Graduate Handbook
UCCS Masters in Physics

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Please see the Policies and Procedures page on the Graduate School website for more details than are contained in this handbook:

https://graduateschool.uccs.edu/current-students/policies-and-procedures

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Admission Requirements

- Applicants with a BA or BS in physics or in a related area, such as chemistry, computer science, electrical engineering or mathematics, are natural candidates for graduate study in physics.
- A BS or BA degree from a college or university of recognized standing, or work equivalent to that required for such a degree and equivalent to the degree given at this university, may satisfy the requirements for admission.
- Considerable course work in physics is required.
- Sufficient mathematical background is needed, i.e. at least two semesters of mathematics beyond the normal calculus sequence, such as differential equations and mathematical methods of physics.
- Promise of ability to pursue advanced study and research.
- Undergraduate grade point average of at least 3.0 on a 4.0 scale.
- Students should submit an application form, 3 letters of recommendation, all academic transcripts and a goal statement.

Students with an undergraduate grade point average of less than 3.0 but at or above 2.5, or students with an inadequate background, may be allowed into the program provisionally. This decision is made by the UCCS Physics Graduate Student Committee. Provisional status would subsequently be removed and a student given regular standing after completion of nine hours of graduate courses with a 3.0 average (or better).

Additional requirements for some students:

- students with **international transcripts** must take the Physics GRE exam. A minimum score for regular admission is in the range of 520-550.
- applicants for whom **English is a second language** must complete the TOEFL exam with a minimum score of 560 (paper-based exam) or 83 (internet-based exam) or 220 (internet-based exam). A band score of 6.5 on the IELTS is also acceptable. If the student has successfully completed one year of full-time academic study at a U.S. institution, this requirement can be waived. An oral interview with Physics faculty may also be required as proof of English proficiency, as the department sees fit.

Students meeting these minimum requirements are not automatically guaranteed admission to our program.

The graduate application forms are completed online and can be found at the Graduate School webpage: https://graduateschool.uccs.edu/

Transfer student requirements

Students who are transferring from other physics graduate programs must meet the minimum standards outlined above and, in addition, have a 3.0 average (or better) in all graduate work done previously. Full credit, up to nine hours (normally one semester of full-time course work), will be given for course work done previously, assuming the prior work is done at accredited institutions with approved programs. Course equivalency will be decided by the UCCS Physics Graduate Student Committee after interviewing the student and comparing textbooks, class notes, or any other helpful documentation. A Transfer of Credit form should be filled out by the student and the Physics Graduate Student Adviser.

Degree Requirements for Graduation

- 30 hours of course work, either 24 credit hours of course work plus six hours of thesis work (the thesis option) or 30 credit hours of course work without a thesis (the non thesis option).
- Regular degree students must maintain at least a 3.0 grade point average each semester or summer term on all work taken, whether or not it is to be applied toward the advanced degree intended.
- The Master's Comprehensive Exam is an exit oral exam that must be passed by all students. Students electing the thesis option may substitute an oral defense of their thesis. (See details below.)

Note: Courses from other departments may also be used as part of the coursework requirement, with the **prior written consent** of the graduate adviser. Some classes commonly used are:

	Course	**Credits**
PHYS 5030	Mathematical Methods in Physics	3
PHYS 5410	Statistical Mechanics	3
PHYS 6210	Theoretical Mechanics	3
PHYS 6250	Introduction to Quantum Mechanics	3
PHYS 6260	Quantum Mechanics II	3
PHYS 6310	Electromagnetic Theory I	3
PHYS 6320	Electromagnetic Theory II	3
PHYS 5150	Solid State Laboratory	2
PHYS 5160	Thin Films Laboratory	1
PHYS 5200	Computational Physics	3
PHYS 5220	Nonlinear Physics	3
PHYS 5240	Modern Magnetism: Fundamentals and Applications	3
PHYS 5300	Biophysics I: Life in Motion	3
PHYS 5420	Physics of Materials	3
PHYS 5460	Introduction to Solid State Physics I	3
PHYS 5470	Introduction to Solid State Physics II	3
PHYS 5480	Surface and Interface Physics	3
PHYS 5510	Modern Optics	3
PHYS 5490	Physics of Thin Films	3
PHYS 5600	Special and General Relativity	3
PHYS 5720	Stellar Structure and Evolution	3
PHYS 5950	Special Topics (when offered, such as Particle Physics or Nanotechnology)	1-6
PHYS 6900	Theory of the Solid State I	3
PHYS 6910	Theory of the Solid State II	3
CS 5600	Numerical Computing	3
ECE 5020	Semiconductor Devices II	3
ECE 5030	Advanced Semiconductor Device Modeling	3
ECE 5050	Microelectronics IC Fabrication Laboratory	3
ECE 5070	Electronic Property of Materials	3

