McMaster University

FINAL ASSESSMENT REPORT

Institutional Quality Assurance Program (IQAP) Review

Physics and Astronomy

(Graduate & Undergraduate Combined)

Date of Review: February 12th and 13th, 2024

In accordance with the University Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the Physics and Astronomy graduate and the undergraduate programs. This report identifies the significant strengths of the programs, together with opportunities for program improvement and enhancement, and it sets out and prioritizes the recommendations that have been selected for implementation.

The report includes an Implementation Plan that identifies who will be responsible for approving the recommendations set out in the Final Assessment Report; who will be responsible for providing any resources entailed by those recommendations; any changes in organization, policy or governance that will be necessary to meet the recommendations and who will be responsible for acting on those recommendations; and timelines for acting on and monitoring the implementation of those recommendations.

Executive Summary of the Review

In accordance with the Institutional Quality Assurance Process (IQAP), the Physics and Astronomy program submitted a self-study in December 2023 to the Vice-Provost Teaching and Learning and the Vice-Provost and Dean of Graduate Studies to initiate the cyclical program review of its program. The approved self-study presented program descriptions, learning outcomes, and analyses of data provided by the Office of Institutional Research and Analysis. Appendices to the self-study contained the CVs for each full-time member in the department.

Two arm's length external reviewers and one internal reviewer were endorsed by the Dean, Faculty of Science, and selected by the Vice-Provost Teaching and Learning and the Vice-Provost and Dean of Graduate Studies. The review team reviewed the self-study documentation and then conducted an on-site visit review to McMaster University on February 12th and 13th, 2024. The review included interviews with the Deputy Provost, Vice-Provost Teaching and Learning, delegate for Vice-Provost and Dean of Graduate Studies, Dean of Faculty of Science, Associate Deans of Undergraduate and Graduate Studies, Department Chair of the program and meetings with groups of current students, full-time faculty and support staff.

The Department Chair of the program and the Dean of the Faculty of Science submitted responses to the Reviewers' Report (June 2024). Specific recommendations were discussed, and clarifications and corrections were presented. Follow-up actions and timelines were included.

- **Strengths**

The Department of Physics and Astronomy is recognised across McMaster University as being a strong department in research and teaching. It has internationally recognised research faculty and a growing stream of teaching faculty who are leading the charge on implementing teaching innovation across all programs. As a small department with relatively low enrolment programs compared to other disciplines in the Faculty of Science, it faces budgetary pressure to grow its enrollment. The programs offered by the department are designed to meet this challenge through a combination of factors. First, the quality of the physics courses offered to students in the life sciences gateway in their first year is excellent. Using an active-learning pedagogy it showcases to students the strengths of physics training in terms of broadly applicable scientific skills. Next, the Medical & Biological Physics program, that students can enter in their second year, appeals to those with medical aspirations and is effective at attracting students who perhaps were not initially considering going into physics on entering University. Combined together these aspects are a program strength that ensures a consistent throughput of students into physics.

A second program strength is the excellent student experience that physics programs offer to those who choose it. We heard from students that a key factor in this is the smaller classes that they attend where they are able to get plenty of individual attention from instructors. While this appeal may counteract growth to enrolment, it is likely that there is still plenty of room in physics courses to allow for growth, but still provide the levels of attention that students currently enjoy.

Summary of the Reviewers' Recommendations with the Department's and Dean's Responses

1. Overall Recommendations

Recommendation #1.1: Work with the Faculty of Science to improve communication and messaging from Year 1 gateway into Year 2, use this to continue to grow enrollment. In conjunction with this explicitly find ways to provide more visibility to physics and the broad applicability of the skills that physicists develop during the Year 1 experiences.
Department's Response and Actions to be Taken: We will coordinate with the Associate Dean (Undergraduate) through the Academic Planning & Policy Committee to improve communication and messaging. We will also continue and look to enhance our outreach and inreach communication to provide maximum visibility to physics and the skills that we develop.
Dean's Response: The Faculty is committed to showcasing all of our Departments and Schools, while supporting enrolment of students in all programs. In particular, throughout the most recent high school recruitment cycle, and the Level 1 to Level 2 program selection periods this year, we have made increased efforts to work with the Department of Physics and Astronomy to amplify the various courses, learning experiences and overall programming. This has led to positive results in Level 1 confirmations (~10% increase relative to June 2023), and Level 2 program enrolment numbers (~30% increase relative to June 2023). We will continue to work with the Department to increase the visibility of all programs to our Science students.

