AUBURN UNIVERSITY

COLLEGE OF SCIENCES
AND MATHEMATICS

Department of Physics

Graduate Student Handbook

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1 Introduction and Overview

Welcome to the Department of Physics at Auburn University. We take pride in our long tradition of fostering a collegial, collaborative, and supportive academic environment, with departmental faculty, staff, and administration strongly committed to excellence in graduate education and research.

This handbook is an informational resource to both graduate students and faculty, outlining the procedures and paperwork needed to satisfy both Department and Graduate School requirements for a graduate degree. In addition, the handbook outlines the guidelines and standard practices of the Department, College and Graduate School as students proceed through their graduate school career in the Auburn Department of Physics. For exceptional cases, modifications to these guidelines for individual students are possible, subject to approval of the Department Chair in consultation with advising faculty and the Graduate Program Officer.

We encourage any faculty, staff or students to contact the Graduate Program Officer with comments or questions regarding this handbook or the program in general.

1.1 Overview

With more than 20 full-time faculty members, approximately 70 graduate students, and approximately 60 undergraduate physics majors, each student in the department receives the sort of individual attention that is usually only available at much smaller universities. Meanwhile, the department maintains a variety of vibrant research groups, currently clustered in five major areas:

1. **Atomic, Molecular, Optical (AMO) physics** with an emphasis on interactions with ionizing radiation and ultra-fast laser pulses as well as AMO processes in space,
2. **Biophysics** with an emphasis on the physics of molecular transport systems within and among cells and computational biophysics, particularly on mechanobiology,
3. **Condensed matter physics** with an emphasis on semiconductors, novel low-dimensional materials and electronic devices,
4. **Physics Education Research (PER)** with an emphasis on studying authentic problem-solving in STEM as well as student experience and performance in introductory STEM courses,
5. **Plasma physics** with an emphasis on magnetic fusion related plasma physics and dusty plasmas,
6. **Space physics** exploring the Earth's magnetosphere with an emphasis on computational methods applied to space plasma dynamics and satellite data.

In recent years, the department has invested heavily in state-of-the-art laboratory equipment and computational facilities, and most recently the Department has moved to a new Physics building. Our graduate students have an opportunity to choose among a wide range of research projects to pursue a graduate degree through collaboration with teams of fellow graduate students, post-doctoral researchers and faculty members, both on campus and across the globe.

To serve our graduate students with diverse academic and personal backgrounds, exceptions to some guidelines in this handbook are possible. All requests for exceptions should be made directly to the Department Chair and/or Graduate Program Officer, who will consult with the student's advisor, committee and additional faculty members as needed. It is also important to emphasize that not all exception requests are approved. The Graduate Program Officer (GPO) will review this Handbook annually by the end of each Spring semester, and recommend revisions for approval by the Physics Graduate Faculty, if needed.

1.2 Financial Support

Financial stipends are provided for both graduate teaching assistants (GTAs) and research assistants (GRAs). The teaching assistantships are awarded by the Department Chair, and the research assistantships are awarded by the individual faculty members. All prospective Ph.D. students will be automatically considered for the full-time GTA support. No separate application for financial aid is required. Tuition waivers will be issued by the Graduate School for full-time GTAs or GRAs. A graduate student is allowed to take graduate-level hours without paying tuition for his/her degree study up to 110% of degree requirements. Therefore, up to 33 credit hours for the M.S. degree and 66 credit hours for the Ph.D. degree are included in this tuition waiver. Note that students not on assistantships during the semester of their graduation will not receive the waiver for that semester, so it is strongly encouraged to schedule a final defense to take place before beginning employment outside of Auburn University.

Graduate students in the department typically begin their graduate career as Graduate Teaching Assistants (GTAs). When the student begins research in earnest, a graduate research assistantship (GRA) will usually be offered. However, when a GRA is not available, the department *may* offer a teaching assistantship to a graduate student who is making adequate academic progress toward his/her degree. GTAs will lead laboratory/activity classes in the 1000- and 2000-level introductory physics courses, or perform other comparable duties in support of the Department's teaching effort. As detailed below, once the student matriculates into the Ph.D. program, they become eligible for a stipend increase of $1000/year.

In order to maintain a graduate assistantship, it is expected that a student continues to make adequate progress toward a degree. During PhD studies, this includes the following:

1. **Maintain a minimum 3.0 GPA**,
2. **Maintain a level of performance deemed acceptable by the major professor while active in a research program**.

Failure to meet any of these expectations may result in the withdrawal of financial support. If this situation should arise, the student and the advisor will meet with the GPO and Department Chair, and an appropriate course of action will be determined.

1.3 Department Contact Information

Administration

Chair	Prof. Allen Landers	4-4264	landeal@auburn.edu
Associate Chair	Prof. David Maurer	4-7809	dam0014@auburn.edu
Graduate Program Officer	Prof. Guillaume Laurent	4-8712	glaurent@auburn.edu
Office Manager	Ms. Mary Prater	4-4614	mlp0077@auburn.edu
Accountant	Ms. Jahneel Tyrell	4-4626	jst0052@auburn.edu
Office Assistant	Ms. Glenda Stroud	4-4264	gms0015@auburn.edu

Graduate Admissions Committee

Chair Domestic	Prof. David Ennis	4-4366	dae0005@auburn.edu
Chair International	Prof. Sarit Dhar	4-4755	szd0024@auburn.edu
Domestic	Prof. Eric Burkholder	4-4204	ewb0026@auburn.edu
Domestic	Prof. Michael Fogle	4-4280	fogle@auburn.edu
International	Prof. Jianjun Dong	4-2943	dongjia@auburn.edu
International	Prof. Rafael Bernardi	4-4393	rcbernardi@auburn.edu
GPO	Prof. Guillaume Laurent	4-8712	glaurent@auburn.edu

