Department of Physics
University of California
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Graduate Student Guide

2024-2025

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I. Department Overview

Chairperson: Richard Scalettar (175A PHY)

Vice Chairperson, Graduate Affairs ("Graduate Program Advisor"): Rena Zieve (219 PHY)
- Graduate academic matters and graduate administrative matters having to do with financial support, course requirements, exams, exceptions to Graduate Studies policies, etc.

Vice Chairperson, Administration & Undergraduate Affairs: Mike Mulhearn (317 PHY)
- Courses and teaching assignments, general administration, and the undergraduate program.

Laboratory and Teaching Supervisors: Dina Zhabinskaya and Tom Weideman
- Train and supervise Teaching Assistants for Physics 7 (Dina) and Physics 9 (Tom)

Department Manager: Lourdes Hernandez Gomez (175B PHY)
- Heads administrative side of the department.

Graduate Program Coordinator: Lenna Crabbe-Charlesworth (174C PHY)
- All administrative aspects of graduate program.

Undergraduate Academic Advisor: Amy Folz (174A PHY)
- Course registration, grades, PTA numbers, Roster program, other enrollment issues.

Student Assistants (174 PHY)
- Handle desk copies of text books and lab manuals related to TAing, schedule rooms for office hours, and manage end-of-quarter course evaluations.

Financial Assistants: Monda Korich (174 PHY) and Falicia Savala (174C PHY)
- Employment records, reimbursement forms, and keys.

Computer Support: Nathan Domek and Daniel Wang (536 PHY)
- Computer support, email access. Email help@physics.ucdavis.edu for technical assistance.

Academic Advisor
- Assigned at start of first year, but possibly re-assigned later on. Should be consulted for all academic matters. Can also discuss the prelim exam, finding a research advisor, personal difficulties that may arise, etc.

Research Advisor ("Major Professor")
- The professor who guides a student's thesis research. When the student advances to candidacy, the research advisor becomes the chair of the dissertation committee.

Graduate Curriculum Committee, Student issues: (2024-25 Chair: Steve Carlip)
- Petitions and exceptions to departmental policies.

II. Practical Details

OFFICES

All first year graduate students are provided with a desk. Students beyond the first or second year are generally assigned to an office designated for a particular research area. Some students have desks in their research labs. Office locations are posted on the bulletin board outside the department office.

If you want to change offices and can arrange a trade, please be sure to inform Lenna. **Do not move offices without talking to Lenna Crabe-Charlesworth.**

KEYS

All physics graduate student will receive a "GRAD KEY" (A1AAB). Please see Valerie Hoag in 174 Phy to check out the key. This key gets you into the building, your office, and undergraduate lab rooms. If you need access to other places, the faculty member who is in charge of the area must give authorization. Forms for this purpose are available in the Business Office, or the faculty member can send an email to Valerie.

COMPUTER POLICIES AND SERVICES

For all computer-related inquiries, please contact the Physics IT team at help@physics.ucdavis.edu. The Physics IT knowledgebase, full of handy information concerning computer services inside and outside of Physics, is located at:

https://ithelp.physics.ucdavis.edu

Physics computer policies fall under the Campus Electronic Communications Policy and Cybersafety policy. It speaks to privacy and security policies. Please review the PDF policy here:

https://ucdavispolicy.ellucid.com/documents/view/361/active/

Computer Lab, Room 106: There is a Physics general-use computer lab in room 106 of the Physics building. The computers in the classroom are available for graduate student use at any time, except when a scheduled class is using the room. While incoming graduate students should have their own campus login ID and passphrase, to activate their accounts for the computer lab in room 106, students need to visit:

https://physauth.physics.ucdavis.edu

The computers in the classroom all run a version of the GNU/linux operating system. Software may be requested to be installed on the systems by contacting the Physics IT team.

Departmental Computers: For other departmental computer use, such as a department-assigned office computer, PI approval is required and the login may differ a bit between systems. Contact the Physics IT team for access.

Personal Computers: Graduate students may also use their own laptop computers on the wired Physics network with PI approval. Computers must first be registered with the Physics IT team. Systems must be running an up-to-date operating system with all security patches, firewall, and antivirus software where appropriate before being allowed to use the wired network.

Wifi: Campus provides EduRoam wifi in most areas of the Physics building and is available to everyone without prior approval though network resources are limited. Log in using yourKerberosid@ucdavis.edu and your campus passphrase. Note that although the login looks like an email address, it may not be your UCD email. For some people, yourKerborosid is not the same as yourEmailid.