MAE 5410	Astrodynamics	3
MAE 5091	Space Environment	3
MATH 5450 **OR** MATH 5620	Complex Variables **OR** Complex Variables II	3

Credits that are transferred into the program cannot be used in the calculation of the GPA. Therefore, a GPA above 3.0 must be obtained for classes that are taken at UCCS and that may be counted towards the degree. Grades of B or above are considered as passing grades in the program. If a class is retaken, then the higher grade only will be used to calculate GPA.

Degree Options

Thesis and Non-Thesis: For the thesis option, the student must take 24 credit hours. Thesis work is an additional six hours (three credits per semester) for a total of 30 credit hours. The non-thesis option requires 30 credit hours from the approved courses. For the thesis option, students are strongly encouraged to identify a Physics faculty adviser for their research when they start in the program, whose research interests match those of the student. They are also encouraged to start work on the thesis immediately.

Concentration areas: In order to design a more specialized degree, students may concentrate their elective courses in areas outside of physics. Concentration areas could include space studies, electrical engineering, mechanical engineering, geography, computer science, applied mathematics or other graduate disciplines. These concentration areas might be appropriate for students who have very well-defined career objectives which require a combination of physics with another discipline. Students should consult with the Physics graduate program advisor to establish a course sequence for the MSc degree.

Course Schedule

Please note that classes are offered every other year. You must plan accordingly to make sure that you take classes when they are available. The tables below show when we anticipate offering courses.

The core courses should follow the schedule below unless there are exceptional circumstances. Electives are often determined only one or two semesters in advance, depending on faculty availability and student demand. However, we will try to keep close to the schedule below. This is meant as a general guide only.

Academic Year 2022-23, 2024-25, 2026-27 etc.

	Fall (even year)	**Spring (odd year)**
Core:	5030 Mathematical Physics	
Core:	6250 Intro to Quantum Mechanics	6260 Quantum Mechanics II
Elective:	5460 Intro to Solid State Physics 1	5470 Solid State Physics 2
Elective:	5490 Physics of Thin Films	5300 Biophysics
Elective	5220 Nonlinear Physics	5510 Modern Optics
Elective		5150 Solid State Lab

Academic Year 2023-24, 2025-26, 2027-28 etc.

	Fall (odd year)	**Spring (even year)**
Core:	6210 Theoretical Mechanics	5410 Statistical Mechanics
Core:	6310 Electromagnetic Theory I	6320 Electromagnetic Theory II
Elective:	5200 Computational Physics	5240 Modern Magnetism
Elective:	5950 Special topics: Nanotechnology	5480 Surface and Interface Physics

Other courses that are not on the 2 year schedule but will be included as appropriate:
- 6900 Theory of the solid state 1
- 6910 Theory of the solid state 2
- 5950 & 6950 Special topics (Particle Physics, Group Theory, etc - as available)

Students may look up the time and location of their classes by going to the UCCS Course Information Center webpage: https://www.uccs.edu/cic/

Most graduate classes will be in Osborne Room A204 at 3:05pm or at 4:45pm.

Note: **5 credit hours per semester** is considered a **full time graduate load.**

Satisfactory Academic Progress and Examinations

Students will be assessed as making satisfactory progress in a number of ways, detailed below.

1. **GPA requirements**

   Students must maintain a 3.0 GPA in the program. If the GPA falls below 3.0 after completing a minimum of 9 credits, then students have one academic year in which to return the GPA to above 3.0. Note that transferred credits cannot be used to calculate GPA. Also, only graduate credits that may be counted towards the degree are counted towards the GPA.

