



Physics and Astronomy Graduate Studies Handbook
Academic Year 2009 – 2010

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A. INTRODUCTION

This handbook offers guidance to students working toward advanced degrees (Ph.D., thesis M.S., and nonthesis M.S.) in physics at Washington State University; as such it represents the current policies of WSU as a whole, the Graduate School, and the Department of Physics and Astronomy on the date of issue. Although an attempt has been made to provide necessary information, it is not possible to cover every situation. Students are urged to contact the main physics office for issues and questions not covered here. Details regarding the research programs and course offerings are presented on the departmental website at www.physics.wsu.edu. General policies regarding graduate enrollment are discussed in detail in the *Graduate School Catalog and the Policies and Procedures Manual 2009* (GS PPM 2009), which is published by the Graduate School (http://www.gradsch.wsu.edu/current-students/2008_updatedpolicies/).

Note: In addition to specific requirements as set out by the Graduate School, the Department of Physics and Astronomy possesses its own internal requirements. Students are encouraged to discuss relevant issues with members of the Graduate Studies Committee, who are appointed by the department chair. This committee, listed in the Appendix, is responsible for policies, regulations, admissions, and T.A. awards subject to final approval by the department chair. Also appointed by the department chair is a secondary committee known as the Graduate Student Council. The Graduate Student Council is made up of three graduate student representatives who serve in an important advisory role. The Graduate Student Council representatives attend graduate studies committee meetings and act as liaisons between students and faculty. While students are encouraged to bring questions and/or issues to the attention of our faculty and staff, the Graduate Student Council may be an appropriate forum for students to consider. Students should feel free to approach members of the Graduate Student Council.

B. DOCTORAL PROGRAM

B.1. Core Curriculum

The core curriculum consists of seven 3-hour courses:

- Classical Mechanics I, 521
- Thermal and Statistical Physics I, 533
- Electromagnetic Theory, 541
- Electrodynamics, 542
- Quantum Theory I, 550
- Quantum Theory II, 551
- Methods of Theoretical Physics, 571

In addition, the student is expected to take at least one course from the list below. Given the importance of the courses, students are encouraged to take two or even all three of these courses.

- Thermal and Statistical Physics, 534
- Quantum Theory III, 552
- Solid State Physics, 563

The core is normally taken in the following sequence:

	Fall	Spring
First year	521, 550, 571	533, 541, 551
Second year	542, electives	Ph.D. Preliminary and Qualifying Exam

B.2. Seminars

All physics graduate students in degree programs are expected to enroll for a total of 4 credits of Phys 590 (offered each semester for 1 credit). In addition, all first-year students are required to take Phys 501 where they will be introduced to research in the department.

B.3. Additional Graded Courses

The student's doctoral program of study must include a minimum of 72 semester hours of credit beyond the bachelor's degree, of which 36 semester hours of credit must be for graded course work. Appropriate classes must meet the following two criteria to count toward the doctoral program. First, the course cannot be remedial; i.e., the content must not be covered by a standard undergraduate physics core curriculum. Second, the course must contain a significant level of student active participation, measured by some combination of graded homework, graded mid-terms, graded final examination, and graded written research project. Thus, courses that are graded seminars are not acceptable. *Students may take classes that are not approved for the doctoral program. Grades from such classes will appear on the transcript; however, the credits earned will not count towards the student's doctoral program.*

- 500-level courses in the department count toward the doctoral program.
- 500-level courses from mathematics, chemistry, and engineering departments may be counted toward the doctoral program, subject to approval by the advisor and the department chair.
- 400-level courses do not normally count toward the doctoral program. However, up to two 400-level courses may be counted toward the doctoral program if these courses are critical to the student's education, subject to approval by the advisor and the department chair.

B.4. Advisor and Committee

A member of the Graduate Studies Committee will be appointed as a temporary advisor during the student's first semester. The Ph.D. student should select a faculty member to serve as thesis advisor as early as possible, preferably by the beginning of the second year. Students are encouraged to discuss research projects with all members of the physics graduate faculty to ensure a broad exposure to departmental research activities.

It is important for the student to consult with the advisor about coursework, research, and general academic issues. The student and advisor prepare the *Program of Study* that is submitted through the department chair to the Graduate School for approval. The doctoral committee must include an advisor and at least two other graduate faculty members with the advisor serving as chair of the committee. This committee has the responsibility of directing and evaluating the student's progress, supervising the dissertation, and participating in the preliminary and final examinations.

B.5. Cooperative Program with University of Idaho

The physics departments at WSU and University of Idaho have a cooperative arrangement whereby students have an increased number of options concerning graduate-level courses. No special fees are charged for these courses. In each cooperative class, the regulations of the host institution prevail, but official enrollment and grades are recorded only by the institution in which the student is seeking an advanced degree. The cooperative program is limited to specific courses.

B.6. Program of Study

Doctoral programs should be submitted no later than the end of the first year of the student's post-master's graduate work. If a master's degree has not been previously earned, the program should be submitted no later than the end of the third semester of graduate work. In addition to the core requirement, the program shall show research and additional course work. A minimum of 20 hours of 800 credit is required. Contact the chair's assistant for information on the program of study.

B.7. Transfer Credit

Transfer credit is limited to no more than half of the total graded course credits required by the department for the master's degree. All transfer work under consideration must have a grade of "A-" or better and be no more than 10 years old at time of submission on the program of study. None of these credits may be applied toward another advanced degree at WSU. *Students wanting to transfer course work should talk to the chair of the Graduate Studies Committee immediately upon enrolling at WSU.*

B.8. Residence

The period of study for doctoral degrees is at least three years (six semesters) beyond the baccalaureate degree, at least two of which, including two consecutive semesters, must be in credit enrollment while in residence at WSU, Pullman. Except where the two consecutive semesters at WSU are concerned, three summer sessions may be counted as a year, and two summer sessions as a semester.

