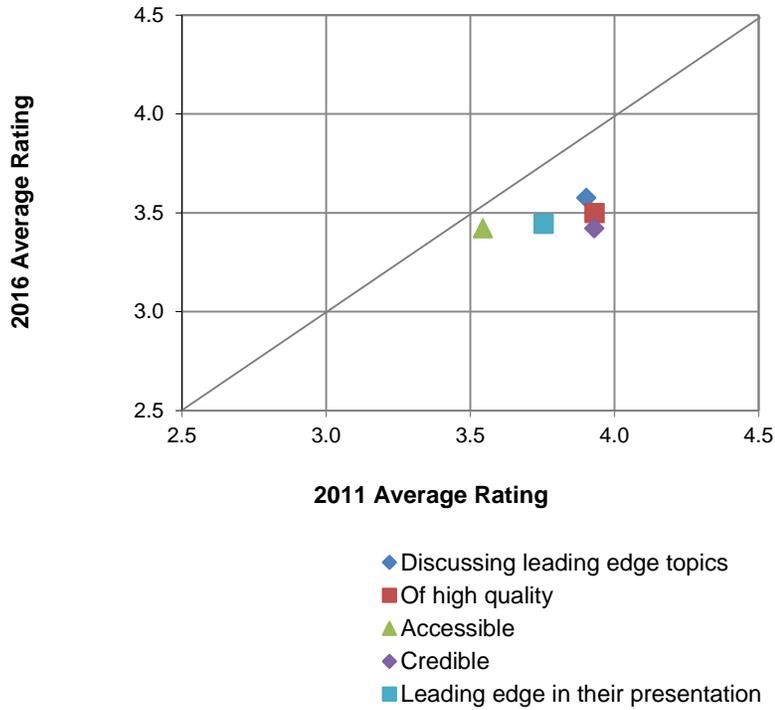
Teachers Survey - Comparison of PI information





June, 2016

General Public Survey - Comparison of PI information



Looking at the effect Perimeter’s educational material has had on high school students¹⁸ (Exhibit 18), teachers indicated Perimeter materials have enabled students in various learning aspects by at least a great extent. Of the highest rated, it was identified by teachers

¹⁸ Teacher opinions were used as proxy data to determine impacts on students.

that Perimeter’s educational material enabled students to stretch their understanding and actively engage in lessons to a very great extent.

Exhibit 18
Extent to which Perimeter’s educational materials enable student learning – Opinion of teachers

	Not at all	Minor extent	Moderate extent	Great extent	Very great extent	Don't know / not applicable	Total (n)	Mean
	1	2	3	4	5	0		
Stretch their understanding	1%	3%	15%	32%	42%	8%	254	4.2
Actively engage with lesson(s) content	1%	5%	17%	33%	36%	8%	253	4.1
Foster creative or critical thinking	1%	3%	18%	42%	29%	8%	252	4.0
Approach their work with enthusiasm	1%	5%	20%	37%	27%	9%	254	3.9
Work collaboratively with peers	2%	9%	25%	30%	23%	11%	254	3.7

Teachers were not able to explicitly link a student’s decision to pursue higher education in mathematics or physics as being influenced by Perimeter for the most part. However, there were a few examples where a teacher directly cited Perimeter’s influence on a student’s decision to pursue higher education in physics. The majority of responses were highlighting points such as grade 11 and 12 students taking science courses that have already chosen their path in physics by the time they are exposed to the Perimeter resources but at the same time, the Perimeter material was described as continuing to inspire and raise awareness of opportunities for various areas of research. This is supported by Perimeter’s own performance monitoring data where in 2013 and 2015, following Perimeter’s Inspiring Future Women in Science Conference, conference participants were asked if the conference inspired them to learn more about STEM careers. In both 2013 and 2015 the majority of participants identified they were already considering STEM as a career, but 40% in 2013 and 25% in 2015 indicated that the conference did, in fact, inspire them to learn more about careers in in this field.

Perimeter’s own performance monitoring information has also found that students are influenced by Perimeter educational materials and experiences. For example, students attending the International Summer School for Young Physicists (ISSYP)¹⁹ indicated they were challenged by the lectures and exercises, considered mentoring the most valuable and required part of the program, and the received a better sense of what research work in theoretical physics is actually like through the sessions. A follow-up survey conducted by Perimeter of ISSYP alumni in 2011 and 2015 found that a majority of alumni pursue at least undergraduate degrees in studies of Physics, Math or Engineering and a majority of alumni are working in various degrees of science teaching or research positions.