   Students who fail to recover a 3.0 GPA will be dismissed from the program unless there are extenuating circumstances. This policy is consistent with Graduate School policy section B.7. See: https://graduateschool.uccs.edu/current-students/policies-and-procedures

2. **Continuous enrollment**

   Students must be enrolled at a minimum in Physics classes or thesis work in either Fall or Spring semester to be considered active in the program. Students in the "candidate for degree" status are also considered active. Classes taken from another department and up to two undergraduate classes may be counted towards the degree **with the prior written consent** of the graduate adviser, and students taking these are considered active in the Masters program. Students who are deemed as not active may be dismissed. Exceptions are made for those who have a Leave of Absence (see section below).

3. **Thesis adviser (thesis-option only)**

   By the time students choosing the thesis-option have successfully completed the coursework requirements of the MS program, they must identify a thesis adviser who agrees to supervise their research work. Students should enroll in thesis hours with their adviser and to do so should ask the Physics Program Assistant for an enrollment code. **Students who do not identify a willing thesis adviser will need to follow the non-thesis option, which requires 6 additional credit hours of coursework**.

   With the agreement of the Physics graduate adviser a student may use an external thesis adviser. This could be a faculty member at another university or someone who works in a technical position in a local industry. The external dissertation adviser must have a PhD in physics (or related field) and must be approved by the Graduate School.

   Each semester that thesis hours are taken, the thesis adviser must enter a grade. Typically, this grade will be IP (in progress) and all of the thesis hour grades will be changed to a letter grade on completion of the thesis. However, if a student does not make progress on the research in a given semester, a C, D or F grade may be entered immediately. This is so as to notify the student, the Graduate School and Financial Aid offices that progress is not being made towards the degree.

4. **Thesis requirements (thesis-option only)**

   A member of the Physics graduate faculty must act as the thesis adviser and must be satisfied with the student's thesis in order for the student to defend the work. Students should work with their adviser to meet research expectations. These expectations may vary depending on the area of Physics research in which the student works. However, in general it is expected that a student must make a significant scientific study as part of their MS studies. A first-author peer-reviewed publication may satisfy this requirement.

   Details of the requirements for dissertation formatting, plus the dates that various documents are due, can be found on the Graduate School website.

5. **Thesis defense exam (thesis-option only)**

   After the thesis has been accepted by the thesis adviser, a final oral thesis defense examination will be conducted by the **thesis advisory committee**.* The oral thesis defense must be passed by a majority of the thesis advisory committee in order to be considered passed. In case of failure, the examination may be attempted once more after a period of time determined by the committee.

A student must be registered for at least 1 thesis credit or "candidate for degree" status during the semester (or summer session) in which the thesis defense is held.

Please note that the "admission to candidacy" and "diploma card" must be completed at the beginning of the semester in which the student aims to graduate and defend the thesis, and must be submitted to the graduate adviser in Physics. Due dates are on the Graduate School website.

6. Exit/comprehensive exam (non-thesis-option only)

Students in the non-thesis option are required to write a short (15 page, double-spaced) typed report summarizing either some original research or summarizing a research topic in current physics. The paper should be at a graduate physics level. The exam consists of a 30-40 minute presentation of the report with questions on the topic from the faculty. More details and important tips can be found in Appendix II of this document. Report examples can be provided by the Graduate Advisor.

It is strongly encouraged that students work with a faculty adviser in preparing their report and the exit talk. The faculty adviser and/or the Graduate Adviser will be in charge of selecting the **exit exam committee.*** A majority of the committee must pass the exam for the student to graduate. A second attempt at the exit exam may be made during the following semester.

Please note that the "admission to candidacy" and "diploma card" must be completed at the beginning of the semester in which the student aims to graduate, and must be submitted to the graduate adviser in Physics. Due dates are on the Graduate School website.

*** Thesis advisory committee and exit exam committee**

These committees will contain three graduate faculty members. One committee member may be from another department such as Mathematics, Chemistry or Engineering, as long as that person is a member of the graduate faculty. The thesis adviser or report adviser will be in charge of choosing the committee.