Recommendation #1.2: To make the medical/biophysics program more viable and sustainable, provide more consistent funding to the medical physics experimental labs where important undergraduate experiential learning happens.
Department's Response and Actions to be Taken: We will request funding for medical physics labs in our budget submissions and also work with Nuclear Operations and Facilities to leverage funding opportunities that are beneficial to both parties.
Dean's Response: The Faculty of Science regularly supports Departments and Schools with funding that is needed for mission critical teaching and learning operations through our annual budget submission and consultation process. This includes funding to support materials and equipment that are needed for labs in the Department of Physics and Astronomy and involves a multi-year capital asset replacement plan in each academic unit. We encourage the Department to continue submitting these needs requests through the annual budget submission process, and to continue exploring other potential funding opportunities that can arise through other partnerships.

Recommendation #1.3: Keep growing the DataSci labeled courses as a way to increase enrollments in courses offered by the physics and astronomy department. Use such courses to help students understand the cross-disciplinarity of physics and its broad applicability. Developing skills to address real and often messy data provides great scientific training.
Department's Response and Actions to be Taken: We will be proposing a concurrent undergraduate certificate in Scientific Computing and Data Analysis during the next curriculum cycle, and will be working with departments across the Faculty of Science to identify and potentially cross-list or rename courses that would be appropriate for the DataSci label.
Dean's Response: We are thrilled to hear that this will be a proposal that is brought forward. Especially at a time where we need to increase the computational and data analysis skill sets of our Science students. We encourage the Department to consider inviting all Departments/Schools to the table as they draft the proposed Scientific Computing and Data Analysis certificate. Collaboration with other units will increase student access and interest across the Faculty, and will also add a breadth of course options from various Departments/Schools to the certificate course listings. The Office of the Associate Dean, Undergraduate will support all conversations, consultations and movement of this proposal through the governance process.

Recommendation #1.4: Continue to consider how to rebrand physics topics to attract students. The initiative to leverage current interest in all things "quantum" is a good example. Making connections with practical application in Quantum Materials and potential experiences with the on-site nuclear reactor alongside teaching innovation is an excellent avenue to continue exploring.
Department's Response and Actions to be Taken: We will be proposing a concurrent undergraduate certificate in "Quantum Materials, Information and Sensors" to increase visibility of our expertise in this area, and a second certificate in "Health Physics and Radiation Safety" which will be strongly tied to the reactor. We are also working with Nuclear Operations and Facilities to find ways to bring more students into the reactor and the other facilities they operate, either through larger classes or by having more experiments in our second and third year lab courses.
Dean's Response: The proposal of these concurrent certificates will be a great opportunity to amplify the broad applicability of the physics fields. We encourage the Department to consult with student stakeholders (junior and senior level students) within and outside of the physics programs as they work to create and name these certificates. It will be important that the naming and curriculum within resonates with students from the onset. We also recommend seeking input from the Dean's External Advisory Board or others who are connected in industry. The Office of the Associate Dean, Undergraduate will support all conversations, consultations and movement of this proposal through the governance process.

Recommendation #1.5: While not explicitly a program issue, graduate student funding impacts student experience and performance so strongly that it is difficult to disentangle from the program itself. To help meet the challenges of low levels of graduate student funding, we encourage a constant dialogue with students on this complicated issue.
Department's Response and Actions to be Taken: We discuss graduate funding with students individually during their pre-acceptance visits and when they receive their offer. The School of Graduate Studies provide annual letters to each student which lays out their funding for the year, by source (e.g. TA, department scholarship, research scholarship) and the dates on which it will be paid. Graduate funding is regularly discussed at department meetings, and the graduate student representatives summarize the conversation to their constituents. We will continue these discussions with our students. We are also looking forward to the results of a working group in the Faculty of Science who is developing recommendations about student funding (scholarship redistribution guidelines) and transparency across the Faculty.
Dean's Response: We acknowledge that student funding continues to be a central issue within our graduate programs across the university. The recently released report from the Taskforce on Graduate Funding seeks to address funding directly by offering a number of initiatives at the university and faculty levels. One of the recommendations from the Taskforce was the development of a faculty wide policy on redistribution guidelines so that students are clearly informed of how their funding is impacted if they receive a major award. A draft policy framework is currently being reviewed, with the policy setting out the maximum reductions in financial support by the supervisor and by the graduate program/department after the awarding of Merit-Based (competitive) Scholarships in the Faculty of Science. It is expected that this policy will be in place for the fall of 2025 intake cycle. Further, we will continue to review and address funding issues, including informing students of their funding package. Finally, we were pleased to hear that the Federal government has recently committed to increasing the number and value of graduate awards.