B.9. Ph.D. Preliminary and Qualifying Examinations

Typically, these examinations are taken during the fourth semester (after completing the first three semesters of the core courses).

- The written **Preliminary Examination** is designed to test understanding of physics fundamentals through the level of the core curriculum. The exam is prepared by a faculty committee that selects from problems submitted by the entire faculty. There are four 5-hour sections, each taken on a separate day.
 1. **Classical Mechanics:** Undergraduate and graduate through the level of Goldstein, Ter Haar, and Fetter and Walecka.
 2. **Thermal Physics:** Undergraduate and graduate through the level of Callen, Reichl, and Pathria.
 3. **Electromagnetic Theory:** Undergraduate and graduate through the level of Jackson, and Landau and Lifshitz.
 4. **Quantum Physics:** Undergraduate and graduate through the level of Messiah and Sakurai.

The written examinations are broad in scope and students are strongly encouraged to review several books. The written examinations are *not limited* to the material covered in the core courses. Past written examinations are available to students upon request from the department chair's assistant.

- The oral **Qualifying Examination** is about two hours long and is scheduled after the written examinations are completed. It is administered by three or more faculty members and is used to evaluate how students approach problems in front of an audience. This examination by its nature is more subjective.
- Each student is expected to pass all examinations. All students' performances are considered in detail by the graduate faculty, followed by a vote. To pass the two examinations and thus be admitted to Ph.D. candidacy, 75 percent of the votes must be affirmative, as required by the Graduate School. Depending upon the recommendation of the faculty, a student who does not pass may be allowed to repeat part or all of the examination.

B.10. Application for Degree

A copy of the *Tabular Summary* can be obtained from the Graduate School the semester before the expected date of graduation (see example on page 21 of this handbook). An *Application for Degree* must be filed with the Graduate School according to the schedule on the *Tabular Summary*. It is suggested that the *Application for Degree* be filed the semester before the student intends to graduate. An approved program must be on file in the Graduate School before the *Application for Degree* may be filed. Candidates may not schedule a final examination until an *Application for Degree* has been filed.

B.11. Final Examination

Doctorate candidates must pass a final oral examination that shall be primarily a defense of the dissertation, but may cover the general fields of knowledge pertinent to the degree. The final examination normally lasts approximately two hours. It must follow the preliminary examination by at least four and at most 48 months. Before the final examination may be scheduled, a *Thesis Acceptance/Final Examination Form* must be submitted to the Graduate School *at least 10 working days* in advance of the examination date. This form can be found on line at <http://www.gradsch.wsu.edu/current-students/forms/>

The examining committee consists of the doctoral committee, and in some cases a representative of the University Graduate Studies Committee, and any other members of the Graduate Faculty in attendance. The scheduling form must be submitted to the Graduate School *at least 10 working days in advance of the examination date*. The student's advisory committee will conduct this examination.

NOTE: Scheduling of the final oral examination is the responsibility of the student. Students must confer with the thesis committee before scheduling the examination. If you wish to use the Band Room (Webster 1243) it must be reserved through the chair's assistant.

B.12. Dissertation

All doctoral programs require that a candidate prepare a dissertation. The committee is responsible for ensuring that the content is acceptable and that the student has followed an appropriate format. A description of the Graduate School's requirements for final acceptance is available at <http://www.gradsch.wsu.edu/current-students/forms/DissertationsandGuidelinesMarch09.pdf>.

A bound copy of the thesis should be submitted to the physics department after all other requirements have been satisfied. Details are as follows: Binding is done locally at the Student Book Corporation or J and H Printing. Copy should be on "acid-free" paper and bound with red sturdite. The front cover should have the title, name, degree, and year printed as it appears on the front page of the thesis with gold lettering; the spine should have the name, degree, and year with gold lettering.

B.13. Materials Science Program

In addition to the Ph.D. in physics, Washington State University has a related Ph.D. program in materials science. The Materials Science Program shares faculty and facilities with the Department of Physics and Astronomy, to the mutual benefit of both programs. For additional details, see the department chair's assistant.

C. MASTER'S PROGRAM

C.1. Nonthesis M.S.

The program must include a minimum of 30 semester hours of approved graded 500-level course work in physics; 18 credits must be in the Ph.D. core curriculum; plus a minimum of 4 credits of Phys 702. Time required for completion is about two years.

C.2. Thesis M.S.

The program must consist of a minimum of 30 semester hours of approved graduate credit, including 21 hours of graded 500-level course work in physics (18 of which must be from the core curriculum); a minimum of 4 total hours of 700—Master's Research; 4 hours of seminar credit; and includes a substantial thesis project. It may also include 6 semester hours in supporting areas as approved by the thesis committee, upon consideration of the nature of the project. Time required for completion is about three years.

A bound copy of the thesis should be submitted to the Physics and Astronomy Department after all other requirements have been satisfied. Details are as follows: Binding is done by the Student Book Corporation or J & H Printing. The copy should be on "acid-free" paper and bound with red sturdite. The front cover should have the title, name, degree, and year printed as it appears on the front page of the thesis with gold lettering; the spine should have the name, degree, and year with gold lettering.

