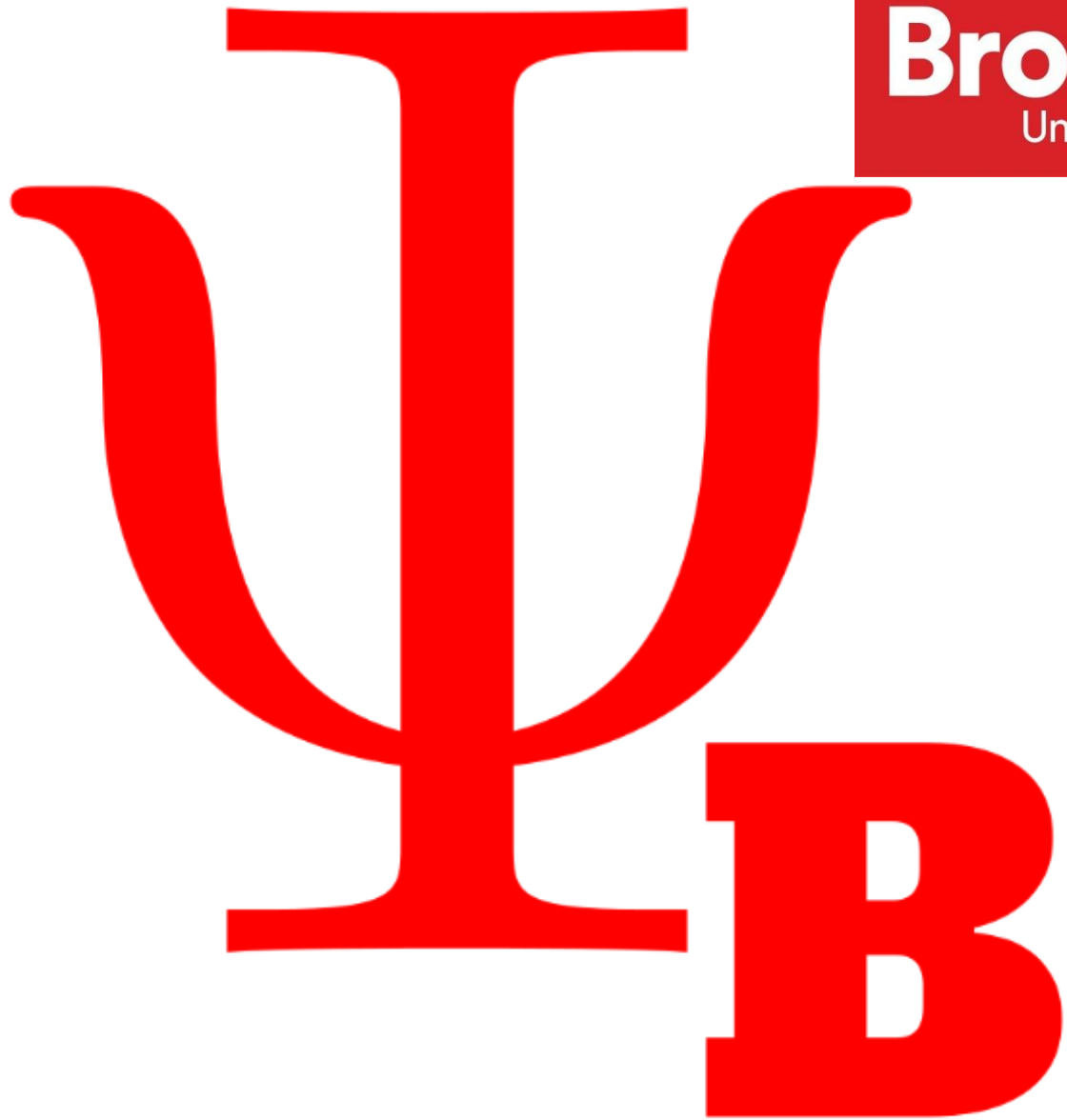




Program Handbook

PhD in Physics

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About This Handbook

The content in this program handbook is accurate at the date of posting and is applicable for the current academic year. Program handbooks are updated annually, and students should ensure they are referring to the current version. Occasionally, changes to policy and program requirements do occur so students should also check with their supervisor, program chair or the Faculty of Graduate Studies on critical matters where they are unsure.

This program handbook should be read in conjunction with general policies and guidelines as outlined in the [Brock University Graduate Calendar](#) and the [Brock Faculty Handbook](#).

1 WELCOME

Welcome to the department of Physics at Brock University. The PhD in Physics program is one of three graduate programs in the department, the other two being the Master of Science in Physics, and Master of Science in Materials Physics International Student Program.

2 PROGRAM DESCRIPTION

2.1 Program Overview

This handbook provides information pertaining to the Brock university thesis-based Doctoral Program in Physics, which focuses on condensed matter physics, materials science, theoretical physics, and biophysics. Potential fields of research which may be pursued are described below.

2.2 Fields of Specialization

Experimental Condensed Matter Physics and Materials Science:

Investigation of the optical properties of materials via spectroscopy at cryogenic temperatures from mm wave to uv. Raman spectroscopy. Preparation and characterization of ceramic, single crystal and thin film (using pulsed-laser deposition) materials. Magnetic and transport properties at ambient and high pressure utilizing measurement techniques such as SQUID magnetometry, specific heat, and resistivity. Synthesis, engineering and investigation of nanostructured materials.