Recommendation #1.6: The Department should define the purpose and goals of the PhD comprehensive exam including any essential requirements. This can then be clearly communicated to students. Establishing the essential requirements will help to ensure that any student accommodations are reasonable and appropriate. To ensure that student support for the preparation of the comprehensive exam is uniform across the Department, clearly articulate what form this will take and how it will be deployed.
Department's Response and Actions to be Taken: We will look at our current documents around the comprehensive exam to find ways in which the communication could be clearer or perhaps done earlier. We are looking at improving the process of defining the essential topics for those research groups which do not currently have the same level of consistency (mainly biophysics & soft condensed matter) as others. We are searching for ways to ensure that student support for preparation is less dependent on the supervisor and research group, and more uniformly available across the department. Accommodations are individual and discussed with a student's SAS coordinator, but indeed having clearly defined requirements will help in determining the most appropriate accommodations.
Dean's Response: The Office of the Associate Dean (Graduate) will work with the program in identifying essential requirements and ensuring that the purpose of the comprehensive exam is clear. More broadly, student success among students needing accommodations is supported through McMaster's Student Accessibility Services (SAS). SAS has recently developed a new process map for graduate students seeking accommodation support. The new process will help to streamline accommodation requests through the development of a Graduate Student Academic Accommodation Plan, with consultation with the Associate Dean (Graduate), the Graduate Chair from the program, the supervisor and the student.

Recommendation #1.7: To broaden the number of graduate courses offered, explore ways to partner with other universities for virtual courses. Seek expert support (e.g. MacPherson Institute) to determine the optimal modes of delivery and pedagogical frameworks that give students the best learning experiences when students external to McMaster take your grad courses. Additionally, consider a modular approach to other non-Astro graduate level courses including core courses.
Department's Response and Actions to be Taken: We are rolling out hybrid learning in our Medical Physics graduate courses to support a suite of micro-credentials in that area. If successful, we will expand this option to our other graduate courses and work with our peer institutions to advertise these opportunities. We will discuss the use of modular courses in other areas beyond astronomy and theoretical physics.
Dean's Response: The Department's efforts to provide special topics courses to their students is acknowledged as an important way to provide flexibility and timeliness in course offerings. External to McMaster, opportunities for students to take courses through the Perimeter Institute and TRIUMF are critical and can continue to be leveraged, and the Ontario Visiting Graduate Student (OVGS) provides another option for students to access courses relevant to their studies beyond McMaster. The Faculty also supports opportunities to grow hybrid course options while recognize the need for student learning in a variety of situations and contexts, including the importance of in-person learning. Micro-credential course offerings have also emerged as opportunities, but their implementation and use must be structured in such a way as to ensure students continue to meet program requirements.

