Carnegie Mellon University

Physics Graduate Program Handbook

(Academic Year 2023/24)

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Welcome to Carnegie Mellon University and the Department of Physics within the Mellon College of Science. Graduate students are an integral part to the educational and research mission of the department. Attracting and training talented graduate students is vital to Carnegie Mellon's mission and essential to the research success of the department. A thriving research program is, in turn, necessary to attract students and to provide the environment they need to reach their potential as scientists when leaving the university with a higher degree.

This graduate student handbook presents general information for all graduate students in the Department of Physics at Carnegie Mellon University and summarizes the rules and degree requirements governing the Physics Graduate Program. While this handbook is specific to the academic experience of a graduate student in the Physics Department, there are several other resources and offices graduate students are encouraged to consult during their tenure at Carnegie Mellon University. Information about The Word, the student handbook, the Office of Graduate and Postdoc Affairs, the Office of the Dean of Student Affairs and others are included in Appendix A of this handbook.

This Handbook has been updated so as to give current information for the 2023-2024 academic year.

1 Overview

1.1 University Mission and Brief Overview of Department and its Mission

Carnegie Mellon University (https://www.cmu.edu/about/mission.html)

Vision

Carnegie Mellon University will have a transformative impact on society through continual innovation in education, research, creativity, and entrepreneurship.

Mission

To create a transformative educational experience for students focused on deep disciplinary knowledge; problem solving; leadership, communication, and interpersonal skills; and personal health and well-being.

To cultivate a transformative university community committed to (a) attracting and retaining diverse, world-class talent; (b) creating a collaborative environment open to the free exchange of ideas, where research, creativity, innovation, and entrepreneurship can flourish; and (c) ensuring individuals can achieve their full potential.

To impact society in a transformative way — regionally, nationally, and globally — by engaging with partners outside the traditional borders of the university campus.

Department of Physics, Carnegie Mellon University (https://www.cmu.edu/physics)

The Department of Physics within the Mellon College of Science (MCS) welcomes all incoming and returning graduate students to a new academic year at Carnegie Mellon University (CMU). The mission of the Department of Physics through its research and educational activities is to create knowledge of our physical world by applying the skills that constitute a physicist's unique approach to problem solving, and to disseminate knowledge to our professional community and society. We enable our students to become scientists with the knowledge, skills, and experience necessary to succeed in their chosen professions and to contribute to society in meaningful ways as part of our role within the mission of CMU. We maximize our impact using strategic alliances within the department, across the University, and with the international physics community.

In 1906 the first students were admitted to the School of Applied Science, and six years later the institute changed its name from the Carnegie Technical School to the Carnegie Institute of Technology, as the first four-year degrees, including physics, were awarded. By the 1920's the Department of Physics had formed a research center that focused on the application of physics and chemistry to the production of metals, established a tradition of interdisciplinary research and laid the foundations of what became our condensed matter program. In 1933, the second president of Carnegie Tech, Thomas Baker, traveled to Europe and successfully recruited several eminent scientists to Carnegie Tech, including Otto Stern, who had just discovered spin quantization in a magnetic field. Stern brought parts of his original equipment with him to his new Pittsburgh lab where he continued his studies of molecular physics and applied chemistry as the first full-time graduate students began their studies in the department. Our tradition in nuclear and particle physics was born in 1946 when Department Head Frederick Seitz, a condensed-matter theorist, oversaw the creation of the Nuclear Research Center and initiated the construction of the 450 MeV Saxonburg Cyclotron, which operated from 1951 to 1969. Other notable milestones occurred in 1948 and 1950, when Lincoln Wolfenstein and Julius Ashkin joined the faculty.

The department both attracted and trained many outstanding physicists. For example, Clifford Shull received his Bachelor of Science in 1937 and went on to win the 1994 Nobel Prize in Physics "for the development of the neutron diffraction technique." John Hall received his Bachelor of Science (1956), masters (1958), and doctorate (1961) and was awarded the 2005 Nobel Prize in Physics for his contributions to "the development of laser-based precision spectroscopy, including the optical frequency comb technique."

Today the Department of Physics employs over 30 full-time tenure-track faculty as well as teaching and research track faculty. Our faculty is engaged through world-class research groups in Astrophysics and Cosmology, Biological Physics, Condensed Matter Experiment and Theory, High Energy Experiment and Theory, and Medium Energy Experiment and Theory. The department houses the McWilliams Center for Cosmology, the NSF AI Planning Institute for Data-Driven Discovery in Physics, and is affiliated with the Pittsburgh Supercomputer Center, the Data Storage Systems Center at CMU, and the Molecular Biophysics and Structural Biology Graduate Program that has been established jointly between the University of Pittsburgh and CMU, to name a few. More information about the department, its research portfolio and graduate program can be found at https://www.cmu.edu/physics/.

1.2 Degrees Offered

There are a few advanced degrees available for students entering the Physics Graduate Program at CMU. The standard degree awarded on successful completion of the graduate program is a Ph.D. (Doctor of Philosophy) in physics. Besides the conventional Ph.D. program, the department also offers a degree in applied physics. Ph.D. thesis research that may appropriately be characterized as applied physics can be carried out either within physics or in conjunction with other branches of the University such as the Robotics Institute, the Data Storage Systems Center, the Materials Science and Engineering Department or the Electrical and Computer Engineering Department.

A Master's of Science (M.S.) degree in physics is awarded to students enrolled in the Ph.D. program typically after two years of course work and research. The Physics Department does not offer an M.S. only program, and the M.S. degree is usually offered only to students enrolled in the Ph.D. degree program. However, in exceptional circumstances applicants can be considered who intend to obtain only an M.S. degree. In this case admission without financial aid may be considered.

1.3 Graduate Student Handbook

This handbook presents the rules and requirements governing the Graduate Program in the Department of Physics at CMU and offers resources for students available within the department, college and the university. This document shall be updated annually to reflect new rules and future requirements that flow from university policies, and changes in the physics graduate program will be approved by the faculty of the Department of Physics.

Major changes in the physics graduate program were developed by a Graduate Program Working Group during the 2016-2017 academic year and approved by the physics faculty on May 4, 2017 and ratified by the MCS College Council on May 11, 2017. The Written Qualifying Exam was replaced by an enhanced procedure for final exams in the core courses, and students were immersed in research starting with the first semester. Research readiness became an essential part of the requirements for passing a student on to Ph.D. candidacy, and correspondingly the Oral Qualifying Exam was modified to serve as an oral exam with emphasis on the assessment of the student's research aptitude and readiness. This version of the Graduate Program Handbook reflects these changes that went into effect starting with the Fall 2017 semester and other changes since then so as to be current for the 2021-2022 academic year.

Requirements for the faculty of CMU as a whole or those of the Mellon College of Science on research, mentoring, thesis advising and other matters relate to those of graduate students and are found in the

- "Carnegie Mellon University Faculty Handbook" available at https://www.cmu.edu/faculty-senate/faculty-handbook/index.html
- "Mellon College of Science Faculty Handbook" available at https://www.cmu.edu/mcs/people/faculty/resources/handbook/index.html

In the following, university policies and expectations, resources available to students, the physics graduate degree requirements and the operation of the graduate program, are described.

In general, candidates for the degree of Ph.D. in physics should expect to spend at least four years of full-time graduate study, including a minimum of one year of full-time course work at Carnegie Mellon. The first three semesters are devoted to concentrated study of fundamental topics, and to the identification of a supervisor and subject area for their thesis research. Midway through their second year, students typically take the Oral Qualifying Examination. After a student is passed to Ph.D. candidacy, a committee of faculty conducts annual reviews of the students research progress until the student's thesis defense and graduation. An overview of the program is shown in Table 1.

1.4 University Policies and Expectations

It is the responsibility of each member of the Carnegie Mellon community to be familiar with university policies and guidelines. In addition to this departmental graduate student Table 1: CMU Physics Graduate Program Overview with Milestones. During Fall and Spring semesters, tuition is paid either by the Physics Department if the student is a teaching assistant (TA) or from funding sources of the student's advisor if the student is a research assistant (RA). Students receive a stipend throughout the calendar year as either an RA or TA. This overview shows the 4 core courses being taken in the first year, but other options are available (see Sec. 3.2.5).

Year 1		
Fall	Spring	
 Orientation (before classes begin) Placement exams Core course QMI Core course EMI 	 Core course QMII Core course SM Research Project (find advisor) Tuition/stipend: TA typically 	
• Research Project (find advisor)	Summer	
 Tation/supend. TA typicany 1 semester of classroom/laboratory TA required (by end of program) 	ResearchStipend: RA typically	

Year 2		
Fall	Spring	
 Breadth courses (2 needed) Specialized Subject Course(s), if needed Research project Tuition/stipend: RA or TA 	 Oral Qualifying Exam (January) Ph.D. candidacy (January) Breadth and/or subject courses, if needed Thesis research Tuition/stipend: RA or TA 	
	Summer	
	 Thesis research Stipend: RA typically Oral Exam Retake (May, if needed) 	

Years 3 and on (Minimum 4 years)		
 Find Ph.D. advisor by end of year 2 Thesis research Tuition/stipend: RA or TA 	Annual Review (each spring)Thesis defense	

handbook the following resources are available to assist you in understanding community expectations:

- The Word/Student Handbook: https://www.cmu.edu/student-affairs/theword/index.html
- Academic Integrity Policy: https://www.cmu.edu/policies/student-and-student-life/academic-integrity.html
- University Policies Website: https://www.cmu.edu/policies/
- Office of Graduate and Postdoc Affairs: https://www.cmu.edu/graduate/policies/index.html
- Mellon College of Science Faculty Handbook: https://www.cmu.edu/mcs/people/faculty/resources/handbook/index.html

Please see Appendix A for additional information about The Word and university resources.

Due to the changing nature of conditions and expectations surrounding public health and safety requirements please visit www.cmu.edu/coronavirus for the most up to date information.

1.5 Carnegie Mellon University Statement of Assurance

Carnegie Mellon University does not discriminate in admission, employment, or administration of its programs or activities on the basis of race, color, national origin, sex, handicap or disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Furthermore, Carnegie Mellon University does not discriminate and is required not to discriminate in violation of federal, state, or local laws or executive orders.

Inquiries concerning the application of and compliance with this statement should be directed to the university ombudsperson, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone 412-268-1018. Obtain general information about Carnegie Mellon University by calling 412-268-2000.

Carnegie Mellon University publishes an annual campus security and fire safety report describing the university's security, alcohol and drug, sexual assault and fire safety policies, and containing statistics about the number and type of crimes committed on the campus, and the number and cause of fires in campus residence facilities during the preceding three years. You can obtain a copy by contacting the Carnegie Mellon Police Department at 412-268-2323. The annual security and fire safety report also is available online at https://www.cmu.edu/police/annualreports.

Information regarding the application of Title IX, including to admission and employment decisions, the sexual misconduct grievance procedures and process, including how to file a

report or a complaint of sex discrimination, how to file a report of sexual harassment, and how the university responds to such reports is available at https://www.cmu.edu/title-ix. The Title IX coordinator may be reached at 412-268-7125 or tix@cmu.edu.

The Statement of Assurance can also be found online at:

https://www.cmu.edu/policies/administrative-and-governance/statement-of-assurance.html

1.6 The Carnegie Mellon Code

Students at Carnegie Mellon, because they are members of an academic community dedicated to the achievement of excellence, are expected to meet the highest standards of personal, ethical and moral conduct possible.

These standards require personal integrity, a commitment to honesty without compromise, as well as truth without equivocation and a willingness to place the good of the community above the good of the self. Obligations once undertaken must be met, commitments kept.