Theoretical Physics:

Superconductivity: unconventional pairing, high-T_c, magnetic, noncentrosymmetric superconductors. Topological quantum materials. Quantum magnets. Topology in physics. General relativity, foundations of quantum mechanics, the nature of time and causality, time travel and faster-than-light travel. Mathematical physics. Dynamic systems. Symbolic and high-performance scientific computing, parallel and concurrent computing.

Biophysics:

Nuclear Magnetic Resonance spectroscopy and relaxation measurements in soft condensed matter systems. Study of collective motions in model membranes, phase transitions in liquid crystals. Exploration of various morphologies and phase behaviour of lipid/water systems using scattering techniques (e.g. neutrons, x-ray and light). Study of the protein/membrane interactions; structural characteristics of membrane active peptides. Computational methods in biomolecular simulations.

3 PROGRAM GOVERNANCE AND ADMINISTRATION

The PhD in Physics has several governance and administrative bodies that support students and faculty.

3.1 Program Governance

An overview of Brock University' governance structure can be found on the [University Secretariat](#) webpages. The following committees and units are responsible for varying aspects of the governance and administration of the Physics PhD program.

Faculty of Graduate Studies

The Faculty of Graduate Studies works closely with Brock's six academic Faculties — Applied Health Sciences, Education, Humanities, Mathematics and Science, Social Sciences, and the Goodman School of Business — to:

- support the growth and development of the graduate studies sector;
- integrate graduate studies into the research, pedagogical, and outreach missions of the University;
- provide quality administrative service and support to current and future graduate students, supervisors, and graduate programs; and
- offer competitive funding packages to financially support students through their studies.

Academic regulations and University policies are outlined in the [Graduate Calendar](#). All students are required to be aware of, and adhere to, these regulations and policies. Students who have maintained enrolment in each calendar year (May to April) may complete the degree program using the Academic Regulations section and program degree requirements operative in the year in which that program was entered, or any subsequent Calendar published while enrolled. Students who interrupt their studies for more than one calendar year (by not enrolling in at least 1 credit) become subject to the Calendar regulations in effect at the time of their re-registration.

For more information, visit the [Faculty of Graduate Studies](#) website.

Department of Physics

The people of the Physics Department are engaged in experimental and theoretical research, primarily in the fields of condensed matter physics, materials science, biophysics and theoretical physics. We are dedicated to high-quality teaching, at both undergraduate and graduate level (we offer B.Sc., M.Sc. and Ph.D. degrees). Hands-on access to research grade equipment and computing facilities provide our graduates with excellent problem-solving skills. We collaborate with physicists all over the world and are involved in the community at large.

Brock University Graduate Council

Brock's Graduate Council normally meets monthly and is chaired by the Dean of the Faculty of Graduate Studies. The Council provides a forum to exchange and discuss ideas and information about graduate programs and to advise the Dean of Graduate Studies on all matters pertaining to graduate studies at Brock.

Senate Graduate Studies Committee (SGSC)

This Senate standing committee oversees and makes recommendations on all matters directly related to graduate academic programs and related policies, considering and pursuing policy initiatives to enhance the academic programs, well-being and reputation of the University. Meeting schedules and minutes are available from the [University Secretariat's website](#).

Graduate Program Committee (GPC)

Graduate Programs at Brock are governed by a Graduate Program Committee (GPC), administered by a Graduate Program Director (GPD), and supported by a Graduate Program Administrative Coordinator (GPAC).

- **Graduate Program Committee (GPC):** The GPC has responsibility for recruitment and admissions, preparation of the Graduate Calendar submission, course offerings, teaching allocations, scholarship adjudication, student progress, community liaison, responding to student concerns, changes to the structure of the program and the selection of the Graduate Program Director. The Graduate Program Committee is normally composed of the Graduate Program Director (who serves as chair) and faculty members of the department.
- **Graduate Program Director (GPD):** The GPD is appointed by the Graduate Program Committee to oversee the graduate program. The GPD carries out all duties in regular consultation with the Graduate Program Committee. The Director has the support of an administrator/coordinator and receives an administrative course release. The usual term is three years.
- **Graduate Program Administrative Coordinator (GPAC):** The GPAC oversees the day-to-day operations of the program and provides administrative support to the Graduate Program Director.

3.2 Program Administration & Faculty

Administrative Contacts

Important: All Physics PhD inquiries should be directed to physics@brocku.ca

Graduate Program Director (GPD)

Dr. Maureen Reedyk
mreedyk@brocku.ca

Graduate Program Administrative Coordinator (GPAC)

Jessica Campbell
jcampbell4@brocku.ca
905-688-5550 x3412

Courtney Lee (on leave)
clee2@brocku.ca
905-688-5550 x 3412

Graduate & Administrative Specialist, Faculty of Mathematics and Science

Elena Genkin
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905-688-5550 x 3551

Faculty

A full Department of Physics faculty listing, along with profiles and research interests, can be found in the Department's [faculty directory](#).

Faculty and Staff of Physics

Professors

Stephen Anco (Mathematics), Peter Berg (Physics), Shyamal K. Bose (Physics), David A. Crandles (Physics), Fereidoon S. Razavi (Physics), Maureen Reedyk (Physics), Kirill Samokhin (Physics), Art van der Est (Chemistry), Thomas Wolf (Mathematics), Tony Yan (Chemistry)

Associate Professors

Thad A. Harroun (Physics), Edward Sternin (Physics)

Assistant Professors

Gavin Hester (Physics), Jasneet Kaur (Physics), Barak Shoshany (Physics), Ganesh Ramachandran (Physics), Pouria Ramazi (Mathematics and Statistics)

Adjunct Professors

Tapash Chakraborty (University of Manitoba), Josef Dubicki (Hamilton Health Sciences), John Katsaras (NRC, Chalk River), Reinhard Kremer (Max-Planck Institute, Germany), Jerry Sokolowski (University of Windsor), Ole Steuernagel (University of Hertfordshire, UK), Heping Xu

Professors Emeritus

John E. Black (Physics), Bozidar Mitrovic (Physics), Stuart M. Rothstein (Chemistry)

A full Department of Physics faculty listing, along with profiles and research interests, can be found in the Department's [faculty directory](#).