Recommendation #1.8: Leadership in EDI from the physics and astronomy department is excellent. However, the diversity within the Department is not uniform. To build on their excellent work in this area, the department is encouraged to develop a strategic hiring plan that aims to improve diversity in all research area sub-groups. Where it does exist, diversity clearly brings energy and a dynamic feel that is able to propel strategic curriculum improvements and develop innovative solutions to challenges that arise at the undergraduate and graduate levels. Additionally, a fully diversified department would improve student recruitment and experiences in all research areas.
Department's Response and Actions to be Taken: Tenure-track faculty hires are currently frozen, but when they resume, we will continue our intense efforts to diversify all our research groups. We note that our latest tenure-track hire, who should arrive in summer 2024, will bring more diversity to a group which until recently has been lacking in this area.
Dean's Response: We are pleased to hear that the reviewer's noted that EDI leadership within the department was excellent. This is reflective of broader attention and leadership in the EDII domain across both the faculty and university. While faculty hiring is currently paused, careful attention is paid to EDII in any recruitment effort. Hire committee members receive training in EDII, each committee has an equity facilitator that has received advanced training, and committees work closely with the Equity and Inclusion Office to ensure EDII is front and center of any recruitment effort. The Office of the Associate Dean of Science (Equity, Diversity, Inclusion and Indigeneity) (AD EDII) serves as resource for Employment Equity Facilitators, liaison with the Employment Equity program in human resources, and when needed provides consultation to search committees. The AD EDII meets short listed candidates during interview process, and provides feedback to Dean, which is included in the letter to Provost. EDII is also considered in Tenure/Permanence & Promotion process; Faculty by-laws were amended to included AD EDII as a non-voting, consultant in Faculty of Science Tenure/Permanence & Promotion committee. EDII is also a priority in graduate recruitment so that diversity is reflected at all levels. The Faculty of Science has recently developed and shared its EDI in Graduate Admissions Best Practices document.

This document highlights ways that the graduate admission process can be made more equitable by breaking down barriers to entry for equity deserving groups (EDGs). The AD EDII office has regular meetings with graduate student leadership together with Office of the Associate Dean Graduate.

2. Program Recommendations

Recommendation #2.1: On the Indigenous side, Indigenous content has been added to the physics undergraduate programs in a level II course offering on Indigenous astronomy. Further expansion of content is encouraged with continued support from either the Indigenous community or from the creation of Indigenous positions at an appropriate level (research faculty, teaching stream, instructional assistant). Furthermore, the inclusion of Indigenous pedagogical approaches is an avenue to explore. This may be considered in partnership with others in the Faculty of Science since pedagogy can transcend discipline. It would be helpful to ensure that whatever pedagogical approaches that are included continue to be evidence-based and student-centric where possible.

Department's Response and Actions to be Taken: We will build on our relationships with local Indigenous communities to determine if there is an appetite for more jointly-created courses or other content. We are also happy to support any initiatives for creation of Indigenous positions, and to use our networks to identify and support appropriate candidates. We are also happy to be involved with and support the Indigenous priorities led by the Associate Dean EDII.

Dean's Response: The Department of Physics and Astronomy has created and nurtured exemplary partnerships with Indigenous communities and our colleagues within the Indigenous Studies Department. This is very nicely exemplified through the astronomy curriculum (e.g. ASTRON 2A03-Perspectives on Indigenous and Eurocentric Astronomy) and outreach activities (e.g. Celestial Bear on-campus and mobile planetarium Shows; panel discussions during the recent eclipse that were focused on eclipses and astronomy from indigenous perspectives).

Both offices of the Associate Dean's EDII and Undergraduate have been engaged in conversations with the Indigenous Education Council and the Indigenous Studies Department to discuss additional possible collaboration points between Science and Indigenous Studies curricula. This includes possible joint curriculum and programming. Both Offices are committed to expanding and supporting this important initiative across the Faculty of Science and are happy to support conversations that the Department will be engaged in moving forward.

Recognition of initiatives to grow awareness of Indigenous content will also be explored at the graduate level. The recent establishment of the Department of Indigenous Studies offers new opportunities for collaboration in this space.

A faculty member of Physics and Astronomy (R. Cockcroft) is a member of an *ad hoc* committee struck of Office of AD EDII working on priorities and possible framework for Indigenous priorities in the Faculty of Science.

Co-curricular development is an important priority that is being examined in multiple ways, and builds on reciprocal and respectful interactions with Indigenous colleagues on campus. We envision the Department of Physics and Astronomy to play significant roles in these efforts.