Remote Access or Open Firewall Ports: To request remote access to your computer or to a server within the Physics network, please contact the Physics IT team.

Web Sites: Web space and domain names can be provided to students.

Email: As a student at UCD you automatically also have access to Davismail, UCD-branded Gmail, as your primary @ucdavis.edu address. The campus IT Catalog lists many campus services available to you, including email information:

https://servicehub.ucdavis.edu/servicehub?id=catalog

Your professors and other colleagues within the department will assume that they can reach you by sending email to your UC Davis email account. You must either check that account regularly (once a day or more) or set up your account to forward email to an account that you do check regularly. For forwarding see: https://computingaccounts.ucdavis.edu. It is recommended to keep your UCD email separate from personal email.

Computing Cluster: There is a division-wide shared computing cluster called Peloton. For information and access, please see the following site. Feel free to contact the Physics IT team for training to run jobs on the cluster.

https://wiki.cse.ucdavis.edu/support:systems:peloton

MAILBOXES

Mailboxes are located in room 173. It is essential for you to check your mail at least weekly, and more often if you are a TA. If you are away from the building, have a friend check it for you on a regular basis.

PHOTOCOPYING and SUPPLIES

Copying and other department services and office supplies are provided **only for departmental purposes, and require proper faculty authorization. Supplies and copying are NOT provided for your personal coursework.** Specific instructions for TAs are provided in Section VI of this handbook.

SCANNING DOCUMENTS

The photocopier in Room 173 can also be used to scan documents and e-mail them to yourself. Another scanner is available in Room 428.

COFFEE/TEA GATHERING

On Mondays during the academic year, there is a coffee/tea gathering at 3:30 pm in the department atrium on the first floor, before the colloquium talk at 4:10 pm. This is an opportunity for faculty and graduate students to meet and talk in an informal atmosphere. For schedule changes, a notice will be posted in the Physics Dispatch, a weekly email.

PARKING

Students can park in C and L lots. Typically you'll pay by the day, using the AMP Park app. There are also some hourly parking options for short visits. Generally campus parking is free weekdays 10 pm to 7 am, weekends, and University holidays. For more information, visit Transportation Services.

BICYCLES

You must register your bicycle. You can be ticketed for riding an unregistered bike. For more information, visit https://transportation.ucdavis.edu/bicycleprogram .

III. Expectations and Policies

Graduate students have three main demands on their time: coursework, teaching, and research. The balance among the three shifts as a student progresses. Most students find that coursework dominates during the first year, with a significant amount of teaching and almost no time for research. The balance shifts towards research in the second and third years, as less time is spent on classes and in many cases also on teaching. Most of our Masters degrees are awarded based on coursework, but the Ph.D. is always a research degree. These three elements of graduate school are discussed more in later sections. This section focuses instead on administrative aspects of the program.

The rules governing graduate school have many sources. The main ones are Physics and Astronomy Department Policy and Graduate Studies Policy, but some regulations come from other places such as the Registrar's Office, the UC Office of the President, or Graduate Council. In general, only the body that sets a policy can override or waive it. Talk to the Graduate Coordinator if you may need an exception; even if it is not a Physics and Astronomy policy, the Department can lend support to your exception request.

Graduate Studies has its own Graduate Student Guide with many additional topics: https://grad.ucdavis.edu/graduate-student-resource-guide

CONDUCT

As you enter and go through the Physics and Astronomy graduate program, you are making a transition from being a student to being a professional, i.e. to becoming an independent researcher and colleague. You need to recognize the new responsibilities that come with this development. In your relations with your professors and fellow students, you are expected to maintain the sort of courteous, helpful and respectful attitude which provides a supportive environment for all your colleagues in the department to do their coursework and research.

The transition to professional also involves maintaining appropriate behavior towards your students. As a teaching assistant/instructor, you must follow the same policies enunciated in the University of California Faculty Code of Conduct. This Code includes the ethical principles to which faculty are to be held: “Professors demonstrate respect for students as individuals and adhere to their proper roles as intellectual guides and counselors... They avoid any exploitation, harassment, or discriminatory treatment of students.” Among the types of unacceptable faculty behavior is the “Use of the position or powers of a faculty member to coerce the judgment or conscience of a student or to cause harm to a student for arbitrary or personal reasons.”

