PHYSICS, MS

The Department of Physics and Astronomy offers the master of science degree in physics with the option of a focused area of study in astronomy. Although we offer a course-only MS, our graduate program is mostly oriented toward current physics research.

Research toward a degree may be conducted in either experimental or theoretical areas. Experimental programs include magnetic materials, high-energy physics, materials science, observational extragalactic astronomy, and particle astrophysics. Theoretical programs include condensed matter, elementary particles, atomic and molecular physics, extragalactic astronomy, astrophysics and particle astrophysics.

Admissions

A student who wishes to take graduate work leading to the MS or PhD degree should have the equivalent of an undergraduate major in physics. Any undergraduate courses required to complete the student’s preparation should be taken as soon as possible. A comprehensive background in general physics is considered as important as mastery of a specialized field.

In addition to the minimum Graduate School admission requirements, to be considered for regular admission an application must include:

• A resume
• 3 letters of recommendation.

See the Admission Criteria section of this catalog for more information.

Curricular Requirements

M.S. in Physics (thesis option)

A total of 24 semester hours of coursework is required (18 of which must be in physics and astronomy), in addition to 6 semester hours of research. Physics students must take:

<table>
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<tr>
<th>Code and Title</th>
<th>Hours</th>
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<tr>
<td><strong>Required Courses</strong></td>
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<tr>
<td>PH 501  Classical Dynamics</td>
<td>3</td>
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<tr>
<td>PH 531  Electromagnetic Theory</td>
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<tr>
<td>PH 541  Quantum Mechanics</td>
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<tr>
<td>PH 571  Statistical Physics</td>
<td>3</td>
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<tr>
<td>PH 599  Thesis Research</td>
<td>6</td>
</tr>
<tr>
<td>PH 597  Physics Seminar (taken every semester in residence)</td>
<td>1</td>
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</tbody>
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**Elective Courses**

All full-time students must take one hour of seminar PH 597 Physics Seminar each semester. Up to three semester hours of pass/fail coursework (PH 597, PH 598 Non-Thesis Research) and up to three semester hours of PH 590 Research Techniques can count toward the 24 hour course requirement. An oral examination covering coursework is required for completion of the degree.

M.S. in Physics with Astronomy focused area of study

(thesis option)

A total of 24 semester hours of coursework is required (18 of which must be in physics and astronomy), in addition to 6 semester hours of research (PH 599 Thesis Research). Students must take:

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<td>AY 521 or Theoretical Astrophysics</td>
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<tr>
<td>AY 533  Observational Techniques</td>
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<tr>
<td>AY 597  Astrophysics Seminar</td>
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</tbody>
</table>

**Elective Courses**

All full-time students must take one hour of seminar AY 597 Astrophysics Seminar each semester. Up to three semester hours of pass/fail coursework (AY 597,PH 598 Non-Thesis Research) and up to three semester hours of PH 590 Research Techniques can count toward the 24 hour course requirement. An oral examination covering coursework and the thesis is required for completion of the degree.

M.S. in Physics (non-thesis option)

A total of 30 hours of coursework is required, 24 of which must be in physics and astronomy. Students must take:

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<td>3</td>
</tr>
<tr>
<td>PH 531  Electromagnetic Theory</td>
<td>3</td>
</tr>
</tbody>
</table>

**Elective Courses**

All full-time students must take one hour of seminar AY 597 Astrophysics Seminar each semester. Up to three semester hours of pass/fail coursework (AY 597,PH 598 Non-Thesis Research) and up to three semester hours of PH 590 Research Techniques can count toward the
30 hour course requirement. An oral examination covering coursework is required for completion of the degree.

**Precision Timing Concentration**

Students can take a precision timing concentration if they complete the following courses. This concentration is only available as an option with completion of a thesis.