3. Admission Recommendations

Recommendation #3.1: Acknowledging faculty comments concerning burn-out – and the obvious energy and commitment needed to launch new initiatives along with the concerns about the stability of the Department – we recommend that the Faculty of Science articulate goals for the near term in terms of any enrolment growth.
Department's Response and Actions to be Taken: We are encouraged by the recent transparency from the Faculty of Science about enrolment targets and echo the reviewer's recommendation to continue this approach. Clear targets will allow us to more clearly evaluate the outcomes of new strategies and approaches.
Dean's Response: The Faculty recognizes that the challenges imposed by the COVID-19 pandemic has elevated the level of fatigue and even burnout for faculty, staff and students in the educational sector. From a curriculum and programming perspective, our Office of the Associate Dean, Undergraduate will continue to work towards supporting all faculty, staff and students, especially as it relates to course-related supports and advising. Through our Science Undergraduate Academic Planning and Policy Committee, we will also work with all Departments/Schools to advocate for additional supports that can be useful from other central University offices to better support our teaching and learning activities in Science. The Faculty is committed to continually amplifying the innovations and strengths of all Science programs. Over the last year, we have worked to increase our connections to Departments/Schools so that we can better understand unit goals and gain real-time updates on programming that we can use to better leverage our recruitment activities both at Level 1 and Level 2. While working to maximize student recruitment for Physics and Astronomy, we have done so responsibly by working with Departmental leadership to maximize enrolment targets that will best ensure Departmental success. These practices will be continued as we move forward into upcoming academic years.

Recommendation #3.2: To further advise students in the life sciences gateway of the opportunities available in physics programs, we recommend a partnership between Physics and Astronomy faculty and the Faculty of Science advising group.
Department's Response and Actions to be Taken: We will coordinate with the Office of the Associate Dean (Undergraduate) to find the most appropriate ways to provide relevant information to the advisors and to reach the students in the life sciences gateway.
Dean's Response: The Physics 1A03 – Introductory Physics course is an excellent example of a curricular innovation that has changed the perspective of many science students towards the physics discipline as a whole. With its blended learning model, creative video demonstrations and activities, non-physics inclined students who enroll at McMaster through the Life Science Gateway, have the opportunity to learn about the applications of the physics discipline to the real world in innovative and fun ways. From a recruitment perspective, we are already sharing with incoming high school students that this is the one physics course to consider taking in the event that they choose not to complete Grade 12 physics, as we believe that the 1st year team has done a tremendous job covering both Grade 12 and Introductory Level 1 content. Beyond level 1, our advisors and recruitment team already direct Life Science Gateway students who have completed Physics 1A03 and who have become physics-inclined, towards Level 2 Physics programs. We will continue to work with the Department to amplify this effort. We are also happy to

work with the Department to develop digital media physics-specific marketing material, that can be then distributed through the Faculty and Department-specific social media platforms.

From a career opportunities perspective, attention will also be given to opportunities for graduate student careers (see responses regarding recruitment and retention in Recommendation #3.3). The Science Careers and Cooperative Education (SCCE) office provides extensive support for students in developing their career goals and tools.

Recommendation #3.3: Encourage the Department to reconsider recruiting its own undergraduates at the graduate level. There are many benefits particularly if students have already had research experience at McMaster and can build on the connections already established to hit the ground running. It may also be helpful to explore support for graduate student recruitment at the Faculty of Science level, perhaps with a Faculty of Science recruitment event to target McMaster undergraduates. This could be tied in with the Faculty's accelerated MSc initiative.

Department's Response and Actions to be Taken: We have seen an increase in the number of our own undergraduates who stay at McMaster for graduate school, and we note that we do not actively discourage faculty members from keeping their students here. We will watch the accelerated MSc initiative with interest, and we could discuss what Faculty recruitment events could support the department. Those events would need to target students with a BSc in physics or related field. Other than students in Engineering Physics, all other students with an appropriate background for our program are already part of the Department of Physics & Astronomy.

Dean's Response: The recruitment and retention of our undergraduate students into our graduate programs has emerged as an important option given benefits to students and faculty alike. The recently approved accelerated MSc pathway elsewhere in the Faculty provides an example by which recruitment of our own students can be furthered without additional financial resources. Recruitment strategies used by other departments within the Faculty have been shared during Graduate Council meetings. The office of the Associate Dean (Graduate) will work with departments interested in developing similar pathways for their students.

The Office of the Associate Dean, Undergraduate is committed to collaborating with the Office of the Associate Dean, Graduate to further amplify Physics-specific graduate programs within the Faculty of Science, especially as students seek support from our Academic Advisors regarding their trajectories beyond their time as McMaster Undergraduates.