EXAMS

Preliminary Exam (Written exam): The Preliminary Exam is given twice per year, in the week before the start of Fall quarter and midway through Spring quarter. The exam consists of two four-hour sessions, each with five questions. Topics are Electricity and Magnetism, Classical Mechanics, Quantum Mechanics, Statistical Mechanics and Thermodynamics, and Experimental Methods, all at the level of junior or senior undergraduate coursework. Some questions are standard textbook

problems, but others may require creativity, common sense, or synthesis of concepts across multiple topics.

Students must pass the exam by the end of their second year. The department hopes and expects that all students will pass, which is indeed what usually happens. That said, students need to put in the effort to prepare for it thoroughly. One purpose of the exam is to give students a chance to synthesize material learned in separate classes. Many faculty remember an analogous exam as the time in their life when they knew the most physics. After passing and moving on to research, the focus quickly becomes far more specialized, so that physicists know much more about certain topics but have less breadth of general knowledge. Entering students are strongly encouraged to take the exam when they first begin the program. Studying for the test is an excellent review for the graduate coursework.

Qualifying Exam (Oral exam): The Qualifying Exam is the final test of whether a student is prepared to do the independent research required for a Ph.D. The exam is conducted by a five member committee, proposed by the student and approved by the Graduate Vice Chair. The committee should include faculty from both within and outside the student's broad research area, and should include both theorists and experimentalists. The research advisor may not be on the committee. An example of a committee for a Condensed Matter Experiment student is as follows:

CME faculty member– Chair
CME faculty member
CMT faculty member
Physics faculty member outside of CM
Faculty member outside of the Department

Students should prepare a 30 minute talk for the exam. The committee asks questions during the talk and may have an additional question session afterwards. Questions are usually inspired by the research talk, but they may also probe course material from before or after the Preliminary Exam.

The exam result is pass, fail, or not pass. A student who passes will then select a dissertation committee and complete the Advancement to Candidacy paperwork. A student who fails must leave the Ph.D. program. A not pass is an intermediate result which comes with conditions specified by the committee; the student may be told to retake the entire exam, write a paper for the committee, etc. If the student retakes the exam, the result on the second attempt must be either pass or fail.

Students must take the Qualifying Exam for the first time by the end of Spring quarter of the third year. All students must pass the Qualifying Exam and advance to candidacy before the start of their fourth year. Exceptions may be requested from the Graduate Curriculum Committee before the end of Winter quarter of the third year.

Receiving a not pass on the first attempt is common; probably one-quarter to one-third of our students must do some additional work or retake the entire exam. Failing on the second attempt happens very rarely.

COMPLETING THE DEGREE

M.S. Degree: After passing the Preliminary Exam, either at the Ph.D or M.S. level, you can file for a M.S. degree under Plan II. Plan II also has course requirements. The usual way to satisfy both departmental and university rules is to complete 36 units of 200-level graduate courses, including all of the standard first-year graduate classes. It is possible to include some units from upper-division classes, and the Graduate Curriculum Committee can approve exemptions from specific courses.

Ph.D. Degree: To file your dissertation, you must contact Graduate Studies and set up an appointment to turn in your completed and signed title page and abstract. You must submit an electronic copy of the dissertation at least 48 hours before the meeting so that Graduate Studies can check for formatting issues. You must also complete exit questionnaires before the final meeting. For more information, see https://gradstudies.ucdavis.edu/preparing-filing-your-thesis-or-dissertation. Please provide the department with an electronic copy of your dissertation to be included in your student record.

EMPLOYMENT AND FINANCIAL SUPPORT

The Department of Physics has a longstanding goal that all students making satisfactory progress toward their Ph.D. receive financial support. This may mean a TA for the first two or three years and then a GSR on the Research Advisor's extramural grant(s) until finishing, but the amount of GSR support available depends strongly on the research area and advisor. Students whose progress is marginal or unsatisfactory should not count on support. In addition, the department will not normally support more than three students in third year and above per advisor. An advisor may have more than three students, as long as some are supported through GSR or non-departmental fellowships.

The department normally does not guarantee funding for M.S. students, but if positions are available they may receive support.

Types of Financial Support

Fellowship: External fellowships, often very competitive, are available from NSF, DOE, NASA, and other agencies. The Office of Graduate Studies awards several internal UC Davis fellowships, and the Physics department has direct control of some fellowship funds as well. Fellowships awarded through the department or Grad Studies require US citizens and permanent residents to have a current FAFSA on file. International students are also eligible for many of these fellowships, and they do not need to file a FAFSA.

Graduate Student Researcher (GSR): Consult with your Research Advisor about the possibility of being employed as a GSR. The department does not keep a list of "open" GSR positions so you must be proactive about seeking out this type of funding.