As members of the Carnegie Mellon community, individuals are expected to uphold the standards of the community in addition to holding others accountable for said standards. It is rare that the life of a student in an academic community can be so private that it will not affect the community as a whole or that the above standards do not apply.

The discovery, advancement and communication of knowledge are not possible without a commitment to these standards. Creativity cannot exist without acknowledgment of the creativity of others. New knowledge cannot be developed without credit for prior knowledge. Without the ability to trust that these principles will be observed, an academic community cannot exist.

The commitment of its faculty, staff and students to these standards contributes to the high respect in which the Carnegie Mellon degree is held. Students must not tarnish that respect by their failure to meet these standards.

For more information, consult the Carnegie Mellon Code, which can be found online at: https://www.cmu.edu/student-affairs/theword/

1.7 Academic Calendar

The Academic Calendar can be found at https://www.cmu.edu/hub/calendar/index.html and provides information on all deadlines including registration dates, class start dates, add/drop deadlines, exam dates and more.

2 Departmental Resources

2.1 Department Personnel

This section identifies some key people that graduate students will get to know and interact with at some point throughout their career toward a Ph.D. in physics. A complete listing of all faculty, staff, post-doctoral researchers, and graduate students in physics can be found online at http://www.cmu.edu/physics/people/index.html.

The following list of people might be of particular importance to graduate students in physics:

- Dean of Mellon College of Science: Rebecca W. Doerge, Mellon Institute MI 414, 412-268-8156, mcsdean@andrew.cmu.edu.
- MCS Associate Dean for Graduate Affairs: Manfred Paulini, Wean Hall 7307, 412-268-3887, paulini@cmu.edu.
- Department Head: Scott Dodelson, Wean Hall 7325, 412-268-6681, sdodelso@andrew.cmu.edu.
- Director of Physics Graduate Studies: Markus Deserno, Wean Hall 6319, 412-268-4401, deserno@andrew.cmu.edu.
- Academic Program Manager: Amanda Bodnar, Wean Hall 7319, ugradphy@andrew.cmu.edu.
- MCS Director for Scientific Computing: Florin Manolache, Wean Hall 6201, 412-268-8486, florin@cmu.edu.
- Physics Graduate Student Assembly (GSA) Representatives: Keegan Cove, kcove@andrew.cmu.edu
 Logan Carpenter, lcarpent@andrew.cmu.edu
 The current roster of all GSA representatives can be found here: here.
- Graduate Student and Department Ombudspersons: Students may confer with the MCS ombudsperson Manfred Paulini, 412-268-3887, paulini@cmu.edu or Sharon McCarl, 412-268-3018, sm5r@andrew.cmu.edu.

2.2 Departmental Information

Most departmental information can be found on the main Physics Department website or at the link for the Physics Graduate Program at https://www.cmu.edu/physics/graduate-program/.

Below is an incomplete list of departmental information relevant for graduate students:

• Main departmental phone number: +1 (412) 268-6681

- Department FAX number: +1 (412) 681-0648
- Department mailing address: Department of Physics Carnegie Mellon University
 - 5000 Forbes Ave.
 - Pittsburgh, PA 15213
- Mailboxes: Wean Hall 7322
- Department Printers: Wean Hall 7322
- Department Copy Machines: Wean Hall 7322

2.3 Operation of the Physics Graduate Program

The operation of the Physics Graduate Program is the responsibility of the Director of Graduate Studies, working together with the Head of the Department of Physics and the Graduate Student Program Coordinator. The director acts as the advisor of the first-year students, monitors the progress and success of pre-candidacy students, works with students who are facing challenges to their progress in the program, and monitors the progress of post-candidacy students, starting with annual reports on their research progress toward a thesis. The director also draws up TA assignments in consultation with the Department Head. The director reports to the faculty, about the status of the graduate program in general, presents students eligible for Ph.D. candidacy following the Oral Qualifying Exam, candidates for the Physics Graduate Teaching Award, etc.

In addition to the director and the Department Head, the other elements contributing to the operation of the Physics Graduate Program are the Graduate Admission Committee, the Oral Qualifying Exam Committee, and the Graduate Curriculum Committee.

2.4 Diversity, Equity, and Inclusion

The Department of Physics is committed to creating an environment welcoming to all. The Diversity, Equity, and Inclusion (DEI) Committee was established to proactively take steps to ensure that we move in this direction. Students can provide feedback to the Committee in a variety of ways. In particular, there exists a Google form where anyone can log in with their Andrew ID and leave anonymous feedback. The link to that form is also available on our Departmental Resources page on Canvas (https://canvas.cmu.edu/courses/31886), as well as on the website of the DEI committee (https://www.cmu.edu/physics/discover/diversity.html). An inclusive environment means that students are involved in the activities of the department, so students serve not only on the DEI Committee, but attend department meetings and serve if they wish on the Curriculum Committee. One student each year serves as Diversity and Outreach TA and, instead of grading and teaching undergraduate courses, focuses on building the department's outreach and diversity efforts. (This position provides financial support, but does not satisfy the requirement of TAing in a classroom at least one semester during the student's PhD studies.) The department also works closely with DEI resources

in MCS and the university and with the Title IX Office.

3 Graduate Degree Attainment and Requirements

The requirements to attain the advanced degrees of Ph.D. and M.S. in physics for the Physics Graduate Program at CMU are detailed in this section. It also specifies program outcomes and research expectations.

3.1 Orientation Program

Entering graduate students are required to attend an orientation program held during the week preceding the beginning of classes (which is typically near the end of August). International students need to arrive one week earlier, as they will receive additional orientation organized by the Office of International Education (OIE). During the week of physics orientation students attend talks introducing them to the department, meet with the Director of Graduate Studies to plan their course work for the first and second semesters, discuss the responsibilities of teaching assistants, meet with current graduate students and enjoy informal social events. At least one placement exam will be taken by all incoming graduate students during the orientation week (see Section 3.2.3 for details). The responsibility for advising incoming graduate students is handled by the director, who also serves as the academic advisor for all first year graduate students.

3.2 Course Requirements

Students must successfully complete a series of courses before being admitted to Ph.D. candidacy. The typical pre-qualifying course program includes research project courses as well as required core and breadth courses as detailed in the following sections.

3.2.1 Research Project Courses

Students are required to choose a research project advisor by the end of the second week of their first fall semester. They will work with this advisor in the form of 33-775 Introduction to Research 1 on a 12-hour-per-week project for the entire semester. Students will have an additional 12-hour-per-week research project in the second semester, in the form of 33-776 Introduction to Research 2, followed by an intensive full-time research experience covering the entire summer after the second semester. Some rotation between research groups is encouraged to enable each student to get at least two different research experiences before qualifying for candidacy. The details of switching between groups can differ from student to student. In general, one research "rotation" each in the fall and spring of the first year is envisioned, but it is also possible for students to switch only after the first year or again for the first summer or fall of their 2nd year, allowing for 3 rotations. On the other hand, students are also allowed to stay with the same advisor who they started with in their first semester. In the fall, spring, and summer graduate students are required to be enrolled for 36 total units.

Whenever beginning work with a new advisor, students should meet with their advisor to discuss expectations in this group. Different advisors may have different expectations regarding working hours, research locations, travel, and other job duties, as outlined in Sec. 3.9.1. Students should make sure they will be able to abide by these expectations, and should agree with their advisors on reasonable accommodations, before committing to a research group long-term.

To continue research during the summer after the first academic year, the fall of the second year, and onwards, students need to sign up for at least 12 units of 33-997 Graduate Laboratory. Students will be encouraged to identify their long-term thesis advisor ideally in the fall of their 2nd year and are required to have chosen a thesis advisor by the end of their second year.

3.2.2 Required Core Courses

Students are required to take the following four introductory core courses as soon as practicable, usually within the first 3 semesters: Quantum Mechanics I (33-755) and Electrodynamics I (33-761) offered in the fall plus Quantum Mechanics II (33-756) and Statistical Mechanics (33-765) offered in the Spring.

Introduction to Mathematical Physics (33-759) is encouraged for students with weaker undergraduate preparation (requiring extra background). Knowledge of mathematical physics is expected in Quantum Mechanics, Electrodynamics, and Statistical Mechanics, and a required placement exam (see below) will enable students to gauge whether they have sufficient knowledge so that 33-759 need not be taken. This applies to students with a masters degree as well as those with undergraduate degrees.

Exceptional students can place out of either Quantum Mechanics I (33-755) or Electrodynamics I (33-761) by taking a placement exam on request (see below)

3.2.3 Placement Exams

At least one short placement exam will be taken by all incoming students during orientation week.

Exam 1:

- Is taken by all incoming students.
- Covers advanced undergraduate material from Electricity and Magnetism, Quantum Mechanics and Mathematical Physics.
- Is used to identify students who would benefit from placement in undergraduate Electricity and Magnetism and Quantum Mechanics.
- Is also used to test whether students have enough knowledge of Mathematical Physics to successfully take the Graduate core courses (Quantum Mechanics, Electrodynamics,

and Statistical Mechanics). Students who are identified as needing to take Introduction to Mathematical Physics (33-759) will be strongly encouraged to do so.

Exam 2:

- Is optional, being taken by special request after consultation with the Director of Graduate Studies.
- Is taken by exceptional students who wish to place out of one (and only one) of either Quantum Mechanics I (33-755) or Electrodynamics I (33-761). The students need only take the relevant part of the exam.

3.2.4 Two Required Breadth Courses

Before advancement to PhD candidacy, and typically by the end of the second year of graduate studies, students should complete the breadth requirement consisting of two courses out of the following list:

- 33-758 Quantum Computation and Quantum Information Theory
- 33-767 Biophysics: From Basic Concepts to Current Research
- 33-777 Introductory Astrophysics or 33-778 Introduction to Cosmology
- 33-779 Introduction to Nuclear and Particle Physics(The equivalent course at the University of Pittsburgh with 9 units can be substituted in a year in which 33-779 is not taught at Carnegie Mellon.)
- 33-783 Solid State Physics

With special permission from the Director of Graduate Studies, other physics courses can on occasion be allowed to be used to satisfy the breadth requirement. Courses outside of physics are not a substitute for a course from the list above. In addition, individual research groups may impose further course requirements on their students.

3.2.5 Introductory Course Schedule

To allow flexibility for students to take non-core courses in their first year, multiple options for the timing of course choices are possible. The two most common course schedules are illustrated in Table 2. Option A students complete all 4 core courses in Year 1, while Option B students postpone one core course until Year 2 in order to take an advanced topic course or Mathematical Physics in Year 1. Students should consult with the Director of Graduate Studies before embarking on any particular schedule.

Both schedules A and B enable students to complete important program milestones on a similar time-scale (i.e. pass on to Ph.D. candidacy after 3 semesters), while providing some flexibility for an entry into advanced courses in the first year for those students who find this advantageous.

Semester	Option A	Option B
Year 1 Fall	Core course QMI	Core course QMI
	Core Course EMI	Breadth/subject course or Math. Phys.
Year 1 Spring	Core course QMII	Core course QMII
	Core course SM	Core course SM
Year 2 Fall	Breadth/subject course	Core course EMI
	Breadth/subject course	Breadth/subject course
Year 2 Spring	Breadth/subject course	Breadth/subject course
	(if needed)	Breadth/subject course (if needed)

Table 2: The two most common course schedules during first two years of the program. Other schedules are allowed with permission from the Director of Graduate Studies.