4. Curriculum Recommendations

Recommendation #4.1: Consider ways to provide formal course development time for teaching stream faculty. The modern teaching landscape is evolving rapidly. To remain at the forefront of modern, evidence-based, pedagogy requires time. This is difficult for teaching stream faculty because of their high course loads, even though they are the ones who have the most expertise in this area.

Department's Response and Actions to be Taken: We will work with MacPherson and our teaching-stream faculty to identify opportunities for funding to allow for course development and will also advocate for additional sessional instructors from the Faculty of Science when opportunities arise. If the department were able to maintain a complement of 4 teaching-intensive faculty, we would be in a better position to have the flexibility to offer teaching release for course development and other initiatives.

Dean's Response: The Faculty recognizes the incredible contributions of our teaching stream faculty towards driving innovations in our undergraduate curriculum and programming. The Office of the Associate Dean, Undergraduate is committed to supporting the applications of teaching stream faculty for any pedagogical research or teaching and learning projects that will provide additional resources and timing for these faculty members to engage in these activities. While this has been a long-standing support provided by the Office, most recent examples include supporting a cohort of Online Learning Fellows who have attained funding through the Office of the Vice-Provost Teaching and Learning (VPTL) towards the creation of online/virtual or hybrid course options. We have also supported 3 Leadership in Teaching and Learning Fellowship applications and look forward to supporting all of these faculty members as they explore and deploy these initiatives.

We recognize the time and commitment required for course development, especially with an increased emphasis on hybrid or on-line / virtual course offerings. Of course, any reduction in teaching comes with the need for a sessional instructor or someone else to fill the teaching shortfall.

Recommendation #4.2: Consider ways to lower the use of sessional instructors in favour of teaching stream faculty and/or instructional assistants. This will consolidate curriculum and teaching quality and allow for continued developments on the pedagogical front.

Department's Response and Actions to be Taken: We continue to advocate for additional teaching-stream faculty and instructional assistants in our budget requests and through the Faculty Appointment Advisory Committee process. We have just been approved for a one-year teaching-stream CLA, likely starting summer 2024.

Dean's Response: The Faculty encourages the Department to submit teaching -stream faculty requests as part of the formalized appointments process, through the Faculty Appointments Advisory Committee (FAAC). The Faculty continues to be proactive with the teaching and learning needs of our Departments/Schools and this past year, the FAAC has focused solely on teaching track hiring requests. P&A submitted a proposal for a hire. Decisions on what proposals (if any) are allowed to proceed will be made in the near future pending budget considerations. If Physics and Astronomy are allowed to hire, the expected start date would be in July 2025. While hiring is currently on hold given the current fiscal challenges, we have advocated for critical CLA renewals, and teaching stream hires to Office of the Provost.

Recommendation #4.3: Advertise the independent study course 4IS3, while concurrently looking to ways to fund more paid summer research options for undergraduates.

Department's Response and Actions to be Taken: We will find more ways to let students know about Physics 4IS3, including through our department newsletter and directed emails. This course will likely be included as an eligible course in the three proposed concurrent undergraduate certificates which should increase visibility. We have been successful in finding donor funding to support summer research options for students from under-represented groups and will continue to work on this area in the future. This summer, through further donor funds, Office of Undergraduate Research opportunities, MacWork positions and new Canadian Nuclear Laboratory Funding, we have increased the number of summer research opportunities for domestic students in the department, while also hosting international MITACs students. We are hopeful we can maintain this vibrant undergraduate summer research environment into the future.

Dean's Response: The Faculty is delighted to see efforts that the Department has placed on supporting our students as they seek to gain hands-on research opportunities throughout their undergraduate journeys. The Office of Undergraduate Research will continue to be a valued partner, as we continue to support and amplify these unique research experiences, and the Physics 4IS3 course as a whole, to physics students within the Faculty.