C.3. Advisor and Committee

A member of the Graduate Studies Committee will be appointed as a temporary advisor during the student's first semester. The M.S. student should select a faculty member to serve as thesis advisor as early as possible, preferably by the end of the first year. It is important for the student to consult with the advisor about coursework, research, and general academic questions. The student and advisor should meet to discuss the Program of Study that is submitted through the department chair and then sent to the Graduate School for approval. The master's committee is nominated on the *M.S. Program Form*. For both the thesis and non-thesis programs, a Master's committee should include at least three faculty members who hold either master's or doctoral degrees. At least two members must be approved physics faculty members.

C.4. Program of Study

A proposed *Program of Study* and advisory committee must be submitted to the associate dean of the Graduate School no later than the beginning of the semester preceding the semester of graduation. Please note: All course work must have prior approval of the chair.

C.5. Transfer Credit

Transfer credit is limited to no more than half of the total graded course credits required by the department for the master's degree. None of these credits may be applied toward another advanced degree at WSU. Students wanting to transfer course work should talk to the chair of the Graduate Studies Committee immediately upon enrolling at WSU. All transfer work under consideration must have a grade of "A-" or better and be no more than 10 years old at time of submission on the program of study.

C.6. Final Examination

A final oral examination is required of all master's candidates. This examination is intended to test the candidate's ability to integrate and interpret material in the major and supporting fields with emphasis on the work presented in the thesis or special problem. This examination may be scheduled when all requirements of the department and Graduate School have been satisfied (or are expected to be satisfied by the end of the current semester). The scheduling form must be submitted to the Graduate School at least *10 working days in advance of the examination date*. A student's advisory committee will conduct this examination.

NOTE: Scheduling of the final oral examination is the responsibility of the student. Students must confer with their thesis committee before scheduling the examination. A form is available from the Graduate School's web site. *If you wish to use the Band Room (Webster 1243) it should be reserved through the chair's assistant.*

C.7. Application for Degree

A copy of the Graduate School's *Tabular Summary* should be obtained the semester before the expected date of graduation. An Application for Degree must be filed with the Graduate School according to the schedule on the Tabular Summary. It is suggested that the Application for Degree must be submitted the semester before the student intends to graduate. An approved Program of Study must be submitted to the Graduate School before the Application for Degree may be filed. *A candidate may not schedule a final examination until an Application for Degree has been filed.* For additional details, please contact the department chair's assistant.

C.8. Residence

The residence requirement for the master's degree is one academic year (two semesters or one semester and two summer sessions, or three summer sessions). Enrollment by mail does not count toward residence requirements.

D. ASSISTANTSHIPS AND FELLOWSHIPS

D.1. Assistantships

Research and teaching assistantships serve the following purposes:

- To provide the assistant with financial support.
- To give the assistant opportunity for training in research and teaching
- To augment the research and teaching program of the department

Terms

The normal appointment to a research assistantship (RA) or teaching assistantship (TA) is half-time. Academic year appointments normally begin August 16 and conclude May 15. Summer appointments can vary in duration depending on the nature of the duties. Paydays are twice a month.

Assistantships are offered on the basis of academic merit, with preference given to students making satisfactory progress in the physics graduate academic program. Re-appointment to an assistantship will be approved if recommended by the department, and provided that the student has a cumulative grade point average no lower than 3.00 since the initial appointment. Graduate School regulations specify that the time a student may hold an appointment is ordinarily limited as follows:

- Master's candidates: two years.
- Doctoral candidates, with a master's degree: four years.
- Doctoral candidates, without a master's degree: six years.

If a student is making satisfactory progress towards a program, the student's advisor may petition the Graduate School for an extension.

Students who receive any waiver of tuition (operating fee waiver for TA's, qualified tuition reduction for RA's or nonresident tuition waiver for TA's/RA's) must reside within the state of Washington. Students on teaching assistant appointments are required to live in the state of Washington. The award of an assistantship for a one-time period does not guarantee a similar offer at a later time. First- and second-year graduate students supported on a teaching assistantship should be aware that if they deviate from the program plan approved by their advisor in such a way that their progress towards a physics graduate degree is impeded, the Physics and Astronomy Department may cease financial support—regardless of a good academic standing

Duties of Teaching Assistants

Duties will be assigned by the instructional supervisor in conformity with accepted department policies and practices. Note: It is the graduate student TA's responsibility to obtain permission from the instructional supervisor before making any deviations or changes in his/her teaching schedule. This includes a family emergency or an unscheduled leaves of absence.

Handling Classroom Disruptions

Teachers must be prepared to handle the unexpected. One unpleasant task that confronts all teachers at some time is handling a disruptive student. Each instructor has his or her own personal approach to such problems, but a few guidelines are described here in an effort to provide some direction for teaching assistants.

- Since classroom disruptions come in all sizes and shapes, no general policies can be applied to every situation. The cardinal rule, however, is for the instructor to remain as calm as the situation warrants. The instructor should remember that he/she is serving as a university official, and thus has authority supported by the state of Washington Administrative Code.
- Most disruptions can be handled within class. Most students will not repeat disruptive behavior if it is pointed out to them. The instructor's personal style will determine the approach to be taken in informing the student of the inappropriate behavior and of the admonition to cease and desist.
- In cases of repeated disruptive behavior that are not so serious as to cause immediate risk to the class, the teaching assistant should inform the course faculty instructor, who should then undertake corrective action.
- In case of a serious incident that causes physical or verbal intimidation of the instructor or students and that cannot be handled within the classroom, the teaching assistant should leave the room and contact the course faculty instructor for assistance. If the faculty instructor is not available, the Department chair or another faculty member should be immediately notified.
- In extreme cases of disruptive behavior where the teaching assistant perceives there to be an immediate threat to the safety of persons or to the continuation of orderly instruction, the teaching assistant may leave the classroom and contact the campus police for assistance.