General Doctoral Examination Committee

Chair	Prof. Jianjun Dong	4-2943	dongjia@auburn.edu
Classical Mechanics	Prof. Luca Guazzotto	4-4692	lzg0022@auburn.edu
Electromagnetism	Prof. Evdokiya Kostadinova	4-4298	egk0033@auburn.edu
Statistical Mechanics	Prof. Marcelo Kuroda	4-4617	mkuroda@auburn.edu
Quantum Mechanics	Prof. Stuart Loch	4-5154	lochstu@auburn.edu
GPO	Prof. Guillaume Laurent	4-8712	glaurent@auburn.edu

Director of Instructional Laboratories

	Dr. David Crawford	4-2950	dec0014@auburn.edu

Physics Graduate Student Association leadership

President	Nick Holland	nzh0078@auburn.edu
Vice-President	Ash Coleman	aec0189@auburn.edu
Secretary	Gabriel Presotto	gap0054@auburn.edu
Treasurer	Evan Pate	ezp0073@auburn.edu

1.4 Useful Weblinks

The Graduate School Bulletin is a resource for all graduate students at Auburn University and the Physics Graduate Study page describes the graduate program specific to Physics. Additional useful information can also be found at the websites for both the Department of Physics and the Graduate School.

- Auburn University Bulletin
- Graduate School Policies
- Department of Physics Homepage
- Department of Physics Graduate Study
- Doctoral Completion Checklist
- Master's Completion Checklist
- University Counseling Services

2 Admissions

The Department of Physics welcomes applications from prospective students with an interest in our graduate and research programs. Prospective students should have a bachelor's (or equivalent) degree in physics or a related field and should apply online at the Auburn University Graduate School webpage. **Detailed application instructions can be found at:** Application Instructions

Under the category Admissions Information, applicants should select Physics/PHD as their Planned Course of Study. The following information is required for a complete application:

1. Undergraduate and graduate transcripts
2. The names and contact information for three Recommendation Providers
3. General GRE scores (international students only)
4. TOEFL scores (international students only)

Applications submitted by January 15 will receive full consideration for the upcoming academic year that begins August 15. In special cases, the Department will accept mid-year applications.

3 Degree Programs and Requirements

Currently, Auburn University's Department of Physics Graduate Program offers three distinct doctoral degrees:

- **Master of Science non-thesis (MSNT)**
- **Master of Science with thesis (MST)**
- **Doctor of Philosophy (Ph.D.)**

The majority of physics graduate students enter our graduate program as Ph.D. students. During the first two years, the initial course requirements for both the Ph.D. and M.S. degrees are identical. As a result, Ph.D. students are awarded a M.S., when the requirements of the M.S. degree have been met. This also allows for a high level of flexibility should the student decide to switch to a terminal M.S. program during the first two years.

3.1 Master's Programs

A Master of Science Degree in Physics is often required for entry level teaching positions in junior colleges and for many research-related positions at government and industrial laboratories. It requires about two years of coursework and provides an excellent grounding in fundamental physics at the advanced level. Thirty (30) credit hours of coursework are required for the M.S. degree as listed below:

Courses	Total Hrs	Course #
Core Courses	18	PHYS 7100, 7200, 7250, 7300, 7350, 7400
Colloquium	3	PHYS 7950
Electives MSNT:	9	PHYS 6000-, 7000-, or 8000-level
Electives MST:	3-4	PHYS 7990 and
	6-5	PHYS 6000-, 7000-, or 8000-level
Total	**30**	

Table 1: Master of Science degree: Course requirements.

All Master's candidates work under the direction of **an advisory committee** through the completion of their M.S. degree. For a Non-Thesis M.S. degree, only a major professor (often the Graduate Program Officer) is required. For a Thesis M.S. degree, the advisory committee is composed of three members recommended by the Graduate Program Officer in collaboration with the major professor (committee chair) and Department Chair. Two must be members of the Auburn University graduate faculty. The committee chair (or one of the co-chairs) must be a graduate faculty member in the Department of Physics. This committee will approve the student's program of study, conduct required examinations and direct the required field project or thesis. The names of the committee member(s) are submitted to the Graduate School by filing a Committee Selection Form.

3.1.1 M.S. Non-Thesis Option

For students who are planning a teaching career or who are on their way to a Ph.D., the M.S. with the non-thesis option is recommended. At least nine (9) credit hours of 6000-, 7000-, or 8000-level physics courses may be applied as electives to complete the required 30 credit hours. Up to three (3) credit hours of Independent Study in Physics (PHYS7900) and Independent Study in Advanced Physics (PHYS8900) can be included as allowed electives. Requests for substituting one physics elective course with a graduate level course from other Auburn University departments should be made to the GPO. In addition to the Graduate School requirement of a minimum 3.0 cumulative GPA in all graduate level course, a student must further achieve a minimum 2.8 GPA in the six physics graduate core courses (total 18 credit hours) to receive a non-thesis M.S. degree. Students may re-take one or more core courses in order to improve their GPA, but no substitutions to any of the six core courses are allowed. A student who has a 3.0 and above cumulative graduate GPA, yet does not achieve the 2.8 GPA requirement in the six core courses might still be awarded a non-thesis M.S. degree if he/she takes the GDE and achieves a qualifying score on each of the four parts of the GDE.

It is expected that a student will complete the non-thesis option within two years of entering the graduate program. In rare cases, extensions may be granted following a request in writing submitted to the Graduate Program Officer and Department Chair.

3.1.2 M.S. Thesis Option

A student must conduct a thesis research project under the guidance of a major professor and Research Committee, and successfully defend his/her thesis. A Master's thesis fully details the research performed under the direction of the major professor, and must be approved by the advisory committee before graduation. Four to six (4-6) credit hours of Research and Thesis (PHYS 7990) are required for the thesis option. The rest of the required thirty (30) credit hours may be fulfilled with graduate level physics electives or substituting non-physics courses approved by the GPO. PHYS 7900 or PHYS 8900 are not counted as the allowed electives for the thesis option. There is no minimum core-course GPA requirement for the thesis option. The steps for completing a Physics M.S. with Thesis include (detailed instructions can be found on the Graduate School Webpage):

1. Complete all the required courses.
2. Establish an advisory committee.
3. Request a graduation application.
4. Arrange for a final oral examination. For students proceeding to the Ph.D. program, this examination may also serve as the General Oral Examination (see Ph.D. Program below).

