

UTQAP Cyclical Review: Final Assessment Report and Implementation Plan

1. Review Summary

Programs Reviewed:	Physics, Hons. BSc: Specialist, Major, Minor Biological Physics, Hons. BSc: Specialist, Advanced Physics Stream Biological Physics, Hons. BSc: Specialist, Biochemistry Stream Biological Physics, Hons. BSc: Specialist, Immunology Stream Biological Physics, Hons. BSc: Specialist, Physiology Stream Physics, MSc, PhD
Unit Reviewed:	Department of Physics
Commissioning Officer:	Dean, Faculty of Arts and Science
Reviewers (Name, Affiliation):	<ol style="list-style-type: none">1. Susan Allen, Associate Dean of Science and Professor, Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia2. David Campbell, Professor, Department of Physics, Boston University3. Steven Rolston, Professor and Chair, Department of Physics, University of Maryland4. Rick Van Kooten, Executive Dean, College of Arts & Sciences and Professor, Department of Physics, Indiana University Bloomington
Date of Review Visit:	June 17-18, 2021 (conducted remotely)
Date Reported to AP&P:	April 12, 2022

Previous UTQAP Review

Date: February 25-26, 2013

Summary of Findings and Recommendations

1. Undergraduate Programs

The reviewers observed the following **strengths**:

- Innovative first-year physics course for life sciences students

The reviewers made the following **recommendations**:

- Enhancing the undergraduate curricular delivery

2. Graduate Programs

The reviewers observed the following **strengths**:

- Outstanding and unique graduate program

The reviewers made the following **recommendations**:

- Remaining sensitive to issues associated with the tri-campus graduate program
- Adding graduate mini-courses on technologies that cross sub-disciplines, such as common instrumentation techniques
- Admitting and providing support to international graduate students

3. Faculty/Research

The reviewers observed the following **strengths**:

- Notable and diverse research programs

The reviewers made the following **recommendations**:

- Strengthening the faculty complement

4. Administration

The reviewers observed the following **strengths**:

- High morale of faculty, students, and staff
- Strong relationships with other units both within and external to the University

The reviewers made the following **recommendations**:

- Examining undergraduate and doctoral program time-to-completion
- Reviewing administrative and research support staffing

Current Review: Documentation and Consultation

Documentation Provided to Reviewers

Terms of reference; Self-study & Appendices; Previous review report including the administrative response; Access to all course descriptions; Access to the curricula vitae of faculty.

Consultation Process

Dean, Vice-Dean Academic Planning, and Associate Dean, Unit-Level Reviews, Faculty of Arts & Science; Department Chair; Associate Chair for Undergraduate Studies; Associate Chair for Graduate Studies; Junior and Senior Faculty; Tri-campus graduate faculty; Undergraduate and Graduate students; Administrative staff (Finance & HR; Facilities & Projects; Undergraduate Teaching Administration; Graduate Teaching Administration; Research Administration & Library); Chairs/Directors of relevant cognate units including Division of Engineering Science (Engineering), Astronomy & Astrophysics, Chemistry, School of the Environment, Philosophy, Earth Sciences, Mathematics (all A&S).

Current Review: Findings and Recommendations

1. Undergraduate Program

Unless otherwise noted, all bulleted comments apply to all programs reviewed.

The reviewers observed the following **strengths**:

- Overall quality
 - ▶ Undergraduate program “world-class” quality
- Admissions requirements
 - ▶ Various undergraduate programs are robust, with roughly 860 students enrolled
- Curriculum and program delivery
 - ▶ Teaching Stream faculty critical to success and quality of the undergraduate program
 - ▶ Curriculum typical of major research university, with appropriate number of required physics courses, as well as math requisites
- Student engagement, experience and program support services
 - ▶ Students very happy with the undergraduate program
 - ▶ Students generally report positive experiences in upper-level lab courses
 - ▶ Students appreciate pandemic-related recorded lectures allowing asynchronous access to material, and suggested that this might continue if possible (though reviewers note that this could be a burden on faculty, and require substantial technology investments)

The reviewers identified the following **areas of concern**:

- Curriculum and program delivery
 - ▶ Students express some concern about utility and timing of required math courses
- Student engagement, experience and program support services
 - ▶ Undergraduates indicate that it can be difficult for first and second-year students to find research opportunities

The reviewers made the following **recommendations**:

- Curriculum and program delivery
 - ▶ Program requires updates in computer science, statistics and data science
 - ▶ Re-evaluation of math requirements and their integration into curriculum could be helpful
 - ▶ Reviewers support tentative plans to add computing to curriculum, for example a Python course early on in the sequence
- Student engagement, experience and program support services
 - ▶ "Having opportunities for the best students to be engaged in four years of research is something that the department should strive to make possible"

2. Graduate Program

Unless otherwise noted, all bulleted comments apply to all programs reviewed.