Teachers were asked to provide one or two words that would describe their own and their students’ experience with Perimeter’s materials. Exhibit 19 compiles the words into a visual

¹⁹ The ISSYP is a two-week program for Canadian and international high school students to attend Perimeter. The program consists of presentations by Perimeter researchers, opportunities for mentoring sessions, mini-courses in physics, and hands-on labs, among other opportunities.

June, 2016

display, with the largest words representing those most frequently stated, and a decrease in size mirroring a decrease in frequency of use. As can be seen in the exhibit, the most frequently used words to describe students' experiences included encouraging, interesting, and challenging.

Exhibit 19
Teacher and student experience with Perimeter – opinions of teachers

The independent 2015 SAC report discusses education and outreach briefly but with high praise and a number of the SAC interview respondents also spontaneously complimented Perimeter's innovative outreach and education efforts (including the PSI Program) for both the general public, the public education system, and international education efforts.



"[Perimeter] has also become a poster child for public-private partnership in research funding, a hub for teachers' education, and a prominent advocate of the value and long-term benefits of fundamental science, in Canada and beyond."

SAC Report

[These give] Perimeter a rightly deserved Canadian and international visibility.

SAC Interviewee

Donor interviewees were not explicitly asked about this question either, but many of them commented spontaneously that Perimeter's outreach and education material were first rate and highly interesting for both the general public and especially for high school students. This was quite relevant for a number of the donor organizations, as they also support research and/or work to increase scientific education and knowledge in Canada.

A particularly strong feature of Perimeter’s material is that it addresses cutting-edge content in interesting and innovative ways – including how physics is relevant to daily and community life. This effect was seen by many respondents to help attract students (including women) into STEM fields, build local scientific and technical capabilities, and (ultimately) build a stronger society. Several respondents commented that these effects were broader than perhaps originally intended, as they were helping support the public education system generally (e.g., by helping provide a central source of top quality physics teaching material in the context of more constrained education budgets), and commented that if possible they should be extended and expanded.

If possible, Perimeter should provide more education outreach at public school. Our teachers need to motivate more of our students into fundamental science, and get kids to think outside the box.

Donor Interviewee

These effects were noted not just in Canada, but also in the UK and US. One outreach partner commented, for example, that the UK does not have a central system or organization at the government level to help disseminate new knowledge for its teachers. Schools and teachers are left to do this effort on their own individually. Therefore, Perimeter’s material and support are great resources, helping the donor organization structure its courses to UK teachers.

One respondent noted that Perimeter education material had potentially important effects for students with poor education and career prospects, as it demonstrated the inherent interest and excitement of science.

We are seeking to use Perimeter’s education outreach support, such as its moveable education program, to assist us in continuous efforts to help the low-income / under-served school districts in LA. With Perimeter’s support and UCLA’s involvement, we believe this helps our effort in stabilizing these communities and help reduce poverty and crime. . . It provides real content that helps encourage them to pursue dreams and aspiration. ... [and] helps reduce poverty and provide stability for these children in the long run.

7.3 Potential Area for Improvement

Perimeter hopes to increase general public interest and appreciation for physics and science in general, in large part through its outreach and education initiatives. The results of the evaluation suggest that Perimeter is having considerable success in this area, perhaps in ways and to an extent that were not entirely anticipated. There appears to be opportunity for Perimeter to continue to further extend these activities – likely through external partnerships, so as to not dilute its central mission – in order to create even broader societal benefits. For youth, women, and the disadvantaged, and in certain regions, career



June, 2016

opportunities are often slim in the STEM fields. Attracting youths into these fields can in turn create more community income, stability, and safety. Perimeter's education and outreach materials are perceived to be highly compelling, to the extent that STEM careers may appear to be viable options for such individuals.

Perimeter's materials are widely seen as relevant, cutting-edge, and well-packaged, and benefit from having been developed through focused and well-resourced efforts. Similar materials from other sources are often developed through the initiative of single individuals, often with limited time and resources. Perimeter's outreach and education materials stand out by comparison, and several donor organizations encouraged Perimeter to continue to widely distribute its education and outreach materials, provide easy access, and continue to establish and maintain partnerships to develop and deliver such materials which are seen to be of significant (if indirect) value to delivering societal benefit. Such efforts fit well with Perimeter's efforts to increase general scientific literacy, e.g., in Africa and South America, and could also explicitly address the point of having scientific literacy at all – to ultimately benefit society.