It is expected that a student will complete the thesis option within three years of entering the graduate program. In rare cases, extensions may be granted following a request in writing submitted to the Graduate Program Officer and Department Chair.

3.2 Ph.D. Program

Pursuing a Ph.D. degree in physics generally involves two primary stages that together provide students with both a broad academic foundation and the specialized research training necessary to become independent scientists and researchers:

1. **Coursework**: The first stage involves mastering the fundamental principles of physics and developing a broad understanding of the major areas of the field. This foundation is typically acquired through coursework and demonstrated by successfully passing the General Doctoral Examination (GDE).

2. **Research project**: The second stage consists of conducting original research in a specialized area of physics. This work ultimately culminates in the preparation and successful defense of a Ph.D. dissertation.

Obtaining a Ph.D. in Physics from Auburn University involves several required steps established by the Department of Physics, the Auburn University Graduate School, or both. The following sections provide an overview of these requirements, together with useful links and resources. Many of these steps are completed simultaneously during the course of the program, particularly alongside coursework and research activities. The Graduate School also offers additional information regarding doctoral degree requirements and procedures.

3.2.1 Summary of steps to a Ph.D.

1. **Meet requirements for admission to Ph.D. Candidacy** (first 2-3 years)
   (a) Perform at a satisfactory level in all six physics graduate core courses.
   (b) Take and Pass General Doctoral Examination.
   (c) Determine major professor and form Research Committee.
   (d) Student takes and passes General Oral Exam:
      i. The timing and nature of this exam will be determined by the student's research committee.
      ii. Student files Application for General Oral Exam with Graduate School.
      iii. Major Professor approves and files *Report of General Oral Exam* with Graduate School.
   (e) Student obtains M.S. degree or meets equivalent requirements. We encourage graduate students to accept MS degree, but it is not required.

2. **Perform independent dissertation research guided by the major professor and the research committee.**

3. **Complete remaining required coursework.**

4. **Write a research dissertation using the electronic dissertation guide provided by the Graduate School**.

5. **Prepare for Ph.D. defense and graduation.**

   (a) Submit the Graduation Application one semester before you plan to graduate.

   (b) Check the doctoral completion checklist on the graduate school webpage for important information and deadlines regarding both the **dissertation process** and the **graduation**.

   (c) Submit First Submission Approval Form to the Graduate School.

   (d) Submit PDF of your dissertation to doctoral@auburn.edu for Format Check.

   (e) When notified by the Graduate School, complete your Application for Final Oral Exam **using the link that will be emailed to you**. Once submitted, the committee and University Reader will be notified of the final examination date.

   (f) Complete your final oral exam. On the day of your final oral exam, the Graduate School will send your committee and University Reader the Report on the Final Oral Exam and Publishing Approval Form. Please note: **All committee members including the University Reader MUST be present at the Defense.**

   (g) Submit Dissertation on AUETD.

Note that students admitted to PhD candidacy — including passing the GDE, forming a dissertation committee, passing the oral examination, and maintaining good academic standing — are eligible for a stipend increase beginning with the next full Fall or Spring semester. The current stipend increase is $1000/year. **To apply for this stipend increase, please send a copy of submitted Report on General Oral Exam to Mary Prater and the Graduate Program Officer.**

3.2.2 Course Requirements

Sixty (60) credit hours of coursework beyond a Bachelor's degree are required for a Ph.D. degree as listed in table 2. Of the 60 required credit hours, **thirty (30) must be graded coursework**. Six (6) credit hours of Colloquium and ten (10) credit hours of Research and Dissertation are also required. Additional elective courses may be completed either as graded or ungraded courses, with the approval of the course instructor. A full list of elective courses can be found in section 7.

Courses	Total Hrs	Course #
Core Courses	18	PHYS 7100, 7200, 7250, 7300, 7350, 7400
Colloquium	6	PHYS 7950
Graded Elective	12	PHYS 6000-, 7000-, or 8000-level
Additional Electives	14	PHYS 6000-, 7000-, or 8000-level
Research and Dissertation	10	PHYS 8990
Total	**60**	

Table 2: Doctor of Philosophy (Ph.D.) degree: Course requirements.

3.2.3 General Doctoral Examination

The General Doctoral Examination (GDE) is given once a year at the beginning of the Fall semester. It consists of four written exams on Classical Mechanics, Statistical Mechanics, Quantum Mechanics, and Electricity & Magnetism. The student is expected to demonstrate the ability to solve complex physics problems at the advanced undergraduate level and the graduate level covered by the four core physics courses (PHYS 7100, PHYS 7200, PHYS 7300, and PHYS 7400). Each subject exam consists of five problems, and students are free to choose to work on any four out of the five problems. Only four of the five problems will be graded, or counted for the grade.

After the written examination has been graded, a meeting of the graduate faculty will be held to decide whether the student's performance on each of the four exams is "Satisfactory" or "Unsatisfactory". Students must receive "Satisfactory" grades on all four exams in order to pass the GDE. Students who do not pass the GDE on the first attempt will be given a second examination within three to six months of the first examination, typically at the beginning of the following Spring semester. At the second examination, students will be required to retake only those subject exams with "Unsatisfactory" grades from the first examination. After the second examination, the graduate faculty will again meet to decide whether the student's performance on the individual subject exams is "Satisfactory" or "Unsatisfactory". Students who do not pass the GDE after the second examination will not be admitted to candidacy for the Ph.D. degree.