The reviewers observed the following **strengths**:

- Overall quality
 - ▶ Graduate program is strong and highly ranked, with about 65% of MSc students continuing on to PhD program
 - ▶ Graduate program critical to research and teaching excellence of department
- Curriculum and program delivery
 - ▶ Overall ratio of students to potential advisors consistent with most peer institutions
 - ▶ 2016 reduction in PhD course requirements generally applauded by faculty and students
 - ▶ Number and range of courses listed seems appropriate for size and quality of graduate program and faculty
 - ▶ Department has developed "modular courses" to help maintain breadth with limited number of faculty
- Student engagement, experience and program support services
 - ▶ PhD attrition rate consistent with peer and peer-plus institutions
 - ▶ PhD students generally satisfied with processes for measuring their progress
 - ▶ Widespread student enthusiasm for advising and support provided by graduate staff
- Quality indicators – graduate students
 - ▶ Quality of students judged by admissions, qualifying exams, and completion rates remains high

The reviewers identified the following **areas of concern**:

- Admissions requirements
 - ▶ Limitations on number of international applicants and end of provincial support for increased graduate enrolments have made attracting top candidates more difficult, and put pressure on individual faculty research grants to support students
- Curriculum and program delivery
 - ▶ Significant program growth between 2012 and 2020 (from 168 students to 219), without corresponding increase in tenure stream faculty, has increased the research supervisory burden
 - ▶ Not yet clear if reduction of PhD course requirements will achieve intended goal of reducing Time-to-Completion
 - ▶ Varying offerings from year to year may force students to take courses not related to their research
 - ▶ No new modules have been offered since 2016, and few have been developed on cutting-edge research
- Student engagement, experience and program support services
 - ▶ Some students note that that changing mentors and thesis topics had been difficult, and that the annual supervisory committee meetings were not well-focused

The reviewers made the following **recommendations**:

- Admissions requirements
 - ▶ Admissions must be carefully monitored to ensure all five major research groups have the requisite number of students
- Curriculum and program delivery
 - ▶ Department needs to consider modular offerings carefully, and decide how to credit faculty who teach them
- Assessment of learning
 - ▶ High PhD qualifying exam passage rate likely reflects selectivity of incoming students, but still should be examined by the department
- Student engagement, experience and program support services
 - ▶ Dept should consider standardizing content of annual PhD committee meetings

3. Faculty/Research

The reviewers observed the following **strengths**:

- Overall quality
 - ▶ Department “is an outstanding group of researchers and teachers”
 - ▶ Earth, Atmospheric, and Planetary Physics (EAPP) group is internationally renowned and well connected with strong collaborations and numerous co-authored papers; new young faculty show strong promise to continue similar level of excellence

- ▶ Quantum Optics (QO) group is excellent, internationally known, and very active in research
- ▶ Biological Physics (BIO) group is diverse and research-active, with joint appointments and large variety of research collaborations outside the department
- ▶ Five of the six Condensed Matter Physics (CMP) group faculty are Fellows of the American Physical Society, and the group performs well in terms of publications, grant funding and other honours
- ▶ High Energy and Particle Physics (HEP) group conducts high-quality research, provides excellent training, and are respected in Canada and beyond as leaders in their fields
- Research
 - ▶ A significant strength of the experimental HEP group is their expertise and excellence in high-performance computing and development of advanced instrumentation
 - ▶ Research quality of faculty at UTM and UTSC is world class and “they are a strategic benefit to Physics at [U of T]”
- Faculty
 - ▶ Department has made some progress towards increasing faculty gender diversity since 2016
 - ▶ Teaching Stream faculty are aware of and implement active learning strategies for their courses
 - ▶ Pre-tenure faculty energetic, committed, confident and more comfortable in roles than is typical; “[U of T] Physics should be proud of this culture”
 - ▶ Balance between tenure- and teaching-stream faculty seems appropriate, given department’s size and teaching and research responsibilities

The reviewers identified the following **areas of concern**:

- Research
 - ▶ EAPP research connections to rest of the department are weaker
 - ▶ A challenge facing the CMP group is increasing cost of graduate students and post-doctoral fellows, in view of the flat levels of funding from NSERC
- Faculty
 - ▶ Currently a deficit of faculty due to departures
 - ▶ “Surprisingly low” uptake of active learning methods and other modern pedagogy in lectures by Tenure Stream faculty
 - ▶ Teaching Stream faculty are unable to have graduate students, which somewhat limits their ability to pursue educational research
 - ▶ A challenge for continued success of the QO group is the lack of hiring in the area
 - ▶ Core faculty in CMP group supervise a larger than average number of graduate students, and seem spread somewhat thin in ability to teach appropriate advanced CMP graduate courses
 - ▶ COVID-related shift to online has had a “colossal” impact on young faculty; reviewers note that teaching online has presented a huge hurdle to faculty who are learning how to teach and construct new courses

