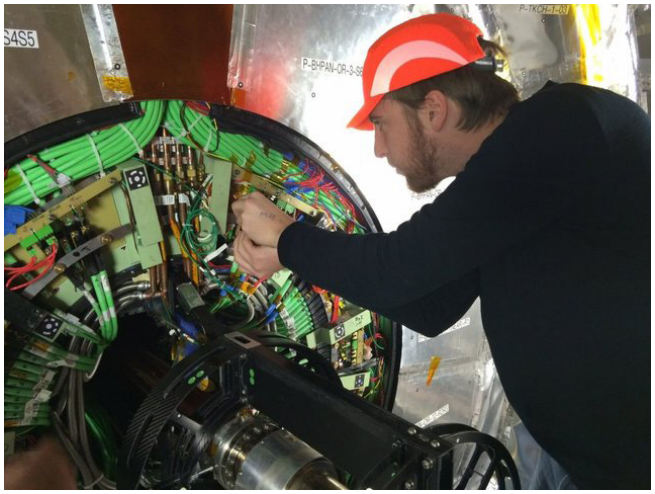
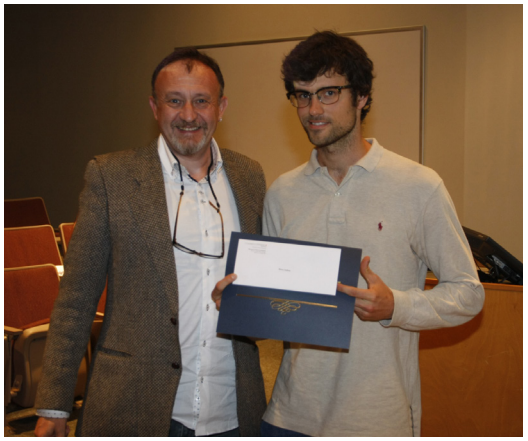
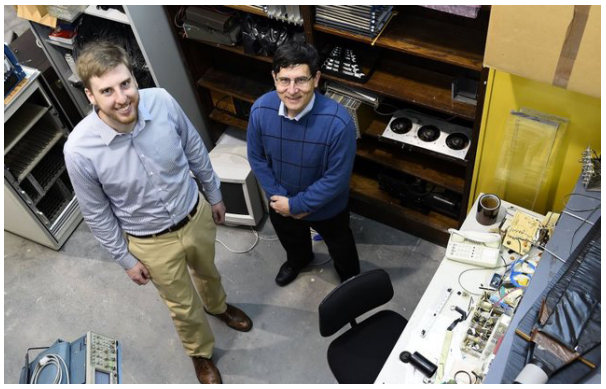


Graduate Handbook



Academic Year 2016-2017



THE UNIVERSITY OF TENNESSEE KNOXVILLE

COLLEGE OF ARTS & SCIENCES

Department of Physics and Astronomy

401 Nielsen Physics Building

The University of Tennessee

Knoxville, TN 37996-1200

PHYSICS & ASTRONOMY

Graduate Handbook
2016-2017

Contents

Welcome from the Department Head

Dear Graduate Students,

Welcome to the Graduate Program in the Department of Physics and Astronomy. The department has a long-standing tradition of excellence in physics research and education, and currently employs over 30 professors. Our faculty and students work on-campus, at Oak Ridge National Laboratory, and at other major laboratories around the world. Research in our department is primarily carried out by the graduate students and encompasses all major areas of physics, including interdisciplinary fields such as materials research, biophysics, and energy science. Our research output and graduation rates have increased significantly over the years and we are now among the 40 to 50 largest graduate physics programs in the United States. Needless to say, we are very proud of our graduate program and of our graduate students.

This graduate handbook for the Department of Physics and Astronomy will provide you with all the information you need to know specifically about our graduate program in physics. It is a very important supplement to the university's *Graduate Catalog*. Together these two documents should be able to provide you with answers to most of your questions or concerns concerning graduate studies in physics at the University of Tennessee. But as always, we will be more than happy to talk with you and to help you to be successful here in our department.

Hanno Weitering
Professor and Head

Introduction

To serve the mission and vision of the Graduate School and preserve the integrity of Graduate Programs at the University of Tennessee, information related to the process of graduate education in each department is to be provided for all graduate students. Based on best practices offered by the Council of Graduate Schools, it is important that detailed articulation of the information specific to the graduate degrees offered in each department/program be disseminated.

This handbook outlines degree requirements, student responsibilities, and research and teaching opportunities in the UT Department of Physics and Astronomy. Although general descriptions of both university and departmental requirements are provided, it does not deviate from established Graduate School policies as outlined in the *Graduate Catalog* (catalog.utk.edu), which serves as the last word for official UT policies regarding graduate study. Graduate students are expected to be familiar with and comply with all requirements in *Academic Policies and Requirements for Graduate Students* as outlined in the catalog. **All graduate students are advised to periodically review the M.S. and Ph.D. degree guidelines as set forth in the catalog to keep up with the most recent requirements.** Students are notified of any changes in departmental requirements by internal memoranda and announcements.

Graduate students must assume full responsibility for knowledge of rules and regulations of the Graduate Council and departmental requirements for the chosen degree program. Graduate students are expected to be aware of and satisfy all regulations governing their work and study at the university. The Graduate School website provides links to the *Graduate Catalog*, *Hilltopics* (the UT student handbook), and the Graduate Student Appeals Procedure at gradschool.utk.edu/documents/2016/02/student-appeals-procedures.pdf. All graduate students are expected to make a full commitment to their graduate studies and complete their degree requirements in a timely fashion, in accordance with all Graduate School policies.