Students are encouraged to attempt the GDE as soon as they have finished taking the first four core graduate physics courses, whose contents are covered in the GDE. Students who enter with a Bachelor's or a Master's degree in physics are expected to take the GDE no later than the beginning of their second year of study. Under special circumstances, a student may apply for a one-year postponement of the GDE; this request must be approved by the Chair of the Department.

The Chair of the GDE committee is in charge of communication with the graduate students on the topics related to the GDE. A call for registration for the coming Fall GDE is usually issued to all pre-GDE Ph.D. students at the end of spring semester or the beginning of summer semester each year. The exact exam schedule will be announced at least two weeks in advance of each examination period.

3.2.4 Research Committee

Once a student passes the GDE and successfully finds a research advisor (major professor), a Research Committee will be formed by the student and major professor, with approval of the Department Chair. The Research Committee is responsible for developing the student's Plan of Study and conducting the General Oral and Final Oral Examinations. The AU Graduate School requires that the Research Committee consist of at least four members of the Auburn University Graduate Faculty. The major professor must be a member of the Department of Physics. The major professor and at least two additional faculty members must also be members of the university graduate faculty at Level 2.

As a general guideline, the committee should include members from the Ph.D. student's chosen subfield along with at least one member outside the chosen subfield in order to assess the breadth of the dissertation work. Additional voting members may be appointed to the committee

including non-Auburn University faculty who hold the terminal degree in the field. The formal appointment of the research committee occurs when the committee selection form is approved by the Graduate School as well as the Graduate Program Officer and/or Department Chair.

The Research Committee will be responsible for the following:

1. **Give an Oral Examination** following successful completion of the GDE. Possible examples include presentation of student's previous work, a literature review in the relevant field, and/or a dissertation proposal. This is an opportunity for the committee to get to know the student and begin the student's research career with clear expectations.

2. **Provide annual feedback** to both the student and GPO of progress towards a degree. This reporting serves as an important oversight mechanism for both the student and major professor to ensure that the student is making adequate progress towards a degree. Brief annual reports noting satisfactory or unsatisfactory progress should be filed with the Graduate Program officer by the end of the calendar year.

3. **Give a final oral examination** (dissertation defense) during the student's final semester. Because the committee has met at least annually with the student, they can fully appreciate and assess the student's research efforts presented in this final defense.

Details of Oral Examination content, timeline and the student's research path will vary to some extent based upon physics sub-field and whether the student is pursuing an experimental or theory degree. These details will be determined by the major professor in consultation with the Research Committee.

3.2.5 General Oral Exam

The graduate oral exam is the second and final step toward candidacy for the Ph.D. degree. It is designed to allow the student to demonstrate readiness for research through a clear understanding of their research topic and its broader context, the ability to communicate research objectives, results, and plans effectively, and the familiarity with relevant literature and research methodologies. The oral preliminary examination should normally be taken near the completion of coursework, typically toward the end of the second or the beginning of the third year of graduate study, and **no later than the end of the fifth semester**.

To promote consistency across the department while allowing flexibility, the following recommended structure should be used as a guideline. Actual durations may vary modestly depending on the flow of the presentation and discussion.

- **Presentation (target 30 minutes)**
  - Students should aim to give a presentation at the level appropriate for a professional conference audience.
  - The presentation may run slightly longer or shorter as needed, depending on the nature of the material and committee engagement.
  - Committee members may ask brief clarifying questions during the presentation; more in-depth questions should be reserved for after the presentation.

- **Question and Answer Period (target 30 minutes)**
  - The committee will question the student on the presentation content and related research topics.
  - This segment provides an opportunity to demonstrate depth of understanding and critical reasoning.
- **Closed Discussion Between Committee and Student (target 15 minutes)**
  - The student meets privately with the committee (excluding the supervisor) for follow-up questions or discussion.
- **Closed Discussion Between Committee and Supervisor (target 15 minutes)**
  - The supervisor meets privately with the committee (without the student) for feedback and evaluation discussion.

These time-frames are guidelines rather than strict limits; committees are encouraged to exercise reasonable flexibility to ensure a fair and thorough examination. **The student and their major advisor should determine the presentation content**. Examples include, but are not limited to (1) a literature review and framing of the scientific question for the planned dissertation, (2) early experimental or computational results and their interpretations, or (3) a research proposal or outline of future dissertation work. Students are encouraged to aim for clarity, confidence, and conciseness in their explanations. They also need to be prepared for questions regarding methodology, assumptions, results, and broader impacts.

To help students tailor their presentations to a technically informed yet broadly diverse physics audience, the following presentation template is suggested:

1. **Title Slide:** Name, Program, Department, Presentation Title, Date, Committee Members
2. **Introduction:** Background, Motivation, Key Research Questions or Objectives
3. **Literature Review (if applicable):** Major studies, Knowledge gaps, How your research addresses them
4. **Research Objectives / Hypotheses (if applicable):** Clear aims, Hypotheses, Defined scope
5. **Methodology (if applicable):** Design or approach, Methods, Data sources, Rationale for choices
6. **Preliminary Results (if applicable):** Early findings, Interpretation, Challenges
7. **Proposed Work / Future Directions:** Remaining steps, Timeline, Expected contributions
8. **Conclusion:** Problem restatement, Summary, Broader significance
9. **Acknowledgments:** Supervisors, Committee, Collaborators, Funding sources

4 Graduate Course Sequence

The course sequence for the Ph.D. degree is illustrated in the chart below, outlining the recommended progression of coursework, examinations, and research milestones throughout the program. The chart is intended to help students plan their academic trajectory and ensure timely completion of all departmental and Graduate School requirements. While individual schedules may vary depending on research focus, prior preparation, and course availability, students are encouraged to follow this sequence as closely as possible in consultation with their academic advisor and graduate program officer.