The reviewers made the following **recommendations**:

- Faculty
 - ▶ Prioritize formal mentoring of young faculty and ensure that these relationships are working
 - ▶ Faculty gender diversity could be further improved
 - ▶ Reviewers supportive of EAPP's desire to add a Theoretical Atmospheric Physicist
 - ▶ "If UofT wishes to see more knowledge translation and entrepreneur activities, they should consider how these will be incorporated in the merit and promotion evaluation of faculty"
 - ▶ Teaching Stream faculty "are a definite benefit to the educational mission, and increasing their numbers should be a priority for the department"
 - ▶ It is important to maintain strength of research groups by assuring distribution of faculty seniority
 - ▶ Prioritize finding replacement position for CMP experimentalist with expertise in optical probes
 - ▶ Reviewers highly recommend implementing official faculty mentorship assignment process
 - ▶ U of T needs to formalize how the pandemic-related interruption in research will be handled for promotion, tenure and merit, and communicate procedures to faculty

4. Administration

Note: Issues that are addressed through specific University processes and therefore considered out of scope for UTQAP reviews (e.g., individual Human Resources issues, specific health and safety concerns) are routed to proper University offices to be addressed, and are therefore not included in the Review Summary component of the Final Assessment Report and Implementation Plan.

The reviewers observed the following **strengths**:

- Relationships
 - ▶ Each of five disciplinary faculty groups is very cohesive and most work very well together
 - ▶ EAPP group has played significant leadership role in Canadian atmospheric physics
 - ▶ CMP group has strong internal collaborations with ultracold atoms group and with faculty members in Chemistry
 - ▶ HEP group is advantaged by affiliation with the faculty of the Canadian Institute for Theoretical Astrophysics (CITA)
 - ▶ Department chair should be commended for effective efforts in encouraging closer connections and collaborations between campuses than in past (although reviewers note further room for improvement)
- Organizational and financial structure
 - ▶ Department functions very well and current leadership is excellent; management of department's facilities and programs is strong and forward-looking

- ▶ Experimental HEP group enjoys a level of infrastructure such as a recently expanded clean room, comprehensive machine shop, and high-performance computing
- Long-range planning and overall assessment
 - ▶ Undergraduate and graduate programs are of world-class quality
- International comparators
 - ▶ Department is very highly rated internationally, and best overall in Canada
 - ▶ U of T Physics is well-positioned to compete internationally in all of its major subdisciplines

The reviewers identified the following **areas of concern**:

- Relationships
 - ▶ “Given the status of [U of T] Physics in Canada, it is surprising they have not taken more of a leadership role in initiatives such as the Canadian National Quantum Initiative”
 - ▶ Faculty express some concerns that there were no significant efforts on the part of the University to encourage entrepreneurship, at least to the extent that faculty members are unaware of how such efforts would be assessed in their evaluations
 - ▶ Split between three campuses presents some challenges, with UTM and UTSC expressing some concerns around feeling “invisible” to UTSG
 - ▶ Current graduate recruitment system to individual research groups disadvantages UTM and UTSC
- Organizational and financial structure
 - ▶ Undergraduates note that there is no quiet place to study after the Physics library closes at 4:00 pm; student lounge referred to as a “party all the time” and not conducive to studying
 - ▶ Graduate students report that travel between campuses presents challenges
 - ▶ Layout of Burton Tower tends to contribute to siloing of the five different research areas, with decreased opportunities for physical mixing
 - ▶ Besides effective renovations in the undergraduate wing, department’s facilities are aging and in desperate need of renovation
 - ▶ A consequence of the age of the McLennan building is the absence of accessible and women’s washrooms, which is a significant EDI issue
 - ▶ Poor quality of much laboratory space – including water leakage and inadequate electrical and HVAC infrastructure – threatens some of the experimental work across most of the experimental groups, and will present a critical issue in recruitment of new faculty, if facilities offered are substandard compared to competitor institutions
 - ▶ “Justifiable” concerns around reduction of staff in clean rooms, machine shop and high-performance computing facilities
- Long-range planning and overall assessment
 - ▶ Upcoming caps on graduate students will impact research progress, and will enhance strains within the department on how grad students are allocated among groups and campuses

The reviewers made the following **recommendations**:

- Relationships
 - ▶ It is critical that faculty in Physics and elsewhere at U of T be deeply engaged and knowledgeable about the development of Canadian National Quantum Initiative activities
 - ▶ Consider enhancing efforts to encourage both faculty and student entrepreneurship
 - ▶ Enhance efforts to build cohesiveness in biological physics group, and to amplify their impact and reach
 - ▶ Reviewers note that it is important for condensed matter physics group to maintain relationships with related groups within Physics, in connected departments such as Chemistry, and with colleagues and organizations outside the university
 - ▶ Relationships of physics faculty across three campuses should be strengthened
- Organizational and financial structure
 - ▶ Department needs access to better space, in order to continue as a world-class centre of experimental physics, and to improve undergraduate experience
 - ▶ Enhance efforts to fully bring the physicists at the three campuses together
 - ▶ Issue of travel between campuses must be rectified, either through shuttle service, or providing reliable remote access to lectures
 - ▶ “[It] is the opinion of the review committee that a floor-by-floor and year-by-year refurbishing of the McLennan Physics building, particularly Burton Tower, is the most feasible intermediate-term resolution of [the space] problem”
 - ▶ Address lack of accessible and women’s washrooms in the McLennan building
- Long-range planning and overall assessment
 - ▶ The University should attempt to obtain more demographic data, and the department should consider the creation of a departmental diversity statement
 - ▶ It is important that the department advertise the general utility of a physics degree, to potentially attract a larger undergraduate population
 - ▶ Enhance efforts to advertise joint program opportunities
 - ▶ It is vital that the department look to synergistic hires to not only strengthen existing groups, but to strengthen the links among them and with other units (for example in the area of quantum science)
 - ▶ No student has taken the Option III MSc in the past 20 years and reviewers support department’s tentative plans to close this program
 - ▶ “[U of T] needs to formalize how the COVID interruption in research will be handled for promotion, tenure and merit and communicate those procedures to the faculty”
 - ▶ Department will require solid and consistent support from FAS—in faculty hires, graduate student support, and infrastructure—to maintain its strong position among international peers and competitors

2. Administrative Response & Implementation Plan



UNIVERSITY OF TORONTO
FACULTY OF ARTS & SCIENCE

March 16, 2022

Professor Susan McCahan
Vice-Provost, Academic Programs
University of Toronto

Re: UTQAP cyclical review of the Department of Physics

Dear Professor McCahan,

Along with the faculty, staff and students of the Department of Physics, I am pleased with the external reviewers' assessment of the department and its undergraduate and graduate programs: Physics, H.B.Sc. (Specialist, Major, Minor); Biological Physics, H.B.Sc. (Specialist, Advanced Physics Stream); Biological Physics, H.B.Sc. (Specialist, Biochemistry Stream); Biological Physics, H.B.Sc. (Specialist, Immunology Stream); Biological Physics, H.B.Sc. (Specialist, Physiology Stream); Physics (M.Sc., Ph.D.). The reviewers complimented the Department on being "*an outstanding group of researchers and teachers*" and noting that its "*undergraduate and graduate programs are of world-class quality.*"

The quality of this program notwithstanding, as per your letter dated January 7, 2022, the review report raises a number of issues and challenges. I am writing to address the areas of the review report that you identify as key. The responses to these items and implementation plan are separated into immediate- (six months), medium- (one to two years), and longer- (three to five years) term, along with who will take the lead in each area. Where appropriate, I have identified any necessary changes in organization, policy or governance; and any resources, financial and otherwise, that will be provided, and who will provide them. The Dean's Office has discussed the reviewers' comments through consultation with the Chair of the Department of Physics to develop the following implementation plan incorporating the reviewers' recommendations.

Implementation Plan

The reviewers recommended updates to the undergraduate curriculum, including the addition of courses in computer science, statistics, and data science, as well as a reevaluation of the timing and sequencing of required mathematics courses.

Immediate-term response: Responding to the widespread demand for data science education is one of the strategic priorities outlined in the Faculty of Arts and Science's 2020-25 Academic Plan. This year (2021-22), we launched three innovative introductory data science courses—one in each of the sectors (humanities, social sciences and sciences), to provide accessible data

science courses to students in any program of study. We are also offering broad-based support to instructors who are involved in (or considering adopting) computational and data science content into their courses through a new Computation and Data Science Education Community of Practice. This provides a platform for instructors to share their experiences designing and implementing educational activities, pedagogical best practices and use of various technologies in the sphere of computation and data science education. The Faculty continues to investigate how best to advance undergraduate education in computation and data science through an active Working Group with broad sectoral representation.

The Department will consult with departments offering computer, statistical, and data science courses, to identify relevant courses and their viability for students in our programs of study. The new first-year course, *Introductory Computation and Data Science for the Life and Physical Sciences* (offered through EEB) may be a particularly useful addition to the curriculum. The Department will also initiate discussions with the Department of Mathematics to reconsider the timing and sequencing of the required math courses as well as their relevance to physics studies.

Medium-longer term response: Any curricular changes will be undertaken within the Dean's Office through the normal curriculum governance and quality assurance processes.

The reviewers noted “surprisingly low” uptake of active learning methods and other modern pedagogy in lectures by tenure stream faculty.