Physics Laboratory Supervisor/ Instructor

Ivana Komljenovic Metcalf, ikmetcalf@brocku.ca
905-688-5550, ext. 3417

Laboratory Demonstrator

Fulvio (Phil) Boseglav, fboseglav@brocku.ca
905-688-5550, ext. 4019

Graduate Laboratory Supervisor

Sara Monfared, smonfared@brocku.ca
905-688-5550, ext. 4723

4 ADMISSIONS

4.1 General Admissions Policy

Students can be admitted into the PhD program through one of the following three options:

1. After successful completion of an MSc degree or equivalent in Physics or closely related discipline, with at least an 80% overall average; or
2. After one year in the Brock Physics MSc program. Students wishing to transfer to PhD Studies will be expected to have completed all master's coursework, with the exception of PHYS 5P91, with at least an 80% average. In addition, the student must submit a report on the progress made on the MSc thesis research, including a literature review and a PhD proposal, prior to the transfer. The transfer requires approval by the supervisory committee.
3. In exceptional cases, a student may be admitted directly to the PhD program with a four-years honours Bachelor's degree, or the equivalent; his or her academic standing (normally, with at least an 80% major average) and research potential must be demonstrably commensurate with readiness for doctoral study.

Students admitted into the PhD program cannot transfer into the MSc stream.

The Graduate Record Examination (GRE) is recommended for international students, but not required. Agreement from a member of the Physics graduate faculty to supervise the student is also required for admission to the program. The Graduate Admissions Committee will review all applications and recommend admission for a limited number of suitable candidates. Only full-time PhD students will be admitted.

The Brock University Faculty of Graduate Studies establishes regulations for admission, which specify the minimum entrance requirements. These requirements are designed to ensure that students entering a graduate program have both the capacity and preparation necessary to effectively undertake a program of study at the graduate level. However, possession of the minimum entrance requirements is not a guarantee of admission. Resource allocations play a significant role in the number of students that any graduate program may adequately accommodate. The University reserves the right to limit enrollment and to refuse admission to any candidate.

Brock University has a non-discriminatory policy to ensure against discrimination of applicants based on race, color, national or ethnic origin, creed, sex, or sexuality.

4.2 Admission Requirements

For information on the admissions process, including application dates and required supporting documents, please visit the Faculty of Graduate Studies [How to Apply](#) pages.

4.3 Offer Letters and Acceptance

Assessment of academic background and eligibility for admission to the program is the responsibility of the Physics Graduate Program Committee. Recommendations for acceptance of applicants are made by the Graduate Program Committee to the Brock University Faculty of Graduate Studies. The official letter of acceptance and offer of admission will be issued by Brock University's Dean of Graduate Studies.

Applicants who are admitted, pending receipt of final transcripts, must submit an official copy of their final transcripts to Brock University's Faculty of Graduate Studies prior to registration.

Applicants receiving an offer of admission to the PhD in Physics program in the Faculty of Math and Science must normally accept that offer within three weeks from the date of issue. Failure to do so may result in the offer being withdrawn.

Students accepted for admission to the PhD in Physics program in the Department of Physics in the Faculty of Math and Science must commence their program of study on the date specified in their letter of acceptance. If circumstances prevent a student from starting study on the specified date, the University can rescind the original offer, and the applicant may be required to submit a new application.

5 FEES & FUNDING

5.1 Fees

The fee structure of degree programs offered through the Faculty of Math and Science are as outlined by Brock University and the Faculty of Graduate Studies. Students should consult the [Graduate Calendar](#), the [Graduate Tuition and Fees](#) webpage, and the information provided in their offer letter for the most current fee scale.

5.2 Funding and Financial Assistance

Many graduate students require financial assistance to pursue their studies. Graduate students in the Faculty of Math and Science are eligible for a variety of scholarships, fellowships, and awards administered by Brock University and the Ontario and Canadian Governments (e.g. NSERC, OGS, etc.) A listing of these awards can be obtained by consulting the section on Financial Assistance in the Graduate Studies Calendar.

- Check your eligibility to apply for loans through the [Ontario Student Assistance Program \(OSAP\)](#). Additional information is also available on [Brock's OSAP webpages](#).
- **Brock internal funding support packages** are available to eligible full-time PhD students. Personalized funding package details are normally included as part of your offer of admission and can differ from student to student. Funding sources may include scholarships, Research Fellowships, Graduate Fellowships, and Graduate Assistantships (employment income earned through teaching assistant or research assistant positions).
- **External funding** is generally secured by students through an application for grants and fellowships offered by provincial or federal governments, foundations or other agencies. These applications may be accepted prior to a student beginning their studies, or during their graduate studies.
- A complete listing of available awards may be obtained by consulting the Faculty of Graduate Studies' [Funding Information](#) and [Awards and Scholarships](#) webpages.

6 SUPERVISION & COMMITTEES

All graduate students are supervised by a supervisory committee. The supervisory committee usually consists of the student's research supervisor (or supervisors, in the case of a joint supervision) and two additional faculty members from the Physics graduate program, one of whom will serve as Chair of the committee. Exceptions to this structure may occur, e.g., when the supervisor's primary appointment is not in Physics.