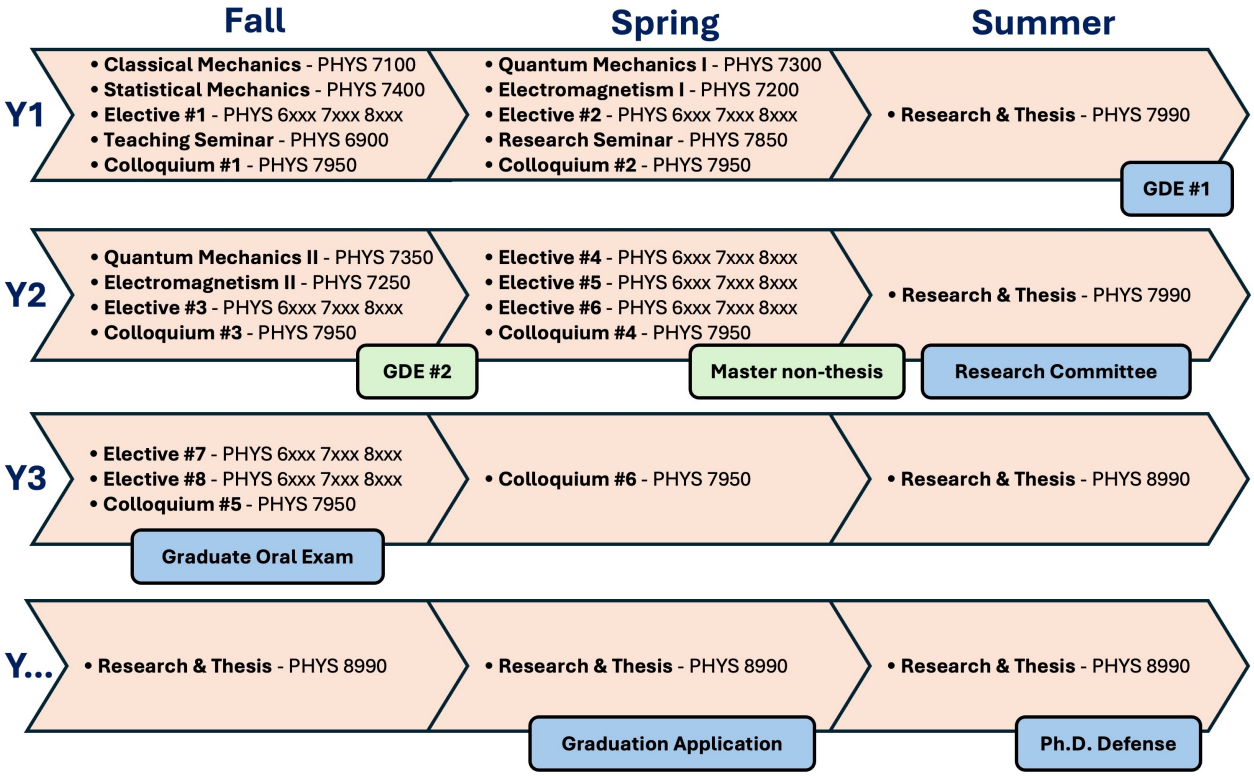


Figure 1: Recommended timeline and coursework sequence for the Ph.D. degree. A total of sixty (60) credit hours is required, including thirty (30) credit hours of graded coursework, six (6) credit hours of Colloquium, and ten (10) credit hours of Research and Dissertation. Core courses are normally completed during the first three semesters: PHYS 7100 and PHYS 7400 (Fall, Year 1), PHYS 7300 and PHYS 7200 (Spring, Year 1), and PHYS 7350 and PHYS 7250 (Fall, Year 2). The General Doctoral Examination (GDE) is typically taken at the end of the first year, with a second attempt, if needed, at the end of the third semester. The research committee should be formed by the end of the second year, and the Graduate Oral Examination should be completed by the end of the fifth semester (Fall, Year 3).

5 Evaluation of the Academic Progress

Annual evaluations of all graduate students are submitted to both the Auburn University Graduate School and the College of Sciences and Mathematics (COSAM). Regular monitoring of the academic progress of graduate students and Graduate Teaching Assistants (GTAs) is essential to both student success and the continued excellence of Auburn's graduate programs. Teaching performance evaluations are conducted by the Director of Instructional Laboratories, while research evaluations are carried out by the student's Research Committee. In both cases, evaluations are reported to the Graduate Program Officer (GPO) as either Satisfactory or Unsatisfactory. GTA evaluations are subsequently reported by the GPO to the Graduate School early each Fall semester. Research evaluations, by contrast, are due by the end of the calendar year and are reported by the GPO to the Associate Dean for Research.

At any stage of graduate study, a physics graduate student placed on Academic Probation (GPA below 3.0) or Academic Suspension (GPA remaining below 3.0 after the probationary period) by the Auburn University Graduate School must meet with the Department Chair, the Graduate Program Officer, and their research advisor. In cases of Academic Suspension, a formal Remediation Plan must be submitted to the Graduate School. Reappointment as either a Graduate Teaching Assistant (GTA) or Graduate Research Assistant (GRA) is contingent upon the student demonstrating satisfactory progress toward completion of the degree.

5.1 TA Professionalism Policies and Teaching Evaluation

The following is a non-exhaustive list of expectations for Graduate Teaching Assistants ("TA") to demonstrate professionalism according to the Graduate School's Graduate Assistant Performance Improvement and Administrative Action Policy (GAPIAA Policy). Physics TAs will be evaluated by the Lab Director ("LD") according to the expectations listed below.

1. **Professional Conduct**
    - Treat students and colleagues with respect, fairness, and professionalism.
    - Maintain appropriate boundaries and avoid conflict of interests.
    - Read and respond to emails and other communication in a timely manner.
        - Read and acknowledge or respond to all emails from the LD, the Instructor of Records (IOR) for the assigned course, and/or the Teaching Supervisor (currently Dr. Daniel Merrill) within one business day.
        - Read and respond to all emails from students in the TA's assigned course within one business day.
    - Inform the IOR and LD of any incident pertaining to the normal development of the TA duties, *e.g.*, student misconduct, anticipated absences, etc.
        - Scheduled absences from assigned duties must receive prior approval from the LD, and it is the responsibility of the TA to find a substitute.