Time to graduation and Leave of Absences (LOA)

Students have 6 years within which to finish the MS degree. An application may be made to the Graduate School to extend beyond the 6 year time frame.

Students are able to take a semester leave from studies without any academic penalty. For an absence of more than one semester, a student must apply for a "Leave of Absence" in their enrollment. This can be done by submitting the appropriate form to the graduate adviser, who then passes the form on to the Graduate School and Admissions and Records. Students who fail to notify the graduate adviser may be dismissed from the program as not making adequate progress. Please note that a Leave of Absence does not stop the clock with regard to the 7 year time limit.

Students should also notify the graduate adviser when they wish to re-enter the program after a Leave of Absence. If any changes have been made to the program during the student's leave, they may need to complete the new degree requirements.

Sources of funding

Students admitted to the MS program are NOT guaranteed funding. However, various funding opportunities exist that students are encouraged to look into:

1. **Teaching Assistant** positions worth roughly $2,000 per lab, plus the possibility of some tuition support. Physics faculty will nominate students for these positions but students can indicate their interest in their goal statement. Note that in 2018-19, first year, full-time PhD students were prioritized for these teaching positions. Students in good academic standing and those not working in local industry were also prioritized. Students further along in the program doing dissertation work should look at ways of obtaining Research Assistant positions instead.

2. **Grading** of undergraduate homework. Please contact the Physics Program Assistant or Physics Faculty teaching large enrolment classes to register your interest.

3. **Work study awards**. By completing the FAFSA and nominating UCCS as your school, you may be eligible for a work study award to pay for your research work on campus.
   Information can be found on various UCCS webpages, including Student Employment. https://stuemp.uccs.edu/frequently-asked-questions-student-employees
   In particular information on the FAFSA form is available at: https://studentaid.gov/h/apply-for-aid/fafsa. The priority deadline in order to be considered for Financial Aid including work study for the next school year is March 1st. (But completing early is recommended!) You should complete a FAFSA annually; they are available online by January 1st of each year. The school code for UCCS is: **004509**.
   If you are not awarded a work study award, you may appeal the decision and may pick up an award that someone else did not take up.
   If you do qualify for work study, please let your employer know ASAP so that your award can be applied to that job.

4. **External grants** for PhD students, including:
   - NSF Graduate Fellowships (https://www.nsfgrfp.org/)
   - The National Defense Science and Engineering Graduate (NDSEG) Fellowship (https://ndseg.sysplus.com/)
   - American Fellowships Dissertation Fellowships for women https://www.aauw.org/resources/programs/fellowships-grants/current-opportunities/american/dissertation-fellowships/
   - Ford Foundation Pre-doctoral Fellowship (http://sites.nationalacademies.org/PGA/FordFellowships/PGA_047958)
   - Paul and Daisy Soros Fellowships for New Americans (https://www.pdsoros.org/apply/eligibility)
   - List of many graduate fellowships (https://pathwaystoscience.org/Grad.aspx)
   - Department of Energy Graduate Fellowship (http://science.energy.gov/wdts/scgf/)

5. **Internal UCCS grants** for PhD students (https://graduateschool.uccs.edu/uccs-finances/finance-resources) including:
   Graduate Research Fellowships (first and second year students involved in research)
   Research and Professional Development Awards (maximum of $400)
   Mentored Doctoral Scholarships
   Graduate Opportunity Scholarship (new students only)
   Charles Zalabak Award for Best Physics PhD Student

6. **Research Assistant positions**. If the professor you wish to work with has a research grant available to fund students, you may be paid an hourly rate to do research work. Please note that on-campus work may not exceed 25 hours per week for all paid positions during Spring and Fall semesters. Contact Physics Faculty to register your interest.

Appendix I - Frequently Asked Questions

1) How long does it take to get a Masters?

   Typically 2-3 years. The thesis option typically takes more time than people expect.

2) How long is a Masters thesis?

   Again there is no specific requirement or rule, but the typical thesis is about 40-60 pages long, with double spaced text, figures, and references.