**Precision Timing Concentration (Available only for thesis option)  Hours**

Electives - Choose two from the following: 6

- PH 590 Research Techniques
- PH 542 Quantum Mechanics
- PH 532 Electromagnetic Theory
- PH 534 Digtl Elect Comp Interfc
- PH 681 Adv Solid State Physics
- PH 591 Advanced Laboratory

Electrical Engineering Courses

- ECE 593 Special Topics (Control Systems Analysis) 3
- ECE 579 Digital Control Systems 3
- ECE 693 Special Topics (in Precision Timing Applications) 3

Statistics Course

- MATH 551 Math Stats W/Applictn I 3

**Total Hours** 18

**Transfer Credit**

Transfer of credit should be discussed with the departmental graduate director before submitting a transfer request to the graduate school.

See general Academic Policies: Degree Requirements for Masters Degrees.

**Accelerated Master's Program**

Accelerated master’s students must fulfill the same requirements, except that they need not register for PH 597 or AY 597 during the second-to-last year of their program.

See general Academic Policies: Admission Criteria for the Accelerated Masters Program.

**Comprehensive Exam**

All master’s students must complete a comprehensive (oral) exam with a committee approved by the department. For students completing a masters with thesis, their thesis defense forms the comprehensive exam.

**Time Limits for Degree Completion Requirements**

See general Academic Policies: Degree Requirements for Masters Degrees.

**Student Progress Requirements**

Students who are supported on assistantships are subject to semester and annual reviews to evaluate progress, with their support being discontinued in the case of insufficient progress. Generally assistantships for master’s study are not provided beyond 2 years after entry, and may be discontinued earlier if it is unlikely the degree will be completed before then.

Note that the general Academic Policies: Scholastic Requirements pertaining to Academic Standing provide for dismissal of students based on their GPA and hours.

**Academic Misconduct Information**


**Withdrawals and Leave of Absence Information**


**Academic Grievances Information**

See General Information: Grievance Procedure.

**Scholastic Requirements**

See general Academic Policies: Scholastic Requirements.

**Graduate School Deadlines Information**

See Graduate School Deadlines.

**Application for Graduation Information**

See the Application for Graduation sub-section of the general Academic Policies: Degree Requirements for Masters Degrees.

**Master’s Degrees**

The primary purpose of master’s degree programs is to provide students with subject matter at an advanced level in their fields of study. Master’s degrees are designed to assist students either to continue their graduate studies or to meet the goals of their professions. In most cases, master’s programs also help students become familiar with methods of independent investigation.

**Program Requirements**

Two plans are offered for the master’s degree:

**Plan I.** Candidates for the master’s degree under Plan I must earn a minimum of 24 semester hours of credit in coursework plus earn a minimum of 6 additional hours of thesis research hours, for a total of 30 hours.

**Plan II.** Candidates for the master’s degree under Plan II must earn a minimum of 30 semester hours of coursework credit and pass the comprehensive examination or complete a culminating or “capstone experience” as described under the Comprehensive Examinations section below.

Both plans require a minimum of 18 semester hours in the major subject. With the approval of the major department, the remainder of the coursework may be completed in either the major or a related field.

In some divisions and in many departments of the University, candidates are required to do their work under Plan I. Candidates working under Plan II may be required to participate successfully in seminar or problem courses that will give them an acquaintance with the methods of research and an appreciation of the place and function of original investigation in the field.

**Residency Requirements**

A student’s program at the master’s level must provide sufficient association with the resident faculty to permit individual evaluation of the student’s capabilities and achievements.
Graduate Credit

A student must be admitted to the Graduate School and must register as a graduate student in order to receive graduate credit. Approval for graduate registration must be obtained from program advisors prior to registration.

Graduate Credit for Noncredit Experiences

All course credit used toward a UA graduate degree must be taught at the graduate level. No graduate credit may be earned for experiential learning not conducted under the direct supervision of graduate faculty of The University of Alabama. UA does not offer graduate credit for noncredit workshops, seminars, continuing education experiences, professional development, internships, work/life experience, and so forth.

Transfer of Credit

Courses of full graduate-level credit earned in a regionally accredited institution where a student was enrolled in the graduate school, may be submitted for review for inclusion in a master's degree program. Evaluation of credit for transfer will not be made until after the student has enrolled in the Graduate School of The University of Alabama. Acceptance of credit requires the approval of the student's advisory committee and the dean of the Graduate School.