  - In the event of unforeseen circumstances, the TA should communicate with the IOR and LD at their earliest convenience.

2. **Instructional Reliability**

   - Attend assigned lab sections, arriving 5-15 minutes before the start time; dress: dressy casual or business casual.
   - Attend assigned Tutoring Center hours in the provided shirt and name tag. Students are not required to hold separate office hours or review sessions.
   - Attend and participate in all lab meetings, arriving on time.
   - Prepare for labs and recitations in advance, including but not limited to working problems and practicing experiments.

3. **Administrative/Grading**

   - Grade assignments—labs, quizzes, recitations, tests, and exams—within one week unless instructed otherwise by the LD or the IOR, to provide timely and constructive feedback while consistently applying rubrics.
   - Proctor exams if requested by the IOR and you have no prior conflicts.

5.1.1 Evaluations of Teaching Assistants

Physics TAs will be evaluated every semester by the Lab Director. The LD will request periodic updates from IORs for relevant factors, such as grading punctuality and recitation preparedness. The evaluation will be on the following scale:

- **Exemplary (3.7 – 4.0)**: The TA exceeds all basic expectations. Performance is validated by IOR commendations and consistently high marks in student evaluations regarding clarity and fairness.
- **Proficient (3.0 – 3.6)**: The TA has zero violations this policy. They are fully prepared for all sessions and maintain professional communication without requiring reminders.
- **Developing (2.0 – 2.9)**: The TA demonstrates sufficient professionalism. Any minor issues are swiftly rectified.
- **Below expectations (<2.0)**: The TA has accumulated multiple violations of this policy. This rating triggers a formal report to the Department Chair, as outlined in the "Acts of Misconduct and Unprofessionalism" section below.

COMPONENTS OF THE EVALUATION:

1. **Professional Conduct (40%)**:

   - Exemplary (4): Reads and responds to all emails quickly and consistently; professional in all settings. Rated highly in student evaluations for comfort, respect, and collaboration.

- Standard (3): Reads and responds within one business day; maintains appropriate boundaries; dresses appropriately as described above.
- Unresponsive (2): Occasionally misses emails, requires reminders; occasionally fails to adhere to dress standards; neutral student feedback.
- Unprofessional (1): Regularly fails to read emails (violation); uses inappropriate language (violation).

2. **Instructional Reliability (30%)**:

- Proactive (4): Arrives early to lab, meetings, Tutoring Center shifts; prepares ahead of time; proactive engagement in all meetings. Rated highly in student evaluations for preparedness and leading them to answers without telling them the answer.
- Reliable (3): Arrives on time as required; answers student questions accurately; labs run smoothly.
- Passive (2): Arrives exactly at the start time; lacks deep familiarity with the experiment or recitation; relies heavily on the IOR/LD during lab.
- Deficient (1): Late to lab, meetings, or Tutoring Center shifts (violation); unprepared for experiments or recitations (violation); consistent mistakes in physics during lab, tutoring, and/or grading.

3. **Administrative/Grading (30%)**:

- High Quality (4): Grades recorded within three business days; feedback is exceptionally detailed and consistently aligns student performance with learning objectives. Rated highly in student evaluations for timely grading and helpful feedback.
- Consistent (3): Grades recorded within the 7-day window; feedback is constructive and rubrics are applied accurately and consistently.
- Developing (2): Meets the 7-day deadline but feedback is minimal/generic; occasional minor inaccuracies in applying rubrics.
- Late/Inaccurate (1): Grading exceeds the 7-day deadline without LD and IOR approval; disregard for grading rubrics.

DATA SOURCE COLLECTION:

- IOR Pulse Checks: Monthly "Satisfactory/Unsatisfactory" pings to the IOR regarding grading turnaround, prep, etc.
- Performance log: A log of violations of this policy kept by the LD and available to review upon request.
- Student evaluations: End of semester evaluations submitted by students and reviewed once grades are submitted.

5.1.2 Acts of Misconduct and unprofessionalism

Failure to uphold the expectations outlined above may result in invoking the aforementioned GAPIAA Policy, which may affect the TA's assistantship. The following will generally apply:

- **After two (2) violations** of the above expectations, the Lab Director will call a meeting with the TA to remind them of this Policy and professional expectations.
- **After four (4) violations** of the above expectations, the Lab Director will call a second meeting with the TA, alerting them that any further violations will formally invoke the GAPIAA Policy.
- **After five (5) violations** of the above expectations, the Lab Director will formally invoke the GAPIAA Policy, documenting the situation, including all prior violations, in a written report that will be provided to the department chair and the graduate program officer, who will schedule a meeting with the LD and TA to discuss further actions. According to the GAPIAA Policy, "*appropriate actions include termination of an assistantship, suspension of an assistantship for a specified period, and reduction of the FTE and/or benefits associated with that assistantship.*"

Please note that the application of these guidelines may vary depending on the severity of the infraction. For example, failure to acknowledge emails from the Laboratory Director (LD) may be considered a minor violation and count as half a violation, whereas the use of abusive or unprofessional language in the workplace may result in the immediate filing of a formal report.

5.2 Annual Research Committee Meeting

All graduate students who have established a graduate committee are required to participate in an annual evaluation process. The purpose of this evaluation is to formally document the student's academic and research progress, provide constructive assessment and guidance, and support timely and successful completion of degree requirements.

The annual evaluation is intended to facilitate a structured and collaborative exchange between the student, research advisor, and committee members. This process promotes professional development through goal setting, critical self-assessment, and recognition of academic and research accomplishments. In addition, the evaluation serves to ensure clear communication and alignment of expectations among all parties with respect to research progress, workload, meeting frequency, professional responsibilities, and both short- and long-term academic objectives.