Recommendation #4.4: Continue discussions related to streamlining the 2nd year labs for more continuity in student experience after their 1st year. For example, 2B03 E&M is disconnected from the lecture; in contrast 1st year labs are well-timed with respect to the lectures. This may be as simple as explaining to students the pedagogical approach regarding the relationship between lecture courses and labs.
Department's Response and Actions to be Taken: The lab component of Physics 2B03 has recently been given instructional assistant support but the lecture component has not. As a first step, we can bring that IA into the lecture part of the course as well so that there is some continuity in instruction between both components of the course.
Dean's Response: Continuity in student experience between lectures and labs is an important part of course and curriculum planning for any program. We support the Department's plan to bring the IA into the lecture so that they can introduce connections that are made between lecture and lab components of the courses, but also encourage the Department to consider broader ways by which the lead faculty members can also interweave lab examples or insights into lecture material throughout the semester. Perhaps through touchpoints at certain key times in the semester, or even weekly "this upcoming week in lab" type discussions that can be highlighted in lecture at the end of any given week. In addition, the Department may want to consider reviewing the lab manual materials to see if there can be a way to reinforce the connections between and lab, and in particular, highlight introductions into how physics theory and practice are interconnected within the pre-lab introduction.

Recommendation #4.5: Consolidate and develop existing training for graduate students to translate the skills they learn in their graduate programs into employment opportunities.
Department's Response and Actions to be Taken: We will investigate the most appropriate and useful way for our existing informal training of graduate students in "soft skills" to be made available for all research groups in the department. We will re-start our graduate alumni career panel events (cancelled since the pandemic) to provide an opportunity for graduate students to learn from their predecessors' employment opportunities. SCCE is also working on an initiative called Advancing Tomorrow's Science Careers which also aims to provide graduate students with the general competencies they will need. The Faculty of Science occasionally run career events using alumni. We are involved in providing names of potential speakers and advertising the events to our students.
Dean's Response: The Faculty's Science Career and Cooperative Education office (SCCE) supports the career development of our graduate students by providing a number of workshops related to career development and growth. Workshops have included career advising, exploration, and information sessions, cover letter and resume critiques, mock interviews, and more. Our Graduate Student Association group (SciGSA) also offers a career night for graduate students from across the faculty. While both of these are focused on the broader group of graduate students within the faculty, we are committed to creating and offering opportunities for graduate students to work toward employment opportunities and will support P&A in further advancing opportunities for career development of our students.

5. Teaching and Assessment Recommendations

Recommendation #5.1: The Department should continue to engage with the Dean's office and other experts across campus to identify methods for consistent assessment of teaching quality. Combining such assessment with student experience surveys will formulate a more complete picture of teaching effectiveness.
Department's Response and Actions to be Taken: The department undertakes annual peer reviews of teaching for faculty members who are not yet full professors. These are performed by members of the departmental Tenure/Permanence & Promotion committee, and involve an in-class visit, a review of the faculty member's teaching portfolio, and discussion. The student experience surveys are not used to assess teaching effectiveness; they are provided to the faculty members for the purposes of feedback upon which the instructor may act should they so choose.
Dean's Response: We support the Departmental peer-review process undertaken by Physics and Astronomy. Through peer-review and consultation, the Faculty believes that this is the best opportunity for faculty members to engage in and cultivate thoughtful approaches to teaching strategies, practice and innovations. While recognizing the value of the peer-review process, we do continue to encourage instructional teams and the Department as a whole to still take written student feedback into consideration as part of ongoing course and curricular refinements. We also encourage the Department to engage in connections with the MacPherson Institute for any instructors or courses that are in need of additional supports.

Recommendation #5.2: The students in biophysics/soft condensed matter groups would benefit from a clearer definition of core topics for the background/foundational knowledge section of the qualifying exam. If possible, this material should be taken from a standard textbook or similar resource so as to be consistent with the experience of students in astronomy and quantum/hard condensed matter areas.
Department's Response and Actions to be Taken: We have started discussions to develop a core biophysics course for this purpose. Our goal is to have a course ready for curriculum approval shortly. This year the polymer physics course has been expanded to be a core course in soft condensed matter.
Dean's Response: We support the intent to provide consistent evaluations and experiences for students in Physics & Astronomy when and where appropriate.

6. Quality Enhancement Recommendations

Recommendation #6.1: Leadership in the Department of Physics might benefit from clarity around enrollment targets from the Faculty of Science. Efforts to increase enrollment require significant energy and effort on the part of faculty members whose primary responsibilities are research and teaching and who may also be experiencing post-pandemic fatigue. To ensure that requested effort is managed appropriately it is important to know what are sensible goals and what the consequences of reaching the goals will mean to the Department.
Department's Response and Actions to be Taken: We will continue to work with the Faculty of Science, particularly the Dean and Associate Dean (Undergraduate) to understand, influence, and respond to enrolment target changes.