Work-Study: This program is available in conjunction with the GSR appointments. You must have a FAFSA on file to be considered. International students are not eligible.

Teaching Assistantship (TA): The department employs approximately 90 graduate students each quarter for teaching duties, mainly in Physics 7 D/Ls, Physics 9 discussions and labs, and upper-division lab classes. Another large group are Course TAs for lower division, upper division and graduate courses. To be fully considered for a TA position in a given quarter, you must respond promptly to calls that are sent out the previous quarter.

Loans: Need-based loans are available (check with the financial aid office in Dutton Hall); even GSRs and TAs qualify for some of these. Short-term emergency loans are also available.

Summer Teaching Positions: The Department hires about 60 graduate students for summer teaching positions, compared to about 90 each term during the academic year. Fortunately faculty hire more GSRs in the summer, so in recent years we have been able to provide summer funding for all students making good progress. Be aware that this may not continue. **Plan your budgets accordingly - don't assume you will have summer support after your first year.**

A typical summer TA position is for one 6-week summer session and pays only 50% to 75% of a standard TA position for an academic quarter. This reduced salary is paid in two equal installments, with no salary for the remaining month of the summer. Which month is skipped depends on which session you teach.

Limitations on Employment: There is an upper limit of 18 quarters of employment as a TA, and 21 quarters as a GSR, not including summer employment. This means that you cannot, for example, be a TA for more than six years. Please plan accordingly. This is UC-wide policy and there are no individual exceptions to these limits. (However, each limit is increased by 3 quarters for students who were in graduate school during the first year of the Covid-19 pandemic.)

TUITION, FEES, AND HEALTH INSURANCE

Any TA or GSR appointment of 25% time or more pays all of the student's in-state tuition and fees and health insurance.

Non-Resident Tuition (NRT) of about $5000 per quarter is imposed on domestic out-of-state students for at least one year, and on international students for their entire term of study. The department covers this expense for first-year Ph.D. students who are making satisfactory progress, but both domestic and international students must take measures to limit the expense in future years. Domestic out-of-state students must take action **immediately upon arrival** so that they can establish CA residency before the start of their second year. More information about establishing CA Residency can be found at the Office of the Registrar's website. The key points are that all out-of-state students who are U.S. citizens or permanent residents should obtain a California driver's license or state ID **by the end of October** or explain to the Graduate Coordinator why this is impossible; they should file California taxes for 2024 as Part-Year Residents (not Non-Residents); U.S. citizens should register to vote in California, again by the end of October; and they cannot spend a total of more than 6 weeks outside California during the year. Under no circumstances should a student vote in another state after beginning graduate school or retain another state's driver's license or state ID. Students who omit the required steps and are denied residency will be responsible for paying their own NRT.

International students have a different deadline. NRT will be covered for three years, subject to the student's making satisfactory progress, but the student must pass the Qualifying Exam and advance to candidacy before the start of the fourth year. The department will not pay NRT for students who do not advance on time. After a student advances, NRT is zero for the next three years by a UC-wide policy. Students can then receive UC Davis fellowships that cover NRT for up to two more years. An international student who has not graduated by 5 years after advancement to candidacy will have to pay the NRT without assistance from the department.

ALTERNATE STATUSES

In Absentia Registration: This status is suitable for students who are conducting research outside of California. Students are able to register for fewer units and pay reduced fees since they are away from the university and have access to fewer instructional resources and student services than students who are on or near campus. For more information about *In Absentia* registration please visit: http://gradstudies.ucdavis.edu/forms/in-absentia-policy.pdf

Filing Fee: A student whose dissertation is nearly finished may go on Filing Fee for one quarter. The student may not be employed or receive fellowship support while on Filing Fee, and Filing Fee cannot be renewed beyond one quarter. The student does not receive health insurance, but can choose to continue SHIP by paying the one-quarter premium of about $2500. For more information about Filing Fee visit: https://grad.ucdavis.edu/filing-fee.

PELP: The Planned Educational Leave Program (PELP) allows students to take leave from the university for up to one year, with automatic reinstatment in the graduate program at the end of that time. A student on PELP cannot hold UC Davis employment. For more information about PELP please visit: https://grad.ucdavis.edu/planned-educational-leave-program-pelp.

Withdrawing: A student can withdraw entirely from the University and apply for readmission at a later date. There are three key differences from PELP. First, there is no limit on the time the student spends away from the University. Second, after withdrawing the student is free to accept employment at UC Davis. Third, readmission is not guaranteed.