6.1 Supervisory Committee

Supervisory committees are formed by the Graduate Program Director, who will ensure that at least one other committee member will be from the same research area as the student and the supervisor.

Normally, at least two of the research areas of the Department of Physics will be represented on the committee. The Graduate Program Director will attempt to distribute supervisory committee duties equitably among faculty.

In the absence of the supervisor (e.g., during a sabbatical), the Graduate Program Director, in consultation with the supervisory committee, shall ensure that a resident faculty member is responsible for overseeing the student. In the event that the supervisor leaves the University permanently, the Graduate Program Director, in consultation with the supervisory committee, shall appoint a new supervisor.

If either the student or supervisor wishes to initiate a change in supervisor, the request must be presented in writing, with explanation, to the Graduate Program Director for review. If approved by the Graduate Program Director, the request will be forwarded for approval to the Dean of the Faculty of Mathematics and Science and the Dean of Graduate Studies. The supervisor change may result in an extension to the length of time needed to complete the degree.

6.2 Meetings

Graduate students are responsible for convening their supervisory committees for regular meetings. Minimally, supervisory committees should meet at least once in each year of a student's program. Additional meetings may be called at the request of the student, the supervisor, other members of the committee, the Graduate Program Director, or the Chair of the Department of Physics. A meeting of the supervisory committee should also be held when major changes to a student's program are contemplated, such as a transfer from the MSc into the PhD stream or a major change to the student's research project.

The supervisory committee shall review:

- program course and ancillary requirements;
- performance in courses;
- progress in research;
- performance as a teaching assistant, if appropriate.

6.3 Monitoring Student Progress

The decision of the supervisory committee is by majority, except when the sole dissenting vote is that of the supervisor. If this happens, the supervisory committee will be expanded to hear the case. The Graduate Program Director will add two members of the Physics graduate program, in consultation with the student. The decision of the expanded committee will be that of the majority and final.

In a case when a graduate student's performance has been deemed unsatisfactory, the committee will meet again within six months to evaluate the student's progress. Students will normally be dismissed from the graduate program after two successive meetings of the supervisory committee in which their performance in the program is deemed unsatisfactory. In some circumstances, with an approval of the Graduate Program Director, a student can be dismissed from the program after one unsatisfactory review by the supervisory committee.

Students should be aware that it is their responsibility to make sure their committee meetings take place (unless the meeting is called by the supervisor, other members of the committee, the Graduate Program Director, or the Department Chair). The supervisory committee meetings must be documented with the

Graduate Student Progress Report Form

<https://www.physics.brocku.ca/Programs/GradDocs/ProgressReport.pdf> which should be brought to the committee meeting by the student.

Each graduate student receiving an external scholarship must also have a satisfactory yearly Graduate Student External Progress Report Form sent to the scholarship agency by the Graduate Studies Office in order to continue receiving external scholarship funding. This form is available from the Graduate Studies website, currently at https://brocku.ca/safa/awards-and-bursaries/future-students/#Brock_Scholars_Renewal

7 DEGREE REQUIREMENTS

7.1 Overview

The PhD in Physics degree requirements consist of required course work and that all students complete a research project that culminates in writing and defending a thesis. There will be an oral defence of the thesis.

7.2 Courses

7.2.1 Required Courses

All students must complete a research project that culminates in writing and defending a thesis. There will be an oral defence of the thesis. PhD students must enroll in the thesis course PHYS 7F90 each term. All students are also expected to attend Departmental seminars.

Students admitted through option 1 (with a completed MSc) and option 2 (transferring following completion of one year in the Brock MSc Physics program) must complete a total of 3.0 credits: two PHYS half-credit courses at the 5(alpha)00 level or higher, PHYS 5P91, PHYS 7P91, PHYS 7F90 and PHYS 5N01 (non-credit mandatory course). Students admitted through option 1 (with a completed MSc) who have already completed PHYS 5P91 must replace it with another PHYS half-credit course at the 5(alpha)00 level or higher. All students must complete three courses from the following list during their graduate studies (Master and Doctoral): Advanced Quantum Mechanics(PHYS 5P50), Advanced Statistical Physics(PHYS 5P41), Advanced Electrodynamics(PHYS 5P30), Group Theory(PHYS 5P66) and Magnetism and Magnetic Materials(PHYS 5P74). Equivalent courses from other institutions could be acceptable to satisfy this requirement upon approval by the Physics program at Brock University.

Additional credits may be required where a candidate is deficient in a particular area of study as determined by the supervisory committee.

Students admitted through option 3 (direct entry from a BSc) must complete a total of 4.0 credits: four PHYS half-credit courses at the 5(alpha)00 level or higher (which must include three of the courses in Advanced Quantum Mechanics(PHYS 5P50), Advanced Statistical Physics(PHYS 5P41), Advanced Electrodynamics(PHYS 5P30), Group Theory(PHYS 5P66) and Magnetism and Magnetic Materials(PHYS 5P74)), PHYS 5P91, PHYS 7P91, PHYS 7F90 and PHYS 5N01.

Depending on their background and progress in the program, students may be required by the supervisory committee to take additional credits.

7.2.2 Course Evaluation

Faculty must provide students with a course syllabus, including an evaluation scheme, in the first week of class. All course grades must be submitted on or before the deadline listed by the Faculty of Graduate Studies via BrockDB GradeBook; the GPD will subsequently approve those grades. Only the Faculty of Graduate Studies may release final grades. Students must meet the minimum academic performance criteria set out in the Brock University [Graduate Calendar](#) (see Academic Regulations and University Policies, Section X). Course evaluation information is also available in the [Faculty Handbook](#) (Section 3B, #10 Evaluation).