A contact list of physics department faculty and staff members involved with the graduate program is included on page 14.

Admission Requirements

Students applying to the graduate program in physics must apply both the UT Graduate School and the UT Department of Physics and Astronomy. Admission procedures for the Graduate School are outlined in the *Graduate Catalog* and on the graduate admissions website (gradschool.utk.edu/admissions/). Please note that the physics department cannot formally make an offer until an application for admission has been received and accepted by the Graduate School.

A student who enrolls in graduate study with the intention of attaining an advanced degree in physics will have completed an undergraduate major in physics or its equivalent. Physics 311-312, 321, 361, 431-432, 421, 461, and 411-412 constitute the minimum courses prerequisite to graduate study. A student who intends to present physics as a graduate minor will have completed an undergraduate minor in physics or its equivalent. Physics 311 and 431-432 constitute the minimum course work prerequisite to a minor in physics. In addition to meeting the Graduate Council's minimum requirements, applicants are strongly encouraged to submit scores from the Graduate Record Examination (general and subject). Students are unlikely to be offered financial support from the department unless they submit a GRE subject score.

Financial Support

Graduate Assistantships

The department offers graduate students the opportunity to gain valuable experience while offsetting tuition costs with teaching and research assistantships. Teaching and research assistants are appointed for 12-month periods with the authorized stipends paid in 12 equal checks and the remission of fees for the semesters covered by the period of appointment. University policy dictates that the waiver of fees for assistantships applies to

maintenance and tuition fees only; it does not include the programs and services fee, facilities fee, or the technology fee. For graduate research assistants, the maintenance fee is paid by the granting agency and is in addition to the stipend paid. Both teaching and research assistants are expected to register as full-time students as outlined in the *Graduate Catalog* (9 hours until they complete the core curriculum; 6 hours afterward if engaged in research). If engaged in research:

- If working on research for a master's degree, take Physics 500 (Thesis).
- **Once admitted to Ph.D. candidacy**:
  - If working on research for a Ph.D., take Physics 600 (Doctoral Research and Dissertation). Note: once registration for 600 has begun, the student must register for at least three hours of 600 every semester until the dissertation is accepted.
  - If the student is doing research that will not be applied to a thesis or dissertation, the appropriate course number is Physics 501 (Graduate Research Participation).
- Besides regular course work, other options to meet the required requirements include Physics 593 (Independent Study) and 502 (Registration for Use of Facilities).

Students should consult the *Graduate Catalog* for a more thorough discussion of graduate assistantship rights and responsibilities, evaluation, etc.

The assistantship and graduate course work constitute a full-time load. Students may not hold outside employment during the academic year. Violation of this statute will result in termination of the assistantship. Students under severe financial stress should consult with their advisors.

Graduate Teaching Assistants

GTAs are normally expected to teach either laboratory or recitation sections in general physics and/or grade to the extent of half-time or 6 credit hours per week for two semesters. The graduate teaching assistantship offers a stipend for 9 months, paid over a 12-month period. Teaching assistants who wish to work during the summer term must apply to the director of undergraduate laboratories. Summer appointments are not guaranteed, although priority is given to students enrolled in summer courses and who have demonstrated excellence in teaching.

Graduate Research Assistants

GRAs work different hours depending on the percent of full-time appointment made. Usually the decision concerning the percent full-time is reached by mutual agreement between the student and the research group leader. For example, an appointment of 50 percent full-time requires working 20 hours per week, whereas a 75 percent appointment requires 30 hours per week. Generally, appointments over 50 percent full-time are not made until the student has completed general course work and is concentrating on dissertation or thesis research. Students at the university on F1 or J1 visas must follow work hour limits of Immigration and Naturalization Services.

Departmental Fellowships

The department offers outstanding fellowship opportunities for qualified students, including fellowships with the Joint Institute for Advanced Materials. More information about these awards is available at: www.phys.utk.edu/graduate/support.html.

UT-ORNL Distinguished Fellowship

The university and Oak Ridge National Laboratory have established a joint Ph.D. graduate fellowship program. Successful graduate applicants will simultaneously gain experience in both academic and national lab settings, while pursuing engineering and scientific research related to national energy-related priorities. Applications from students with backgrounds in physics, materials science, materials engineering, chemistry, chemical engineering, nuclear engineering, and computational science are welcome. For more information on this highly competitive program please visit the website: bredesencenter.utk.edu.

University Fellowships

The Graduate School (gradschool.utk.edu/graduate-student-life/) provides information

on fellowships and other forms of finanical assistance for graduate students.

Departmental Honors

Graduate students are eligible for a number of departmental honors. Traditionally, announcement of these awards is made at the honors day ceremonies each spring. The UT chapter of the Society of Physics Students screens all physics students for initiation into Sigma Pi Sigma, the physics honor society. Any interested graduate students must have met Sigma Pi Sigma requirements at their respective undergraduate institutions, or must satisfy the following prerequisites:

- Must have completed one full year of graduate study in physics with 6 graduate level courses in physics completed. Seminar, thesis, and independent study courses are excluded from the 6 hours.
- Must have a minimum GPA of 3.5 for all physics courses
- Must have a minimum GPA of 3.25 for all graduate courses

Faculty members nominate and select graduate students for the following departmental awards:

The Paul H. Stelson Fellowships in Physics: established by the Stelson family to assist aspiring physicists and continue the strong physics research tradition between UT and ORNL. Two awards are presented; one to a first-year student exhibiting professional promise and one to a student who has excelled in graduate research.

The Joe Fowler and Jerry Marion Outstanding Graduate Student Award: recognizes outstanding achievement by a graduate student.