Immediate-to-Medium-term response: A number of Physics faculty, both teaching stream and tenure stream, are engaged in some form of active learning. Some also participate in workshops and make use of the teaching and learning resources offered by the Centre for Teaching Support & Innovation and the Faculty of Arts and Science. In order to catalyze interest in, and adoption of, active learning methods and other modern pedagogy more broadly, the Department plans to restart its own teaching seminar series, a forum that was paused during the pandemic. Leadership within this forum should be greatly enhanced by renewal of the Department's teaching stream complement. With one successful faculty search last year and an additional search underway this year, the teaching stream complement will return to its previous size (four).

The Dean's Office will ensure that the Department is aware of new and existing resources in this area, such as the new Community of Practice noted above.

The reviewers noted undergraduate student comments regarding difficulty finding research opportunities in their first and second years of study.

Immediate-term response: At the Faculty level, we regularly advertise research opportunities for undergraduates such as the Research Opportunity Program (ROP) and Research Excursions Program (REP). The Faculty has increased activity and presence on social media in recent years to great effect, with broader reach and increased website activity. Undergraduate students can find dedicated, comprehensive and up-to-date information on research opportunities on the [Sidney Smith Commons \(SSC\) website](#).

That said, providing such opportunities to students in their early years of study is an on-going challenge, as there are more students than available ROP or REP openings (for example). To address this, many programs of study embed research in courses, as a pedagogical best-practice, but also to ensure that all students can access research opportunities.

To expand opportunities (a strategic priority), the Faculty established the Experiential Learning & Outreach Support (ELOS) office, which provides administrative, pedagogical and partnership development support for experiential learning activities, including industry and community-engaged projects, field experiences, academic internships, paid work placements, and research and international opportunities. We also recently appointed a Faculty Advisor on experiential learning to provide strategic guidance and support to academic units interested in expanding or launching experiential learning programming. Finally, in Fall 2021, we launched an Arts & Science Internship Program (ASIP), which embeds paid work experience with professional development training, within particular programs of study (in departments ranging from Statistical Sciences to Chemistry to Book and Media Studies). The ELOS office is currently seeking to expand the set of programs of study eligible for this internship initiative.

The Department provides research opportunities to students in third and fourth year through supervised reading or research courses and summer projects. Some second-year students find research opportunities through the Department's Summer Undergraduate Research Fellowship (SURF) program and the NSERC Undergraduate Student Research Awards (USRA) program, for which they are eligible. The Department will redouble its efforts to track and advertise all available undergraduate research opportunities. The Dean's Office will connect the Department with the new Faculty Advisor on experiential learning to explore ways in which to expand research opportunities for students in Physics programs of study.

Medium-to-Longer-term response: The Department is investigating participation in the new Arts & Science Internship Program, starting in Fall 2023; an Expression of Interest has already been submitted. The Department will also review its undergraduate curriculum with an eye to enhancing opportunities for student research within its second-year course requirements or as part of a new research course offering.

In order to encourage more students to choose undergraduate Physics programs, the reviewers recommended enhanced communication about the value of a Physics degree and the opportunities presented by joint programs in which the Department participates.

Immediate-term response: The Department will update its webpages to provide better information for prospective students and more resources related to career information, including links to relevant information and resources provided by professional Physicist organizations in Canada and beyond. The Departmental webpages will also be revised to better advertise the Specialist programs that are offered jointly with the Departments of Philosophy, Chemistry, Mathematics, and Astronomy. The Department will seek to coordinate with those departments to ensure reciprocal advertising on their webpages; similarly for the partner departments in our four Biological Physics Specialist programs.

Medium-to-Longer-term response: Participation in the new Arts & Science Internship Program (ASIP), discussed above, with placement in a relevant workplace, would give students a tangible sense of the value of a Physics degree.

The reviewers observed that limitations on international graduate enrolment and the end of provincial support for graduate enrolment expansion have made attracting top graduate students more difficult, and put pressure on individual faculty research grants to support students; they noted that enrolment caps may impact faculty research progress and lead to increased tensions within the tri-campus research environment.

Immediate response: The Dean's Office has struck a Graduate Intake and Enrolment Working Group in Fall 2021 to develop criteria and a process for the allocation of domestic PhD student spots, to ensure that the allocation is fair and transparent. The Working Group has tri-campus representation and has spent the past six months consulting broadly to develop a set of principles and criteria to guide the allocation of intake spots to FAS graduate units and oversee the translation of those principles into a resultant intake quota per unit. Consultation has revealed a range of perspectives and the complexity of the exercise. The Physics Department, for example, has conveyed that their faculty would be better served by a significantly larger cohort of graduate students and by having supervisory activity "counted" appropriately within the Department in the case of cross-appointed faculty with primary appointments elsewhere (which is quite common among faculty in the Physics Department).

Medium-term response: Once the restructured program caps have been developed by the Faculty of Arts & Science (anticipated in 2022), all units, including the Department of Physics, will be in a position to plan accordingly. Departments will be able to exceed their quotas with Departmental resources.