Duties of Research Assistants

Duties will be assigned by the student's research supervisor as deemed appropriate for conducting the research project.

D.2. Other Awards

Fellowships, traineeships, and other kinds of support for graduate students are also available. These are provided by state, federal, and private agencies. Graduate students at WSU are automatically considered for those administered at WSU as these become available. Information about fellowships offered by the department is available at the department website. Applying for awards not administered through WSU are the responsibility of the individual student. Information about external fellowships and traineeships may be available from OGRD at <http://www.ogrd.wsu.edu/>

D.3. Annual Review of Graduate Students

In accordance with Graduate School policy, an annual review is carried out for all graduate students. For students who have not started their research work, this review consists of an examination of their course grades. Teaching assistants are also evaluated by the instructional laboratory supervisor on the basis of student evaluations. Research assistants and graduate students conducting research activities are evaluated annually in the spring semester by their research supervisors regarding their progress. A copy of the evaluation form is provided to the students and submitted to the Graduate School (see Appendix).

E. POLICIES AND REGULATIONS

E.1. Enrollment

Graduate students must maintain continuous enrollment until all requirements for the degree are completed. Enrollment may be in one of the following categories: (a) full-time enrollment of 10 credits or more; (b) part-time enrollment of less than 10 credits; (c) summer session enrollment for credit; (d) graduate leave status for credit; or (e) enrollment by mail for 600, 700, 702, and 800. Students wishing to schedule a preliminary or final examination *must be enrolled for 2 examination credits* (700, 702, 800) during the term in which the examination is taken (for prelims it is during the semester in which the balloting occurs).

E.2. Time of Completion and Leave Status

Time Limits for Completion of Doctoral Degree

The time limit for use of graduate credit toward a doctoral degree is ten years from the beginning date of the earliest course applied toward the degree. The Graduate School recognizes that part-time students may require a longer completion period. As appropriate, departments may request an extension of this time limit.

Each program for a doctoral degree is considered individually. *In most cases, the requirements for the degree should be completed within three years of the date of satisfactory completion of preliminary examination.* A signed letter from the Graduate Studies Committee chair, outlining a definitive plan for completion, will be sent to those requesting extensions. For unusual cases, the expected date of completion of requirements for the doctoral degree can be set at the time of preliminary examination with the approval of the Dean of the Graduate School. At least four months must elapse between preliminary and final examinations for doctoral degrees.

The time limit for use of graduate credit toward a master's degree is six years from the beginning date of the earliest course applied toward the degree. As necessary, departments may request an extension for up to one year.

The Graduate School's policy on requesting extensions for program completion as taken from pp. 51-52 of the PPM 2009 reads: "A one-year extension may be requested as an exception to Graduate School policy for students not able to complete their master's degree in 6 years or doctoral degree in 10 years from the beginning date of the earliest course applied toward the degree."

Second Extension. "The 2nd extension is a serious matter and should be considered a final stage of the process to complete the degree." If the extension is granted, a letter will be sent to the student (and copied to the department chair, the chair of the thesis/dissertation committee, and the Dean of the Graduate School) explaining that this 2nd extension is essentially a final opportunity to complete the thesis/dissertation by following the time-line developed by the student and thesis/dissertation committee. "The letter will indicate that 3rd extensions are very rare."

3. Third Extension. "It is possible to obtain a 3rd extension under exceptional circumstances (personal and/or family medical issues, etc.). The 3rd extension is absolutely final. Because of this, the process for requesting it is more formal and involves a wider segment of the university community."

Graduate Leave Status

Graduate students are considered to be actively pursuing a degree from the time of first enrollment in Graduate School until graduation or until the limits described below have expired. Students who find they cannot enroll can be considered for *Graduate Leave Status*. (Taken from (G S PPM 2009, pp. 45 – 46).

- Graduate Leave Status is granted in individual cases for compelling reasons. "Students must apply for GLS through the Graduate School by completing the Graduate Leave form <http://www.gradsch.wsu.edu/current-students/forms/>. The leave must be approved by the student's committee chair, program chair, International Programs (for international F-1/J-1 students only) and Dean of the Graduate School. A student may be on GLS for up to one calendar year but may be extended for special circumstances (e.g., for military or Peace Corp service). GLS entitles students to have access to library services if needed. At the end of the leave, the student must complete the Reenrollment form to reenroll in their program. International students must submit information on their finances to the Graduate School if they require issuance of new immigration documents. Students on approved GLS do not have to pay a reenrollment fee.
- A degree-seeking graduate student who fails to maintain continuous enrollment or official leave status and who is absent for up to two consecutive semesters (excluding the summer) must complete the Reenrollment form. Reenrollment requires a nonrefundable processing fee. A Reenrollment form must be completed and the nonrefundable fee must be paid before the student can register for credits.
- A degree-seeking graduate student who fails to maintain continuous enrollment or official leave status and who is absent for more than two consecutive semesters (excluding the summer) is required to reapply and pay a nonrefundable application fee to the Graduate School if he/she wishes to be considered for readmission to a program. Readmission is not guaranteed; students must have departmental approval for re-enrollment.
- Students may not take graduate examinations (preliminary, qualifying, or final) during *Graduate Leave Status* terms.

E.3. Course Load

The following table indicates the number of credits that constitute a normal load for a graduate student. Anything below the indicated range is less than a full load; anything above is an overload, and must be approved not only by the student's department advisor, but also by the department chair.