Outstanding GTA Award: given to the GTA with the best record of teaching, as indicated by student evaluations.

Robert Lide Citations: recognition of students who make exceptional contributions to the undergraduate physics laboratories.

Wayne Kincaid Award: named for the late Wayne Kincaid, an alumnus of the department and a research associate with the astrophysics group. The award honors a student who shares his love for astronomy and astrophysics education and who has made exceptional contributions to educational technology, astronomy education, or scientific writing.

Travel Support

Graduate students in physics who travel for research purposes, meetings, etc., are typically supported by the department in the forms of grants or donor-supported funds. The university also has a Graduate Student Travel Fund administered by the Graduate Student Senate (gss.utk.edu/travel-awards/).

Getting Started

The physics department offers a rewarding intellectual program as well as a congenial environment for the development of professional and personal relationships. To help graduate students realize their potential, the department has established certain general requirements to set them on the best course of study and incorporate them into the physics community.

Diagnostic Examination

A graduate placement examination (diagnostic exam) is required of all first-year graduate students. This exam, administered strictly for advising purposes, covers material from undergraduate physics and is given during the fall registration period. The exam gives students and faculty a clear idea of students' aptitude and accomplishments in physics as they begin graduate work.

Graduate Advising

Dr. Thomas Papenbrock is the designated academic advisor for all first year graduate students. Each student should consult with him before registering for courses during the first year of graduate study. Dr. Papenbrock remains the student's advisor until he or she joins a research group and becomes an advisee of a faculty member in that area. The student must inform Chrisanne Romeo of the change in advisor status.

Colloquium

The physics department holds a weekly colloquium to spark the exchange of ideas and encourage interaction among scientific colleagues. **Graduate students are required to attend the colloquia** as a means of learning about future directions in physics research and developing relationships with faculty members and other students. Students should register for Physics 503: Physics Colloquium. Doctoral students are to register for the course five times; master's candidates, twice. The colloquium is traditionally held on a Monday afternoon, with the speaker list, time, and date circulated in advance by e-mail.

General Administrative Items

The physics office resources (copier, fax machine, etc.) are available to all graduate students. Information on e-mail accounts and other technology resources is available at https://oit.utk.edu/accounts/Pages/default.aspx. The department also has a mechanical shop for students, who must first consult with the Dr. Jim Parks for orientation and approval for shop use.

The Physics Community

Graduate students are an important part of the physics department's social and professional structure. A graduate student liaison committee meets periodically with the department head to discuss issues relating to graduate requirements, responsibilities, etc. Graduate students are also encouraged to participate in various departmental affairs, including the annual spring picnic and guest lectures. The Graduate Physics Society also plays an active role in sponsoring social events and informational sessions.

Disability Statement

If you need course adaptations or accommodations because of a documented disability or if you have emergency information to share, please contact the Office of Disability Services at 191 Hoskins Library at 974-6087. This will ensure that you are properly registered for services.

Fields of Study

The physics department offers several opportunities for graduate students to pursue specific scientific interests. Graduate students may emphasize study in the following fields:

Master's Degree

- Astrophysics concentration
- Atomic, molecular, optical, and low temperature physics concentration
- Biophysics concentration
- Chemical physics concentration
- Condensed matter and surface physics concentration
- Elementary particle physics concentration
- Geophysics concentration
- Mathematical and computational physics concentration
- Nuclear and relativistic heavy ion physics concentration
- Theoretical physics concentration
- Minor or Simultaneous M.S. in Statistics (Interdisciplinary Graduate Statistics Program)
- Intercollegiate Graduate Minor in Computational Science

Doctoral Degree

- Astrophysics concentration
- Atomic, molecular, optical, and low temperature physics concentration
- Biophysics concentration
- Chemical physics concentration
- Condensed matter and surface physics concentration
- Elementary particle physics concentration
- Energy science and engineering concentration
- Mathematical and computational physics concentration
- Nanomaterials concentration
- Nuclear and relativistic heavy ion physics concentration
- Theoretical physics concentration

Students are encouraged to contact faculty members working in areas of interest to them to learn more about opportunities in specific fields (see appendices for a faculty list). Master's and Ph.D. programs are also available at **The University of Tennessee Space Institute at Tullahoma**, with emphases in fields including laser applications, quantum and applied optics, laser spectroscopy, fluid physics, medical physics, computational physics, and theoretical physics. Students interested in these programs should contact the UTSI Dean for Academic

Affairs. More information is available from the Space Institute's Office of Graduate Admissions. The UTSI website is: www.utsi.edu/.

The Master's Program

The department offers three programs to complete the M.S. degree: a thesis option, a project option, and a non-thesis option. Candidates for the M.S. degree may not at the same time be candidates for a Ph.D. degree.

The Thesis Option

The course requirements for the thesis option include 24 hours of physics courses, of which at least 12 hours are taken from Physics 506, 513-514, 521-522, 531, 541, 555, 571, 573. Each candidate must present an acceptable thesis, 6 hours of Physics 500, and pass an oral examination on course material and thesis.

The department also offers an M.S. thesis program with a concentration in **geophysics**. Program requirements are: 12 hours from Physics 506, 513-514, 521-522, 531, 541, 571, 573; a minimum of 12 additional hours in geology, geophysics, and/or physics, as approved by the student's committee; and the presentation of an acceptable thesis, 6 hours of Physics 500, and the passing of an oral examination on course material and thesis.

The university requires candidates in the thesis M.S. program to earn at least 6 semester hours of Physics 500 (Thesis Registration) while the student is preparing the thesis. A student must be registered for course 500 each semester during work on the thesis, including a minimum of 3 hours the semester in which the thesis is accepted by the Graduate School.