In order to address tri-campus or other tensions over these limited resources, the Department will maintain clarity in the admissions process, with representatives from all research areas. To address imbalances between research streams, the Department will expand application questionnaire data to learn more about applicants' intended area of study, research experience, and relevant training.

The reviewers commented that increases in graduate student enrolments have not been accompanied by corresponding increases in tenure stream faculty, and noted "clear issues regarding the number of graduate students per faculty" in some research groups; they recommended synergetic hires to strengthen the groups as well as the links among them and with other units.

Immediate-term response: All requests for new positions across the Faculty are submitted to the Faculty Appointments Committee (FAC), which includes representation across its sectors (Humanities, Social Sciences and Sciences) and from the Colleges. The FAC reviews all requests for new positions and makes recommendations to the Dean regarding which requests should be granted. Last year, the Physics Department was granted four positions. A fifth search is underway

for a position granted in 2020. These searches are in synergic areas that will strengthen groups and link them to other units. For example, two are in the cross-disciplinary Quantum Information Science, one is a joint search in Quantum Materials with the Department of Chemistry, and a fourth is in Experimental Quantum Condensed Matter. These new tenure stream faculty will help address the lack of supervisory capacity in critical areas.

Medium-to-Longer-term response: The Faculty instituted a new layer of Unit-Level Academic Planning in 2021, in which Departments engage in a consultative process to produce a forward-looking academic plan in the year following the completion of the UTQAP and discusses that plan with the Dean's Office. The Department of Physics will undertake its Academic Plan next year. As complement planning is a central component of the Plan, this exercise will help solidify the Department's future research and complement priorities. The Department will consult broadly, including with cognate units, as it develops its Plan.

The reviewers recommended revitalizing a formal mentoring program for junior faculty members, with appropriate structures in place to ensure that mentoring relationships are effective.

Immediate-term response: The Physics Department has a formal mentoring program in place in which each new tenure stream and teaching stream faculty member is assigned a senior faculty mentor from the Department. The mentor and mentee are provided with the Faculty of Arts & Science "Mentoring Program for New Faculty Member" guidelines and encouraged to meet regularly. Currently, mentors are primarily assigned on the basis of research area. The Department will augment this by assigning a second mentor from a different group who will have a broader focus, including teaching. To assess the effectiveness of the mentoring program, the Chair will meet individually with all junior faculty to help ensure they are receiving appropriate mentoring and a simple check-in process will be implemented.

The Dean's Office added another layer of mentoring for junior faculty through a new Massey Junior Faculty Fellowship program for faculty new to Arts & Science in the past two years (2020 and 2021). This program connects new faculty across the Faculty and offers career-oriented support, in addition to opportunities for social interaction. Finally, the Faculty has created a new position within academic HR to support faculty professional development, including support for mentorship. The Dean's Office will ensure that the Department is aware of this new source of support.

Noting that the COVID-19 pandemic may negatively impact faculty career progression, the reviewers commented that the University should formalize and communicate the ways in which pandemic-related interruptions in faculty research will be handled for promotion and tenure processes. *(In responding to this prompt, you may wish to make reference to the [COVID-19 Letter of Understanding Between the University and UTFA](#), which includes the provision that 'Any pre-tenure or pre-continuing status faculty member may request a one year delay in their timeline to tenure or continuing status,' in addition to any provisions that have been communicated within the Division or the Department.)*

Immediate-term and Medium-term response: The *COVID-19 Letter of Understanding Between the University and UTFA* sets out a number of provisions intended to mitigate the impact of the pandemic on career progression. These include adjustments to the determination of 2021 and 2022 PTR payments and the option for pre-tenure and pre-continuing status faculty to request a one-year delay in their timeline to tenure or continuing status, as well as other provisions.

Longer-term response: The COVID-19 pandemic is having a negative impact on research that may last for some years for some faculty. The uneven impact of the pandemic on research will need to be considered with care going forward.

The reviewers noted that issues with Departmental space are a “significant threat to many of the experimental groups and to the department overall”; they note concerns regarding the ability to conduct modern research in the existing spaces, the potential impact on faculty recruitment, and issues regarding accessibility and equity.

Immediate-term response: Space on the St. George campus is a pressing concern across the Faculty. It is perhaps especially acute within the sciences, with aging laboratories that are not designed for modern research. The Department has used its operating budget funds to mitigate immediate infrastructure issues, particularly as they relate to accessibility and equity. For example, the Department was recently able to convert six single-use washrooms to all-gender facilities at minimal cost. In addition, a low-cost proposal to address inadequate women’s washroom availability in the teaching lab wing of the building is expected to begin within the year. The Department is also exploring a plan to create two accessible all-gender washrooms in the teaching lab wing. It is worth noting that Facilities & Services is currently engaged in a review and planning process for short-term strategies to mitigate the risk of leaks. FAS will support the Department to ensure that critical maintenance and repairs of building infrastructure are done in a timely fashion.

