

Graduate Handbook

UCCS Ph.D. in Applied Sciences

Physics Option

Last updated: Nov 03, 2020

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>

Current Physics Graduate Advisers:

Prof. Anatoliy Pinchuk (effective 01/01/2021 please contact Kristen Petersen) – applying students

Assoc. Prof. Kathrin Spendier – enrolled students

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Admission Requirements

All applicants at a minimum requirement must:

- hold a baccalaureate degree in biological sciences, mathematics, physics or equivalents from an accredited college or university and have an appropriate background of undergraduate physics courses
- have an undergraduate GPA of at least 3.00 ("A" is equivalent to 4.0)
- provide three letters of recommendation, all past university transcripts and fill out an application form
- have interests that fit with our department's research directions
- submit all academic transcripts
- submit one goal statement
- promising students who do not meet all of the requirements may be considered as provisional applicants. Provisional status may be removed when the student fulfills all the requirements set out by the Physics Department when they were admitted. Students admitted provisionally should work with the Physics graduate adviser to ensure they have all the coursework preparation needed before undertaking graduate-level classes.

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.
- applicants who already hold a **Masters degree** in Physics should discuss their application with a potential faculty research adviser in advance, and mention these discussions in their goal statement.

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

Satisfying these minimum requirements does not guarantee admission to our program.

Transfer of Credits

Students transferring into the program with a Master's degree in an appropriate discipline also need to satisfy all the standards below for graduation. However, students may request a review of their existing credits and may have the number of credits required reduced at the discretion of the physics graduate adviser. If appropriate, the entire set of Master's degree courses can be applied to the PhD program. A transfer of credit form must be completed by the student and the graduate adviser, and must be approved by the graduate school, by the time the student is due to graduate from the PhD program.

Program Requirements

The student must complete a minimum of 66 hours of coursework and dissertation. This includes:

1. A minimum of 36 hours of passed graduate course work with average UCCS GPA above 3.0
 - o 21 hours of Core courses
 - o 15 hours of Specialization, Elective or Interdisciplinary courses
2. A minimum of 30 hours of dissertation work, plus passing the comprehensive exam, and completing and successfully defending the dissertation.

Physics Core courses: (21 hours)

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

Primary Physics Elective courses

Course	Credits
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

Note: Courses from other departments may also be used as electives with the **prior written consent** of the graduate adviser.

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.

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 2018-19, 2020-21, 2022-23, 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 2019-2020, 2021-22, 2023-24, 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 .	
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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 dissertation 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 may be used as electives **with the prior written consent** of the graduate adviser, and students taking these are considered active in the PhD program. Students who are deemed as not active may be dismissed from the PhD program. Exceptions are made for those who have a Leave of Absence (see section below).

3. Dissertation adviser

By the time students have successfully completed the coursework requirements of the PhD program, they must identify a dissertation adviser who agrees to supervise their research work. Students should enroll in dissertation 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 dissertation adviser must exit the program with a Masters degree, if all the MS requirements have been met, after giving an exit talk.**

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

4. Comprehensive exam

The comprehensive exam occurs after the student has taken 9-12 dissertation hours. This is not an exam covering all of physics. It is intended to determine whether the student is capable of doing original research in their selected field at the level appropriate to a PhD student.

The exam involves a presentation by the candidate, followed by questions. There can also be questions during the talk. The candidate should plan to talk for 25-30 minutes, leaving at about 15 minutes for questions. The exam is administered by the dissertation advisory committee* to determine if the dissertation topic is appropriate, and if the student is adequately prepared for work on the dissertation. Students must demonstrate a command of the physics, a strong plan for the work, and show that a thorough literature review has been completed. (See Appendix I for a typical evaluation sheet for the Comprehensive Exam)

Students refusing to take the comprehensive exam when asked by Physics faculty member(s) after completing 9 dissertation credits may have a hold placed on their enrollment until this fulfillment is completed, and may be dismissed if the exam is not attempted within one calendar year.

A passing grade in the exam is counted if over half of the dissertation advisory committee votes that the student is prepared for work on the dissertation. A written report will be given to the student by the committee. If students do not pass this exam, they may take the exam **once** more in the following semester. If after retaking the exam, the student still does not pass, then the student will be

dismissed from the PhD program with the option of leaving with a Masters degree if all requirements have been met. The Comprehensive Exam may be used as the oral exit exam required for graduating Masters students or students wanting Masters on the way to PhD.

If a student switches projects and/or advisers after the Comprehensive Exam, they will be required to take a second Comprehensive Exam within one calendar year to demonstrate preparation for the new PhD dissertation.

5. **Dissertation requirements**

A member of the Physics graduate faculty must act as the dissertation adviser and must be satisfied with the student's dissertation 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 new scientific contribution as part of their PhD studies. **Several first-author peer-reviewed publications would normally be expected.** Note that publications which are not subjected to peer review are not counted as part of a "significant scientific contribution." Students and dissertation advisers are encouraged to communicate clearly with each other about the expectations and scope of work.

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

6. **Dissertation defense exam**

After the dissertation has been accepted by the dissertation adviser, a final oral dissertation defense examination will be conducted by the **dissertation advisory committee**.* The oral dissertation defense must be passed by a majority of the dissertation 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 dissertation credit or "candidate for degree" status during the semester (or summer session) in which the dissertation defense is held. See the Graduate School website for the last date in a semester that defenses are allowed. Typically this is roughly a month before the end of the 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.