Before registering for Physics 500, each student must decide with whom he or she wishes to work and discuss research possibilities with that professor. Students should notify Chrisanne Romeo of their respective thesis directors before registering for Physics 500. The student and his or her research director will then choose the student's committee. The university's thesis/dissertation consultant is available to help students meet UT thesis requirements (see points of contact list on page 14).

The Project Option

The course requirements for the project option include a minimum of 30 hours of graduate credit in courses composed of Physics 513-514; 9 hours from Physics 411-412, 421, 431-432, 461, 507, 508, 521-522, 531, 541, 555, 571, 573 (at least 3 hours above the 500 level); 6 hours from Physics 593, 594 for a Project in Lieu of Thesis; and 6 additional hours which may come from physics or from a single minor field outside of the physics department, such as computer science, mathematics, engineering, chemistry, biology, education, business, or law.

The candidate must pass an oral examination on course material and on the project representing the culmination of an original research project completed by the student. **The exam should be scheduled through the physics department at least two weeks prior to the examination.** An announcement of the scheduled examination should be made to the department, usually via e-mail sent by the graduate secretary. A written report must be approved and accepted by the physics graduate committee and the department head. An electronic version of the written report must also be submitted to the permanent electronic archive of the department available on the Internet.

The Non-Thesis Option

Students seeking the non-thesis option must apply to the director of the graduate program for permission to enroll under this program. The requirements are the satisfactory completion of 30 hours of course work composed of 18 hours from Physics 506, 513-514, 521-522, 531, 541, 571, 573; 6 additional hours from physics or a minor field; and 6 hours from other courses numbered above 400 (preferably of advanced laboratory nature.) At least 20 hours must be taken at the 500-level or above. In addition, the candidate must pass a written examination administered by his/her committee.

Policies & Procedures for M.S. Students

1. Committees: The M.S. committee comprises at least three persons with the rank of assistant professor or above, usually with the research director as chair. In the case of a master's committee, the members will normally all be from the department, if there is no minor. If the student has a minor, one member of the committee must be from the minor department. All members must hold an official appointment with the university. The student should check with his or her professor to decide upon the committee and see that the appointments are made.

2. Admission to Candidacy: Admission to candidacy indicates that the student has demonstrated ability to do acceptable graduate work and that satisfactory progress has been made toward a degree. This action usually connotes that all prerequisites to admission have been completed and a program of study has been approved. The application for the master's degree is made as soon as possible after the student has completed any prerequisite courses and 9 hours of graduate course work with a 3.0 average or higher in all graduate work. The Admission to Candidacy form must be signed by the student's committee and list all courses to be used for the degree, including transfer course work. The student must submit this form (with original signatures) to the Graduate School no later than the last day of classes of the semester preceding the semester in which he or she plans to graduate.

3. Thesis (if applicable): A draft of the thesis in a form approved by the student's major professor should be submitted to all committee members **at least two weeks before the date of the final oral examination**. The exam must be scheduled through the physics department office at least two weeks prior to the defense. The Graduate School supplies information as to the format of theses and deadline dates for these examinations each semester. The official manual used in thesis writing is the *Guide to the Preparation of Theses and Dissertations* (available at gradschool.utk.edu/thesesdissertations/) and it should be followed closely with some exceptions (see appendices). An electronic copy of the thesis must be accompanied by one original approval sheet, signed by the members of the master's committee. The approval sheet reflects the final format for submission. The approval sheet certifies that the committee members have examined the final copy of the thesis and have found that its form and content are satisfactory. In addition to the university's copy of the thesis, the student is required to give the physics department one unbound copy, including a copy of the approval sheet, for the departmental file.

4. Graduation: A student planning to graduate must submit an application for graduation no later than the last day of classes of the term prior to the term he or she intends to graduate. Students who expect to complete degrees should inform Chrisanne Romeo at the beginning of the final semester. See the steps to graduation online at registrar.utk.edu/graduation.shtml.

The Ph.D. Program

All doctoral students are expected to take the graduate core curriculum in physics consisting of the following courses: Physics 521-522, 531, 541, 551, and 571. Students concentrating in chemical physics may substitute Chemistry 572 for Physics 551, and should complete at least 6 semester hours from Chemistry 530, 570, 571, 573, 595, 630, 670 and 690. Students concentrating in energy science and engineering should complete ESE 511, ESE 512 (Introduction to Energy Science and Technology (3 + 3 credits), at least 3 hours from the Knowledge Breadth Curriculum (a list of courses is available from the Graduate Program Director) and 3 credit hours (1+1+1) of topical seminars in the focus area of CIRE. Students must take either i) a minimum of 15 hours of 600-level courses with 6 of these hours in their concentration area, or ii) a minimum of 12 hours of 600-level courses with 6 of these hours in their concentration area and a minimum of 3 hours of 500-level courses described in a list available from the Director of the Graduate Program and approved by the student's Doctoral Committee. Among

the 600-level courses, Physics 601-602 are normally required of students concentrating in atomic physics; Physics 621-622 of students in nuclear physics; Physics 626-627 of students in elementary particle physics (and/or Physics 611-612 for students concentrating in theoretical elementary particle physics); Physics 615-616 of students in astrophysics and cosmology; and Physics 671-672 of students in condensed matter and surface physics. The **energy science and engineering concentration** is offered in collaboration with the Bredesen Center for Interdisciplinary Research and Graduate Education (CIRE), a joint effort between University of Tennessee colleges and the Oak Ridge National Laboratory. Students who wish to pursue this concentration will normally have completed the ESE Core for CIRE students, and 1 hour of CIRE seminar.