Medium-to-Longer-term response: The Department has begun discussions with the Faculty of Arts & Science Office of Infrastructure Planning, and Facilities & Services, to develop an infrastructure master plan for the building. This will include a thorough evaluation of the building’s systems and current condition as well as the establishment of current and future programmatic needs of the Department, Faculty, and building. The plan will consider all aspects of the building, including washrooms, classrooms and teaching labs, improved facilities for collaborative research, research labs and student spaces. This plan would need to assume continuous occupancy of the building and will likely require tolerance to a certain level of disruption. The Faculty of Arts & Science will help advocate for and facilitate discussion with the Office of Infrastructure Planning to ensure timely commitment to implementation of the prioritized actions identified in the plan.

The reviewers recommended continuing to strengthen relationships among Physics faculty across the three campuses, noting that the tri-campus structure presents significant challenges – particularly regarding departmental cohesion, information sharing, and

allocation of graduate students – as well as opportunities for faculty hiring and strategic collaboration.

Immediate-term response: The Department has implemented several recent changes to improve integration of the tri-campus graduate faculty. The Chair and Associate Chair for Graduate Studies meet periodically with UTM and UTSC Chairs. The Department continues to hold online faculty meetings, and re-ordered the agenda so that matters with tri-campus relevance are discussed first. UTM and UTSC faculty are being included in Departmental committees that deal with graduate and research activities. They have added web materials to promote and explain the UTM research cluster, and plan similar materials for UTSC. The Department is also committed to continue live-streaming the weekly Physics Colloquium and is purchasing A/V equipment to improve capabilities in MP606.

Medium-term response: To further enable tri-campus vitality for its students, the Department, with the support of the Faculty, will explore the use of virtual classrooms and meeting rooms. The Department is piloting a rotations option for incoming graduate students, so that incoming students can explore research options on all three campuses, and is planning to improve graduate student recruitment in cross-disciplinary areas of physics that include focus areas of UTM and UTSC faculty.

The reviewers recommended that the Department of Physics seek greater involvement and leadership in national and international research initiatives.

Immediate-term response: The Department is seeking to strengthen its leadership in the relatively young and rapidly developing field of Quantum Information Science and is currently conducting two faculty searches in this area, discussed above, one of which is a senior position intended for a leader who will be able to strategically develop and champion quantum science and technology. The Department is otherwise actively involved in many national and international research initiatives: for example, numerous Biological Physics collaborations with hospitals and other institutes; atmospheric satellite and suborbital missions, observing networks, and modelling initiatives; the ATLAS and MATHUSLA experiments at CERN; the T2K experiment in Japan; SuperCDMS at SNOLAB; Ricochet in France; TRIUMF; high-altitude balloon missions for cosmology; the Canadian Institute for Advanced Research; and many others.

The Faculty will connect the Department with a recently created Research Partnerships and Business Development Officer (new hire in October 2020) with expertise in industry-sponsored research partnerships to identify new industry, government, and non-profit organization partners for our research community. This resource may be useful for faculty in the Department with applied science research agendas.

Medium-to-Longer-term response: The Department will continue to seek opportunities to develop research relationships with both academic and non-academic partners. The Dean's Office will continue to ensure that the Department is aware of relevant supports available in the Faculty (and beyond).

The reviewers recommended the creation of a departmental diversity statement, and commented that the University should attempt to obtain more demographic data to support progress on issues of equity, diversity, and inclusion.

Immediate-term response: The University undertook its first Student Equity Census in November 2020, a voluntary demographic data collection initiative that involves a set of seven questions on gender identity, sexual orientation, disability, Indigeneity, race and ethnicity, and educational attainment of parents/guardians. These data, linked to other student-related data, will be a powerful resource that will enable Faculties and units to more effectively understand the experiences of its students and support progress on issues of equity, diversity and inclusion.

The Department is working on the development of an IDEA (Inclusion, Diversity, Equity and Accessibility) Statement. A subcommittee of the IDEA Committee was set up in October 2021 specifically to address this issue. It conducted a survey about equity, diversity and inclusion in the Physics Department that was open to all members. The survey results are being analyzed and shared through townhalls with different groups (undergraduates, graduate students, PDFs/RAs, staff, and faculty) for discussion and feedback. The IDEA Committee will use the survey, townhalls, and any additional input to develop a draft statement, which will be circulated for feedback and revision, before a final version is voted on at a faculty meeting. This statement is the first step in the development of a rolling plan and initiatives to improve the inclusivity, diversity, equity, and accessibility in the Physics Department and its culture.

Medium-to-Longer-term response: As the Student Equity Census is voluntary, it will take some time for participation rates to grow and for the information to be readily accessible to units.