8 Issue 6: To what extent has Perimeter established a high quality research environment?

8.1 Key Findings

- Researchers seek out association and opportunities with Perimeter because it is an Institute that is home to international and Canadian researchers of top talent.
- Researchers are very positive about Perimeter's research environment - 94% say it fosters and supports cutting edge research from a great extent to a very great extent, and three-quarters believe it does so better or much better than other top-rank international institutions.
- Key factors for this support (and for attracting researchers to Perimeter in the first place) are the freedom and time to pursue novel research, funding, and access to many research activities (e.g., seminars, conferences, top international visiting researchers, collaborations), but many other aspects were mentioned as well, including the reduction in administrative workload and physical infrastructure.
- Some SAC interviewees spontaneously commented that Perimeter made visiting researchers very welcome and more "at home" than through similar programs at other world-leading institutions.

8.2 Analysis

Exhibit 20 shows that the attributes of the research environment at Perimeter are seen by 94% of researchers to foster and support cutting edge research from a great extent to a very great extent. This remains consistent with the 2011 results.

Exhibit 20

Extent to which the environment at Perimeter fosters cutting-edge research

	Not at all	Minor extent	Moderate extent	Great extent	Very great extent	Don't know / not applicable	Total (n)		Mean		Comparison 2011
	1	2	3	4	5	0	2016	2011	2016	2011	
Researchers	0%	0%	5%	27%	67%	1%	85	102	4.6	4.5	+

Some of the best features identified by researchers included:

- Complete freedom to pursue research.
- Access to a large number of activities (seminars, conferences, visitors in many different areas of research).
- High quality in-house and visiting researchers.



June, 2016

- The Visitor’s Program.
- Physical infrastructure including collaboration and interaction spaces
- Reduced administrative work load.
- Administrative supports.

Some areas of potential enhancement identified by researchers include:

- Increased connection with experimentalists, including bringing on experimental faculty.
- Reduce the amount of simultaneous activities taking place, as there were some difficulties at times having to navigate the schedule.

Notwithstanding the mention of these possible enhancements, in comparison to other institutions where these researchers are/were affiliated, 76% of respondents believed the attributes of the research environment at Perimeter are better or much better than these other institutions, as demonstrated in Exhibit 21. Researchers were comparing Perimeter to other institutions such as: Cambridge University, Utrecht University, Yale University, Harvard University, Princeton University, Johns Hopkins University, University of California, Pennsylvania State University, Michigan Institute of Technology, University of Oxford, University of Waterloo, and University of Western Ontario.

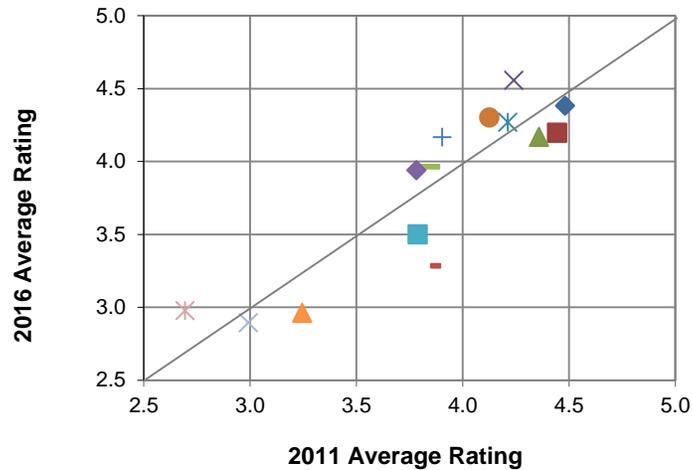
Exhibit 21

Comparison of Perimeter research environment to that of other institutions

	Much worse	Worse	About the same	Better	Much better	Don't know / not applicable	Total (n)		Mean		Comparison 2011
	1	2	3	4	5	0	2016	2011	2016	2011	
Researchers	0%	5%	16%	44%	32%	4%	85	102	4.1	4.0	+

While all features of Perimeter’s research environment were ranked as having moderate to very great importance and attractiveness for recruiting top-flight researchers, eight features of Perimeter’s research environment were rated of great or very great importance by researchers, Associate Faculty Partner institutions and trainees as shown in Exhibit 22. Increased opportunity to interact with top people in their field was ranked the highest, with trainees’ additionally ranking a new category of unique training experience / opportunities near the top at 4.5 (not shown in the exhibit below). These results are consistent with the results from 2011.