3.2.6 Total Number of Units

There is no total number of units required for Ph.D. degree attainment, but at the time when a student is passed on to Ph.D. candidacy, the required core and breadth courses add up to a total of 72 units. In addition, the research project courses in the fall and spring of the first year and the fall of the second year result in 36 units of research.

For the master's degree in physics, students must complete at least 96 units of courses taken during the fall and spring semesters with a B average (3.0) or better. To obtain 96 course units, students will have to take at least one course in addition to the required core and breadth courses. For more information on the M.S. degree requirements, please see Sec. 3.15.

3.2.7 Transfer Credits

The department does not accept transfer credits for graduate courses taken as undergraduate or graduate student (for example, as a masters student) before enrolling as a graduate student at CMU. See also Section 3.2.3 on Placement Exams.

3.2.8 Transfer Courses & PCHE

Carnegie Mellon University offers students the opportunity to take courses for credit through a cross-registration program (see Pittsburgh Council on Higher Education (PCHE) and Cross-registration below) and through the receipt of transfer credit from other accredited institutions. The Carnegie Mellon University transcript will include information on such courses as follows: Carnegie Mellon courses and courses taken through the university's crossregistration program will have grades recorded on the transcript and be factored into the QPA. All other courses will be recorded on this transcript indicating where the course was taken, but without grade. Such courses will not be taken into account for academic actions, honors or QPA calculations. (Note: suspended students may take courses elsewhere; however, they may receive transfer credit only if their college's and department's policies allow this).

3.3 Academic Performance

The Department of Physics follows the University Policy on Grades, which is outlined online at https://www.cmu.edu/policies/student-and-student-life/grading.html. This policy offers details concerning university grading principles for students taking courses and covers the specifics of assigning and changing grades, grading options, drop/withdrawals and course repeats. It also defines the graduate grading standards using letter grades: A+ A, A-, B+, B, B-, C+, C, C-, D+, D, or R.

Students must pass all required physics core and breadth courses with a grade of B- (Bminus) or higher before being admitted to Ph.D. candidacy. Exceptions can be made only if a student demonstrates proficiency in the subject matter of a particular course and receives prior approval by the director. Students have a second attempt to achieve a passing grade in a required course that must be taken the next time the course is offered.

3.3.1 Required Core Courses

To pass on to Ph.D. candidacy, students need to achieve at least a grade-point average (GPA) of 3.0 (B average) in the four core courses. If a student does not reach the B average when the core courses are taken for the first time, the course(s) with the lowest grade(s) need(s) to be re-taken in order to achieve the required B average in the 4 core courses.

3.3.2 Research Project Courses

Faculty advisors will assign letter research grades for student performance in the Research Project Courses every semester and also during the summer. Guidelines to evaluate the research project performance are given in form of a rubric; rubrics for pre- and post-candidacy students are found in Appendix B.B The criteria in the rubric follow the research expectations for graduate students as outlined in Sec. 3.9.1. In addition to assigning research grades, the faculty advisors discuss the research performance with their student and give constructive feedback (based on the provided rubric).

3.3.3 Academic Semester Performance

Students are also required to maintain a satisfactory academic semester record in order to continue in the Graduate Program. This means students cannot have a grade-point average of less than 3.0 in each of two consecutive semesters (see Sec. 3.12 for more details).

3.4 Academic Integrity

Please review the University Policy on Academic Integrity:

https://www.cmu.edu/policies/student-and-student-life/academic-integrity.html. The policy includes the University expectations around academic integrity and provides definitions of cheating, plagiarism, and unauthorized assistance.

A review of the University's Academic Disciplinary Actions procedures

https://www.cmu.edu/student-affairs/theword/academic-discipline/index.html is also recommended. These procedures outline the process for investigating, reporting, and adjudicating violations of the University Policy on Academic Integrity. The procedures also outline the appeal process.

3.5 Oral Qualifying Exam

The purpose of the Oral Qualifying Exam is to evaluate the student's ability to (1) apply knowledge from course work to research they have performed, (2) present a coherent talk to scientists outside their field, and (3) answer questions on the student's research projects and the physics concepts involved. Students in the Ph.D. graduate program are required to take the Oral Qualifying Exam in their second year of graduate studies. The exam is administered by a committee with faculty from multiple research areas. The exam is given annually in January and May of each year. If the Oral Qualifying Exam is not passed on the first attempt, students are allowed a second chance immediately when the next exam is given.

The chair of the committee giving the exam will send out in December a message to all students taking the exam discussing the purpose, scheduling, and content of the exam. (See Appendices B1 and C.) During the exam students will give a 30 minute presentation (PowerPoint is allowed) about their research from the first to third semester detailing what the student considers the most important and interesting aspects of the performed research. In case students have switched research topics, they can choose which research topic to present for their Oral Qualifying Exam. However, they would be encouraged if at all possible to present something related to their longer-term research direction that will eventually lead to a thesis topic.

To facilitate evaluation of their knowledge of basic physics, students will be asked to spend 10 minutes of their presentation specifically addressing the question of basic physics connections (Electrodynamics, Statistical Mechanics, Quantum Mechanics, Classical Mechanics, Mathematical Physics) in their work. Students should prepare their talk completely on their own with no discussion between the candidate and faculty concerning any aspect of the exam. After the presentation the Exam Committee will ask questions related to the student's research as well as basic physics concepts relevant to the presented research topic. The question period will last typically from 30 minutes to one hour.

The committee will be given access to the students' course grades, previous evaluations and written reports on research from their first year, summer and second year fall. The student's research advisor should be present during the exam as a silent observer and can be consulted for context during the committee deliberations as a non-voting committee member.

If a student fails the Oral Qualifying Exam, he/she is allowed a second chance immediately after the spring semester in their 2nd year. If a graduate student does not pass the exam after the second attempt, the student cannot continue in the graduate program. Although there is no requirement or promise, the student is typically still supported as TA in the summer following the last attempt on the Oral Qualifying Exam but must leave CMU before the beginning of the fall semester.

3.6 Advancement to Ph.D. Candidacy

Passing on to Ph.D. candidacy requires passing each of the four core courses with at least a B- grade, achieving at least a B average in those four core courses, passing each of the two breadths courses with at least a B- grade, and passing the Oral Qualifying Exam. After a student has fulfilled those requirements, a meeting of the faculty is held to review the student's academic record and qualifying exam performance. Progress in research, finding a research advisor, and the research aptitude of the student are part of that discussion as well. After a positive vote by the faculty, the student is passed on to Ph.D. candidacy and begins full-time thesis research. Completing the teaching requirement (see Sec. 3.10) is a requirement for graduation, but not for passing on to candidacy.

Students are expected to engage in active research each semester, as well as during the summer unless they are on an external internship. In rare circumstances, a student may seek a new thesis advisor after the 2nd year. In such a case the student should consult with the Department Head and the Director of Graduate Studies about the situation and about an acceptable transition period without an official research advisor of record.

Students are encouraged to familiarize themselves with the University Policy for Doctoral Student Status: https://www.cmu.edu/policies/student-and-student-life/doctoral-student-status.html. This policy sets forth a definition of All But Dissertation (ABD) status, time limits on doctoral candidacy status, a definition of being In Residence and In Absentia for candidates and the tuition and fees charged for candidates in each status. The ABD Status Agreement Form can be found at: https://www.cmu.edu/hub/docs/abd-status-agree.pdf

3.7 Thesis Research

After being passed on to Ph.D. candidacy, students begin full-time thesis research and typically sign up for 36 units (24 minimum) of 33-998 Thesis Research. The minimum load to be considered a full-time graduate student is 36 units. Students are required to have chosen a thesis advisor by the end of their second year. Their faculty advisor continues to assign letter research grades for the student's research every semester. Guidelines to evaluate the research performance are given inform of a rubric, where a copy of the suggested rubric for students after Ph.D. candidacy is provided in Appendix B.2. The criteria outlined in the rubric follow the research expectations for graduate students as outlined in Sec. 3.9.1. In addition to assigning research grades, the faculty advisors discuss the research performance with their student and give again constructive feedback.

3.8 Annual Research Reviews

After passing the Oral Qualifying Exam, the student begins to form their thesis committee. The Annual Research Review is given to the nucleus of that committee. It provides an opportunity to

- practice presenting scientific progress;
- discuss research with scientists beyond the student's research group;
- build relationships with the thesis committee.

The first annual review should happen no later than one year after the student's successful Oral Qualifying Exam, but could be scheduled earlier for those students who are already well on track to define a thesis project. The annual research review is repeated each academic year with the review meeting held before the end of each spring semester. The student's annual review committee will continue to provide feedback on research progress toward a timely thesis defense.

To facilitate annual reviews, each student and their advisor must submit a list of tentative thesis committee members, constituting a quorum, by the end of the semester following the student's successful Oral Qualifying Exam. The outside member can be chosen at this stage, but need not be. Information on forming a thesis committee can be found in the Mellon College of Science Faculty Handbook. In the exceptional case that students are not able to complete the annual review for the current academic year, students need to indicate that they have taken steps to schedule their review and provide the proposed date for the review.

The annual research review includes:

- the presence of at least 3 of the tentative thesis committee members.
- a presentation by the student which includes a discussion of research progress over the past year. (This part typically takes about 30 minutes, but conventions in different research groups may vary. The student should consult with their advisor about this.)
- a discussion between the student and committee members on the progress and a plan for continuation of the student's research toward a Ph.D. thesis. (This part typically also takes about 30 minutes—again with some variability between groups.)
- an opportunity for the student to converse with their thesis committee without their advisor present.
- documentation of the annual review by the advisor, through the completion of a form which can be obtained from the Graduate Student Program Coordinator or the departmental website. The completed and signed form needs to be returned to the Graduate Student Program Coordinator. It is at the discretion of the thesis advisor to forward a copy of the annual review form to the student.

• the submitted form can be accompanied by a 1–2 page progress report prepared by the student or a copy of the student presentation.

If a student graduates by the end of the spring semester, the thesis defense can replace the annual review.

3.9 Graduate Program Outcomes

The Graduate Program in Physics is designed to provide an environment that will allow students to build on their prior education and acquire state-of-the-art core physics skills and knowledge through course work and research-based activities, as well as grow from a student to a colleague. In brief, students in the physics graduate program will be able to demonstrate broad knowledge of physics, deep knowledge in some specific area of physics, and an ability to formulate and advance a scientific project that leads to publishable research. In the course of doing the above, students will acquire problem-solving skills as well as written and oral communication skills. In particular, upon graduation with a Ph.D. in physics, students will:

- Have acquired detailed knowledge in the core physics subjects, including quantum mechanics, electrodynamics, and statistical mechanics, and be familiar with the structure of matter, as well as the corresponding interactions from the subatomic scale to cosmological distances.
- Be able to demonstrate mastery of advanced physics topics within their chosen subfield of research and apply experimental, observational, computational, and/or theoretical scientific methods to conduct independent research.
- Be able to understand, within a reasonable time frame, the needed background knowledge for a given scientific problem, while their physics knowledge base will allow them to recognize the physics fundamentals underlying a given problem.
- Have acquired problem-solving methodology and skills, including the analysis of uncertainties arising from the limitations of experimental data and models, as well as the critical use of scientific literature.
- Have developed skills to effectively communicate research results to professionals within their subfield and the broader physics community through both oral presentation and scientific publication.
- Have completed individually or as a member of a team an original research project that advances the understanding of nature.