7.3 Comprehensive Exam

The PhD comprehensive exam will test student's knowledge of their research field and related areas of physics, and also their ability to pursue and complete original research at the PhD level.

7.3.1 Procedures

The comprehensive exam takes place within the first 24 months of the student's PhD program, after all course requirements (except the thesis, the graduate seminars, and the writing course) have been fulfilled. If the student has not completed the course requirements within the first 24 months, the appropriate course of action will be determined by the Graduate Program Director in consultation with the supervisory committee.

The arrangements for the exam are made by the Graduate Program Director, who will form the examination committee and set the examination date. The examination committee consists of the Chair, two members of the supervisory committee and one additional Physics graduate faculty member. The supervisor may attend but will not directly participate in the examination, however, may provide confidential feedback on the student.

At least one week prior to the exam, the student must submit to the examination committee a written proposal of research for his/her thesis. The proposal should be about 5 pages in length and contain an abstract, a brief summary of the current status of the field and a literature review, a statement of the research objectives, a description of the methodology, an outline of the progress to date, and a work plan with a timeline.

The examination will consist of an oral presentation by the student about his/her research, around 25-30 minutes in length, followed by questions from the examination committee. The questions of the committee may not necessarily be related to the student's research project, in particular, the examiners may test the student's knowledge of his/her broader research area and also fundamentals from other areas of physics. The total duration of the presentation and the questioning period cannot exceed two hours. When the committee is satisfied with the questioning, the examination chair thanks the student, who then leaves the room so that the committee may deliberate *in camera*.

7.3.2 Evaluation

All four members of the examination committee will vote on the outcome of the exam. The examination committee will award the student either a Pass or Fail grade. A Pass grade will be awarded if a minimum of three members of the examination committee vote that the performance was acceptable. All aspects

of the student's written proposal of research and his/her performance during the examination will be taken into consideration when determining the grade.

The decision of the examination committee will be recorded on the PhD Comprehensive Exam Evaluation Form (available at the Physics graduate program website, see also Appendix C) and submitted to the Graduate Program Director.

If failed, the student must repeat the examination within four months. A student who fails twice will be dismissed from the program.

7.4 Thesis Submission Procedure

Faculty of Graduate Studies Thesis Format Specifications, can be viewed at:

<https://brocku.ca/graduate-studies/current-students/research-based-students/>

and all forms needed regarding thesis' can be found at:

<https://brocku.ca/graduate-studies/student-resources/forms/#thesis>

Please note that all typing and other costs of preparing the thesis are the responsibility of the student.

7.4.1 First Draft Submission/ Final Stage Status

First draft of the thesis is a complete draft that requires no further research or additional chapters/sections. Students with a completed first draft of the thesis can apply for the final stage status. The first draft can be submitted only after all the course requirements have been fulfilled. Students with Final State Status must be deemed by their supervisory committee to be able to complete their degree requirements within the subsequent term.

Once the student has completed a first draft of the thesis and it has been reviewed and approved by the supervisor and the supervisory committee, the student can submit the first draft electronically to the Graduate Program Director along with the First Stage Status Form [First Stage Status Form](#) from the Faculty of Graduate Studies to apply for the final stage status tuition reduction. Students must be mindful of the Faculty of Graduate Studies deadlines regarding receipt of the final stage status form.

Final stage status may only be awarded once and only for one term.

7.4.2 Internal Thesis Review

Once the supervisor agrees that the thesis is ready for internal review, each member of the supervisory committee will receive a copy of the thesis to decide if the thesis is ready for external review. The internal review process will normally take no longer than two weeks. Once the student has made the thesis corrections as directed from the internal review, all members of the supervisory committee will sign off indicating that the thesis is ready for external review using the PhD appointment of External Examiner form [PhD Appointment of the External Examiner](#)

The internal review must be completed, and the final draft of the thesis must be submitted to the Graduate Program Director before the end of the last term of the students' program. Students are strongly encouraged to submit the final draft of the thesis at least 4-6 weeks before the end of the last term.

After the final draft of the thesis has been submitted to the Graduate Program Director, the student will be required to deposit with the supervisor all laboratory notebooks, together with all other original data records, spectra, samples, etc. These will be retained as the property of the supervisor or the Brock

Department of Physics, as appropriate.

7.4.3 External Thesis Review and Setting the Defence Date

Once the thesis has passed the internal review, an electronic PDF file of the thesis is submitted to the Graduate Program Director. The supervisor, in consultation with the student, must also complete and have approved by the Graduate Program Director a list of three potential external examiners, ranked in order of preference which are listed on the PhD appointment of External Examiner form [PhD Appointment of the External Examiner](#).

The PhD appointment of External Examiner Form is forwarded to the Graduate & Administrative Specialist for the Faculty of Mathematics and Science who will liaise with the Faculty of Graduate Studies who will arrange the defence. A signed Declaration of Originality form is required to be submitted with your thesis. https://www.physics.brocku.ca/Programs/GradDocs/Declaration_of_Originality.pdf The Dean of the Faculty of Graduate Studies (or the Dean's designate) will appoint the external examiner and forward a copy of the thesis along with the program's policies for thesis examinations to the external examiner. The Dean of the Faculty of Graduate Studies (or designate) will also appoint a internal examiner who is external to the Physics Graduate Program, but internal to Brock University.

Once the examination committee is finalized, a defence date will be set. The date will normally be no more than 4-6 weeks from the external examiner notification date. The remaining examination committee members will then receive an electronic copy of the thesis for the final defence.