A student initiates the Request for Transfer of Graduate Credit form and must ensure that the Graduate School receives an official transcript from the outside institution. This should be done well in advance of the final semester, otherwise it may delay graduation and awarding of the degree.

With the approval of the student's department and the dean of the Graduate School, the greater of 12 hours or 25 percent of the required coursework for a master's degree may be transferred from an outside institution. Some master's degree programs allow fewer hours to be transferred. Be sure to check with your department's graduate program director regarding your department's transfer policy. Eligible coursework will have been earned during the six-year period (18 fall, spring and summer semesters) preceding the semester of admission to the UA master's program. Only courses in which a student earned a "B" grade or better may be transferred. Thesis Research (599) may not be transferred. Be sure to check with your department's graduate director to obtain approval from program advisors prior to graduation.

In some cases, foreign educational credentials may not meet the Graduate School's criteria for transfer of credit. It may be necessary for students in this situation to secure an evaluation of their credentials from World Education Services Inc. (WES), an external foreign credential evaluation service. Additional information on their services can be found at their website.

400-Level Courses

A maximum of 6 semester hours of 400-level course credit may be accepted for graduate credit and used toward a master's degree. The department needs to submit the Approval of 400-Level Course Work for Master's Credit form through the UA DocuSign system in myBama. This form must be submitted for approval to the Graduate School by the last day to add a course for the semester in which the course will be taken.

Time Limit

All requirements for the master's degree must be completed during the six years (18 fall, spring, and summer semesters) immediately preceding the date on which the degree is to be awarded. Previously approved transferred coursework that falls within six years of admission to the master's degree program can be counted toward the minimum hours requirement. There is no provision for an extension of the time limit beyond six years for master's students.

Revalidation of Expired Credits

There may be particular and limited instances where a student is re-admitted to a graduate program, and revalidation of expired credits is justified. In such cases, where the department and Graduate School feel it is appropriate to do so, the student may work with the graduate program director to petition for such revalidation, on a course-by-course basis. For each course for which revalidation is requested, the student must demonstrate, to the department's satisfaction, that the knowledge and skills gained in that course are still current. Currency will be evaluated by a committee of faculty, composed of at least three graduate faculty members within the degree program to which the student is requesting re-admission, and two from a separate department.

The committee will then issue a recommendation to the dean of the Graduate School, who will rule on the petition.

Some methods for demonstrating currency may include but are not limited to 1) a professional portfolio; 2) an exam or essay linked to each course and demonstrating up-to-date knowledge; 3) a re-take of the comprehensive exams under current program guidelines, and/or 4) other methods deemed appropriate by the committee.

Students may request revalidation of up to 50% of the required minimum coursework for their degree. Credits earned from an institution other than The University of Alabama may not be revalidated.

Consideration of revalidation, and a plan of study based on the demonstration-of-currency and other remaining requirements, must be completed as part of the student's re-admission to the Graduate School. Revalidation of credits is not guaranteed. From the time of re-admission, students must complete the degree within the standard time limit, as specified in the Graduate Catalog at the time of the student's re-admission.

Thesis

A thesis evidencing research capacity, independent thought, and the ability to interpret materials is required of all master's degree candidates who pursue Plan I. The subject chosen must be in the major field and must be approved by the graduate committee of the major department or school and by the head of the student's major department or division.

A thesis committee must consist of at least three members appointed by the dean of the Graduate School. Students set up their committee through the Graduate Academic Activities portal on the Graduate School website. The request normally is made as soon as the successful defense of the thesis proposal has been completed. All members of a thesis committee must be members of the Graduate Faculty. The Committee Chair must be a full or associate member of the Graduate Faculty. One member must be from outside the student’s major department. The majority of the thesis committee must be full-time regular University of Alabama faculty. The outside member is not a full or associate member of the UA Graduate Faculty (e.g., a highly qualified person from another university, a business, or industry), the graduate dean needs to appoint that member by approving Affiliate Graduate Faculty status for the specific purpose of serving on the student’s thesis committee. Unless there are extraordinary circumstances meriting approval by the graduate dean before the final oral defense of the thesis, all members of the thesis committee must attend the defense.