IV. Coursework

First-Year Students

Apart from the regular courses discussed below, first-year students should sign up for the department Colloquium (290) each term. However, if a student's TA assignment conflicts with 290, the student should not enroll in 290 that term, and there is no need to "make up" the class later. First-year students should also take Introduction to Department Research (295), usually offered in Winter. All TAs must take the training class 371 in Fall, and they should enroll each term in the 390 section corresponding to the course they are teaching.

Core Classes

All students must take required core courses in mechanics, electromagnetism, quantum mechanics, and statistical mechanics. These provide the foundation for further more specialized coursework and for reading physics journals and attending talks. The core classes are offered in fall and winter every year.

Cluster Classes

Each research subfield has further required classes, known as a "cluster" and listed below. The student must be taking the final courses in the cluster before attempting the Qualifying Exam.

Condensed Matter Experiment: PHY 240ABC
Condensed Matter Theory: PHY 219B, 240ABC
Astrophysics: PHY 261, four courses from 265-269, and one of 260, 262, or 263
Theoretical Cosmology: PHY 230AB, 261, 260, 262, 263, and one of 265-269
Fields, Strings, and Gravity: PHY 230ABC, 232, 233, 260
Nuclear Physics: PHY 230A, 252B and three courses from 224ABC, 229AB, and 252C
Particle Experiment: PHY 230AB, 245ABC, 252BC
Particle Theory: PHY 230ABC, 245ABC, 246A, 252B
Computational Science and Complexity: PHY 219B, either 256AB or 255, and one additional graduate course in complex systems which could be outside physics (e.g. ECS 253, NPB 287)
Biophotonics Designated Emphasis (Experiment): PHY 240AB; EAD 271; BIS 101 or 102 or 104 or BIM 202
Biophotonics Designated Emphasis (Theory): PHY 219B, 240AB; EAD 271; BIS 101 or 102 or 104 or BIM 202

Example Schedules For First Two Years:

There are many ways to arrange the core and cluster classes. This is something to discuss with your academic advisor, and with your research advisor when you have one. Course instructors, the graduate vice-chair, and other grad students may also be helpful resources. The example schedules

below illustrate a few of the many options. Empty spots in the schedule can always be filled with research units, 270 or 299.

Astrophysics student with no prior quantum mechanics, who takes the undergraduate quantum class 115AB. The astrophysics cluster classes are usually offered in alternate years, so the student also takes one of those during the first winter and takes 219A to the second year.

Fall 1	Winter 1	Spring 1	Fall 2	Winter 2	Spring 2
115A	115B	250/261	215A	215B	263
200A	269		260	219A	268
200B	200C		267	266	

Condensed matter experiment student with no prior solid-state physics class. It's important to take 140A before 240A, which can mean taking one of the core classes in the second year.

Fall 1	Winter 1	Spring 1	Fall 2	Winter 2	Spring 2
215A	215B	215C	240B	240C	
200A	219A	240A		200C	
200B	140A				

Condensed matter theory student who took a solid-state physics class as an undergrad. This student takes the 104C math methods class to learn contour integration.

Fall 1	Winter 1	Spring 1	Fall 2	Winter 2	Spring 2
215A	215B	215C	240B	240C	
200A	219A	219B	104C		
200B	200C	240A			

Fields, strings, and gravity student entering with a Masters degree. If the student has the core classes and 230A waived based on prior work, the schedule could be quite light and the student can get a quick start on research.

Fall 1	Winter 1	Spring 1	Fall 2	Winter 2	Spring 2
260	232	233			
230B	230C				

Particle experiment student who spent two years away from school after college. Some undergraduate review, or at least a reduced courseload, is often a good idea.

Fall 1	Winter 1	Spring 1	Fall 2	Winter 2	Spring 2
215A	215B	230A	230B	252C	245C
200A	219A	252B	200B	200C	
104A			245A	245B	

Student who spent six years away from school after college. Spending a year reviewing undergraduate coursework is almost always appropriate after a long gap. The 250 in spring of the first year is a prelim exam review class. The student takes the core classes in the second year.

Fall 1	Winter 1	Spring 1	Fall 2	Winter 2	Spring 2
104A	105A	105B	215A	215B	(depends
115A	115B	250	200A	219A	on research
			200B	200C	area)

ADDITIONAL CLASSES

Although students usually complete all required courses during their first two or three years, they must continue to enroll in at least 12 units per term throughout graduate school. This can be done in part through courses outside the student's cluster or even outside the department, although students should be careful to leave enough time for their research. A rule of thumb is to take no more than one class per quarter and to fill the remaining units through research and seminar credits. Some options are described below.