3.9.1 Research Expectations

While engaged in full-time research toward a Ph.D. in physics, graduate students are generally supported as a Research Assistant (RA) or a Teaching Assistant (TA) and are expected to follow certain guidelines. In particular, students are expected to:

- Be curious and passionate about their research project, demonstrating creativity in applying scientific ideas to solve the research problems at hand.
- Be self-motivated and dedicated to hard work, becoming the active driver toward an excellent Ph.D. thesis in a timely manner.
- Focus their efforts on the work needed to complete a Ph.D.
- Communicate effectively with their advisor by pro-actively seeking advice, accepting constructive criticism, and being willing to adjust, as needed, their research methodology.
- Develop independence as their Ph.D. research progresses, taking it upon themselves to identify and find resources needed to solve problems.
- Assume responsibility for the advancement of the research group that they join, recognizing that science is a collaborative effort.
- Take responsibility for developing professional presentation skills, allowing them to communicate research findings to professionals within their subfield and the broader physics community, as well as being capable of producing well-written drafts for publications.
- Display overall professional behavior and follow all university guidelines regarding academic integrity and responsible conduct of research, as well as regulations governing safety and best practices in laboratory settings, in particular while operating equipment and handling potentially dangerous substances.
- Take responsibility for meeting field- or group-specific expectations as discussed with their research advisor and insofar as these expectations are consistent with university policy. Several common types of group expectations are listed below to guide these discussions.
 - Research modality (in-person on campus, or remote)
 - Core working hours
 - Short-term or long-term travel for collaboration, conferences, or worksite visits. In some groups it is the norm to live at the experimental site for periods longer than 1 year.
 - Taking regular experimental shifts
 - Group "service" requirements, e.g. maintaining lab supplies or computational resources; helping groupmates debug their code; presentations at group meetings
 - Communicating with students, vendors, collaborators, technicians, etc.
 - Mentoring or training more junior group members
 - Physical job duties, e.g. light lifting; bending; working on ladders; fine adjustments; typing
 - Additional coursework beyond the basic Physics Department requirements

3.9.2 Performance Measures

While enrolled in the graduate program, students must demonstrate an appropriate level of progress toward graduation with a Ph.D. in physics, including the following performance measures:

- Demonstrate mastery of knowledge in the core physics subjects, including quantum mechanics, electrodynamics, and statistical mechanics, by performance on course exams and assignments.
- Demonstrate ability to apply skills acquired from core courses to research-field-specific problems through performance in special-topics and breadth courses.
- Demonstrate the ability to apply core and research-field-specific knowledge by suitable performance in research project courses.
- Demonstrate the ability to apply physics knowledge and problem-solving skills in research including the ability to comprehend and critically analyze scientific literature, by suitable performance in the Oral Qualifying Exam.
- Demonstrate an appropriate level of understanding of their dissertation topic and make suitable progress on their research as part of research course work and during a formal annual thesis review.
- Demonstrate the ability to create new knowledge in their chosen subfield of physics and to communicate effectively, both orally and in writing, through a Ph.D. dissertation and successful Ph.D. defense.

3.10 Teaching and Language Requirement

All graduate students are required to perform classroom or laboratory teaching for at least one semester before receiving a Ph.D. in physics. Students will benefit from the practice gained by explaining complex physics concepts in an understandable way and by responding to questions.

If a student's native language is not English, a certification of proficiency in spoken English is required before the student will be allowed to perform the required classroom teaching. Graduate students are required to have a certain level of fluency in English before they can instruct in Pennsylvania, as required by the English Fluency in Higher Education Act of 1990. Through this Act, all institutions of higher education in the state are required to evaluate and certify the English fluency of all instructional personnel, including teaching assistants and interns. The full university policy can be reviewed at: https://www.cmu.edu/policies/faculty/evaluation-certification-english-fluency-instructors.html. The fluency of all instructional personnel will be rated by Language Support in the Student Academic Success Center to determine at what level of responsibility the student can TA. To obtain certification, non-native English speakers must pass an International Teaching Assistant (ITA) test (a mandatory screening test for any non-native speaker of English), administered by Language Support in the Student Academic Success Center at CMU. A student must reach as a minimum an ITA test score of "Restricted II" (former Category 3), which allows for restricted TA assignments such as teaching in a laboratory course. In addition to administering the ITA test, Language Support in the Student Academic Success Center helps teaching assistants who are non-native English speakers develop fluency and cultural understanding to teach successfully at Carnegie Mellon. Visit the Student Academic Success/.

Expectations and duties of TAs and graders vary between courses and instructors. Guidelines and parameters are laid out in https://canvas.cmu.edu/courses/31886/files/9649586. Note that TA duties may require some light physical work, including equipment setup, takedown and maintenance; lecturing at a chalkboard or whiteboard; or handling documents.

3.11 Thesis Committee and Thesis Defense

The purpose of a doctoral thesis committee is to judge the validity, originality, significance, and proper presentation of the candidate's doctoral thesis. To that end, the committee shall examine the thesis submitted by the candidate, conduct the public oral final examination on the thesis, prescribe corrections or revisions to the thesis before or at the time of the examination, and certify to the dean its finding on the acceptability of the thesis in its final form.

Normally, the members of the thesis committee shall be nominated by the thesis advisor with the agreement of the candidate, and their appointment approved by the department Head or the faculty member designated to supervise the department's doctoral programs. Ultimate responsibility for the appointment of a thesis committee rests with the department.

The doctoral thesis committee shall consist of no fewer than four members, and shall include the thesis advisor, as well as the "departmental sponsor" if there is one. With respect to a departmental sponsor, the thesis advisor need not be a faculty member in the department, or even in the university. When the thesis advisor is, however, not a regular or research faculty member at Carnegie Mellon University, the Department Head or the faculty member designated to supervise the department's doctoral programs shall appoint, in consultation with the thesis advisor and the candidate, a regular or research faculty member in the department to serve as the candidate's departmental sponsor. It shall be this departmental sponsor's responsibility to monitor the candidate's work and to assist him or her, the thesis advisor, and the department in assuring that it conforms to the candidate's doctoral program.

At least half of the members of the committee shall be regular or research faculty members in the Department in which the degree is to be conferred; one of these, who must be a regular faculty member with the rank of Assistant Professor or higher, shall chair the committee. If qualified under the preceding provision, the thesis advisor will ordinarily chair the committee; the same is applicable to the departmental sponsor if there is one. At least one member of the committee shall be a "visitor", i.e., a person not affiliated with the department in which the degree is to be conferred nor with any department participating in the candidate's thesis research; the thesis advisor may not serve as "visitor". To be eligible to be a "visitor", a person should be familiar with academic standards and procedures and be especially qualified to judge some aspect of the thesis. A "visitor" may come from another department at Carnegie Mellon, from another university, or from outside academic institutions altogether.

A vacancy on the doctoral thesis committee need only be filled if the remaining members would not constitute a valid committee. When a vacancy is filled, care shall be taken that the new committee member has the time and opportunity to participate effectively in the performance of the committee's functions.

In the rare case that a student has a concern with one of the committee members at some point after the appointment of the thesis committee, it is up to the discretion of the thesis advisor to discuss the student's concerns with the committee member in question. In consultation with the Department Head and director, it is possible to replace a committee member as long as the guidelines for the formation of a valid thesis committee are still followed.

The final examination may proceed only if the committee members present would, by themselves, constitute a valid thesis committee according to the preceding provisions. A member of the committee who is unable to be present at the final examination may, if she or he wishes, submit a written recommendation.

The thesis committee should be appointed no less than two months before the estimated date of the final examination. In order to permit an orderly performance of the committee's functions, it shall be the responsibility of the candidate to keep the committee informed about the progress of his or her work, from the time the committee is appointed to the time the thesis is submitted. The committee may specify whether this should be done individually, or collectively by formal or informal presentations.

When the thesis advisor (and the departmental sponsor if there is one) is satisfied that the thesis is ready, it shall be submitted to the committee. The final examination shall be scheduled so as to provide the committee with two weeks to study the thesis between its submission and the date of the examination.

The formation of a valid thesis committee and the execution of a thesis defense are also governed by the MCS Doctoral Degree Policies as detailed in the Mellon College of Science Faculty Handbook.

3.12 Academic Probation

If a student does not maintain adequate academic performance, such as falling below a GPA of 3.0 for one semester, receiving a non-passing grade on research, failing the Oral Qualifying Exam or does not meet the requirements for the annual reviews, the student can be put on academic probation. In this case, the student will meet with the director and Department Head to discuss the situation and receive a letter from the Department Head stating a list

of steps plus a timeline required to be taken off academic probation. If the student fails to follow these requirements, the faculty will discuss the given case, vote and decide whether the student is allowed to continue in the Graduate Program in Physics. Once the student has met the steps within the given timeline, she/he will be taken off probation and informed about this step through another letter signed by the Department Head. However, if the student fails to meet future academic requirements, she/he can be put back on probation. There is no limit on the number of times a student can be placed on academic probation.

3.13 Statute of Limitations

The Department of Physics statute of limitations follows the university's Doctoral Student Status Policy as outlined at https://www.cmu.edu/policies/student-and-student-life/doctoral-student-status.html. Students will complete all requirements for the Ph.D. degree within a maximum of ten years from original matriculation as a doctoral student. Once this time-to-degree limit has lapsed, the person may resume work towards a doctoral degree only if newly admitted to a currently offered doctoral degree program under criteria determined by that program.

Under extraordinary circumstances, such as leave of absence, military or public service, family or parental leave, or temporary disability, a school or college may, upon the relevant department's recommendation and with the written approval of the dean, defer the lapse of *All But Dissertation* status for a period commensurate with the duration of that interruption. Students, who are pursuing the Ph.D. degree as part-time students for all semesters of their program, as approved by their program, may also appeal to their program or department for extension of the time to degree limit.

3.14 The Ph.D. in Applied Physics

Besides the conventional Ph.D. program, CMU offers a degree in applied physics. Ph.D. thesis research that may appropriately be characterized as applied physics can be carried out either within the Physics Department or in conjunction with other branches of the university such as the Robotics Institute, the Data Storage Systems Center, the Materials Science and Engineering Department or the Electrical and Computer Engineering Department. Students in the applied physics program may find it necessary to prepare themselves in a technical area through courses in another department or through independent study. The Ph.D. Qualifying Examination and the program of basic graduate courses in physics are required as outlined above but also flexible enough to accommodate the various options in applied physics.

3.15 The M.S. in Physics

The Master of Science (M.S.) degree in physics is typically awarded to students enrolled in our Ph.D. program after two years of course work. Note, however, that the Physics Department does not offer an M.S.-only program. Therefore, the M.S. degree is usually offered only to students enrolled in the Ph.D. program. In some cases, we may consider applicants who intend to obtain an M.S. degree only, but such candidates will be typically admitted without financial aid.

Candidates for the M.S. degree in physics must satisfactorily complete at least 96 course units with a B average (GPA of 3.0) or better including the following:

- 1. At least 48 course units of graduate courses (700-level) in the Department of Physics.
- 2. In addition, at least 48 units of graduate or advanced undergraduate courses in physics (300-, 400- or 600-level).
- 3. No more than 36 units of advanced physics laboratory or equivalent research course units (33-775, 33-776, 33-997, or 33-998) during the fall and spring semesters can be counted toward the M.S. degree.

In addition, students must satisfy the following requirements:

- 1. One year of residence as a full-time student is required and all of the 96 units have to be taken as a student enrolled at CMU.
- 2. No courses counted toward another degree at CMU can be included for the M.S. degree in physics.
- 3. There are no research or language requirements for the M.S. degree.