The student, in consultation with their major advisor, shall determine the content and scope of the presentation for the evaluation meeting. Students are expected to present their work with clarity, professionalism, confidence, and conciseness. In addition, students should be prepared to respond to questions concerning the methodology employed, underlying assumptions, interpretation of results, and the broader significance and impact of their research.

At the conclusion of the evaluation meeting, the committee shall notify both the student and the Graduate Program Officer (GPO) whether the student's progress and performance have been deemed satisfactory or unsatisfactory.

6 Physics Graduate Student Association (PGSA)

The mission of the Physics Graduate Student Association (PGSA) is to cultivate an enriching and welcoming atmosphere that nurtures academic excellence, professional growth, and social connections within our department. By championing the needs and aspirations of our fellow graduate students, its goal is to elevate the overall graduate experience and contribute to the advancement of our physics department. The association is dedicated to fostering a sense of unity, facilitating effective communication between students and faculty, and advocating for the concerns of physics graduate students. The association's main focus areas include:

- **Academic Support and Collaboration:** Central to PGSA's mission is providing unwavering academic support and valuable resources for students in the graduate program. PGSA is dedicated to fostering collaborative learning opportunities, allowing students in different research phases to engage in intellectual exchanges that fuel their growth.
- **Professional Development:** PGSA is committed to equipping graduate students with the skills and knowledge necessary to excel in their chosen career paths. Recognizing the significance of preparing physics graduates for successful futures, PGSA is dedicated to offering a comprehensive array of professional development resources.
- **Advocacy:** As a voice for graduate students, PGSA provides a platform for expressing concerns, ideas, and suggestions to the department leadership. PGSA's commitment extends to advocating for enhancements in student well-being through transparent communication with faculty and leadership. PGSA strives to ensure that the needs and interests of physics graduate students are considered in decision-making processes that affect their academic and research environments..
- **Building Community and Fostering Social Engagement:** PGSA places great emphasis on creating a lively community within the physics department. Through a variety of social events both on and off campus, PGSA strives to create opportunities for graduate students to connect, establish lasting relationships, and develop a strong support network.
- **Outreach:** PGSA values the importance of connecting with the wider community and enhancing appreciation for physics. PGSA outreach initiatives aim to ignite interest in physics, promote scientific literacy, and foster a positive perception of the field among the general public.

Each students of the program is encouraged to join the association in shaping a vibrant and dynamic physics graduate community that not only excels academically but also thrives socially and professionally. Together, students can make a lasting impact on the future of physics education and research. Organization specifics can be found in the PGSA constitution

7 Physics Graduate Course Catalogue

The full official course listing for the Department may be found in the Auburn Bulletin.

7.1 Core Courses

- **PHYS 7100 CLASSICAL MECHANICS** (3). LEC. 3. Lagrangian and Hamiltonian formulations of mechanics, canonical transforms. Hamilton-Jacobi theories, action angle variables, rigid rotators, normal modes, and mechanics of continuous media.
- **PHYSICS 7200 ELECTRICITY AND MAGNETISM I** (3). LEC. 3. Electrostatics. special function expansions, magnetostatics, linear media and Maxwell's equations.
- **PHYS 7250 ELECTRICITY AND MAGNETISM II** (3). LEC. 3. Time dependent Maxwell theory, wave propagation and dispersion, diffraction, scattering, radiation, relativistic covariance and applications. *Prerequisite: PHYS 7200 or departmental approval.*
- **PHYS 7300 QUANTUM MECHANICS I** (3). LEC. 3. Schrődinger wave equation, discrete and continuous spectra, matrix formulation, perturbation theory.
- **PHYS 7350 QUANTUM MECHANICS II** (3). LEC. 3. Time-dependent approximation methods, relativistic wave equation, and second quantization. *Prerequisite: PHYS 7300 or departmental approval.*
- **PHYS 7400 STATISTICAL PHYSICS** (3). LEC. 3. Thermodynamic quantities, equilibrium ensembles for classical and quantum systems, fluctuations, phase transitions and critical phenomena.

7.2 Colloquium Course

- **PHYS 7950 PHYSICS COLLOQUIUM** (1) SEM. SU. Offers a series of talks presented by invited speakers on broad fields of physics. Check with graduate advisor for credit allowed. Course may be repeated for a maximum of 6 credit hours.

7.3 Recommended Elective Courses

- **PHYS 6900 PHYSICS TEACHING SEMINAR** (1) LEC. 1. LAB. 0. SU. Graduate Students in Physics or Departmental Approval. Introduction to issues, resources and best practices related to the teaching of physics.
- **PHYS 7850 GRADUATE PHYSICS RESEARCH SEMINAR** (1) LEC. 1. LAB. 0. SU. This course is designed to develop and expand incoming graduate student's knowledge and experience with state-of-the-art research as it is done in the Auburn University Department of Physics.

- **PHYS 6500 MATH METHODS** (3) LEC. 3. Vector calculus and coordinate systems, differential equations, integral theorems and physical interpretation, special functions and series expansions, operator algebra and Hilbert space.

7.4 Research-specific Elective Courses

7.4.1 Atomic, molecular, and optical physics

- **PHYS 6100 APPLICATIONS OF QUANTUM MECHANICS** (3). LEC. 3. Quantum mechanics applied to atomic physics, solid state physics, nuclear physics, particle physics, electrodynamics, and cosmology. *Prerequisite: PHYS 4100*
- **PHYS 8100 RELATIVISTIC QUANTUM MECHANICS** (3). LEC. 3. Dirac equation, 1D barrier scattering, 3D central potentials, S-matrix theory, Feynman diagrams, quantum electrodynamics, renormalization, tree and loop level problems. *Prerequisite: PHYS 7350 or departmental approval.*
- **PHYS 8200 INTRODUCTION TO ATOMIC PHYSICS** (3). LEC. 3. Hydrogen atom Hartree-Fock theory, radiative transitions, photoionization, autoionization, electron-atom scattering. *Prerequisite: PHYS 7350 or departmental approval.*

7.4.2 Biophysics

- **PHYS 6600 BIOPHYSICS COURSE** (3). LEC. 3. Fundamentals of biophysics and the modern techniques behind, protein folding, molecular motors, cellular networks and whole organisms.