Dean's Response: The Faculty is committed to continually amplifying the innovations and strengths of the Physics and Astronomy undergraduate programs. Over the last year, we have worked to increase our connections to Departments/Schools so that we can better understand unit goals and gain real-time updates on programming that we can use to better leverage our recruitment activities both at Level 1 and Level 2. While working to maximize student recruitment for Physics and Astronomy, we have done so responsibly by working with Departmental leadership to maximize sensible enrolment targets that will best ensure Departmental success. These practices will be continued as we move forward into upcoming academic years.

Recommendation #6.2: Those who manage physics programs need help from the Faculty of Science to get feedback from potential/past employers in the biophysics area to help ensure that the biophysics program is meeting student needs. This may be in the form of both focus groups and surveys. The former will help to cement ties with potential employers to ensure adaptability if needs should change.

Department's Response and Actions to be Taken: We have had preliminary discussions with the Science Careers & Co-Op office and alumni engagement officers about reaching out to appropriate employers, and will continue to pursue these efforts.

Dean's Response: The Science Career and Cooperative Education (SCCE) office has robust programming available to help support the student transition into the professional workforce. At the same time, there are new initiatives underway (e.g. Design Your Science Career and Advancing Tomorrow's Science Careers) that will further enhance the programming made available to students such that they can make more meaningful connections between their academic training and professional aspirations earlier on in their journeys. Paired with Career Advisors and various workshops and networking events, we encourage the Department to continue to work with the SCCE towards expanding its partnerships with the various physics-related sectors.

Recommendation #6.3: The Department should update and share their strategic hiring priorities with the Faculty of Science. Underlying goals to consider include maintaining momentum to continue the department's rejuvenation in the quantum condensed matter areas of the curriculum at both the undergraduate and graduate levels, as well as toward building an Indigenous scholar cohort within the University.

Department's Response and Actions to be Taken: The Department will finalize our nascent strategic plan over the next year, and will share it with appropriate stakeholders including the Faculty of Science.

Dean's Response: The Office of the Associate Dean, Undergraduate is happy to support the Department as it prepares and deploys the teaching & learning pillar of its strategic plan.

Implementation Plan

Recommendation	**Action(s) to be Taken**	**Responsibility for Leading Action** (specify the role(s) that will be responsible for each action item e.g. Program Chair.)	**Timeline for Completing Action** (indicate specific timelines (e.g. not 'ongoing') for action)
Work with Faculty of Science improve communication & recruitment between level 1 and level 2	Discuss strategies with Associate Dean (Undergraduate) Implement best strategies	Undergraduate Chair, Associate Dean (Undergraduate)	September 2024 September 2025
Provide more consistent funding to medical physics experimental labs	Include requests in department budget letters.	Department Chair	Recommendation suggests ongoing action.
Grow DataSci labelled courses	Launch Computational Science concurrent certificate Work with other departments to identify possible DataSci courses in their programs	Undergraduate Chair through APPC Associate Dean (Undergraduate)	September 2025 2026/27
Rebrand physics topics to attract students	Launch Quantum Physics concurrent certificate	Undergraduate Chair through APPC	September 2025
Constant dialogue with graduate students about funding levels	Continue current practice	Graduate Chair	Recommendation suggests ongoing action.
Establish essential requirements of comprehensive exams	Launch biophysics core course	Graduate Chair	September 2025
Partner with other universities for virtual graduate courses	Initiate discussion with peer institutions	Graduate Chair	Unknown – viability of interest from other institutions must be assessed.
Improve diversity in all research area sub-groups	Continue faculty hiring following SPS A1 and other best practices.	Department Chair; Dean	Unknown until faculty hiring freeze is lifted.

Quality Assurance Committee Recommendation

McMaster's Quality Assurance Committee (QAC) reviewed the above documentation at the September 19, 2024, meeting. The committee recommends that the **Physics and Astronomy combined undergraduate and graduate** program should follow the regular course of action with an 18-month progress report and subsequent full external cyclical review to be conducted no later than eight years after the start of the last review.