Exhibit 22
Importance of Perimeter features for recruiting top-flight researchers – Average of all researcher, partner and trainee responses²⁰



- ◆ Freedom to pursue novel research ideas and methods
- Time available for research
- ▲ Good funding and support systems
- × Increased opportunities to interact with top people in your field
- × Collaborative atmosphere
- High quality workshops, seminars, colloquia, conferences, etc.
- + Increased interaction with the international academic community in general
- Travel opportunities
- Good physical environment
- ◆ Increased opportunities to interact with top people in complementary fields
- Opportunities for multi-disciplinary research
- ▲ Private, independent, autonomous institution
- × Stimulating outreach program
- × Increased interaction with the Canadian academic community in general

As shown in Exhibit 23, researchers indicated that most (11 out of 14) features to support individual research programs were in place at Perimeter from a great to a very great extent, with freedom to pursue novel research ideas rated highest.

²⁰ The average across all respondent groups is presented in the chart as the variation in averages among groups is negligible.

June, 2016

Overall, most features were identified by researchers as contributing to a moderate extent to their individual research programs. The three features identified as contributing the most included:

- Freedom to pursue novel research ideas
- High quality workshops, seminars, colloquia, conferenced, etc.
- Time available for research

The features identified as contributing the least to the researchers' research programs, being rated as contributing to a minor extent, were stimulating outreach programs and increased interaction with the Canadian academic community in general.

Exhibit 23

Extent to which features are in place at Perimeter, and their importance to individual research programs

	Actually in place at Perimeter Institute			Contributed to your research programs		
	Average Rating		(n)	Average Rating		(n)
	2016	Comparison 2011	2016	2016	Comparison 2011	2016
Good funding and support systems	4.4	neutral	73	3.9	-	73
Freedom to pursue novel research ideas and methods	4.7	+	77	4.2	+	73
High quality workshops, seminars, colloquia, conferences, etc.	4.5	+	80	4.0	+	79
Time available for research	4.5	+	71	4.1	-	70
Stimulating outreach program	4.1	-	68	2.3	-	66
Travel opportunities	4.1	-	57	3.5	-	60
Increased interaction with the international academic community in general	4.2	+	78	3.6	neutral	78
Increased opportunities to interact with top people in your field	4.2	+	80	3.8	+	78
Private, independent, autonomous institution	4.0	neutral	66	3.0	+	61
Good physical environment	4.5	+	80	3.9	+	75
Increased opportunities to interact with top people in complementary fields	3.9	-	81	3.3	neutral	78
Collaborative atmosphere	4.1	+	81	3.7	neutral	79
Opportunities for multi-disciplinary research	3.9	neutral	75	3.3	+	75
Increased interaction with the Canadian academic community in general	3.6	+	76	2.9	+	76

The SAC did not specifically comment on this topic in their independent report, nor was it explicitly asked during the SAC interview program, however, a few SAC interviewees spontaneously commented that Perimeter made visiting researchers very welcome and comfortable. Visiting researchers felt more "at home" than through similar programs at other world-leading institutions. Perimeter was very accepting of visitors if they decided to work closely with other investigators, but equally accepting if they wanted to work entirely alone.



June, 2016

At Perimeter [this individual] had the peace of mind to not to be in a rat race, he could think about combining his work with [some other relevant Perimeter fields].

One respondent reported that there is a cozy, friendly, supportive atmosphere at Perimeter, with a great interactive atmosphere and a beautiful building, with interactions encouraged in its layouts and through social events, lectures, and public lectures, all providing a very warm and supportive atmosphere.