* **Dissertation advisory committee**

The dissertation committee will contain four or more physics faculty plus one outside member of the graduate faculty (from another department or another university). The dissertation adviser will be in charge of choosing the committee. If a member of the committee is not already a member of the UCCS graduate faculty, paperwork to add them must be submitted to the Graduate School by the Physics graduate adviser when the "admission to candidacy" form is due, near the beginning of the semester of graduation.

Time to graduation and Leave of Absences (LOA)

Starting in 2018-19 students have 9 years within which to finish the PhD degree. An application may be made to the Graduate School to extend beyond the 9 year time frame. (Previously, the time to graduation was 7 years for doctoral programs at UCCS.)

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 9 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.

Masters degree on the way to PhD

Many students choose to obtain a Masters degree on the way to PhD. If you would like a Masters degree, you should contact the physics graduate adviser and the Graduate School to organize the application. Students must satisfy the requirements for the Physics Masters degree (see the Masters handbook or website) and must give an exit paper and talk. This talk may be on the research that has started or is proposed as part of the PhD.

Information on this page is subject to change and is not official. Consult the [UCCS Academic Catalog](#) for official information.

Sources of funding

Students admitted to the PhD 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: <http://fafsa.ed.gov>. 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, including:
 - Graduate Research Fellowships (first and second year students involved in research)
 - Travel 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 - Comprehensive Exam – Evaluation Sheet
Applied Science/Physics PhD**

Circle one (A – best)

- | | | | | |
|-----------------------------------------------------------------------------------------------|---|---|---|---|
| 1) Did the student seem to have a reasonable command of the physics involved? | A | B | C | D |
| 2) Did the student show a good knowledge of the research area and what had already been done? | A | B | C | D |
| 3) Did the student have a good understanding of the motivation for the proposed research? | A | B | C | D |
| 4) Did the student explain appropriately what new research he/she had already done? | A | B | C | D |
| 5) Did the student have a good plan as to what was needed to complete the PhD research? | A | B | C | D |
| 6) Is the timeline for this additional work reasonable? | A | B | C | D |
| 7) Is the research at a suitable level | A | B | C | D |

8) If appropriate, list any additional specific projects that should be done to complete the work

- 1) _____
- 2) _____
- 3) _____

Appendix II Typical Timeline for the PhD program

Full time students

Years 1-2 - Primarily coursework (2-3 courses per semester)

In the first couple of years the student should also begin to think about research. Students are advised to talk with several faculty members about their areas of research and what it is like to work with that faculty mentor. Students can begin research as early as Year 1, but should make sure that the research does not adversely affect their coursework.

Typically by the end of Year 2, the student should have arranged to work with a faculty research adviser.

Years 3 and later - Primarily research

Comprehensive Exam

Students will often take their Comprehensive Exam at the end of Year 3 when they have had about a year of research experience. Students who start their research earlier will need to take the Comprehensive Exam earlier as discussed in the main text.

How do you know when you are done?

A PhD can be awarded when a student has completed a significant body of original work. This work is collected in the dissertation, and the PhD committee and the adviser judge whether this requirement has been met.

In satisfying the "original" and "significant body" criteria one often looks for "first-authored" papers and papers in archival journals, rather than conference papers. But this is just a guideline. In this, the PhD adviser plays the major role....and different advisers can and do have different feelings about meeting the "significant" and "original" criteria. **So, the student needs to talk to his or her PhD adviser and make sure they both understand what is expected.**

And just counting papers isn't the point. One paper may be quite significant, others may just be good. And these papers will be evaluated differently, by the student's PhD research adviser and by the PhD committee. In general, one wants to see the equivalent of about 4 first-authored papers in significant journals. But this is not a requirement or a contract; this is simply a way to get a feeling for how much work should be done.

The semester you graduate requires special attention

The semester you graduate has special requirements. These include filling out a Diploma Card, Advancement to Candidacy Form, submitting your dissertation in the appropriate format, and defending your dissertation in an oral presentation and exam. **Many of these requirements need to be completed early in the semester.** Typically the dissertation exam must be completed about a month before the end of the semester, and a near-final version of the thesis needs to be sent to the Dissertation Committee at least a week or two before that.

You should speak with your graduate research adviser and the Physics graduate adviser at the beginning of the semester when you will graduate to learn about the requirements and their specific time-line.

Part-time students

Typically part-time students should take only 1-2 courses per semester. This will extend the time spent in coursework and research. Part-time students who are working on research projects should be able to devote at least 15 hours of research time each week.

Appendix III - Frequently Asked Questions

- 1) How long does it take to get a PhD?

Nationally, the average time is 5-6 years including all coursework and research.

- 2) How long is a PhD Dissertation?

Again there is no specific requirement or rule, but the typical dissertation is about 100 pages long, with double spaced text, figures, and references.

- 3) What is the typical employment after the PhD?

About 60% of students work for industry after the PhD.

The students who are intending an academic career typically look for a job as a post-doctoral researcher where the primary duty is completing research on a specified topic. (These positions typically are for a year or two and could be at a University, National Laboratory, or at a research institution around the world.) One typically looks for a faculty position (Assistant Professor level) after one or two post-doctoral positions.

- 4) What are typical salaries for various positions?

PhD in industry - \$80,000 - \$90,000 per year

PhD in Post-Doctoral position - \$40,000 – \$60,000 per year

Faculty position in physics - \$60,000 - \$70,000 per 9 months

- 5) 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>