The external examiner shall submit a written evaluation of the thesis to the Graduate Program Director at least one week prior to the defence. It will be identified as part of the report whether the thesis is ready for defence. The external examiner's report will be shared with other members of the examination committee and the student.

The external examiner may choose not to attend the defence at Brock or via a video link. In this case, the external examiner's report must include questions to be addressed to the student during the defence by the Chair of the examination committee.

If the external examiner reports that the thesis is not ready for defence, the student must revise the thesis within a reasonable period of time. The revised thesis must be approved by the supervisory committee and then resubmitted to the external examiner. If the external examiner's evaluation is so unfavourable as to jeopardize the approval of the thesis, the defence should be postponed and the Graduate Program Director, in consultation with the supervisory committee, will recommend a subsequent course of action.

A change of external examiner, in exceptional circumstances, must be justified in writing to the Dean of the Faculty of Graduate Studies.

7.5 Thesis Defence

7.5.1 Procedures

Graduate thesis defences will normally be open defences. A request for a closed defence must be approved by the Dean of Graduate Studies and will be based on certified medical or compassionate grounds.

7.5.2 Committee Composition

The PhD examination committee will consist of the Chair of the examination committee (chosen by the Dean of the Faculty of Graduate Studies or the Dean's designate), who will serve as a non-voting

member of the examination committee, the external examiner, the internal external examiner, the supervisor, and two faculty representatives from the Physics graduate program appointed by the Graduate Program Director (normally the other two members of the supervisory committee). With a prior approval of the Dean of the Faculty of Graduate Studies, the external examiner does not have to be physically present at the defence, participating in the proceedings, *e.g.*, via a video link or by providing a list of questions and expected responses.

7.5.3 Format of Defence

The defence will consist of three parts: (1) a research presentation by the candidate, (2) a questioning period, and (3) an *in camera* meeting of the examination committee. The parts (1) and (2) are open to the public.

1. Examination chair introduces the committee members and the candidate, explains the format of the defence. The candidate gives a presentation, around 30-35 minutes in length, followed by questions from the audience, including the members of the examination committee.
2. After a short (around 10-15 minutes) break, an oral examination session is held, during which only the members of the examination committee may ask questions.

Order of questioning is usually the external examiner, followed by the internal external examiner, first member of the supervisory committee (the supervisory committee chair), second member of the supervisory committee, the supervisor. The chair of the examination committee is not required to participate in the questioning period. The duration of the questioning period cannot exceed two hours.

3. When the committee is satisfied with the questioning, the examination chair thanks the candidate and the audience, who then leave the room so that the committee may deliberate *in camera*.

7.5.4 Evaluation and Possible Outcomes

All members of the examination committee, excluding the chair, will vote on the outcome of the defence. All aspects of the written work as well as the student's performance during the defence will be taken into consideration when determining the grade.

Dissertation grades for doctoral programs shall be reported to the Faculty of Graduate Studies as either a Pass or Fail grade. A Passing grade must be further differentiated as one of: Acceptable as is, Acceptable with minor revisions, Acceptable with major revisions. The decision of the examination committee shall be that of the majority, except when the external examiner casts a dissenting vote. If this happens, it must be reported to the Dean of Graduate Studies, who in consultation with the Dean of Mathematics and Science will determine an appropriate course of action. In the event of a tie vote, the vote of the external examiner will determine the outcome of the exam.

A failing grade will be awarded if two or more committee members find the thesis unacceptable or if the External Examiner does not approve the thesis. If a failing grade is awarded for a thesis, the student will be withdrawn from the program. For full information, please see the Brock University [Graduate Calendar](#) (see Academic Regulations and University Policies, Section X). Dissertation evaluation information is also available in the [Faculty Handbook](#) (Section 3B, #10 Evaluation).

The examination committee will award the thesis either a Pass or Fail grade. A Pass grade will be further differentiated as one of: Acceptable as is, Acceptable with minor revisions, Acceptable with major revisions.

7.6 Post-Defence Requirements

Following a successful dissertation defence, several additional steps must be completed in order for students to graduate.

7.6.1 Revisions

If revisions are necessary, the examination committee will specify the areas for revision and the date by which the revised thesis is to be returned to the Graduate Program Director. The date will normally be within four weeks of the defence. The final version of the thesis must be approved by the supervisory committee. Note that the final revised version of the thesis must be received by the Faculty of Graduate Studies no later than 56 days since the end of the student's last term, otherwise the student will be required to register for an additional term.

7.6.2 Required Forms

The following forms should be submitted to the Graduate Administrative Coordinator:

Mandatory:

- Library and Archives Canada Thesis Non-Exclusive License
- Copyright License Forms

Circumstantial:

- Title Change form
- Request to Restrict Circulation

All forms are available from the Faculty of Graduate Studies [student forms](#) webpage.

7.6.3 Submission to Brock Digital Repository

Upon completion of dissertation revisions, students must upload their final dissertation document to the [Brock University Digital Repository](#).

Important: Students will not be approved to graduate by the Faculty of Graduate Studies until their dissertation is finalized in the digital repository.

The document should be in PDF format and be saved using the following file naming convention: Brock_LastName_FirstName_Year.pdf.

8 ACADEMIC PERFORMANCE & PROGRESS

8.1 Academic Performance and Continuation

Graduate students must achieve and maintain minimum satisfactory academic performance to be eligible to continue in a graduate program. Graduate students must maintain a minimum cumulative average of at least a B-(70%) during each term of study. If a graduate student falls below the minimum cumulative average the student will be automatically placed on academic probation for the subsequent term by the Faculty of Graduate Studies. A probationary student must achieve the minimum cumulative average, normally during the probationary term, to be eligible to continue as a graduate student.