9 Issue 7: Has Perimeter Institute helped to position Canada as a world leader in theoretical physics research?

9.1 Key Findings

- Overall, Perimeter has had a dramatic impact on Canada's reputation in foundational theoretical physics. It is a true world-leading institution, standing on equal footing with other institutes of equal fame (and generally much longer history), and now being mentioned in the same context as these other organizations. Further, it now competes successfully against other top-flight institutions when recruiting faculty and PDF “stars”.
 - As examples: (1) the Max Planck Society's study, "Mapping Research Excellence", ranked Perimeter second in theoretical physics world-wide, behind only Princeton's Institute for Advanced Study; and (2) a 2012 study by Thomson Reuters showed that in 2010 Canada ranked first in physics citation impact among G8 countries; without Perimeter, Canada would have ranked fourth.
- The 2015 independent SAC report noted that "Perimeter Institute has established itself beyond doubt as a top international player in theoretical physics and contributes significantly to Canada's visibility in fundamental and potentially “transformative research,”” and is “an extraordinary place with an extraordinary history.”
- The SAC interview respondents stated there was essentially no "Canada" prior to Perimeter, with only a few strong individuals scattered across the country, whereas now there are strong Canadian groups because of Perimeter. Perimeter is now "the default" when international researchers think about Canadian foundational theoretical physics. Respondents rated Canada as roughly "good" in theoretical physics pre-Perimeter vs. "world-class" now - one noted that Perimeter had “an absolutely massive effect.”
- The researcher survey respondents agree: Perimeter has made Canada's reputation in Perimeter's specific fields better to much better than it was previously, with relatively little variation across fields. In addition, the ratings of Canada's reputation across all fields with the exception of Quantum Information were significantly higher than in the 2011 evaluation study.

9.2 Analysis

Perimeter Institute has documented in its annual reports the results of a number of independent studies that support Perimeter positioning Canada as a world leader in theoretical physics research.

June, 2016

The first example is an independent, international study, “Mapping Research Excellence,”²¹ led by a senior researcher at the Max Planck Society in Germany. The study used objective source data: publications and citations from Scopus to rank university or research-focused institutions based on the estimated probabilities of (i) publishing highly cited papers (Best Paper Rate) or (ii) publishing in the most influential journals (Best Journal Rate). This study ranked Perimeter Institute fifth overall in the world of physics, and second in theoretical physics, behind only Princeton’s Institute for Advanced Study.

Another example is a reference from Perimeter’s 2014/15 Annual Report to Canada’s Department of Innovation, Science, and Economic Development in which it is noted that a recent study by Thomson Reuters, published in 2012, showed that in 2010 Canada ranked first in physics citation impact among G8 countries; without Perimeter, Canada would have ranked fourth.²²

Additionally, the Expert Panel on the State of Science and Technology in Canada “identified several infrastructure facilities associated with Physics and Astronomy that are an advantage for Canada, including the Canadian Light Source synchrotron, the Sudbury Neutrino Observatory/Laboratory, TRIUMF (Canada’s national laboratory for particle and nuclear physics), and the Perimeter Institute for Theoretical Physics.”²³

SAC interviewees were asked to directly rate Canada’s reputation in foundational theoretical physics prior to Perimeter’s establishment vs. now, using the scale below:

1	2	3	4	5
Poor	Fair	Good	Excellent	World-class

As noted earlier, it was somewhat difficult for SAC interviewees to rate Canada pre-Perimeter in theoretical physics due to the limited mass of strong individuals in the country in theoretical physics pre-Perimeter. The SAC respondent ratings were approximately:²⁴

- Pre-Perimeter = 2.8 (i.e., roughly “good”).
- Post-Perimeter = 4.7 (i.e., “world-class”).

SAC interviewees noted that when people think “Canadian physics” now, they think “Perimeter,” and especially groups of Canadians at Perimeter, not just individuals. One

²¹ www.excellencemapping.net

²² The Perimeter Institute for Theoretical Physics, 2014/15 Annual Report to Canada’s Department of Innovation, Science, and Economic Development covering the Objectives, Activities, and Finances for the period August 1, 2014 to July 31, 2015 and Statement of Objectives for Next Year and the Future. See: “Publication Output and Citation Impact of Perimeter Institute’s Physics Research,” Thomson Reuters, May 2012 (unpublished; available upon request), and “Bibliometric Evaluation and International Benchmarking of the UK’s Physics Research.”

²³ The State of Science and Technology in Canada, 2012, The Expert Panel on the State of Science and Technology in Canada, Council of Canadian Academies, page 173.

²⁴ Where SAC interviewees found it difficult to make these ratings, the KPMG study team interpreted their qualitative remarks as an approximate quantitative rating.



June, 2016

respondent commented that Perimeter is now “the default” when thinking about Canadian foundational theoretical physics.