Students concentrating in **energy science and engineering** must take a minimum of 15 hours of 600-level courses, of which at least 6 hours are offered by the department and at least 6 hours are from a list of courses offered by several departments which are appropriate for a concentration in energy science and engineering. This list is available from the Graduate Program Director.

Students concentrating in **nanomaterials** must take a minimum 15 hours of 600-level courses, of which at least 6 hours are offered by the department and at least 6 hours are from a list of courses offered by several departments which are appropriate for a concentration in nanomaterials. This list is available from the Director of the Graduate Program. In addition to the departmental core curriculum listed above, they must take additional courses at the 400- through 500-level, with at least 6 hours offered by the department and 6 hours from the list.

To be admitted to Ph.D. candidacy, students must: a) fulfill all general requirements by the Graduate Council, b) pass the qualifying examination, c) have at least a 3.0 GPA on the graduate curriculum in physics, d) form a doctoral committee and e) pass the comprehensive examination.

The Qualifying Exam

The qualifying examination is designed to test the student's general knowledge of the fundamentals of physics. The performance needed to pass this examination corresponds to a mature command of the material typically included in the undergraduate physics major curriculum. The qualifying examination should be passed after the student's first year of study. Based on the student's performance on the qualifying examinations, the course work, the GRE scores, and optional research participation, the faculty will decide if the student will be allowed to continue in the PhD program.

The Comprehensive Exam

The comprehensive examination is designed to test the student on specific knowledge and skills in the areas essential to the student's research program; on capability to successfully complete the doctoral dissertation; and on general knowledge of the graduate core curriculum. The most essential component of this examination is the presentation and defense of an original research proposal. This should be a 10-to-15 page document describing the proposed research topic (What?), the motivation for the proposed research (Why?) and the proposed methods (How?). The document must include relevant factual material and a literature review. The document must be given to each member of the student's committee **AT LEAST ONE WEEK** before the oral part of the examination.

The dissertation topic will be chosen with reference to one of the fields in which research facilities can be made available either at UT laboratories in Knoxville; the University of Tennessee Space Institute at Tullahoma; Oak Ridge National Laboratory; or at other research facilities used by the University faculty.

The oral part of the examination consists of two parts. Part 1 is an oral presentation and defense of the research proposal. Part 2 consists of questions by committee members about any aspect of the student's preparation for the proposed research and may include fundamental questions about the foundations of the physics. The oral part is public and must be announced **AT LEAST ONE WEEK** in advance.

The student must pass both the written and the oral part of the comprehensive exam. If the student passes, the written part (i.e., the research proposal) will be submitted to the

physics department archive and will become a public document. The comprehensive examination must be passed prior to admission to candidacy and must be passed before the end of the third year of study. The exam is conducted by the student's doctoral committee and an additional faculty member appointed by a department head.

Policies & Procedures for Ph.D. Students

1. Committees and Major Advisor: Students are required to find a research advisor and form a doctoral committee before the end of the second year of study. This committee is responsible for advising the student and monitoring his or her progress toward the doctoral degree. This committee comprises at least four UT faculty members holding the rank of assistant professor or above, including adjuncts, three of whom (including the chair) must be approved by the Graduate Council to direct doctoral research. At least one member must be from an academic unit other than that of the student's major field.

In general, the chair of the committee is a regular faculty member in the department and is the student's primary research advisor. Occasionally students want to work on research at Oak Ridge National Laboratory with an ORNL scientist as the primary advisor. The ORNL scientist usually is a research, adjunct, or regular faculty member. If that scientist has faculty status in the department and is approved to direct doctoral research, then that person can serve as one of the four members of the doctoral committee and will have the title of primary research advisor. If the proposed research director does not have such official UT status, then that person will be added to the committee as a fifth voting member and will have the title of primary research advisor. Additional members internal or external to UT can be appointed to the committee as friends, but these members will not have voting rights.

The department requires that a candidate's committee meet with him or her at least once per academic year. The student also can request a meeting without the presence of both the committee chair and the primary research advisor. The student has the right to request this type of meeting at any time. The committee is set up to help the student, who is urged to consult its members when technical, procedural, or other problems arise, and to keep them informed of his or her progress.

2. Admission to Candidacy: Admission to candidacy indicates agreement that the student has demonstrated the ability to do acceptable graduate work and that satisfactory progress has been made toward a degree. This action usually connotes that all prerequisites to admission have been completed and a program of study has been approved. A student may be admitted to candidacy for the doctoral degree after passing the comprehensive examination and maintaining at least a B average in all graduate course work. Each student is responsible for filing the admission to candidacy application, which lists all courses to be used for the degree, including courses taken at UT or at another institution prior to admission to the doctoral program, and is signed by the doctoral committee. **Admission to candidacy must be applied for and approved by the Graduate School at least one full semester prior to the date the degree is to be conferred. The candidacy application must be submitted with original signatures.**

3. Doctoral Research: Students should not register for Physics 600 until they are admitted to candidacy. They are admitted to candidacy when they pass the comprehensive exam. So, **students should not register for Physics 600 until they have passed the comprehensive exam**. Students who wish to register for Physics 600 (Doctoral Research and Dissertation) are requested to notify Chrisanne Romeo of the name of their research director. The student must register continuously for course 600 (minimum of 3 hours) from the time the doctoral research proposal is approved, admission to candidacy is accepted, or registration for course 600 is begun, whichever comes first, including summer semester and the semester in which the dissertation is approved and accepted by the Graduate School. A minimum total of 24 hours of course 600 is required before the dissertation will be accepted. A student who will not be using faculty services and/or university facilities for a period of time may request leaves of absence from dissertation research up to a maximum of six terms (including summer terms). The

request, approved by the major professor, will be submitted by the student and filed in the Graduate School. A student should be registered for the number of dissertation hours representing the fraction of effort devoted to this phase of the candidate's program. Thus, a student working full time on the dissertation should register for 12 hours of course 600 per semester.