	No assistantship	Assistantship*
Semester	12-16	14-18
Summer	6-10	3-6

* Students on TA or RA appointments normally have half-time assistantships.

- Students on an RA or TA after taking prelims must sign up for 18 credit hours (1 credit = 3 hours of effort).
- Students not on an appointment, and enrolling solely for the purpose of completing theses or dissertations and taking final examinations must register for a minimum of two semester hours of 700, 702, or 800 credit during that semester or summer session

- Students not on an appointment, and enrolling solely for the purpose of taking master's or doctoral final examinations must register for a minimum of two semester hours of 700, 702, or 800 credit during that semester or summer session.
- Students not on an appointment and enrolling solely for the purpose of taking the preliminary examinations must register for a minimum of two semester hours of 800 credits during the semester of the ballot meeting.
- International students holding valid visas should consult with the Office of International Students and Scholars for additional enrollment requirements.

E.4. University Policy: Sexual Harassment and Academic Ethics

Sexual Harassment

Teaching Assistants are expected to provide a positive learning environment. WSU's policy on sexual harassment is as follows:

WSU's discrimination policy explicitly prohibits sexual harassment as a form of unlawful sex discrimination. Sexual harassment is defined as follows: Unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitutes sexual harassment when (1) submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment or education, (2) submission to or rejection of such conduct by an individual is used as the basis for employment or educational decisions affecting such individual, or (3) such conduct has the purpose or effect of unreasonably interfering with an individual's work or educational performance or creating an intimidating, hostile or offensive environment. *WAC 504-25-025.*

Academic Ethics

General standards for the conduct of graduate students at Washington State University are given in sections of the Washington Administrative Code (WAC) reproduced in the *Washington State University Student Handbook*. The current handbook excerpt can be found at:

<http://www.conduct.wsu.edu/Content/Documents/119514%20code%20of%20conduct%20p4.pdf>

The following excerpts from that code are particularly relevant to academic ethics:

Washington State University, as a community dedicated to the advancement of knowledge, expects all students to behave in a manner consistent with its high standards of scholarship and conduct. Under the terms of admission to Washington State University, students accept its regulations and acknowledge the right of the University to take disciplinary action, including expulsion, for conduct judged unsatisfactory or disruptive to the educational process. *Academic dishonesty, including all forms of cheating, plagiarism (which includes copying sections from another source without referencing, or submitting the same work for two different classes), and fabrication, is prohibited. Knowingly facilitating academic dishonesty is also prohibited. The expectation of WSU is that students will accept these standards and conduct themselves as responsible members of the academic community. These standards should be interpreted by students as general notice of prohibited conduct. They should be read broadly, and are not designed to define misconduct in exhaustive forms. WAC 504-25-015.*

See: <http://www.conduct.wsu.edu/Content/Documents/119514%20code%20of%20conduct%20p4.pdf>

Professors may sometimes amplify these guidelines by mandating specific procedures applicable to particular courses or examinations. For example, there might be restrictions concerning collaboration on homework, rules delimiting items that may be brought into exam rooms, etc. However, the general principle applicable in all cases may be stated quite simply: *Students must refrain from activities that have even the appearance of academic dishonesty.* The consequences of academic dishonesty may

include any or all of the following: a failing grade for an examination or for the course, dismissal from or denial of an assistantship, and expulsion from the graduate program.

Graduate Student Responsible Conduct of Research Training

Mandatory training on the Responsible Conduct of Research is required of all graduate students. This is a Web-based training located at:

<https://myresearch.wsu.edu/login.aspx?ReturnUrl=%2fdefault.aspx>

Students are encouraged to take this training as soon as possible. The training will need to be repeated after a five-year period.

Students will not be eligible for an assistantship until after the training is completed; however, a grace period of one semester will be allowed. Students who have not completed the training will receive a grace period of one semester to take the training. Should a student complete the training late in the semester, and the assistantship is processed late, the student will be responsible for paying all late fees applied to the student's account before the waiver(s) are applied to the student account. If you have questions about this training, please contact the Graduate School at 335-3535, or Dave Clark, Director, Office of Research Assurances (335-1585, drclark@wsu.edu).

E.5. Grades In the grading system used at WSU, numerical equivalents of letter grades are:

A	4.0
A–	3.7
B+	3.3
B	3.0
B–	2.7
C+	2.3
C	2.0
C–	1.7
D+	1.3
D	1.0
F	0.0

The Program of Study is the list of specific courses required for the advanced degree, defined in this handbook, as approved by the Department of Physics and the Graduate School. To earn any physics degree, a student must have a cumulative grade point average of at least 3.0 in all graded courses in the Program of Study. In addition, the cumulative grade point average since admission must be at least 3.0. No course for which the student has received a grade below "B" may be dropped from a degree program. *Courses in the Program of Study for which a "C–" or below has been received must be repeated.* An admitted student whose cumulative grade point average in all course work falls below 3.0 will be placed on academic probation and may be dropped from WSU. Reinstatement requires written consent of the department chair and the associate dean of the Graduate School.

E.6. Committee Changes

Should a student find it necessary to switch to a new advisor, changes may be requested on forms available through the chair's assistant. The request may be initiated either by the student or by the committee chair. All program and/or committee changes require approval from the department chair *before* submission to the Graduate School.

E.7. Times for Examinations

Final examinations for degrees and preliminary examinations are ordinarily scheduled for times when classes are in session.

E.8. Exceptions to Requirements and Regulations

Exceptions to policy must have the approval of the chair of the Graduate Studies Committee and the department chair.