4 Additional Department and University Policies and Protocols

4.1 Financial Assistance

Nearly all graduate students in the Ph.D. programs receive financial support in the form of an assistantship (teaching or research) or fellowship. Teaching assistantships typically involve a work load of up to 20 hours per week including classroom time, preparation and grading. Such teaching experience is considered a valuable part of a student's graduate training. The hours required are such that the student may pursue a full-time graduate program. Teaching assistantships provide a full-tuition remission and a monthly stipend for the nine-month academic year.

Performing the duties of a teaching or research assistant is part of graduate training. Such service, or its equivalent, is required of all candidates for graduate degrees, whether or not they receive stipends.

To maintain support from the department, all students whose native language is not English must either pass the International Teaching Assistant test administered by Language Support in the Student Academic Success Center or must be satisfactorily participating in the English training program prescribed for them. During their thesis research, candidates for the Ph.D. degree are, in most cases, supported as research assistants by the research group with which they become associated in the second year of residence. Sometimes, a first-year graduate student will be offered a research assistantship. The principal duty of a research assistantship is to aid in the program of one of the department's research groups. The stipend is essentially the same as for a teaching assistantship, with the teaching time requirement transferred to research tasks.

Additional financial support is usually available for students wishing to participate in research projects or teaching during the summer months for which a student will receive the same monthly stipend.

Students accepting appointments with the Department of Physics are not allowed to be employed outside of the university during the academic year nor during the summer if they are being supported by the department or a research grant.

Graduate students who find themselves in need of immediate funds for emergency situations should contact the Office of the Dean of Student Affairs (see Appendix A), available online at http://www.cmu.edu/student-affairs/index.html, to inquire about an Emergency Student Loan.

For qualifying doctoral students the university supports 100% of individual premium cost for medical coverage through the Student Healthcare Insurance Program (SHIP). Here, "qualifying doctoral students" are defined as

...having full-time enrollment in a CMU doctoral program, making satisfactory progress toward their degree in line with the program policy, are stipendsupported and are not receiving full external support from another source. https://www.cmu.edu/graduate/current-grad-students/health-and-wellness/ index.html

More information about the SHIP plan, eligibility requirements, vaccinations, and processes for coverage waiver, can be found at CMU Health Plans – University Health Services – Student Affairs. Observe that the credit is a non-qualified scholarship, and is <u>considered taxable income</u> by the Internal Revenue Service (IRS) to all students who receive it. The credit will be included on your Form 1098-T in Box 5.

4.2 Employment Eligibility Verification

If you are receiving a stipend, are a TA, or are planning to have a position with CMU, then Employment Eligibility Verification is required. Form I-9 must be completed within 3 business days of beginning work for any type of compensation (stipend or employment). Additional details are highlighted below. To ensure compliance with federal law, Carnegie Mellon University maintains the Employment Eligibility Verification (I-9) Policy [pdf] covering the university's I-9 and E-Verify requirements:

• Every individual receiving a stipend from CMU or employed by CMU must comply with the I-9 Policy by completing the Form I-9 within three business days following the first day of stipend start date/employment.

- Individuals who expect to work on a federally funded project are further responsible for submitting an E-Verify Processing Request Form to the Office of Human Resources if required.
- For more information, please see CMU's Guidance for Completing the Form I-9 and E-Verify Requirements at CMU [pdf], or visit the Human Resources Service website to learn more about Form I-9 and E-Verify and to schedule an appointment to complete the Form I-9.

4.3 Enrollment Process

The Physics Department follows the university protocol on enrollment for full-time graduate students.

Enrollment Verification: Enrollment Services is the only University office that can provide an official letter of enrollment, official transcript and enrollment verification. Enrollment verification can be requested online through The HUB:

http://www.cmu.edu/hub/transcripts/verifications/enrollment.html.

Process for Taking & Returning from Leave of Absence: https://www.cmu.edu/hub/registrar/leaves-and-withdrawals/

Process for 'Withdrawal' from Program:

https://www.cmu.edu/hub/registrar/leaves-and-withdrawals/

Withdrawal of Degree:

The university reserves the right to withdraw a degree even though it has been granted should there be discovery that the work upon which it was based or the academic records in support of it had been falsified. In such a case, the degree will be withdrawn promptly upon discovery of the falsification. The complete reference to this university policy is available at: https://www.cmu.edu/policies/student-and-student-life/withdrawal-of-a-degree.html.

4.4 Assistance for Individuals with Disabilities

http://www.cmu.edu/education-office/disability-resources/

The Office of Disability Resources at Carnegie Mellon University has a continued mission to provide physical and programmatic campus access to all events and information within the Carnegie Mellon community. We work to ensure that qualified individuals receive reasonable accommodations as guaranteed by the Americans with Disabilities Act (ADA) and Sections 503 and 504 of the Rehabilitation Act of 1973. Students who would like to receive accommodations can begin the process through the Disability Resources secure online portal or email access@andrew.cmu.edu to begin the interactive accommodation process.

Students with physical, sensory, cognitive, or emotional disabilities are encouraged to self-identify with the Office of Disability Resources and request needed accommodations. Any questions about the process can be directed to access@andrew.cmu.edu, or call (412) 268-6121.

4.5 Graduate Student Appeal and Grievance Procedures

https://www.cmu.edu/graduate/policies/appeal-grievance-procedures.html

Graduate students will find the Summary of Graduate Student Appeal and Grievance Procedures on the Graduate Education Resource webpage. This document summarizes processes available to graduate students who seek review of academic and non-academic issues. Generally, graduate students are expected to seek informal resolution of all concerns within the applicable department, unit or program before invoking formal processes. When an informal resolution cannot be reached, however, a graduate student who seeks further review of the matter is to follow the formal procedures outlined here. These appeal and grievance procedures shall apply to students in all graduate programs of the university. Students should refer to the department specific information in this handbook for department and college information about the administration and academic policies of the program.

4.6 Policy Against Sexual Harassment and Sexual Assault

The University prohibits sex-based discrimination, sexual harassment, sexual assault, dating/domestic violence and stalking. The University also prohibits retaliation against individuals who bring forward such concerns or allegations in good faith.

The University's Sexual Misconduct Policy is available at https://www.cmu.edu/policies/administrative-and-governance/sexualmisconduct/index.html

The University's Policy Against Retaliation is available at https://www.cmu.edu/policies/administrative-andgovernance/whistleblower.html

If you have been impacted by any of these issues, you are encouraged to make contact with any of the following resources:

- Office of Title IX Initiatives, http://www.cmu.edu/title-ix/, 412-268-7125;
- University Police, https://www.cmu.edu/police/, 412-268-2323

Additional resources and information can be found at https://www.cmu.edu/title-ix/resources-and-information/index.html

4.7 Consensual Intimate Relationship Policy Regarding Undergraduate Students

https://www.cmu.edu/policies/student-and-student-life/consensual-relationships.html

This policy addresses the circumstances in which romantic, sexual or amorous relationships/interactions with undergraduate students, even if consensual, are inappropriate and prohibited. The purpose of this policy is to assure healthy professional relationships. This policy is not intended to discourage consensual intimate relationships unless there is a conflicting professional relationship in which one party has authority over the other as in the policy.

4.8 Parental Accommodation Protocol

https://www.cmu.edu/graduate/programs-services/parental-accommodation.html

Carnegie Mellon offers significant accommodations for students who are becoming parents– whether by child birth or other means, such as adoption, foster care, or legal guardianship. Details are spelled out in the university guidelines. Importantly, students who wish to seek any of these accommodations must register with the Office of the Dean of Students by contacting the office for an appointment by calling 412-268-2075.

Beyond the accommodations mentioned above, students should proactively work to develop a plan for what happens with their ongoing course work or research, and they are encouraged to reach out to the Director of Graduate Studies when doing so.

4.9 Change of Address

Students are responsible for notifying their department and HUB of all address changes in a timely manner. Students will be held responsible for any failure to receive official college notices due to not having a correct address on file; F-1 students may jeopardize their status if address information is not kept current. This requirement supports a university initiative to have accurate living information for students for official program/department/college/university notices, the ability to facilitate wellness checks, ensure international students are in compliance with visa requirements, etc.

Students can change their address using SIO, which is available via the HUB website: https://www.cmu.edu/hub/index.html

Students are typically expected to maintain residence in the Pittsburgh area, or at another site of work by arrangement with their thesis advisor. Alternate residence locations should be cleared with their thesis advisor, the Director of Graduate Studies, and the Department Head, as limits may be set by University policy, funding rules, or visa regulations.

4.10 New Policies

When graduate program policies or requirements are changed, it is because the department believes the new rules offer an improvement. Any such changes will be discussed at a town hall meeting with the graduate students. However, students currently enrolled whose degree program is affected by a change in policy may choose to be governed by the older policy that was in place at the time of their matriculation. In case degree requirements are changed and certain courses are no longer offered, the department will try to find some compromise that allows those students to satisfy the original requirements.

4.11 Vacations and Time-Off

Students with graduate assistantships are expected to continue with their research during academic breaks (including Summer months) with the exception of official university holidays

noted below.

Paid time off for personal business or vacation is in general not included as part of a graduate's financial support. However, every graduate student is entitled to two weeks per year of paid time off for personal business or vacation. A supported graduate student who wants to take such a short break (up to two weeks) must get approval from his/her advisor and, if required by the terms of the student's support package, might be asked to make up the work. Supported graduate students wishing to take longer periods of personal time off can do so without financial support and must receive approval from their advisor at least two weeks in advance. The advisor will notify the department's Business Office of any such arrangements so that an appropriate adjustment in the student's support package can be processed.

Official University Holidays:

- New Year's Day
- Martin Luther King Day
- Memorial Day
- Juneteenth
- Independence Day
- Labor Day
- Thanksgiving Day
- Day After Thanksgiving
- Day Before Christmas
- Christmas Day
- Day Before New Year's Day

A Some University Resources

A.1 Key Offices for Graduate Student Support

A.1.1 Office of Graduate and Postdoc Affairs

https://www.cmu.edu/graduate; grad-ed@cmu.edu

The Office of Graduate and Postdoc Affairs provides central support for master's and doctoral students, as well as academic programs, with a focus on supporting graduate student success at Carnegie Mellon.

Examples of resources offered through the Office of Graduate and Postdoc Affairs include but are not limited to:

- Website with university resources, contact information for CMU programs and services, calendar of events related to graduate students
- Bi-monthly newsletter to all graduate students with information on activities, resources and opportunities
- Professional Development Seminars and Workshops
- GSA/Provost Conference Funding Grants
- GSA/Provost Small Research Grants (GuSH)
- Consultations on issues related to the graduate student experience

The Office of Graduate and Postdoc Affairs also works with the colleges and departments by informing and assisting in developing policy and procedures relevant to graduate students and working with departments on issues related to graduate students. Additionally we partner with many other offices and organizations, such as the Graduate Student Assembly, to support the holistic graduate student educational experience.

A.1.2 Office of the Dean of Students

https://www.cmu.edu/student-affairs/dean

The Office of the Dean of Students provides central leadership of the metacurricular experience at Carnegie Mellon, including the coordination of student support. Vice President of Student Affairs and Dean of Students Gina Casalegno, leads the Division of Student Affairs which includes the offices and departments listed below (not an exhaustive list).

Graduate students will find the enrollment information for Domestic Partner Registration and Maternity Accommodations in the Office of the Dean of Students or on their website. This Office also manages the Student Emergency Support Funding process. There are three forms of support funding for enrolled students: emergency student loans, maternity loans, and the Tartan Emergency Support Fund. These funds are made available through generous gifts of alumni and friends of the university as well as support from student organizations, Undergraduate Student Senate and the Graduate Student Assembly. Students will be provided with additional information about the various types of funding during a consultation meeting with a member of the Dean of Students team. Tuition costs are not eligible for Student Emergency Support Funding.