The candidate must give members of the examining committee a minimum of two weeks to read the thesis before the date of the final oral examination. All members must agree that the student is ready for
the final oral thesis defense. A final oral thesis defense is required of all students completing a thesis. All members of the thesis committee must be members of the UA graduate faculty and must attend the final oral thesis defense unless there are extraordinary circumstances warranting the graduate dean's approval of the absence prior to the defense meeting. The final oral thesis defense is the culminating experience in the master's program. As such, all members of the thesis committee are expected to attend and participate in real time. Virtual attendance via interactive video or teleconference is permitted for off-campus external committee members, but the student and Tuscaloosa campus faculty should attend in person unless extraordinary circumstances dictate the need for virtual attendance. In circumstances where virtual participation is necessary, all participants must follow the Virtual Participation guidelines found below.

**Virtual Participation in Committee-Based Exams/Defenses**

All members of a student's graduate committee are expected to attend and participate, usually in person, in any oral examination as part of the student's graduate (Master's or Doctoral) degree program. Traditionally, oral examinations are conducted with the student meeting their committee while gathered in one physical location on campus. However, the need occasionally arises for virtual participation in the oral examination.

If a department or program chooses to allow virtual participation in oral examinations, they must ensure adherence to the following technical requirements. Departments or programs may enforce stricter guidelines than those outlined, including an on-campus-only policy if deemed necessary and appropriate.

**Technical Requirements**

In cases where departments or programs allow any level of virtual participation, from one virtual member to a fully virtual event, they must adhere to the following requirements:

1. Prior to any oral exam, the student and Committee Chair coordinate with other committee members regarding the protocol for the exam.
2. All participants must join using university-adopted videoconferencing tools that allow for **fully interactive** audio and video communications along with screen-sharing capabilities, which must be maintained throughout the examination and any related discussion.
3. The use of audio-only communications is not permitted.
4. Participation merely by viewing a recording of the oral examination is specifically prohibited.
5. All members of the committee, on- or off-site, must participate in the final evaluation of the examination or defense; provisions must be made to record their votes and collect their signatures as necessary using the digital signature system approved by the Graduate School.
6. The Committee Chair, or another non-student designee, shall be the host of the virtual meeting. A co-host may be assigned so that the host can place the student into the waiting room (or have the host of the virtual meeting, or the host may manually remove them. In programs where the defense has both a public and a private portion, the committee may then continue the event as outlined in their program protocols.
7. Following the public portion of the defense, the host shall ask all non-committee members to leave the meeting, or the host may manually remove them. In programs where the defense has both a public and private portion, the committee may then continue the event as outlined in their program protocols.
8. Once the committee has completed the examination of the student, the host shall place the student into the waiting room (or have the committee members use a breakout room) so the committee can conduct their deliberations in private.

The committee chair must have a secondary videoconferencing system available as a back-up in the case of technical difficulties. Cancellation of the examination should only occur in the case where both the primary and secondary back-up systems fail. If an examination must be rescheduled, it will be done without prejudice to the student. Since committee deliberations are an essential aspect of the examination, completing the examination and final discussion via email or other non-audiovisual means is not an option. If the student or any committee member(s) have a disability that will be impacted by virtual participation, accommodations for participation must be provided.

**Article Style vs. Journal Format for Master’s Theses**

**Article Style.**

At the doctoral level, “article-style dissertations” are unified works that include several distinct but related studies of research or creative activity, each of which is of publishable quality. The University does not permit an “article-style thesis” to be presented for a master’s degree.

**Journal Format.**

A “journal-format thesis” is acceptable. Such a thesis follows the format of a particular journal in which the student and advisor want the thesis to be published. To prepare a journal-format thesis, the student uses the journal's "information for authors" or similarly titled guidelines in conjunction with the Graduate School's Student Guide to Preparing Electronic Theses and Dissertations.

All theses are submitted electronically rather than on paper. See the Graduate School’s homepage for a link to information on Electronic Theses and Dissertations (ETD) for details.