4. Submission of Dissertation: Upon completion of doctoral dissertation research, a candidate will submit a draft of his or her dissertation to the committee chair. The department recommends that this draft be available to the professor in charge six weeks before the expected date of graduation. The committee chair will then set a date for the final oral examination. A physics department regulation specifies that draft copies of the dissertation be made available to the entire committee at least three weeks prior to the date of examination. An electronic copy of the dissertation (prepared according to the regulations in the most recent *Guide to the Preparation of Theses and Dissertations*, available at gradschool.utk.edu/thesesdissertations/) must be submitted to and accepted by the Graduate School on behalf of the Graduate Council. Each dissertation must be accompanied by an approval sheet (gradschool.utk.edu/forms-central/thesisdissertation-approval/) signed by all members of the doctoral committee. The approval sheet reflects the final format for submission. The approval sheet certifies to the Graduate School that the committee members have examined the final copy and found that its form and content demonstrate scholarly excellence. A Doctoral Dissertation Agreement Form, Survey of Earned Doctorates, and Abstract form are also submitted at this time.

5. Final Examination: The final oral examination must be held in Knoxville (exceptions are made for UTSI students, e.g., video-conferencing). This rule allows examinations to be open to all members of the faculty. The exam must be scheduled through the Graduate School at least one week prior to the exam. This final examination may cover the student's dissertation, special field, and other fields as the student's faculty committee may specify. This examination must be passed at least two weeks before the date of submission and acceptance of the dissertation by the Graduate School.

6. Graduation: A student planning to graduate must submit an application for graduation no later than the last day of classes of the term **prior to the term** he or she intends to graduate. Students who expect to graduate at the end of a given semester should notify Chrisanne Romeo during the first two weeks of the semester.

Five-Year B.S.-M.S. Program

Qualified students completing a B.S. degree from a department of the College of Engineering or the College of Arts and Sciences who have added a physics minor by completing the requirements listed under the Five-Year B.S. with Physics Minor-M.S. program in the *Undergraduate Catalog,* must apply to the department's graduate committee for permission to enroll under this program. Six hours of 400-level courses required for a minor in physics combined with a B.S. engineering degree may be applied toward a master's degree (project option or non-thesis option) in physics during a fifth year following the award of the BS. This program is designed for students attending the University of Tennessee for the Master of Science degree because other universities may not accept these courses for graduate credit since they were used to satisfy requirements for an undergraduate program. Significant components of the program are:

» Students must have an overall GPA of 3.4 in required course work. Conditional admission may be granted after completing the required 100- and 200-level requirements for the minor while full admission is granted after enrolling in the final semester of courses required for all BS and minor course requirements with a minimum overall GPA of 3.4.

» Students must at least be conditionally admitted to the program prior to taking graduate courses for both their minor and master's degree. All courses taken for graduate credit must be approved by the graduate program director. Students admitted to the program must request permission from the Graduate School to take approved courses for graduate credit.

» Students admitted to the program must also follow the normal procedure for admission to the Graduate School. Admission of students into this program must be approved by the department and the Graduate School. Students will not be eligible for assistantships until they are enrolled as graduate-level students in the Graduate School.

Five-Year Program Project Option

The requirements for the project option are Physics 411, Physics 412, Physics 593, Physics 594, and 12 hours (four courses) chosen from any 500-level physics courses. Examination and reporting requirements are the same as for the standard physics major MS project option.

Five-Year Program Non-Thesis Option

The requirements for the non-thesis option are Physics 411, Physics 412, and six courses (18 hours) chosen from Physics 513, Physics 514, Physics 521, Physics 522, Physics 531, Physics 541, Physics 571, and Physics 573. Examination requirements are the same as for the standard physics major MS non-thesis option.

Interdisciplinary Graduate Minor in Computational Science

The Department of Physics and Astronomy participates in the interdisciplinary graduate minor in computational science (IGMCS) program. Any student pursuing a master's or Ph.D. with a major in physics can receive a minor in computational science by completing the appropriate IGMCS requirements. For further information, see the description of the IGMCS listed under the Department of Electrical Engineering and Computer Science or visit the website at igmcs.utk.edu. The physics department also contributes courses to the IGMCS program curriculum.

Intercollegiate Graduate Statistics Program

The Department of Physics and Astronomy also participates in the intercollegiate graduate statistics program, a formal University of Tennessee academic program established to enable students to earn either a minor or an M.S. in Statistics simultaneously with a master's or doctoral degree in another department. More information is available at igsp.bus.utk.edu.

Degree Progress, Standards, Problems, and Appeals

Students are required to follow the Graduate School's standards regarding grade point average, degree progress, research compliance, and academic honesty, as outlined in the *Graduate Catalog*. Until they have a committee, the director of the physics graduate program will provide a **written evaluation** for students after each academic term to insure they are making sufficient progress toward their degrees in terms of academic progress and meeting their responsibilities as a teaching or graduate assistant. Once a student has a committee, the chair will conduct evaluations. Students will be alerted to any deficiencies or problems. The department follows the university guidelines regarding all appeals and complaints (gradschool.utk.edu/graduate-student-life/).