Additional resources for graduate students include College Liaisons and the Student Support Resources team. College Liaisons are senior members of the Division of Student Affairs who work with departments and colleges addressing student concerns across a wide range of issues. College Liaisons are identified on the student SIO page in the Important Contacts list. The Student Support Resources team offers an additional level of support for students who are navigating any of a wide range of life events. Student Support Resources staff members work in partnership with campus and community resources to provide coordination of care and support appropriate to each student's situation.

- Athletics, Physical Education and Recreation
- Career and Professional Development Center (CPDC)
- Center for Student Diversity and Inclusion
- Cohon University Center
- Counseling & Psychological Services (CaPS)
- Dining Services
- Office of Community Standards and Integrity (OCSI)
- Office of Student Leadership, Involvement, and Civic Engagement (SLICE)
- University Health Services (UHS)
- Wellness Initiatives

A.1.3 Center for Student Diversity & Inclusion

https://www.cmu.edu/student-diversity/

Diversity and inclusion have a singular place among the values of Carnegie Mellon University. The Center for Student Diversity & Inclusion actively cultivates a strong, diverse and inclusive community capable of living out these values and advancing research, creativity, learning and development that changes the world.

The Center offers resources to enhance an inclusive and transformative student experience in dimensions such as access, success, campus climate and intergroup dialogue. Additionally, the Center supports and connects historically underrepresented students and those who are first in their family to attend college in a setting where students' differences and talents are appreciated and reinforced, both at the graduate and undergraduate level. Initiatives coordinated by the Center include, but are not limited to:

- First generation/first in family to attend college programs
- LGBTQ+ Initiatives
- Race and ethnically-focused programs, including Inter-University Graduate Students of Color Series (SOC) and PhD SOC Network
- Women's empowerment programs, including Graduate Women's Gatherings (GWGs)
- Transgender and non-binary student programs

A.1.4 Assistance for Individuals with Disabilities

https://www.cmu.edu/disability-resources/

The Office of Disability Resources at Carnegie Mellon University has a continued mission to provide physical and programmatic campus access to all events and information within the Carnegie Mellon community. We work to ensure that qualified individuals receive reasonable accommodations as guaranteed by the Americans with Disabilities Act (ADA) and Sections 503 and 504 of the Rehabilitation Act of 1973. Students who would like to receive accommodations can begin the process through Disability Resources secure online portal or email access@andrew.cmu.edu to begin the interactive accommodation process.

Students with physical, sensory, cognitive, or emotional disabilities are encouraged to self-identify with the Office of Disability Resources and request needed accommodations. Any questions about the process can be directed to access@andrew.cmu.edu, or call (412) 268-6121.

A.1.5 Eberly Center for Teaching Excellence & Educational Innovation

https://www.cmu.edu/teaching

We offer a wide variety of confidential, consultation services and professional development programs to support graduate students as teaching assistants or instructors of record during their time at Carnegie Mellon University and as future faculty members at other institutions. Regardless of one's current or future teaching context and duties, our goal is to disseminate evidence-based teaching strategies in ways that are accessible and actionable. Programs and services include campus-wide Graduate Student Instructor Orientation events and our Future Faculty Program, both of which are designed to help participants be effective and efficient in their teaching roles. The Eberly Center also assists departments in creating and conducting customized programs to meet the specific needs of their graduate student instructors. Specific information about Eberly Center support for graduate students can be found at: http://www.cmu.edu/teaching/graduatestudentsupport/index.html.

A.1.6 Graduate Student Assembly

https://www.cmu.edu/stugov/gsa/index.html

The Graduate Student Assembly (GSA) is the branch of Carnegie Mellon Student Government that represents, and advocates for the diverse interests of all graduate students at CMU. GSA is composed of representatives from the different graduate programs and departments who want to improve the graduate student experience at the different levels of the university. GSA is funded by the Student Activities Fee from all graduate students. GSA passes legislation, allocates student activities funding, advocates for legislative action locally and in Washington D.C. on behalf of graduate student issues and needs, and otherwise acts on behalf of all graduate student interests. Our recent accomplishments are a testament to GSA making a difference, and steps to implementing the vision laid out by the strategic plan: https://www.cmu.edu/stugov/gsa/About-the-GSA/Strategic-Plan.html. GSA offers an expanding suite of social programming on and off-campus to bring graduate students from different departments together and build a sense of community. GSA is the host of the Graduate Student Lounge on the 3rd floor of the Cohon University Center – a great place to study or meet up with friends. GSA also maintains a website of graduate student resources on and off-campus. Through GSA's continued funding for professional development and research conferences, the GSA/Provost Conference Funding Program and GSA/Provost GuSH Research Grants are able to run, as managed by the Graduate Education Office. As we move forward, GSA will continue to rely on your feedback to improve the graduate student experience at CMU. Feel free to contact us at gsa@cmu.edu to get involved, stop by our office in the Cohon University Center Room 304 or become a representative for your department.

A.1.7 Office of International Education (OIE)

https://www.cmu.edu/oie/

Carnegie Mellon hosts international graduate and undergraduate students who come from more than 90 countries. The Office of International Education (OIE) is the liaison to the University for all non-immigrant students and scholars, as well the repository for study abroad opportunities and advisement. OIE provides many services including: advising on personal, immigration, study abroad, academic, and social and acculturation issues; presenting programs of interest such as international career workshops, tax workshops, and cross-cultural and immigration workshops; international education and statistics on international students in the United States; posting pertinent information to students through email and the OIE website, and conducting orientation and pre-departure programs.

A.1.8 Veterans and Military Community

https://www.cmu.edu/veterans/

Military veterans are a vital part of the Carnegie Mellon University community. Graduate students can find information on applying veteran education benefits, campus services, veteran's groups at CMU, and non-educational resources through the Veterans and Military Community website. There are also links and connections to veteran resource in the Pittsburgh community. The ROTC and Veteran Affairs Coordinator can be reached at uro-vaedbenefits@andrew.cmu.edu, 412-268-8747.

A.1.9 Carnegie Mellon Ethics Hotline

https://www.cmu.edu/hr/resources/ethics-hotline.html

The health, safety and well-being of the university community are top priorities at Carnegie Mellon University. CMU provides a hotline that all members of the university community should use to confidentially report suspected unethical activity relating to areas below:

• Academic and Student Life

- Bias Reporting
- Environmental Health and Safety
- Financial Matters
- High-Risk Incident
- Human Resource Related
- Information Systems
- Research
- Threat of Business Interruption
- Threat of Violence or Physical Harm
- Title IX

Students, faculty and staff can anonymously file a report by calling 877-700-7050 or visiting http://www.reportit.net (user name: tartans; password: plaid). All submissions will be reported to appropriate university personnel.

The hotline is NOT an emergency service. For emergencies, call University Police at 412-268-2323.

A.1.10 Policy Against Retaliation

It is the policy of Carnegie Mellon University to protect from retaliation any individual who makes a good faith report of a suspected violation of any applicable law or regulation, university Policy or procedure, any contractual obligation of the university, and any report made pursuant to the Carnegie Mellon University Code of Business Ethics and Conduct. Additional details regarding the Policy Against Retaliation are available at https://www.cmu.edu/policies/administrative-and-governance/whistleblower.html

A.2 Key Offices for Academic & Research Support

A.2.1 Computing and Information Resources

https://www.cmu.edu/computing

Computing Services maintains and supports computing resources for the campus community, including the campus wired and wireless networks, printing, computer labs, file storage, email and software catalog. As members of this community, we are all responsible for the security of these shared resources. Be sure to review the Safe Computing (https://www.cmu.edu/computing/safe/) section and the University Computing Policy (https://www.cmu.edu/policies/information-technology/computing.html).

Visit the Computing Services website (https://www.cmu.edu/computing/) to learn more. For assistance the Computing Services Help Center is available at 412-268-4357 (HELP) or ithelp@cmu.edu.

A.2.2 Student Academic Success Center

https://www.cmu.edu/student-success/

Student Academic Support Programs

Tartan Scholars

The Tartan Scholars program was created to provide support for limited resourced students through an intentional first year undergraduate experience with the goals of enhancing the cohort's skill and community building through a lens of self-authorship, growth mindset, and a sense of belonging. As part of the Student Academic Success Center, Tartan Scholars are invited to join the University and participate in summer initiatives and pre-orientation activities prior to their first year at the University.

There are opportunities for graduate students to serve as accountability, learning, or development partners, workshop facilitators, and presenters. Contact Diane Hightower at ddhighto@andrew.cmu.edu for more details.

Learning Support

Supplemental Instruction: Supplemental Instruction (SI) is an academic support model that utilizes peer-assisted study sessions The SI program provides regularly scheduled review sessions on course materials outside the classroom. SI is a non-remedial approach to learning as the program targets high-risk courses and is available in select courses based on data related to past student performance and feasibility.

Peer Tutoring: Weekly Tutoring Appointments are offered in a one-on-one and small group format to students from any discipline who need assistance with a course that may not be supported by our other services. Weekly appointments give students the opportunity to interact regularly with the same tutor to facilitate deeper understanding of concepts. Students can register online through the Student Academic Success website.

Academic Coaching: Academic Coaching provides holistic one-on-one peer support and group workshops to help students find and implement their conditions for success. We assist students in improving time management, productive habits, organization, stress management, and study skills. Students will request support through the Academic Success Center website and attend in-person meetings or meet using video and audio conferencing technology to provide all students with support.

"Just in Time" Workshops: The Student Academic Success team is available to partner with instructors and departments to identify skills or concepts that would benefit from supplemental offerings (workshops, boot camps) to support students' academic success and learning. We are eager to help convene and coordinate outside of the classroom skill-building opportunities that can be open to any student interested in building skill or reinforcing course concept mastery.

Study Partners: Support for students to create and benefit from their own study groups: The Student Academic Success team assists students in forming and benefiting from peer study groups, whereby all students can reap the benefits of peer-to-peer learning, student agency, and collaboration skill development. Staff from the Student Academic Success

Center will be made available to instructors and students to assist with the formation of peer-led study groups. This level of support is open to any course where the instructor requests or agrees such support is appropriate and students are interested in both leading and participating.

Language and Cross-cultural Support

More than 60% of graduate students at Carnegie Mellon are international students, and others are nonnative speakers of English who have attended high school or undergraduate programs in the US. Many of these students want to hone their language and cross-cultural skills for academic and professional success. Students can choose from sessions on

- how to give a strong presentation
- writing academic emails,
- expectations and strategies for clear academic writing,
- how to talk about yourself as a professional in the U.S.,
- developing clearer pronunciation,
- using accurate grammar,
- building fluency, and more.
- Students can make an appointment with a Language Development Specialist to get individualized coaching on language or cross-cultural issues.

The Student Academic Success Center is also charged with certifying the language of International Teaching Assistants (ITAs), ensuring that nonnative English speakers have the language proficiency needed to succeed as teaching assistants in the Carnegie Mellon classroom. Students preparing to do an ITA Certification should plan to take classes offered by the language support team at the SASC from the beginning of their first semester. Start by contacting the language support team at the SASC website or attend a Language Support Orientation at the SASC or in your department.