E.9. Summer Program

Graduate courses other than Phys 600, 700, 702, and 800 are not usually offered. It is not necessary for a student to be enrolled in the summer session. All first-year graduate students are strongly encouraged to approach faculty members with similar research interests concerning summer research opportunities, including financial support. It is recommended that students begin this process early in the spring semester. A summer research experience is an excellent way for a student to learn about the research activities without making long-term commitments.

E.10. Final Procedures for Obtaining Graduate Degrees

There are several final formalities listed in the *Tabular Summary* that need attention at the Graduate School during the semester in which one plans to complete a graduate degree. Failure to attend to these may postpone the granting of the degree. As a safeguard, follow this rule of thumb: *Any student who plans to receive a graduate degree at the end of a given semester should contact the Graduate School at the beginning of that semester to determine appropriate requirements and procedures.*

E.11. English Examination for foreign teaching assistants

Graduate student teaching assistants are an integral part of the Physics and Astronomy Department's teaching mission. A good grasp of both written and spoken English is required to retain a teaching assistantship. Good communication skills are crucial to the student's educational experience in his or her own graduate classes. Before being assigned TA duties, international students are required to pass an oral exam. These exams are scored on a scale of "1 – 5" with "1" being the highest level and "5" being the lowest. Students receiving a score of "4" or "5" are required to retake the exam until they get a score of at least "3". Students with scores of either "4" or "5" will be obligated to take intensive English and accent remediation courses. This must continue until they have retested and scored a minimum score of 3 or better. Students receiving a score of 5 will be advised to take a reduced physics course load to allow them extra time to work on their English comprehension and speaking skills. Students with a score of "5" will be assigned to work with an experienced TA as a mentor. The director of undergraduate laboratories supervises the mentoring process and is responsible for assigning duties and monitoring student progress. All second year students are expected to have a score of "3" or their teaching assistantship may be in jeopardy.

E.12. Establish residency!

It is very important that those who are can qualify, seek residency status. United States citizens and permanent residents of the United States can become residents of the state of Washington in one year by fulfilling the following steps:

- Apply for a Washington registration for your car
- Open a bank account in the state of Washington
- Register to vote in the state of Washington

A year after taking these steps, please pick up an application for residency form in Student Affairs, (Lighty, Room 360, Administration Building) and submit it as soon as possible. You can actually submit the application even if you "became a resident" eleven months ago and they will process it when twelve months have elapsed. Otherwise, hold the application and submit it when you are at least eleven months past completing the above steps (the sooner, the better!)

Appendix A: Courses approved for graduate programs

The following courses taught outside of the department have been approved for physics M.S. or Ph.D. programs.

<u>Course Number</u>	<u>Course Name</u>
CHEM 509	Chemical Group Theory
CHEM 535	Computational Quantum Chemistry
CHEM 536	Quantum Chemistry
CHEM 564	Molecular Phenomena
EE 496	Intro. to Semiconductor Device Theory
EE 504	Modern Optics
EE 528	Special Topics in Electromagnetics
EE 535	Numerical Solutions to EM Problems I
EE 536	Numerical Solutions to EM Problems II
EE 574	Optoelectronics
EE 596	Advanced Analog Integrated Circuits
Math 501	Real Analysis
Math 548	Numerical Analysis
Math 570	Mathematical Foundations of Continuum Mechanics I
Mat S 571	Microscopic Analysis of Solid Surfaces
ME 501	Continuum Mechanics
ME 509	MEMS Eng.
MSE 505	Adv. Mat. Science
MSE 515	Electronic Properties of Materials (approved 9/07)
ME 530	Elasticity
Stat 512	Analysis of Variance in Designed Experiments

Appendix B: Physics and Astronomy Faculty at WSU

Name	Email Address	Office	Phone*
Allen, Michael	mlfa@cheetah.it.wsu.edu	1246	335-1279
Blume, Doerte	doerte@wsu.edu	947C	335-2731
Bose, Sukanta	sukanta@wsu.edu	947H	334-3698
Cerruti, Nicholas	ncerruti@wsu.edu	1252	335-2711
Collins, Gary S.	collins@wsu.edu	554	335-1354
**Dexheimer, Susan	dexheimer@wsu.edu	627	335-6389
Dickinson, J. Thomas	jtd@wsu.edu	529	335-4914
Engels, Peter	engels@wsu.edu	652	335-3698
Gittes, Fred	gittes@wsu.edu	1254	335-7380
Gu, Yi	yigu@wsu.edu	544A	335-7208
Gupta, Yogendra M.	ymgupta@wsu.edu	ISP 202	335-7217
*Kuzyk, Mark G.	kuz@wsu.edu	746A	335-4672
Lynn, Kelvin	kgl@wsu.edu	625	335-4661
Marston, Philip L.	marston@wsu.edu	738A	335-5343
McCluskey, Matthew	mattmcc@wsu.edu	646	335-5356
Miller, Michael D.	mdm@wsu.edu	644	335-5303
Tomsovic, Steven	tomsovic@wsu.edu	929	335-7207
Worthey, Guy	gworthey@wsu.edu	948C	335-4994
Zhang, Chuanwei	cwzhang@wsu.edu	947F	335-6125

* = on sabbatical leave Fall 2009

** = on sabbatical leave Fall 2009 – Spring 2010

Note: all telephone area codes are (509)

Appendix C: Departmental Information

Graduate Studies Committee

Prof. Matt McCluskey, Chair
Prof. Sukanta Bose
Prof. Gary Collins
Prof. Susan Dexheimer

Graduate Student Council, 2009

Zhaozhe (David) Li (2009 – 2012)
Shiva Ramini (2008 – 2011)
Jennifer Schei (2007 - 2010)