7.4.3 Condensed matter physics

- **PHYS 6610 INTRODUCTION TO SOLID STATE PHYSICS** (3). LEC. 3. Lattice Vibrations, band description of electronic states in metals, semiconductors and insulators, and magnetic, super-conducting and defect properties of solids. *Prerequisite, PHYS 6100 or departmental approval.*
- **PHYS 7540 NON-EQUILIBRIUM STATISTICAL MECHANICS** (3). LEC. 3. Introduces the fundamental concepts of non-equilibrium statistical mechanics, develops basic transport theories, and simulates statistic properties with Monte-Carlo and molecular dynamic methods. *Prerequisite: PHYS 7400 or departmental approval.*
- **PHYS 8700 SOLID STATE PHYSICS** (3). LEC. 3. Atomic and electronic structures of solids and the associated electrical, optical and transport properties. *Prerequisite: PHYS 6610 or departmental approval.*

7.4.4 Physics education research

- **PHYS 6200 TEACHING AND LEARNING OF STEM** (3) LEC. 3. This course will provide students with a basic knowledge of the relevant research in cognitive psychology and science education and the ability to apply that knowledge to enhance their ability to learn and teach science, particularly at the undergraduate level. The course will involve readings, discussion, and application of the ideas through the creation of learning activities. It is suitable for advanced undergraduates and graduate students with some science background. *Prerequisite: B.S. in a STEM discipline or 20+ credit hours of STEM coursework*.

7.4.5 Plasma physics

- **PHYS 6620 SURVEY OF PLASMA PHYSICS** (3). LEC. 3. Single particle motions: fluid description of a plasma; plasma waves and oscillations; kinetic description, diffusion, and resistivity; non-linear effects. *Prerequisite PHYS 3100 or departmental approval.*
- **PHYS 7520 NONLINEAR DYNAMICS** (3). LEC. 3. Dynamical systems, maps, flows, fixed points and neighborhoods, chaos, fractals and fractal dimensions. Lyapunov exponents, strange attractors, dissipative and Hamiltonian systems, controlling chaos. *Prerequisite: PHYS 7100 or departmental approval*.
- **PHYS 8600 PLASMA PHYSICS** (3). LEC. 3. A detailed study of plasma physics including particle orbit theory, magnetohydrodynamics, plasma waves and transport phenomena. *Prerequisite: PHYS 6620 or departmental approval.*

7.4.6 Space physics

- **PHYS 6600 INTRODUCTION TO SPACE PHYSICS** (3). LEC. 3. Solar-terrestrial physics, upper atmosphere and ionosphere, Physics of magnetized plasmas, the Sun and its atmosphere, the solar wind, Collisionless shocks, solar-wind interaction with magnetized obstacles, solar wind-magnetosphere coupling, the inner magnetosphere

7.5 Laboratory Courses

- **PHYS 6300 OPTICS** (3) LEC. 2. LAB. 2. An overview of optics to include geometrical optics, electromagnetic waves, interference of light, diffraction of light, optical detectors, instrumentation and displays.

7.6 Research and Thesis courses

- **PHYS 7990 RESEARCH AND THESIS**(1-10). MST. TD. course may be repeated as often as is appropriate.
- **PHYS 8990 RESEARCH AND DISSERTATION** (1-10) DSR. May be repeated as often as is appropriate. Course may be repeated with change in topics.

7.7 On-demand Courses

- **PHYS 6500 FUNDAMENTALS OF PHYSICS** (3). LEC. 3. A subject such as Wave Mechanics, Mathematical Physics, Nonlinear Dynamics, Optics, Nuclear Physics, Elementary Particles, Relativity, or Electrodynamics. Course may be repeated for a maximum of 9 credit hours. *Prerequisite: departmental approval.*
- **PHYS 6600 FRONTIERS OF PHYSICS** (3). LEC. 3. A subject from the research areas in the Department such as Solid State, Atomic, Plasma, Space, or Computational Physics will be selected by the lecturer. Course may be repeated for a maximum of 9 credit hours. *Prerequisite: PHYS 4100 or PHYS 3100 or departmental approval.*
- **PHYS 7900 INDEPENDENT STUDY IN PHYSICS** (1-5). IND. SU. Pr., Student will work with a faculty member to study a topic of interest. Course may be repeated for a maximum of 6 credit hours. *Prerequisite: departmental approval.*
- **PHYS 7930 DIRECTED READING IN PHYSICS** (1-5) IND. Student will work with a faculty member to study a topic of interest. Course may be repeated for a maximum of 6 credit hours. *Prerequisite: departmental approval.*
- **PHYS 7970 SPECIAL TOPICS IN PHYSICS** (1-5). SEM. Seminar or lecture series in a rapidly advancing specialty of physics. Course may be repeated for a maximum of 6 credit hours. *Prerequisite: departmental approval.*
- **PHYS 8900 DIRECTED STUDIES** (1-5) IND. SU. Students will work with a faculty member to study a topic of interest. Course may be repeated for a maximum of 10 credit hours. *Prerequisite: Departmental approval.*
- **PHYS 8930 DIRECTED STUDIES IN ADVANCED PHYSICS** (1-5) IND. Student will work with a faculty member to study a topic of interest. Course may be repeated for a maximum of 10 credit hours. *Prerequisite: Departmental approval.*
- **PHYS 8970 SPECIAL TOPICS IN ADVANCED PHYSICS** (1-5) LEC. Topic at the forefront of physics research will be chosen by the lecturer. Course may be repeated for a maximum of 10 credit hours. *Prerequisite: Departmental approval.*