Proper Relationships with Students

If a graduate student, as part of his or her employment at UT, has any kind of power over another person, he or she should NOT have any kind of romantic relationship with that person. Power might consist of being a supervisor, advisor, or teacher at any level, and therefore applies to administrators, supervisors, faculty, lecturers, teaching assistants, etc. The physics website lists the official university policy on consenting romantic or sexual relationships as well as the policy on sexual harassment.

The policy quoted specifically refers to faculty members, but it applies to all people with some

kind of power over other people (i.e., students). The department memo concerning these matters is online at: www.phys.utk.edu/Memos.htm.

Leaving the Program

If, for any reason, a graduate student terminates study in the physics department, he or she must see Showni Medlin-Crump, Senior Administrative Specialist, to follow proper checkout procedures. Failure to comply with this policy will result in a hold on any outstanding paychecks issued to the student, as well as a hold on academic transcripts from the university.

Physics Career Resources

Several resources are available to help physics students explore career options upon completion of their degrees. There are a number of websites that provide information about available positions, career planning, and employment statistics. The following are some starting places:

» American Physical Society Career Page
www.aps.org/careers/

» Physics Today Jobs
jobs.physicstoday.org

» UT Center for Career Development
career.utk.edu/

» brightrecruits
brightrecruits.com/

» PhysLink
www.physlink.com/Community/JobBoard.cfm

Pertinent Websites

» Center for International Education
cie.utk.edu/

» Counseling Center
counselingcenter.utk.edu/

» Department and College of Arts and Sciences
www.phys.utk.edu and artsci.utk.edu

» Funding, Fellowships, and Assistantships for Graduate Students
gradschool.utk.edu/graduate-student-life/

» Graduate School
gradschool.utk.edu

» Graduate Catalog
catalog.utk.edu

» Graduate Student Appeals Procedure
gradschool.utk.edu/documents/2016/02/student-appeals-procedures.pdf

» Graduate Student Senate
gss.utk.edu

» Graduate and International Admissions
gradschool.utk.edu/admissions/applying-to-graduate-school/admissions-for-international-students/

» International House
ihouse.utk.edu

» Judicial Affairs/Student Conduct and Community Standards
studentconduct.utk.edu

» Office of Equity and Diversity
oed.utk.edu

» Multicultural Student Life/Black Cultural Center
multicultural.utk.edu/

» Research Compliance/Research with Human Subjects
research.utk.edu/compliance/

» International Teaching Assistant (ITA) Testing Program (formerly the SPEAK Testing Program)
gradschool.utk.edu/admissions/applying-to-graduate-school/admissions-for-international-students/#proficiency

» Thesis/Dissertation Website
gradschool.utk.edu/thesesdissertations/

» Library Website for Graduate Students
libguides.utk.edu/graduate

» OIT: Office of Information Technology
oit.utk.edu/

Contacts

Contact	Office/Phone/E-Mail	Responsibility
Dr. Hanno Weitering Professor and Head	hanno@utk.edu 974-3342 401 Nielsen Physics	Meets with graduate student liaison committee
Dr. Kate Jones Associate Professor and Associate Head	kgrzywac@utk.edu 974-4022 406A Nielsen Physics	Training for new TAs
Dr. Marianne Breinig Professor and Associate Head	mbreinig@utk.edu 974-7842 202 Nielsen Physics	Director of the graduate program in physics
Dr. Thomas Papenbrock Professor	tpapenbr@utk.edu 974-3128 or 574-4577 106 South College/ORNL	Graduate student advisor
Dr. Christine Cheney Director of Undergraduate Labs	ccheney@utk.edu 974-2631 404B Nielsen Physics	Teaching assistant assignments and supervision of TAs; student machine shop orientation
Dr. Norman Mannella Associate Professor	nmannell@utk.edu 974-6123 407-B Nielsen Physics	Chair of the Graduate Studies Committee
Showni Medlin-Crump Senior Administrative Services Assistant	smedlin@utk.edu 974-2633 401 Nielsen Physics	Keys, copier codes, and employment paperwork
Chrisanne Romeo Administrative Specialist	cromeo@utk.edu 974-3342 401 Nielsen Physics	Changes in advising status, notification of graduation, etc.
Thesis/Dissertation Consultant	thesis@utk.edu 974-1337 111 Student Services Building	University requirements for thesis or dissertation preparation

Appendices

» List of Faculty and Related Research Areas
» Graduate Student Deadline Dates
» Admission to Candidacy Application – Master's Degree
» Doctoral Committee Appointment Form
» Admission to Candidacy Application – Doctoral Degree
» Scheduling Defense of Dissertation Form
» Graduate Student Travel Award Applications are only available online: visit gss.utk.edu/travel-awards/

Faculty and Their Respective Research Areas

JIHIR: Joint Institute for Heavy Ion Research | ORNL: Oak Ridge National Laboratory
SERF: Science and Engineering Research Facility | UTSI: University of Tennessee Space Institute at Tullahoma