8.2 Residency Requirements & Recommended Completion Timelines

The PhD in Physics is designed as a 4-year program involving a combination of coursework, a comprehensive exam, the conduct of an original research program, and the writing and subsequent defense of a dissertation. The 'Academic Performance and Progress' section below describes the suggested timeframes for completion of degree milestones.

Students should consult with their supervisor when planning a program of study. The student's plan of study must be approved by the Graduate Program Director.

The PhD in Physics is designed to be completed in 4 years (12 terms). Broad PhD milestones based on standard completion timelines are outlined below. Please note this is a suggested timeline only; not all students will progress through these stages at the same rate. Your individual progression timelines should be discussed with your supervisor.

Year 1	Select Courses & Complete Majority of Coursework Form Supervisory Committee Begin Thesis Proposal/ Research Meetings with Supervisory Committee to discuss research / future directions Complete Progress Report
Year 2	Complete Remaining Coursework Prepare for Comprehensive Exam Complete Thesis Proposal Comprehensive Exam Carry Out Thesis Research Meetings with Supervisory Committee to discuss research / future directions Complete Progress Report
Year 3	Carry Out Thesis Research Meetings with Supervisory Committee to discuss research / future directions Complete Progress Report
Year 4+	Complete Data Collection & Analysis Draft Thesis Write-Up Completed Thesis Revisions with Supervisor Distribute Thesis to Committee Further Thesis Revisions Thesis Submitted to External Examiners Thesis Oral Defense Final Thesis Revisions Complete Post-Defence Forms Thesis Upload to Brock Digital Repository

8.3 Progress Reports

Graduate Program Committees will review the performance of their enrolled graduate students on a regular basis, at least once per year. Following the establishment of a supervisory committee, a student's performance must be reviewed and documented regularly. After each supervisory committee meeting, a progress report form should be filled out and submitted to the Physics Departmental Administrative Assistant to be placed in the students file.

<https://www.physics.brocku.ca/Programs/GradDocs/ProgressReport.pdf>

8.4 Departmental Seminars, Presentations, Defences, Etc.

To broaden their knowledge in different areas of Physics and to build community, all Physics PhD students must attend physics departmental seminars, presentations, defences and other academic/research events where notice has been given via departmental email. Failure to do so will be deemed unsatisfactory progress in the program.

8.5 Application to Graduate

Students must apply to graduate. For details visit the Faculty of Graduate Studies here <https://brocku.ca/graduate-studies/current-students/important-dates-and-forms/apply-to-graduate/>

In order to graduate, all degree requirements must be completed and all the necessary documentations submitted to the faculty of graduate studies 6 weeks prior to the date of the convocation ceremony (spring or fall).

The graduate program director will sign off on the completion of degree requirements only after supervisor(s) advise that they have received complete versions of data, lab books, samples, etc.

9 ACADEMIC INTEGRITY, ACADEMIC MISCONDUCT, APPEALS

9.1 Academic Integrity

In accordance with the Brock University [Academic Integrity Policy](#), all students are expected to display the highest standards of academic integrity. Academic integrity means upholding a strong personal and professional ethic within your own work, and that of your colleagues. In upholding the principles of academic integrity, graduate students are expected to demonstrate respect and acknowledgement of others' words and ideas when conducting research, writing, publishing, and teaching.

For more information, visit Brock's [Academic Integrity](#) webpages.

9.2 Academic Misconduct

Integrity is fundamental to the process of research and scholarship, and misconduct damages the entire academic enterprise. Academic dishonesty, while traditionally defined as plagiarism, also includes inappropriate collaboration with other students, data falsification, fabrication of results, and the unauthorized resubmission of previous work.

In the event a student is suspected of engaging in academic dishonesty, professors will contact the Graduate Program Director and there will be an interview between Graduate Program Director and the student. During this interview students have the right to have an advisor present such as their academic advisor or Brock's Ombudsperson. Students have the right to decline to attend this interview but should note that the investigation of academic dishonesty will continue, and they will forfeit their right to defend against the claims. If the Graduate Program Director and the professor find the claims valid, they will be forwarded to the Dean's Office for adjudication. In comprehensive exams and the production of a thesis or dissertation, the department may recommend the student be removed from the program of study with a notation from the Dean appended to the student's record. Please note that an act of academic misconduct constitutes sufficient grounds for dismissal from the program.

University procedures covering academic misconduct can be found on the [Graduate Students - Academic Integrity](#) webpage and in the [Graduate Calendar](#).

9.3 Appeals

Appeal types and procedures at the Graduate level are outlined in the [Faculty Handbook](#) as well as the [Graduate Calendar](#).

Students who have concerns about a grade in a particular course should first discuss the issue with the instructor of the course in question. If the issue cannot be resolved, the student should refer the matter to the Graduate Program Committee through your Faculty / School's Associate Dean, Research and Graduate Studies. If the student is not satisfied with the decision of the Graduate Program Committee, the student may appeal to the Faculty / School Dean. If the student is not satisfied with the Faculty / School's Dean's decision, the student may appeal to the Dean of Graduate Studies. Lastly, if the student is not satisfied with the decision of the Dean of Graduate Studies, the Student may appeal to the University's Student Appeals Board. Dissatisfaction with a penalty will not be considered sufficient grounds for an appeal. For more information on appeals process and timing, see the Brock University [Graduate Calendar](#) and visit the [Brock Ombudsperson](#) website.