Theses must comply with the regulations set out in A Student Guide to Preparing Electronic Theses and Dissertations, available on the Graduate School's website. Approval of the thesis by the graduate dean is necessary before graduation.

The thesis should be completed, if possible, while the student is in residence at the University. To request permission to complete a thesis in absentia, the student must, before leaving the University, submit a satisfactory outline of the thesis, as well as evidence that adequate facilities are available where the work will be done, to the head of the student’s major department.

**Protection of Human Subjects for Research**

Scientific research involving human subjects has produced substantial benefits for society, but it also can pose troubling ethical questions. The mission of the University's Institutional Review Board (IRB) for Protection of Human Subjects is to ensure that research involving human subjects is conducted ethically. University and federal policies require that review and approval to use human subjects in research precede the research.

In the case of thesis research that involves the use of human subjects in any way, the principal investigator is responsible for contacting the college Human Research Review Committee to obtain approval for the planned research.

**Final Thesis Defense**

The final oral thesis defense is the culminating experience in the master's program. As such, all members of the thesis committee are expected to attend and participate in real time. Virtual attendance via interactive video or teleconference is permitted for off-campus external committee members.
members, but Tuscaloosa campus faculty should attend in person unless extraordinary circumstances dictate the need for virtual attendance. The thesis must comply with the regulations in A Student Guide to Preparing Electronic Theses and Dissertations.

"Completed" means submitted to ProQuest after being successfully defended, carefully edited following the defense meeting, and having the Committee Acceptance Form (CAF) signed by all committee members, department chairperson, and graduate dean. A majority of the thesis committee must approve the written thesis and defense before submission to the Graduate School. Following the thesis defense, the Committee Acceptance Form is submitted by the thesis chair through the UA DocuSign system in myBama.

Graduate School deadlines, including each semester's thesis deadline, are available at the Graduate School's homepage. Consult the ETD website for details of ETD submission, including information on what needs to be submitted to the Graduate School. The graduate dean must approve the thesis before the student can be cleared for graduation.

Comprehensive Examinations

In addition to the regular course examinations, a final comprehensive examination representing a "culminating" or "capstone" experience for a degree is required of all candidates for the master's degree (except for those candidates pursuing the Master of Accountancy, the Master of Business Administration, the Master of Library and Information Studies, the Master of Social Work, and the Master of Tax Accounting). The comprehensive examination is a culminating experience in which the student is expected to integrate prior learning. Each department, with approval of the Graduate Council, determines the most appropriate format. The various exams may consist of one or more of the following:

- a written and/or oral examination based on the content of the degree program;
- a thesis and final oral defense;
- a course requiring interpretation and integration of information from previous courses;
- a research paper, a "policy and practice" paper, or equivalent experience;
- a public performance or exhibition along with a contextualizing paper; and/or
- a practicum or internship.

If the comprehensive exam requirement is met with option 1 and/or 2 above, then the examining committee for comprehensive examinations must consist of at least three members of the graduate faculty from that department and appointed by the dean of the Graduate School. The examination must be given at least six weeks before the date of graduation (two weeks before for Plan II) and reported promptly to the dean of the Graduate School on appropriate forms. The final report is submitted by the department through the UA DocuSign system in myBama. The form should be submitted when all examinations are completed. A student may take the final oral or written examination only twice. Failing the examination twice results in dismissal from the degree program and the Graduate School.

Application for Graduation

Each candidate for a master's degree must submit an Application for Degree via myBama no later than the last day to add a course for the semester (or first term of the summer semester) in which requirements for the degree are to be completed. That specific date is published each semester at the Graduate School’s website under Current Students/Deadlines for Graduate Students.

Second Master's Degree

Six (6) semester hours of eligible credit from one master's degree at The University of Alabama may be applied to the requirements for a second master's degree, but only if the department of the second master's agrees to the courses in the plan of study. Any hours from the previous master's degree must have been earned during the six years (18 fall, spring, and summer semesters) immediately preceding the date on which the second degree is to be awarded. ***Please note that if a student double counts six hours between two master's degrees, no hours may double count toward any additional master's degrees.