Department chair: Steven Tomsovic

Mailing address: Department of Physics & Astronomy
Washington State University
PO Box 642814
Pullman, WA 99164-2814

Web: physics.wsu.edu

E-mail: physics@wsu.edu

Phone: (509) 335-1698

Fax: (509) 335-7816

Who to contact for various issues:

- T.A. or laboratory matters: Dr. Gordon Johnson
- Payroll: Laura Krueger or Tom Cowger
- Tuition, office space, keys: Tom Cowger
- Schedule appointment to meet with department chair/academic questions: Sabreen Dodson
- Ordering supplies or making travel arrangements: Edie McPherson and Laura Krueger

Support staff:

Name	Email Address	Office	Phone
Cowger, Tom	cowger@wsu.edu	1245	335-2701
Dodson, Sabreen	sabreen@wsu.edu	1245	335-9532
Guenther, Mary	msg@wsu.edu	1245	335-5694
Johnson, Gordon	johngo@wsu.edu	348	335-3398
Johnson, Tom	johnstm@wsu.edu	B7	335-5097
Klover, Annette	aklover@wsu.edu	1245	
Krueger, Laura	lkrueger@wsu.edu	1245	335-9533
McPherson, Edie	mcphere@wsu.edu	1245	335-1698
Whitacre, Tim	whitacre@wsu.edu	341A	335-4722

Appendix D: Annual Review

Department of Physics

Graduate Student Annual Review

Instructions: Rate on scale of 1 (lowest) to 5 (highest) with 3 representing average expectations. Supplement rating with comments and suggestions for overcoming deficiencies. Add additional evaluative comments at bottom of form if desired. Meet with student to discuss evaluation.

Evaluation of: _____

Progress in acquiring knowledge of field (e.g., scientific literature) 1 2 3 4 5

Comprehension of the aims of the research project 1 2 3 4 5

Progress in developing research skills 1 2 3 4 5

Time spent working 1 2 3 4 5

Efficiency (e.g., use of time) 1 2 3 4 5

Anticipated date of finishing:

Other comments:

Signature _____
Advisor/Graduate Coordinator

Date: _____

Signature _____
Graduate Student

Date: _____

Appendix E: Graduate Courses and Descriptions

- 501 Grad Seminar Phys** (1) Seminar introduces new physics graduate students to research within the department as well as interdisciplinary research related to Department of Physics.
- 514 Optoelectronics Lab I** V 1 (0-3) to 3 (0-9) May be repeated for credit; cumulative maximum 3 hours. Prereq graduate standing. Experiments with optical systems: Imaging, interference, coherence, information storage/processing, gas and solid state lasers, optical fibers, and communications systems.
- 521 Classical Mechanics I** 3 Prereq Phys 320; 571 or cc:// Laws of motion as developed by Newton, d'Alembert, Lagrange, and Hamilton; dynamics of particles and rigid bodies. Cooperative course taught jointly by WSU and UI (Phys 521).
- 522 Classical Mechanics II** 3 Prereq Phys 521. Continuation of Phys 521. Classical mechanics of liquids and deformable solids; stress, deformation and strain, flow, oscillations and waves.
- 533 Thermal and Statistical Physics I** 3 Prereq Math 440; Phys 330. Thermodynamic laws and potentials, kinetic theory, hydrodynamics and transport coefficients; introduction to statistical mechanics, ensembles, partition functions. Cooperative course taught jointly by WSU and UI (Phys 533).
- 534 Thermal and Statistical Physics II** 3 Prereq Chem 531, 535; or Phys 533, 551. Phase transitions and critical phenomena, Ginzburg-Landau theory, Bose-Einstein condensation, superfluids, Fermi systems, low-temperature expansions. Cooperative course taught jointly by WSU and UI (Phys 531).
- 541 Electromagnetic Theory** 3 Prereq Phys 342, 571 or c//. Special relativity and the classical electromagnetic field; emission, propagation, and absorption of electromagnetic waves. Cooperative course taught jointly by WSU and UI (Phys 541).
- 542 Electrodynamics** 3 Prereq Phys 541. Interaction of matter and electromagnetic radiation; classical and quantum electrodynamics. Cooperative course taught jointly by WSU and UI (Phys 542).
- 545 Nonlinear Optics** 3 Prereq Phys 534, 542, 551. Nonlinear wave propagation theory applied to several nonlinear-optical phenomena; experimental techniques that probe a material's nonlinearity.
- 546 Quantum Electronics** 3 Prereq Phys 541, 551 or c//. The physics of lasers and of coherent optical radiation generation and propagation.
- 550 Quantum Theory I** 3 Prereq Math 440, 441; Phys 450. Introduction to quantum theory; physical and mathematical foundations; application to atomic systems. Cooperative course taught jointly by WSU and UI (Phys 550).
- 551 Quantum Theory II** 3 Prereq Phys 550, 571. Symmetry and invariance; angular momentum theory; approximation methods. Cooperative course taught jointly by WSU and UI (Phys 551).
- 552 Quantum Theory III** 3 Prereq Phys 551. Scattering theory; relativistic wave mechanics; quantum field theory. Cooperative course taught jointly by WSU and UI (Phys 552).
- 561 Atomic and Molecular Physics** 3 Prereq Phys 550. Physics of atoms and molecules using quantum theory. Cooperative course taught jointly by WSU and UI (Phys 561).
- 563 Physics of the Solid State** 3 Prereq Phys 534, 551. Lattice vibrations and defects; ionic and electronic conductivities; band theory; magnetic properties; luminescence. Cooperative course taught jointly by WSU and UI (Phys 563).
- 565 Nuclear Physics** 3 Prereq Phys 465, 551. Nuclei and nuclear interactions from theoretical and experimental viewpoint, properties of nuclei, two-body problems, complex nuclei, nuclear spectroscopy, reactions, models. Cooperative course taught jointly by WSU and UI (Phys 566).