10 HEALTH, SAFETY & WELLNESS

The health and safety of individuals is to be a primary objective in every area of University operation. Every person utilizing University premises must comply with this policy and all related regulations, standards, programs, and procedures. [Health, Safety and Wellness](#) provides information, resources, tools, and support to assist each Brock community member in creating and fostering a healthy, safe, and environmentally sustainable place to visit, study, live, and especially, work. Students should also be aware of Brock's [Occupational Health & Safety Policy](#).

Students employed by the University are required under the Ontario Occupational Health and Safety Act to take the mandatory [Health and Safety Awareness Training](#) available via Brock's Health Safety and Wellness Toolbox on SharePoint (requires a Brock employee login).

Under the Accessibility for Ontarians with Disabilities Act (AODA) and Human Rights, students employed at Brock University are legally obliged to undertake [mandatory online training](#). It can also be found on Isaak, Brock University's Sakai-based learning management system. Isaak/Sakai uses the same account and password as the my.Brocku.ca portal. Employees are required to print the page after selecting the "Submit for Grading" button following completion of the quizzes and provide it to their supervisor. Information about Student Accessibility Services (SAS) can also be found [online](#).

Please review Brock's [information](#) on health, safety and wellness during the pandemic. At this time, students, staff, faculty and others visiting campus must be masked and may be asked to complete a [self-screen survey](#) for COVID-19 risk. Information on access to campus (and answers to other FAQs) can be found [here](#).

11 STUDENT RESOURCES

There are many services and resources available to students across campus. Some of these are noted below. For a full list of services and supports available at Brock, please visit the University's A-Z listing at: <https://brocku.ca/directory/a-z/>.

Faculty of Mathematics and Science

To find information for current graduate students in the faculty of Mathematics and Science visit

<https://brocku.ca/mathematics-science/resources-for-graduate-students/#1572900755270-c9652ddc-3650>

Academic Policies

Academic policies for undergraduate and graduate students are outlined in the respective Brock University Calendars (visit <https://brocku.ca/webcal/>) and the Faculty Handbook (visit: <https://brocku.ca/university-secretariat/faculty-handbook/>).

Graduate Students Association

The Graduate Students' Association (GSA) is a student organization that represents the interests of all graduate students at Brock University: MBA, MEd, MAcc, MA, MS, MSc, MTL & all PhD students (approximately 1700 in total). For more information on the services they provide, visit: <http://www.brocku.ca/gsa>.

Student Wellness & Accessibility Centre

Staff at the Student Wellness & Accessibility Centre have extensive experience and a wealth of knowledge to help students develop the skills and strategies they need to reach their full potential at Brock, including support in crisis management, personal counselling, student health, and student accessibility. If support is needed, students are encouraged to contact student counselling services at 1-833-BROCK-33, or visit them in Schmon Tower ST 400. For more information, visit: <https://brocku.ca/health-wellness-accessibility/>.

Health, Safety & Wellness

Health, Safety and Wellness provides information, resources, tools, and support to assist each Brock community member in creating and fostering a healthy, safe, and environmentally sustainable place to visit, study, live, and especially, work. For more information, please visit: <https://brocku.ca/human-resources/health-safety-and-wellness/>.

James A. Gibson Library

The Library at Brock offers a variety of resources to students, including a study space and lockers for graduate students on the 6th floor. To see all the services provided by the library, visit: <https://brocku.ca/library/>.

Faculty of Graduate Studies

The Faculty of Graduate Studies (FGS) aims to help Brock graduate students to become well-rounded, ethical, and creative thinkers and researchers who will contribute to the betterment of society.

The FGS recognizes that alongside coursework and research, graduate school is an opportunity for personal and professional growth and development. Visit the Faculty of Graduate Studies website to learn more about the Professional Development opportunities available to Brock graduate students: <https://brocku.ca/graduate-studies/student-development/>.

The FGS also has oversight of graduate student admissions, funding, scholarships, student records, and orientation activities. For details, visit: <https://brocku.ca/graduate-studies/>.

Career Services

Graduate students have unique needs when it comes to planning their careers and finding work. Students may be headed towards a career in research, teaching, or preparing for a specific job in the private or not-for-profit sector. Whatever it may be, Career Services has a variety of resources and programming designed to help students figure out where they're going and how to get there. For information on the services and resources Career Services provides for students, visit: <https://brocku.ca/ccee/career-education/campus/>.

Brock International

Brock International offers in-person and virtual support services tailored specifically to international students, including immigration consulting, academic coaching, language support, transitioning to life in Canada and living in the Niagara region, and working as an international student. For more information on these services as well as a listing of events and workshops for international students, visit <https://brocku.ca/international/>.

Financial and Administrative Services

Financial and Administrative Services is the place to visit for questions regarding tuition, fees, accessing financial accounts, due dates, how to make payments, how to get refunds from withdrawn courses, and anything else related to student finances. For more information, visit: <https://brocku.ca/safa/tuition-and-fees/overview/graduate/>.

12 APPENDICES

1. Graduate Calendar
<https://brocku.ca/webcal/2022/graduate/phys.html>
2. Academic regulations and University policies
<https://brocku.ca/webcal/2020/graduate/acad.html>
3. Code of Student Conduct
<https://brocku.ca/webcal/2020/graduate/code.html>
4. Other University policies (e.g. governing IT use)
<https://brocku.ca/university-secretariat/policies-procedures-and-best-practices/>
5. Graduate Studies academic regulations from the Faculty Handbook
https://brocku.ca/university-secretariat/faculty-handbook/section-3#_genIndex85
6. Registration Policies and Procedures
<https://brocku.ca/graduate-studies/current-students/Registration/>