Further, Perimeter was consistently noted to be one of the top four or five similar institutes world-wide within specific scientific disciplines. It was also noted that although Canada isn’t large compared to other countries, such as Germany, France, or UK, Canada is *much* more visible in theoretical physics because of Perimeter. In fact, one respondent noted that although Perimeter happens to be located in Canada, it’s actually on the world stage, so it’s not really seen as “Canadian” – but this is considered to be very positive: its reputation and impact are global. Another commented that Perimeter “has managed to condense money and brainpower into a centre of excellence, and it really shines as an example.” This effect is seen to go beyond the investments made in Perimeter (simple funding is far from certain to be successful), but instead to reflect the vision, quality, and inspiration of its founders and the people it has attracted (both full-time, and visiting).

Some representative comments from the interview program are:

An absolutely massive effect!

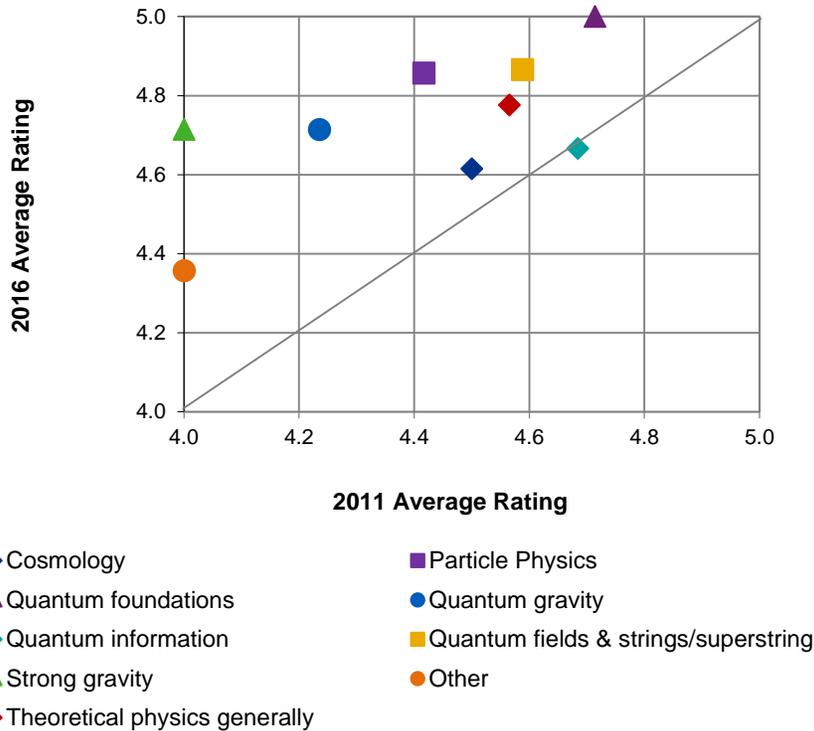
Canada had NO existence [in this area] prior to Perimeter. Perimeter really put Canada on the map, both in [this and related areas] – Perimeter is now a top place to go and for collaboration.

There is no place that compares with Perimeter in this area, except perhaps Caltech

SAC interviewees noted that now, other Canadian universities can attract top people, in part because of Perimeter’s Associate Faculty program. On this topic, one SAC interviewee noted that Perimeter is “a huge perturbation” to the local and regional scientific system in the Waterloo area, and indeed even to Canada as a whole. In contrast, equivalent institutes are not perceived to create as much “perturbation for the field” simply because they are situated within areas with very high scientific capabilities in other nearby institutions. A corollary of this was said to be that Perimeter needs to keep good synergy and relationships with other Canadian universities for this effect to have maximum benefit – which it is seen to do by respondents at this point in time.

Results from the researcher survey support the SAC interview findings. Exhibit 24 shows that researchers perceive that Perimeter has made Canada’s reputation in the specific Perimeter fields of theoretical physics areas better to much better. There is relatively little variation across fields – possibly Canada’s reputation in Quantum Foundations and Quantum Fields & Strings / Superstring have been the most affected by Perimeter in the last five years, however, all identified areas of research, with the exception of Quantum Information, were rated (on average) significantly higher than the 2011 evaluation results.