A.2.3 University Libraries

https://www.library.cmu.edu

The University Libraries offers a wide range of information resources and services supporting graduate students in course-work, research, teaching, and publishing. The library licenses and purchases books, journals, media and other needed materials in various formats. Library liaisons, consultants and information specialists provide in-depth and professional assistance and advice in all-things information – including locating and obtaining specific resources, providing specialized research support, advanced training in the use and management of data. Sign up for workshops and hands-on topic-specific sessions such as data visualization with Tableau, cleaning data with OpenRefine, and getting started with Zotero. Weekly drop-in hours for Digital Humanities and for Research Data Research Management are scheduled during the academic year. Start at the library home page to find the books, journals and databases you need; to identify and reach out to the library liaison in your field; to sign up for scheduled workshops; and to connect with consultants in scholarly publishing, research data management, and digital humanities.

A.2.4 Research at CMU

https://www.cmu.edu/research/index.html

The primary purpose of research at the university is the advancement of knowledge in all fields in which the university is active. Research is regarded as one of the university's major contributions to society and as an essential element in education, particularly at the graduate level and in faculty development. Research activities are governed by several university policies. Guidance and more general information is found by visiting the Research at Carnegie Mellon website.

A.2.5 Office of Research Integrity & Compliance

https://www.cmu.edu/research-compliance/index.html

The Office of Research Integrity & Compliance (ORIC) is designed to support research at Carnegie Mellon University. The staff work with researchers to ensure research is conducted with integrity and in accordance with federal and Pennsylvania regulation. ORIC assists researchers with human subject research, conflicts of interest, responsible conduct of research, export controls, intellectual property rights and regulations, and institutional animal care and use. ORIC also consults on, advises about and handles allegations of research misconduct.

A.3 Key Offices for Health, Wellness & Safety

A.3.1 Counseling & Psychological Services

https://www.cmu.edu/counseling/

Counseling & Psychological Services (CaPS) affords the opportunity for students to talk privately about academic and personal concerns in a safe, confidential setting. An initial consultation at CaPS can help clarify the nature of the concern, provide immediate support, and explore further options if needed. These may include a referral for counseling within CaPS, to another resource at Carnegie Mellon, or to another resource within the larger Pittsburgh community. CaPS also provides workshops and group sessions on mental health related topic specifically for graduate students on campus. CaPS services are provided at no cost. Appointments can be made in person, or by telephone at 412-268-2922.

A.3.2 Health Services

https://www.cmu.edu/health-services/

University Health Services (UHS) is staffed by physicians, advanced practice clinicians and registered nurses who provide general medical care, allergy injections, first aid, gynecological care and contraception as well as on-site pharmaceuticals. The CMU Student Insurance Plan covers most visit fees to see the physicians and advanced practice clinicians & nurse visits.

Fees for prescription medications, laboratory tests, diagnostic procedures and referral to the emergency room or specialists are the student's responsibility and students should review the UHS website and their insurance plan for detailed information about the university health insurance requirement and fees.

UHS also has a registered dietician and health promotion specialists on staff to assist students in addressing nutrition, drug and alcohol and other healthy lifestyle issues. In addition to providing direct health care, UHS administers the Student Health Insurance Program. The Student Health Insurance plan offers a high level of coverage in a wide network of health care providers and hospitals. Appointments can be made by visiting UHS's website, walk-in, or by telephone, 412-268-2157.

A.3.3 Campus Wellness

https://www.cmu.edu/wellness/

At Carnegie Mellon, we believe our individual and collective well-being is rooted in healthy connections to each other and to campus resources. The university provides a wide variety of wellness, mindfulness and connectedness initiatives and resources designed to help students thrive inside and outside the classroom. The BeWell@CMU e-newsletter seeks to be a comprehensive resource for CMU regarding all wellness-inspired events, announcements and professional and personal development opportunities. Sign up for the Be Well monthly newsletter via https://bit.ly/BeWellNewsletter or by contacting the Program Director for Student Affairs Wellness Initiatives, at alusk@andrew.cmu.edu.

A.3.4 Religious and Spiritual Life Initiatives (RSLI)

https://www.cmu.edu/student-affairs/spirituality

Carnegie Mellon is committed to the holistic growth of our students, including creating opportunities for spiritual and religious practice and exploration. We have relationships with local houses of worship from various traditions and many of these groups are members of CMU's Council of Religious Advisors. We also offer programs and initiatives that cross traditional religious boundaries in order to increase knowledge of and appreciation for the full diversity of the worldview traditions. Our RSLI staff are here to support students across thespectrum of religious and spiritual practice and would be more than happy to help you make a connection into a community of faith during your time at CMU.

A.3.5 University Police

https://www.cmu.edu/police

412-268-2323 (emergency only), 412-268-6232 (non-emergency)

The University Police Department is located at 300 South Craig Street (entrance is on Filmore Street). The department's services include police patrols and call response, criminal investigations, fixed officer and foot officer patrols, event security, and crime prevention and education programming as well as bicycle and laptop registration. Visit the department's website for additional information about the staff, emergency phone locations, crime prevention, lost and found, finger print services, and annual statistic reports.

Carnegie Mellon University publishes an annual campus security and fire safety report describing the university's security, alcohol and drug, sexual assault, and fire safety policies and containing statistics about the number and type of crimes committed on the campus and the number and cause of fires in campus residence facilities during the preceding three years. Graduate students can obtain a copy by contacting the University Police Department at 412-268-6232. The annual security and fire safety report is also available online at https://www.cmu.edu/police/annualreports/.

Shuttle and Escort Services

Parking and Transportation coordinates the Shuttle Service and Escort Service provided for CMU students, faculty, and community. The Shuttle & Escort website has full information about these services, stops, routes, tracking and schedules.

A.4 The WORD

https://www.cmu.edu/student-affairs/theword/

The WORD is Carnegie Mellon University's student handbook and serves as the foundation for the department (and sometimes college) handbook. The WORD contains university-wide academic policy information and resources, community policies and resources, and describes the university level procedures used to review possible violations of these standards. It is designed to provide all students with the tools, guidance, and insights to help you achieve your full potential as a member of the Carnegie Mellon community.

Information about the following is included in The WORD (not an exhaustive list) and graduate students are encouraged to bookmark this site and refer to it often. University policies can also be found in full text at https://www.cmu.edu/policies/.

Carnegie Mellon Vision, Mission Statement of Assurance Carnegie Code

Academic Standards, Policies and Procedures Educational Goals Academic and Individual Freedom Statement on Academic Integrity Standards for Academic & Creative Life Assistance for Individuals with Disabilities Master's Student Statute of Limitations Conduct of Classes Copyright Policy Cross-college & University Registration

Doctoral Student Status Policy Evaluation & Certification of English Fluency for Instructors Final Exams for Graduate Courses Grading Policies Intellectual Property Policy **Privacy Rights of Students** Research Human Subjects in Research Office of Research Integrity & Compliance Office of Sponsored Programs Policy for Handling Alleged Misconduct of Research Policy on Restricted Research Student's Rights Tax Status of Graduate Student Awards Campus Resources & Opportunities Alumni Relations Assistance for Individuals with Disabilities Athletics, Physical Fitness & Recreation Carnegie Mellon ID Cards and Services Cohon University Center Copying, Printing & Mailing Division of Student Affairs Domestic Partner Registration Emergency Student Loan Program Gender Programs & Resources Health Services **Dining Services** The HUB Student Services Center **ID** Card Services Leonard Gelfand Center LGBTQ Resources Multicultural and Diversity Initiatives **Opportunities for Involvement** Parking and Transportation Services SafeWalk Survivor Support Network Shuttle and Escort Services Spiritual Development University Police Student Activities University Stores Community Standards, Policies and Procedures Alcohol and Drugs Policy AIDS Policy

Bicycle/Wheeled Transportation Policy Damage to Carnegie Mellon Property **Deadly Weapons Discriminatory Harassment Disorderly Conduct** Equal Opportunity/Affirmative Action Policy Freedom of Expression Policy Health Insurance Policy Immunization Policy Missing Student Protocol Non-Discrimination Policy **On-Campus** Emergencies Pets **Political Activities Recycling Policy** Riotous and Disorderly Behavior Safety Hazards Scheduling and Use of University Facilities Sexual Harassment and Sexual Assault Policy **Smoking Policy** Student Accounts Receivable and Collection Policy and Procedures Student Activities Fee Student Enterprises Workplace Threats and Violence Policy

B Rubrics for Evaluation of Research Performance

B.1 Rubric for Research Performance Before Ph.D. Candidacy

Please rate the student's progress in her/his research project using the following criteria.

- Student acquires basic knowledge about the underlying physics principles governing her/his research project:
 - $\bigcirc \mathbf{A} \text{ (exceeds)} \bigcirc \mathbf{B} \text{ (meets)} \bigcirc \mathbf{C} \text{ (below)} \bigcirc \mathbf{D} \text{ (poor)} \bigcirc \mathbf{N/A} \text{ (not observed)}$
- Student is curious and passionate about her/his research project:
 - \bigcirc A (exceeds) \bigcirc B (meets) \bigcirc C (below) \bigcirc D (poor) \bigcirc N/A (not observed)
- Student demonstrates potential toward creativity in applying scientific ideas to solve the research problem at hand:
 - $\bigcirc \mathbf{A} \text{ (exceeds)} \bigcirc \mathbf{B} \text{ (meets)} \bigcirc \mathbf{C} \text{ (below)} \bigcirc \mathbf{D} \text{ (poor)} \bigcirc \mathbf{N/A} \text{ (not observed)}$
- Student is self-motivated and dedicated to the research project; it is becoming evident that she/he will be the active driver of a given research project:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \bigcirc \mathbf{B} \text{ (meets)} \bigcirc \mathbf{C} \text{ (below)} \bigcirc \mathbf{D} \text{ (poor)} \bigcirc \mathbf{N/A} \text{ (not observed)}$

• Student understands the relative priorities of the research project and focuses her/his efforts on the work needed to move the project forward:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \bigcirc \mathbf{B} \text{ (meets)} \bigcirc \mathbf{C} \text{ (below)} \bigcirc \mathbf{D} \text{ (poor)} \bigcirc \mathbf{N/A} \text{ (not observed)}$

• Student communicates effectively with her/his advisor by pro-actively seeking advice and accepting constructive criticism:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \bigcirc \mathbf{B} \text{ (meets)} \bigcirc \mathbf{C} \text{ (below)} \bigcirc \mathbf{D} \text{ (poor)} \bigcirc \mathbf{N/A} \text{ (not observed)}$

• Student develops independence as the research project progresses, indicating the ability to identify and find resources needed to solve problems:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \bigcirc \mathbf{B} \text{ (meets)} \bigcirc \mathbf{C} \text{ (below)} \bigcirc \mathbf{D} \text{ (poor)} \bigcirc \mathbf{N/A} \text{ (not observed)}$

• Student displays overall professional behavior and follows all university guidelines regarding academic integrity and responsible conduct of research:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \bigcirc \mathbf{B} \text{ (meets)} \bigcirc \mathbf{C} \text{ (below)} \bigcirc \mathbf{D} \text{ (poor)} \bigcirc \mathbf{N/A} \text{ (not observed)}$

• If applicable, student follows all regulations governing safety and best practices in laboratory settings, in particular while operating equipment and handling potentially dangerous substances:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \bigcirc \mathbf{B} \text{ (meets)} \bigcirc \mathbf{C} \text{ (below)} \bigcirc \mathbf{D} \text{ (poor)} \bigcirc \mathbf{N/A} \text{ (not observed)}$

• Proposed overall grade for grading period Fall / Spring / Summer _____:

 $A+\ \dots\ A\ \dots\ A-\ \dots\ B+\ \dots\ B\ \dots\ B-\ \dots\ C+\ \dots\ C\ \dots\ C-\ \dots\ D+\ \dots\ D+\ \dots$