The Faculty is taking a number of other steps to support unit-level progress on IDEA. For example, we created a senior-leadership role within the Dean's Office—Director of Equity, Diversity and Inclusion—whose role is to support the Faculty and its units in advancing IDEA principles. Furthermore, as a new component of the annual activity report, chairs and directors are now evaluated on their progress in enhancing IDEA within their unit. Units are also directed to report on their IDEA progress and plans as part of the Unit-Level Academic Plan, which they will undertake following the completion of a UTQAP cyclical review. To that end, the Department of Physics is already planning to develop an “IDEA Action Plan.”

The Dean's Office will monitor the implementation of recommendations through ongoing meetings with the Chair, as well as the A&S unit-level planning process. A brief report to the Office of the Vice-Provost, Academic Programs, midway between the June 17-18, 2021, site visit and the year of the next site visit, will be prepared.

The year of the next review will be no later than the 2028-29 review cycle.

To conclude, we appreciate that the external reviewers identified the Department of Physics' strengths and noted a few areas for development. The department has already begun to move forward with plans to address the recommendations as presented by the reviewers.

Sincerely,

A handwritten signature in black ink that reads "M Woodin". The letters are cursive and fluid, with a small flourish at the end of the name.

Melanie Woodin
Dean, Faculty of Arts & Science
Professor, Department of Cell & Systems Biology

cc.

Kimberly Strong, Chair, Department of Physics, Faculty of Arts & Science
Gillian Hamilton, Acting Vice-Dean, Academic Planning, Faculty of Arts & Science
Daniella Mallinck, Director, Academic Programs, Planning & Quality Assurance, Office of the
Vice-Provost, Academic Programs
Andrea Benoit, Academic Review Officer, Office of the Dean, Faculty of Arts and Science

3. Committee on Academic Policy & Programs (AP&P) Findings

The spokesperson for the reading group reported that the review summary had accurately reflected the full review. The reading group noted that several of the recommendations, including the highest-priority recommendation about space and facilities, went beyond the control of the Department and that the responses provided by the Department and the Dean had addressed the recommendations appropriately.

Professor Kimberly Strong, Chair of the Department of Physics, commented on several specialist programs offered in partnerships with other Departments and the commitment of the Department's Undergraduate Curriculum Committee to further address the reviewers' comments on updates to curriculum. She also commented on current and upcoming research opportunities for students through supervised research and reading courses, summer research opportunities, and several other planned initiatives. She ended her comments with an update on current faculty complement and future faculty complement planning incorporated in the Department's academic plan.

No follow-up report was requested.

4. Institutional Executive Summary

The reviewers praised the department as “an outstanding group of researchers and teachers,” with excellent, forward-looking leadership and world-class programs; they noted the cohesiveness of the department's five disciplinary subgroups, and exceptional energy and confidence of pre-tenure faculty; they commented that the research quality of the faculty at UTM and UTSC is outstanding and strategically beneficial to Physics at U of T; the reviewers also highlighted the progress the department has made towards increasing faculty gender diversity since the previous review, and the teaching stream faculty's critical importance to the quality of the undergraduate program; they note high undergraduate student satisfaction with the programs and appreciation for pandemic-related asynchronous access to course material; finally, they commended the high quality of graduate students, and widespread graduate student enthusiasm for the advising and support provided by graduate staff.

The reviewers recommended that the following issues be addressed: making updates to the undergraduate curriculum; examining the “surprisingly low” uptake of active learning methods and other modern pedagogy in lectures by tenure stream faculty; addressing undergraduate student difficulties in finding research opportunities; enhancing communication about the value of a Physics degree and the opportunities presented by joint programs in which the Department participates; engaging with issues and tensions around attracting and supporting top graduate students; pursuing synergetic hires to strengthen the Physics disciplinary groups, as well as their connections to one another and to cognate units; revitalizing a formal mentoring program for junior faculty members; formalizing and communicating (at the divisional/institutional level, where appropriate) the ways in which pandemic-related interruptions in faculty research will be handled for promotion and tenure processes; addressing significant concerns around Departmental space; continuing to strengthen

relationships among Physics faculty across the three campuses; seeking greater involvement and leadership in national and international research initiatives; and creating a departmental diversity statement.

The Dean's Administrative Response describes the Faculty, unit and programs' responses to the reviewers' recommendations, including an implementation plan for any changes necessary as a result.

5. Monitoring and Date of Next Review

The Dean's office will monitor the implementation of recommendations through ongoing meetings with the Chair, as well as the A&S Unit-Level Academic Planning process. A brief report to the Office of the Vice-Provost, Academic Programs on the status of the implementation plans will be prepared midway between the June 2021 site visit and the year of the next site visit.

The next review will be commissioned no later than the 2028-29 review cycle.

6. Distribution

On June 29, 2022, the Final Assessment Report and Implementation Plan was posted to the Vice-Provost, Academic Programs website and the link provided by email to the Dean of the Faculty of Arts and Science, the Secretaries of AP&P, Academic Board and Governing Council, and the Ontario Universities Council on Quality Assurance. The Dean provided the link to the Chair of the Unit.