Physics 250: Typically one or more of these special topics classes is offered each term. Certain 250 classes are taught every year, others once every few years or even more rarely. Sometimes the workload is light, but it can be fully as much as for regularly numbered classes.
Physics 270: This three-unit course is for research group meetings. Each faculty member has a unique section number assigned. Students involved in research should sign up; this will be rare for first-year students but common for everyone else.
Physics 285: This “career skills” seminar, offered each Spring, helps students learn about non-university job opportunities. It brings in a variety of speakers with physics degrees who have jobs outside academia. Although the course is mostly taken by students nearing graduation, junior students are welcome. Student not formally enrolled may attend talks that particularly interest them.
Physics 291, 292ABC, 293, 294: These one-unit seminar courses consist of weekly talks in a particular research area, usually given by visitors from outside UC Davis.
Physics 298: One way to explore a possible research area is through supervised reading units. Typically a student reads one or more papers or part of a textbook, with some discussions and guidance from a professor in the field.
Physics 299: Advanced students normally meet the minimum course-load requirements in part through Physics 299, which gives up to 12 units of "research credit" with their thesis advisor.
Physics 371: In Fall terms this class introduces new graduate students to teaching techniques. Students who wish to pursue independent, teaching-related projects may also enroll in 371 for Winter or Spring quarters.
Physics 390: Students who TA should sign up for the appropriate section of the one-credit Physics 390, “Methods of Teaching Physics.”.

COURSEWORK EXCEPTIONS

A student considering a schedule where the required classes will not be completed within three years should discuss the plan with their Academic Advisor and/or Research Advisor. Approval from the Graduate Curriculum Committee will also be needed since the Qualifying Exam will have to be delayed. The Graduate Curriculum Committee will also consider course substitutions and waivers. All such requests should first be approved by the Academic Advisor.

MINIMUM GPA

The minimum GPA for satisfactory progress is 3.0. A student goes on academic probation if the overall GPA or that for the most recent quarter falls below this threshold. Graduate Studies policy does not allow a student to be employed in any capacity (Teaching Assistant or Graduate Student Researcher) while on probation. However, in most but not all cases the department can obtain a one-time exception. Exceptions become more difficult the longer the student remains on probation. The exact situation also matters; a 2.98 GPA is a minor problem but a 1.98 GPA indicates more serious trouble. A separate consequence is that a student cannot advance to candidacy for the M.S. or Ph.D. degree while on academic probation, with exceptions all but impossible. For this purpose there is a world of difference between a 2.998 and 3.002 GPA.

V. Research

The Ph.D. degree is fundamentally about research. You must do original work to earn the degree. Most of our students excel at traditional coursework, and the transition to research with its greater freedom and less well-defined tasks can be frightening. During the first year the 290 (Colloquium) and 295 (Introduction to Research) talks familiarize students with research questions and the type of work that goes into answering them. Research is the ultimate example of learning by doing though, so students need to jump in and get started, often by doing a simple part of a larger project or by trailing a senior student. Ask questions, lots of them. Go to seminars, even when you get lost partway through. Read related work, especially suggestions from others in your group. You will eventually find that what you're doing starts to make sense. You'll learn how to fix things that go wrong and what the next step should be when you finish part of a project. The most valuable part of your Ph.D. training may be the confidence you gain in your ability to tackle a huge unsolved problem, break it into manageable pieces, and ultimately find a solution.

Choosing an Advisor

Usually graduate students approach faculty they are interested in working with. Occasionally a faculty member with a new research grant wants to hire a GSR and contacts students, but you should not wait for this to happen. A good way to start is attending research group meetings, where you will learn both about the research and also about the group dynamic. Finding a good match in terms of personality and working style is at least as important as the research topic. Talk to more senior students and postdocs about how often your potential advisor meets with students, how much research support students receive, what the advisor does to introduce students to the larger research community, and what students do after graduation. You can use the Student-Advisor Expectations worksheet as a guide to aspects of advising style that you might want to ask about. You should also be aware that the department will not normally support more than three students in third year and beyond per advisor. Make sure your potential advisor has fewer than three students, or that some are supported through GSRs or outside fellowships.