3) Where can I find resources for finding jobs?

   American Physical Society Career Page http://www.aps.org/careers/
   Physics Today Jobs http://jobs.physicstoday.org

Appendix II
UCCS Physics Masters
Non-thesis Option
Paper and Presentation Guidelines

Students in the non-thesis option are required to write a short, typed paper summarizing either some original research or summarizing a research topic in current physics under the supervision of an advisor. The paper should be at a graduate physics level. In addition to the paper, the student must give a 30-40 minute presentation of the paper. During the presentation, questions will be asked on the topic from the faculty.

A) Paper guidelines

Paper Format

- The paper must be formatted using some type of word processor.
- 15 pages. Papers over the 15 page limit will not be accepted.
- double spaced
- 12 point Times New Roman font **or** 11 point Arial font only
- 1 inch margins on all sides
- The paper should have the following sections
  - i) Title and author, plus faculty advisor's name
  - ii) Background and Introduction
  - iii) Technical Description (Experimental procedures/ Analytic calculations/ Mathematical models/ Simulations)
  - iv) Results
  - v) Conclusions (possible future work may also be discussed)
  - vi) References/Bibliography
  - vii) Appendix (if needed)

Other details to consider:

a) Background and introduction:
This section must be written for a person without specialized knowledge in the subject, but with a Bachelor's degree in Physics.

b) References/Bibliography
List any article/book/report/website that was used as a reference in the text. You must include appropriate citations to these sources in the text. They must appear in the same order in the bibliography as they appear in the text. You may use superscripts or numbers in square brackets [1], [2], etc to label references. The referencing style used should be consistent throughout the bibliography. Here is an example.

Articles: A. Author & B. Author, "Title of article," *Journal Name* v.21, p.444 (2012).
Books: A. Author, *Title of the Book* (Oxford University Press, New York, 2012).

c) Mathematical symbols and equations:

- Define all mathematical symbols in the text.
- Number each equation (1), (2), etc so it can be referred to later in the text.
- Do not discuss an equation in great detail before presenting it.
- Mathematical equations should be read and punctuated as part of sentences in a report. For example: "The magnetization of a paramagnet at temperature T and under the influence of a magnetic induction B is

$$M(T,B) = N\mu \tanh(\mu B/kT), \quad \text{Eq. (2)}$$

where μ is the magnetic dipole moment of a given site, N is the number of sites, and k is Boltzmann's constant. Notice in Eq. (2) that for very large magnetic fields, the magnetization saturates at its maximum value of $N\mu$."

d) Figures:

- Any figure must be explicitly mentioned in the text. It should be explained what the axes are (and their units) in the main text, and then what the figure shows.
- Figures must have captions. Captions must explain what the axes and units are and what the figure shows.
- Figures (or data for figures) taken from reference sources must be referenced in the figure caption.
- Parameters and equations used to generate figures should be stated in figure caption. For specific functions, the equation number should be stated in figure caption.

e) Abbreviations and Acronyms:

Define abbreviations and acronyms the first time they are used in the text. Do not use abbreviations in the title or section heading unless they are unavoidable.

B) Oral presentation guidelines

- A **30 to 40 minute** presentation of the paper is required using visual aids via presentation software such as Microsoft PowerPoint or Keynote for Mac. A whiteboard can also be used to answer questions or clarify points.
- **Practice** your talk. For a 40 minute presentation around **25 slides** is usually a practical maximum. You will be cut off if you go over the 40 min time limit.
- The presentation should include similar sections as the paper and be at the same level.
- Keep the talk **focused**; summarize the key points at the beginning and the end of the talk.
- Put your material in **context**; make sure the big picture is clear before going into details.
- Do not show figures and equations you do not intend to explain during your presentation.
- Remember to speak slowly, loudly, and clearly; do not mumble. Look out to the audience.
- As for your paper, make sure to give references to your reading where appropriate.
- Make sure that the axes of all plots are labelled clearly, and visible to the audience. This is the most common mistake – figures and axes that the audience cannot read.
- Do not overload slides with text. (You want your audience to listen to you, not read your slides.)