B.2 Rubric for Research Performance After Ph.D. Candidacy

• Student is curious and passionate about her/his research project, demonstrating creativity in applying scientific ideas to solve the research problems at hand:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \dots \bigcirc \mathbf{B} \text{ (meets)} \dots \bigcirc \mathbf{C} \text{ (below)} \dots \bigcirc \mathbf{D} \text{ (poor)}$

• Student is self-motivated and dedicated to the research project, becoming the active driver toward an excellent Ph.D. thesis in a timely manner:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \dots \bigcirc \mathbf{B} \text{ (meets)} \dots \bigcirc \mathbf{C} \text{ (below)} \dots \bigcirc \mathbf{D} \text{ (poor)}$

• Student understands the relative priorities of the research project and focuses her/his efforts on the work needed to complete a Ph.D.:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \dots \bigcirc \mathbf{B} \text{ (meets)} \dots \bigcirc \mathbf{C} \text{ (below)} \dots \bigcirc \mathbf{D} \text{ (poor)}$

- Student communicates effectively with her/his advisor by pro-actively seeking advice, accepting constructive criticism, and being willing to adjust, as needed, her/his methodology:
 - $\bigcirc \mathbf{A} \text{ (exceeds)} \dots \bigcirc \mathbf{B} \text{ (meets)} \dots \bigcirc \mathbf{C} \text{ (below)} \dots \bigcirc \mathbf{D} \text{ (poor)}$
- Student develops independence as the Ph.D. research progresses, taking it upon herself/himself to identify and find resources needed to solve problems:
 - $\bigcirc \mathbf{A} \text{ (exceeds)} \dots \bigcirc \mathbf{B} \text{ (meets)} \dots \bigcirc \mathbf{C} \text{ (below)} \dots \bigcirc \mathbf{D} \text{ (poor)}$
- Student assumes responsibility for the advancement of the research group that she/he joins, recognizing that science is a collaborative effort:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \dots \bigcirc \mathbf{B} \text{ (meets)} \dots \bigcirc \mathbf{C} \text{ (below)} \dots \bigcirc \mathbf{D} \text{ (poor)}$

• Student takes responsibility for developing professional presentation skills, allowing her/him to communicate research findings to professionals within their subfield and the broader physics community, as well as being capable of producing well-written drafts for publications:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \dots \bigcirc \mathbf{B} \text{ (meets)} \dots \bigcirc \mathbf{C} \text{ (below)} \dots \bigcirc \mathbf{D} \text{ (poor)}$

• Student displays overall professional behavior and follows all university guidelines regarding academic integrity and responsible conduct of research:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \dots \bigcirc \mathbf{B} \text{ (meets)} \dots \bigcirc \mathbf{C} \text{ (below)} \dots \bigcirc \mathbf{D} \text{ (poor)}$

• If applicable, student follows all regulations governing safety and best practices in laboratory settings, in particular while operating equipment and handling potentially dangerous substances:

 $\bigcirc \mathbf{A} \text{ (exceeds)} \dots \bigcirc \mathbf{B} \text{ (meets)} \dots \bigcirc \mathbf{C} \text{ (below)} \dots \bigcirc \mathbf{D} \text{ (poor)}$

• Proposed overall grade for grading period Fall / Spring / Summer _____ : A+ ... A ... A- ... B+ ... B ... B- ... C+ ... C ... C- ... D+ ... D

C Guidance for Graduate Students Taking the Oral Qualifying Exam

Illustrative Guidance Given for the May 2021 Exam

(this was during the COVID era when the orals were held over Zoom)

Oral Qualifying Exam Committee: Tiziana Di Matteo, Randall Feenstra, Tina Kahniashvili, Colin Morningstar (chair), Sara Majetich, Manfred Paulini, Michael Widom

Key Dates:

May 7, 2021 Deadline for submitting 6-page write up May 24-28, 2021 Examinations

C.1 Introduction

The purpose of the oral qualifying exam is to evaluate the student's ability to (1) apply knowledge from course work to the research they have performed, (2) present a coherent talk to scientists outside of their field, and (3) answer questions on the student's research projects and the physics concepts involved.

Students in the Ph.D. graduate program are required to take the oral qualifying exam in their second year of graduate studies. The oral qualifying exam is administered by a committee with faculty from multiple research areas. The exam is given in January and in May of each year. If the oral qualifying exam is not passed on the first attempt, students are allowed a second chance when the next exam is given.

C.2 Examination Procedure

The oral exam will be administered via Zoom, on Monday through Friday, May 24-28, 2021. The chair of the oral qualifying exam committee will meet via Zoom with all students taking the exam in mid-April to discuss the exam. Time slot assignments for taking the exam will be randomly selected. The chair email is cmorning@andrew.cmu.edu.

C.2.1 Presentation

At the start of the exam period, students will give a 30-minute presentation about their research from the first to the current semester, highlighting what the student considers the most important and interesting aspects of the performed research. Remember that the presentation must be understandable to scientists outside of your field, so symbols and terminology must be clearly defined, and pertinent background information must be included.

If a student has switched research topics, the student must decide which single research topic to present for the oral qualifying exam. However, presenting the topic most closely aligned with their longer-term research direction is advised. Since the exam will be given via Zoom, the format of the presentation must be in the form of prepared beamer or power-point-type slides. To facilitate questions, **slide numbers** are mandatory.

The first 10 minutes of the talk must focus on pertinent background information relevant to the research such as would be given during a physics colloquium. During this initial time, you must identify some basic physics concepts from prior undergraduate and/or first-year graduate courses that is important to your work and describe how it connects to your research. *Failure to do this will most likely result in a fail grade for the exam.*

The talk is limited to 30 minutes. Students will be stopped at the end of 30 minutes, and the grade on that part of the exam will only reflect the material that the student did cover. It is advisable to practice keeping within the time limit and to practice using Zoom.

C.2.2 Question Period

After the student's 30-minute presentation, members of the exam committee will ask questions related to the **student's research** as well as about any **basic physics** concepts the committee members find relevant to the presented research topic. The question period will typically last about one hour.

C.2.3 Evaluation

The oral qualifying committee will provide a rubric by early May which will be used to evaluate the student's performance on the presentation and question period. The exam is graded pass/fail. The student's research advisor can be present during the exam as a silent observer and can be consulted for context at the beginning of the committee deliberations. If a student's advisor is also a member of the oral exam committee, she/he will be replaced by another faculty for this student's examination.

C.2.4 Preparation

The talk should reflect the student's own understanding and knowledge of the presented research topic and its connection to past physics course work. It is important that the committee can evaluate each student's synthesis of what they have learned during the time of their research project. Hence, students must prepare their presentation on their own, without receiving specific feedback from the advisor or other physics students. Students are not allowed to receive coaching in actually deciding what information to include in their presentation. Rehearsing the talk with faculty or other students is not permitted.

Students are allowed to receive help of a **general nature** in preparing their presentations. Students may practice their talk in front of (non-scientist) friends or family and receive general help to improve the presentation and timing, and get pointers on speaking clearly and creating effective and interesting slides.

While preparing the presentation, if students discover that they do not understand some

aspect of their research, the motivations for the research, or some background information relevant to the research, or students simply wish to learn more about physics related to their research, they may consult with their advisors or other sources.

C.2.5 Connections to Prior Physics Courses

The connections to physics topics learned in past undergraduate and/or first-year graduate physics courses can be made through any aspect of the project and its background. Either one detailed connection with some equations or two or three less detailed connections with less equations should be presented.

Some examples are given below:

- An important classical symmetry could be connected to a conserved quantity by Noether's theorem, so Noether's theorem should be briefly described.
- Important selection rules could be connected to the Wigner-Eckert theorem, which should then be briefly discussed.
- Particle decelerations might be detected through their bremsstrahlung radiation, which would then be briefly described.
- If spectral lines are important to one's research, then details about such lines should be discussed.
- If radiation distributions from black bodies are important, then details concerning black body radiation and its thermal properties should be briefly described.

C.3 Write-up of the Oral Exam Subject

To assist the committee in preparing questions that are fair, reasonably consistent, and appropriate in level for a student at this stage of their graduate career, students must submit a brief write-up on the research and connections to course work that the student plans to present during the oral qualifying exam. Although the exam committee is requesting a certain format for this write-up, the quality of the write-up is **not part of the exam evaluation** (pass/fail grade) as long as the student makes a reasonable effort to follow the guidelines. Students who submit incomplete or unsatisfactory reports will be required to re-submit a revised report.

As is the case with the exam presentation, the write-up should be the work of the student, without editing or feedback/comments on the writing from the advisor or other people in the research group. Students can, of course, talk with their advisor to seek additional clarification about aspects of their project (or suggestions for references to read), just as they do when questions arise while working on their research project.

The length guidelines given below should be followed carefully to ensure that the committee sees a reasonably uniform set of write-ups. This may require the students to carefully organize and think about how to summarize their work, rather than giving a step-by-step description of all work that was undertaken. The exam committee hopes that working on this write-up will assist the student in planning the outline of the exam presentation. The research write-up should be turned in by e-mail to the chair of the oral qualifying exam committee (cmorning@andrew.cmu.edu) with a cc to the student's research advisor by **Friday, May 7, 2021**. A pdf file is the preferred file type. If the given deadline constitutes an unusual issue for a student, please contact the exam committee chair.

C.3.1 Write-up Format

Please compose your report using the outline below, including the headings provided. The outline below suggests a maximum length of six pages of text excluding figures, tables, and references. There is no strict minimum length requirement. Students should use their judgment as to how much space they need to adequately cover the requested content of each section. The write-up should use 12 point font, with 1 inch margins on each side. It should be written so it can be understood by a physicist working in another field (e.g. give the meaning of acronyms when they are first used).

- 1. **Title:** Provide a title, and remember to state your name and the name of your advisor. Do not include an abstract.
- 2. Introductory Background Information and Motivation: (up to 2 pages) Include a description of the basic research area, the specific problem that the research project is meant to address, and its scientific importance in the context of the field. List the particular topics that will be presented as background information.
- 3. Connection to Physics Topics from Prior Courses: (1 or 2 paragraphs) Identify connections from your prior undergraduate and/or first-year graduate courses that is important to your work and describe how it connects to your research.
- 4. Methods and Approach: (up to 1 page) Include a description of the chosen methods used to carry out the research. How are they helpful to address the research problem? What are underlying assumptions or limitations of these methods?
- 5. Status and Results: (up to 2 pages) Include a description of results (if any) and their interpretation. What do the results mean for the problem that the student is trying to address? These may be preliminary results if the project is not complete, project milestones reached, or even a statement that there are no results yet and why. If there are preliminary results, the student should clearly describe them and show an understanding of their implications (e.g., if preliminary findings mean that the methodology has to be updated, that more data is needed, etc.). If there are no results at all, the student should describe what steps were taken in solving the existing problems and what the student knows about why the project has failed to produce results.
- 6. Conclusions and Next Steps: (up to 1 page) Include a summary of the state of the project in light of the preliminary results. Briefly discuss further work that needs to be done, lessons learned (e.g., about applicability of the adopted methods), and relevance to the overall research area.

- 7. Figures or Tables: Students may include figures or tables as needed to illustrate their research problem, experimental method, and/or results. They can refer to these figures/tables in the text of their writeup where needed. Figures or tables should come with descriptive captions and will not count toward the suggested page limits.
- 8. **References** Students may include a list of references from the literature (e.g., for experimental methodology, review articles they found helpful in their research area, etc.). There is no limitation on the length of the list. Students should cite the references where appropriate in the text of their writeup.