Exhibit 24
Extent of Perimeter’s effect on Canada's reputation as a global leader in basic research –
Researcher Survey



The 2015 SAC independent report did not directly address this evaluation question, however, the topic was indirectly addressed in some of its summary remarks, such as:

- *“In summary, Perimeter Institute has established itself beyond doubt as a top international player in theoretical physics and contributes significantly to Canada’s visibility in fundamental and potentially transformative research.”*
- *“The Perimeter Institute is an extraordinary place with an extraordinary history: what started as the visionary project of a small group of people has in the course of merely 15 years become a world leading institute for fundamental research.”*
- *“For an institution dedicated to foundational research to have come this far within such a short time presents a formidable achievement, and an example for the rest of the world to emulate.”*

10 Issue 8: Are Perimeter's activities the most economic and efficient means of making progress towards intended outcomes?

10.1 Key Findings

- Perimeter is roughly equally funded by government (53.5%) and private (46.5%) sources.
- Perimeter is able to leverage a non-federal funding ratio of almost 3:1, for every dollar invested by the federal government.
- Donor respondents noted Perimeter has strong leadership, clear vision, and well managed programs.
- The 2015 SAC independent report identified high efficiency, effectiveness and impact of the Perimeter Institute for its size and investment dollars.
- Donors noted that Perimeter helps create social and community impacts (both Canadian and international) well beyond its central goals, and hoped these could be leveraged and scaled up - for example through increased partnerships and accessible resources for high schools, universities, and the general public. These respondents hoped that its indirect societal effects (e.g., attracting young women and disadvantaged youths into STEM careers, increasing community stability, reducing crime) could be broadened and strengthened. It is recognized, however, that such indirect potential societal impacts are outside the scope of Perimeter's central mission.

10.2 Analysis

The 2015 SAC independent report did not directly address this evaluation question. However, the SAC did indirectly address the topic in some of its summary remarks, such as:

It is difficult to conceive of a research institute of similar scope and size that would generate as much visibility and impact for every dollar invested in it as does the Perimeter Institute.

In our view, the Institute presents a unique low-risk, high-reward investment opportunity for its private and public supporters.

One of the SAC interviewees noted that Perimeter is so successful that the committee had to look “very hard” for constructive criticism, and only at a very high level.



June, 2016

Perimeter is almost equally funded by government (53.5%) and private (46.5%) sources (Exhibit 25), with every dollar invested by the federal government (Innovation, Science and Economic Development Canada and other federal sources), leveraged at the rate of \$2.56 of other funding.

Exhibit 25
Perimeter Funding – Inception to January 31, 2016

Funding Type	From inception to 2011	2012	2013	2014	2015	2016	Total	Percentage of Total	
Innovation, Science and Economic Development Canada	48,990,000	4,344,000	16,667,000	3,333,000	10,000,000	6,666,667	90,000,667	18.14%	Government Funded - 53.5%
Other Federal	40,379,000	1,456,000	1,944,000	2,417,000	2,168,000	642,000	49,006,000	9.88%	
Provincial	83,093,000	8,706,000	5,270,000	13,808,000	10,628,000	5,095,000	126,600,000	25.51%	
Private Donations	213,167,000	1,142,000	909,000	761,000	2,690,000	4,816,000	223,485,000	45.04%	Privately Funded - 46.5%
Private Foundations	627,000	317,000	1,153,000	1,210,000	1,578,000	642,000	5,527,000	1.11%	
Private Sector Sponsorships	580,000	326,500	200,000	122,000	248,000	100,000	1,576,500	0.32%	
Total Funding	386,836,000	16,291,500	26,143,000	21,651,000	27,312,000	17,961,667	496,195,167	100%	

Donor interviewees noted Perimeter’s strong leadership, clear vision, and well managed programs that strive to meet Perimeter’s mandate and objectives as examples of its overall efficiency and effectiveness.

In addition, donors noted that Perimeter is indirectly helping create social and community impacts (both Canadian and international) well beyond what Perimeter’s central goals are, and hoped these could be leveraged and scaled up – while recognizing the practical difficulties of doing so. Five of the 13 donor respondents made some comments explicitly or implicitly related to increasing Perimeter’s societal effects; e.g., wishing that:

- Perimeter provide even more partnerships and accessible resources for high schools, universities, and the general public, in turn helping attract young people into STEM fields, provide exciting opportunities for youth who currently have few, and help encourage community and regional stability.
- Perimeter promote its Perimeter “brand” even more to the general public to increase their understanding of its role.

These views have significant potential long-term societal impacts, and it is noteworthy that the donor organizations were aware of them and believed Perimeter could help create them.