Outside Advisors

Students can choose advisors from outside the Physics and Astronomy Department and even from outside the University. If the desired research advisor is not a member of the Physics Graduate Program, then the student must also have a formal advisor within the Graduate Program. This formal advisor is the chair of the dissertation committee, and the outside advisor is one of the other members of the committee. Students who select outside advisors have low priority for financial support from the Physics and Astronomy Department, unless there is an active collaboration with the Physics and Astronomy Department.

Time Commitment

The standard GSR appointment in the Physics and Astronomy Department is 50% time, or 20 hours per week. However, if you limit your research effort to 20 hours per week, you're unlikely to graduate. You may be scooped, where someone else solves the problem you're working on

first and publishes the result. Since a Ph.D. requires original research, this could send you back to the beginning to find a new problem. In an experimental group, making slow progress means that there is more time for parts to break or be misplaced, for electronics to drift so that calibrations have to be redone, and for co-workers to borrow equipment that you haven't been using but need for a later step. All of this means extra work for you and even slower progress.

From another perspective, most senior students enroll in 12 research-related credits, which nominally corresponds to 36 hours per week by the Carnegie rule. The discrepancy highlights the tension between a grad student's roles as an employee and as a student. It arises in part because physics students with GSRs are fortunate enough to be paid for work that's often closely related to their dissertation research. In some disciplines GSR positions are rare and unrelated to the student's own research. If you view the GSR and the course credits as *independent* time commitments – which would clearly be the case for a student who had a TA position instead of the GSR or was taking a regular class as part of the 12 units – then the total research commitment for a GSR could be close to 55 hours per week.

No one actually counts the hours a grad student spends working. What's important is to be sure you and your advisor understand each other's expectations. These could include being in the department at particular times, working long shifts while making measurements, etc. Making good progress on the research itself matters far more than the exact number of hours you spend along the way.

HOW MUCH IS ENOUGH?

There is no easy way to quantify when the Ph.D. "should" be done. It is tempting to look for a milestone like running a complex experiment unassisted or for a numerical criterion: years of research, number of publications, first-author publications, conference presentations, etc. Unfortunately all of these depend on the student, advisor, research area, and other circumstances. An important publication where you made an especially creative contribution is not at all equivalent to a routine paper where you did a small part of some rote data analysis. Discuss this with your advisor early on so that you know what the expectations are and can work towards them. Maintaining good communication with your advisor is the best way to keep a realistic idea of how long you have left in the program.

WRITING THE DISSERTATION

It will probably take at least six months, sometimes a full year or more, from when you believe you have all the results you need to when you graduate. Do not underestimate how long writing takes, or how often it illuminates gaps that may lead to additional measurements or calculations. If you plan to graduate in a particular quarter, you need to have a near-finished draft by the start of that quarter. You will first get feedback from your research advisor. Then you send the dissertation to the other members of your committee. You should leave them 4 weeks to read and comment, and then you in turn may need a few weeks to respond to their comments with appropriate edits, new calculations, or re-analysis of data.

VI. Teaching

Note: A bargaining agreement covers student academic employees. Information about the agreement and links to the formal contract are available on the Grad Studies website, https://grad.ucdavis.edu/contract-info.

TA Responsibilities and Expectations

- TAs are responsible for securing a replacement when needed. Only in emergencies should a TA expect the course instructor or lab supervisor to find a replacement for them. However, the replacement must be approved by the TA's supervisor.

- All TAs will be expected to work throughout the entire quarter, including potentially grading the final exam. *Do not plan to leave Davis until at least 48 hours after the final exam, unless the instructor confirms that leaving earlier is acceptable.*

- Grading is important work and not to be taken lightly. The instructor you grade for will give instructions as to how you should grade, as well as answer any questions you may have. It is very important that you grade exactly as the instructor has requested.

- All TAs are expected to participate in the department's TA Training and Professional Development Program during their first year of employment. All TAs are expected to participate in the ongoing professional development activities.

- All TAs, including Course TAs, work under the direct supervision of a course instructor. In the case of lower-division labs, this is the lab supervisor.

- All TAs, including Course TAs, must hold *regularly scheduled office hours* with students in the course. TAs for upper-level courses usually should also have weekly time at Hbar.

- All TAs, except Course TAs, will have end of quarter performance evaluations from their students. A summary of these evaluations will be kept in the TA's student record.

- All TAs, including Course TAs, will be evaluated by their direct supervisor.

Contacts For Questions

Course Instructor: You should be in continuous contact with the course instructor or lab supervisor regarding all issues of your employment. It is ***your responsibility*** to stay in contact. You should take the initiative to find out exactly what the instructor expects of you.