571 Methods of Theoretical Physics 3 Prereq Math 440, 441. Mathematical methods for theoretical physics; linear algebra, tensor analysis, complex variables, differential equations, integral equations, variational calculus, and group theory. Cooperative course taught jointly by WSU and UI (Phys 571).

573 Physical Applications of Group Theory 3 Prereq Phys 551. Introduction to group theory with application to atoms, molecules, solids, and elementary particles; no previous knowledge of group theory assumed. Cooperative course taught by UI (Phys 573), open to WSU students.

575 Advanced Solid State Physics 3 Prereq Phys 534, 542, 552 or c//, 563, 571. Quantum theory of solids; Green's functions, correlation functions and other field-theoretic methods; magnetism, superconductivity and transport properties.

581 Advanced Topics 3 May be repeated for credit; cumulative maximum 12 hours. Topics of current interest in advanced physics. Cooperative course taught jointly by WSU and UI (Phys 581).

590 Seminar 1 May be repeated for credit. S, F grading.

592 Wave Propagation Seminar 2 Prereq Math 440, 441. May be repeated for credit; cumulative maximum 4 hours. Waves in the continuum; elastic, plastic, and hydrodynamic waves; shock waves. S, F grading.

Teaching Undergraduate Physics Laboratories 1 May be repeated for credit; cumulative maximum 4 hours. Principles and practices of teaching, planning and management of undergraduate physics laboratories; choice and care of equipment. S, F grading.

600 Special Projects or Independent Study Variable credit. S, F grading.

700 Master's Research, Thesis, and/or Examination Variable credit. S, F grading.

702 Master's Special Problems, Directed Study and/or Examination Variable credit. S, F grading.

800 Doctoral Research, Dissertation, and/or Examination Variable credit. S, F grading.

Astrophysics

581 Topics in Modern Astrophysics 3 May be repeated for credit; cumulative maximum 9 hours. Prereq Math 315; Phys 202. Problems of current astrophysical interest in the areas of stellar atmospheres, stellar interiors, gaseous nebulae, the interstellar medium and galaxies, gravitation and cosmology (formerly 538)

2009-2010 Deadlines and Procedures for Graduate Degrees
 All forms can be found at <http://www.gradsch.wsu.edu/formsfordegree.html>

Procedure Master's Deadlines

**1. Obtain an Advisor/
Committee Chairperson**

Doctoral Deadlines

BOTH
 As soon as possible after
 admission to Graduate School

**2. Submit *Program of Study*
to the Graduate School**

Deadline	Term of <u>Graduation</u>
03-27-2009.....	Summer 2009
06-12-2009.....	Fall 2009
11-13-2009.....	Spring 2010
03-19-2010.....	Summer 2010

No later than one semester
 preceding Preliminary Exam,
 Orals or Final Exam

3. Schedule Preliminary Exam

N/A After approval and completion of most of the
 Program. **No later than 10-working-days** (2 weeks) prior to the Exam.

**4. Preliminary Examination
Examination**

N/A At least 4 months (one semester) prior to Final Oral

**5. Submit *Application for
Degree (Graduation) to the
Graduate School***

*** Last day to apply for a Graduate Certificate**

<u>App Deadline</u>	<u>Graduation</u>
06-26-2009.....	Summer 2009
10-9-2009.....	Fall 2009
03-05-2010.....	Spring 2010
06-25-2010.....	Summer 2010

**6. Pay Graduation Fee (\$50);
and Microfilm Fee (\$75) for
Doctoral Students;
Optional (\$65) Copyright Fee for Doctoral Students**

Pay at *Cashier's Office*
 Phone: (509)335-2018
 Prior to submitting
 Application for Degree

**7. Submit *Final Exam Scheduling
Form* no later than **10-working-days**
prior to the exam. Submit a draft copy (electronic okay)
of thesis/dissertation.
(Ph.D: Be aware of * below when scheduling)**

Scheduling	
<u>Deadline</u>	<u>Graduation</u>
07-03-2009.....	Summer 2009
11-06-2009.....	Fall 2009
04-03-2010.....	Spring 2010
07-02-2010.....	Summer 2010

8. Conduct Final Examination

Exam	
<u>Deadline</u>	<u>Graduation</u>
07-17-2009.....	Summer 2009
11-20-2009.....	Fall 2009
04-16-2010.....	Spring 2010
07-16-2010.....	Summer 2010

**9. Submit final thesis/dissertation in electronic format
to www.dissertations.wsu.edu AND submit Title Page,
Abstract and Signature Page to the Graduate School
along with required forms**

*Doctoral students wishing to participate in Commencement
 must pass defenses successfully and committee must have the ballot
 paperwork to the Graduate School Office prior to Commencement.

Submission	
<u>Deadline</u>	<u>Graduation</u>
07-24-2009.....	Summer 2009
12-04-2009.....	Fall 2009
04-23-2010.....	Spring 2010
07-23-2010.....	Summer 2010

Physics and Astronomy Graduate Studies Handbook

Academic Year 2009 - 2010

The preceding information pertains to all graduate students in the Department of Physics and Astronomy, but particularly applies to the incoming class of 2009 - 2010. For more information on the physics and astronomy program at Washington State University, please send an email to the chair's assistant at physics@wsu.edu