Lenna Crabbe-Charlesworth: Graduate Program Coordinator, located in PHY 174C. Lenna should be your first point of contact for any graduate student matters.

Dina Zhabinskaya: for questions on Physics 7 (TA duties, course structure, etc.)

Tom Weideman: for questions on Physics 9 (TA duties, course structure, etc.)

COMMUNICATION WITH STUDENTS

Students in your lab or discussion sections (or lecture course if you are a course TA) should contact you by e-mail or by leaving written messages in your mailbox, rather than by calling the Physics and Astronomy Department.

SUPPLIES AND HANDOUTS

The Business Office (Rm.174) will assist you with supplies you might need that are directly associated with your TA duties.

From time to time you may need to photocopy enrollment lists or other items directly associated with your TA duties. You can use the copiers in room 173 and on the fourth floor near the elevators. There is a "Department ID" to use as the code; ask in the business office if you don't know the code for instructional copies.

ACCESS TO COMPUTERS AND PRINTERS

Terminals and a printer are located in the department computer teaching lab, Room 106. The computer lab is available when it is not specifically reserved for scheduled labs. You can also use your laptop on the wireless network to connect to various printers throughout the department.

ASSOCIATE INSTRUCTOR POSITIONS

Another opportunity to gain teaching experience is to work as an Associate Instructor (AI). As an AI you will be the course instructor, responsible for giving lectures, supervising TAs, assigning grades, etc. For most AI appointments you must first have taught the course as a TA. Your student teaching evaluations and the assessments of the course instructors must confirm your ability to run the course. You must also have advanced to candidacy for the Ph.D. or hold a M.S. degree.

WHY TRY?

Unlike classes and research, teaching does not directly affect your own degree. Only in extreme cases of poor performance is a student barred from further TA support. Nonetheless, doing a good job is satisfying, seeing students master new ideas can be very rewarding, and you can learn a lot of physics yourself from your teaching duties. As a more material incentive, reliable and effective TAs are more likely to get their requested assignments. They are more likely to be offered AI positions and specialized assignments that they may enjoy: the introductory honors series, the upper-level computer lab course, graduate courses, late-night astronomy labs, course development work, etc. Department fellowship support sometimes rewards students for excellent teaching. (Good research progress is also required.) Finally, a student with a strong teaching record who runs into financial difficulties just before or after graduation may be hired as a temporary lecturer at Davis or a nearby college.

VII. Recreation and Outside Interests

Most students (and faculty!) want some outlet for indulging interests outside of physics, celebrating achievements, and refreshing themselves before the next physics challenge. This is a highly incomplete sampler of activities available nearby.

Courses

As an enrolled student, you can take regular graduate and undergraduate courses at no charge. These include courses outside the department, not only in closely related fields like math and chemistry but also in other subjects from archery to Japanese to winemaking. Graduate students are not enrolled during the summer, so you will need to pay tuition if you choose to take a summer class.

Campus Organizations and Events

You can join various campus activities (https://www.ucdavis.edu/campus-life/clubs-and-communities) organized by shared interests or experiences: student government, cultural associations, performance groups, volunteer organizations, etc. One interesting way to see an overview of UC Davis is the annual Picnic Day in mid-April. This is probably the largest student-run event in the country, with annual attendance estimated at about 100,000 people. Academic departments, clubs, bands, and athletics teams are all involved, filling the campus with performances, presentations, competitions, and interactive events.

Arts and Music

The Mondavi Center for the Performing Arts (https://www.mondaviarts.org) runs an active schedule of music, dance, comedy, and public speakers. New students can request one free ticket, and all students receive a 50% discount. The Music Department organizes free Thursday noon concerts (https://arts.ucdavis.edu/shinkoskey-noon-concerts) at the new Ann Pitzer Center recital hall.

The Crafts Center on campus (https://campusrecreation.ucdavis.edu/recreation/craft-center) and the independent Davis Art Center (https://davisartscenter.org/) offer workshops and longer classes in ceramics, glassblowing, dance, and more.

Sports and Outdoors

The department has a long-running Friday pick-up soccer game and fields intramural teams in softball and soccer. The Activities and Recreation Center (ARC) on campus, free to graduate students during the academic year, has exercise machines, climbing wall, martial arts studio, indoor track, and basketball courts.

The Davis Arboretum can be a pleasant lunchtime walk. Hiking and climbing opportunities abound within a few hours' drive of Davis. Outdoor Adventures (https://campusrecreation.ucdavis.edu/outdoor-adventures) offers equipment rental, classes, and guided trips.