Name	Research Area	Telephone	Office	E-mail
Bertrand, Fred E. Research Professor	JIHIR	574-4740	JIHIR	bertrandfejr@ornl.gov
Bardayan, Dan Adjunct Associate Professor	Nuclear Physics	574-6127	ORNL	bardayandw@ornl.gov
Batchelor, Dan Research Professor		574-1288	ORNL	batchelordb@ornl.gov
Cristian Batista Lincoln Chair Professor	Theoretical Condensed Matter Physics	974-4164	210 South College	cbatist2@utk.edu
Breinig, Marianne Professor	Physics Education and Experimental Atomic Physics	974-7842	202 Nielsen	mbreinig@utk.edu
Burgdoerfer, Joachim Adjunct Professor	Atomic Physics	+43 1 58801 136 10	(TU Vienna)	burg@concord.itp.tuwien.ac.at
Cardall, Christian Adjunct Research Assistant Professor	Astrophysics	576-6341	ORNL	ccardall@utk.edu
Christianson, Andrew Joint Faculty	Quantum Condensed Matter	574-1181	ORNL	christiansad@ornl.gov
Cianciolo, Vince Adjunct Professor	Nuclear Physics	574-4712	ORNL	cianciolotv@ornl.gov
Cormier, Tom Joint Faculty	Nuclear Physics	574-9998	ORNL	cormiertm@ornl.gov
Cousineau, Sarah Joint Faculty	Accelerator Physics	574-6617	ORNL	scousine@ornl.gov
Dagotto, Elbio Distinguished Professor	Theoretical Condensed Matter Physics	974-2122	302 South College	edagotto@utk.edu
Davis, Lloyd Professor	Experimental, Interdisciplinary, Numerical Physics	931-393-7335	UTSI	ldavis@utsi.edu

Name	Research Area	Telephone	Office	E-mail
Dean, David Adjunct Associate Professor	Theoretical and Computational Physics	576-5229	ORNL	dean@mail.phy.ornl.gov
Efremenko, Yuri Professor (Joint Faculty)	Neutrino Physics	974-7857/574-4706	503 Nielsen/ ORNL	yefremen@utk.edu
Egami, Takeshi Adjunct Professor	Condensed Matter and Materials Engineering	974-7204	208 South College	egami@utk.edu
Eguiluz, Adolfo Professor (Joint Faculty)	Theoretical Condensed Matter Physics	974-6182/574-5783	202 South College	eguiluz@utk.edu
Elston, Stuart Professor	Experimental Atomic Physics/Engineering Physics	974-7818	216 Nielsen	selston@utk.edu
Endeve, Eirik Joint Faculty	Astrophysics	576-6349	ORNL	endevee@ornl.gov
Fernandez-Baca, Jaime Joint Faculty	Condensed Matter Physics and Neutron Diffraction	576-8659	ORNL	fernandezbja@ornl.gov
Ferrell, Thomas L. Research Professor	Applied Physics/ Novel Sensors	974-2699	309 Nielsen	tlf@utk.edu
Fishman, Randy Joint Faculty	Condensed Matter Physics	574-5786	ORNL	fishmanrs@ornl.gov
Michael Fitzsimmons Joint Faculty	Experimental Condensed Matter Physis	(505) 901-0534	ORNL	mfitzsi1@utk.edu
Fomin, Nadia Assistant Professor	Experimental Nuclear/Neutron Physics		407B Nielsen	nfomin@utk.edu
Gabriel, Tony Adjunct Professor	Neutron Physics	382-8975	ORNL	gabrielta@ornl.gov
Galindo-Uribarri, Alfredo Adjunct Professor	Nuclear Physics	574-6124	ORNL	uribarri@ornl.gov
Garrett, Ray Adjunct Professor	Chemical Physics	974-8338	610 SERF	wrg@utk.edu

Name	Research Area	Telephone	Office	E-mail
Sowjanya Gollapinni	Elementary Particle Physics		515 Nielsen	sgollapi@utk.edu
Greene, Geoffrey L. Professor (Joint Faculty)	Experimental Neutron Physics	974-0673/574-8435	M-3 Nielsen	ggreene@utk.edu
Grzywacz, Robert Professor	Experimental Nuclear Physics	974-2918/574-4732	613 SERF/ ORNL	rgrzywac@utk.edu
Guidry, Michael W. Professor	Nuclear Astrophysics	974-7810	602 Nielsen	guidry@utk.edu
Hagen, Gaute Adjunct Assistant Professor	Nuclear Physics	576-4295	ORNL	hageng@ornl.gov
Handler, Thomas Professor	High Energy Physics/ Science Policy	974-7820	504 Nielsen	thandler@utk.edu
Hix, William R. (Raph) Associate Professor	Theoretical Nuclear Astrophysics	974-5913	607B Nielsen	raph@utk.edu
Holmes, Jeffrey A. Adjunct Professor	Accelerator Physics	576-5570	ORNL	holmesja1@ornl.gov
Hsueh, Chun-Hway Research Professor	Condensed Matter Physics	974-8998	503 Nielsen	hsuehc@ornl.gov
Johnston, Steve Assistant Professor	Theoretical Condensed Matter Physics	974-7837	203 South College	sjohn145@utk.edu
Jones, Katherine Associate Professor	Experimental Nuclear Physics	974-4022	611 SERF	kgrzwac@utk.edu
Kamychkov, Yuri A. Professor	Experimental High Energy Physics	974-6777	505 Nielsen/603 SERF	kamyshkov@utk.edu
Katsaras, John Joint Faculty	Condensed Matter Physics	241-8270	ORNL	katsarasj@ornl.gov
Keppens, Veerle Adjunct Professor	Materials Science	974-3494	401A Ferris Hall	vkeppens@utk.edu

Name	Research Area	Telephone	Office	E-mail
Kerman, Arthur K. Research Professor	Nuclear Physics	574-4697	ORNL/JIHIR	No e-mail
Kim, Sang-Ho Adjunct Assistant Professor	Condensed Matter Physics	386-1094	ORNL	kimsh@ornl.gov
Krstic, Predrag Adjunct Professor	Theoretical Atomic Physics	574-4701	ORNL	krsticp@ornl.gov
Lentz, Eric Research Assistant Professor	Astrophysics	576-6785	JIHIR	lentzej@ornl.gov
Liu, Jian Assistant Professor	Experimental Condensed Matter Physics	974-3055	406A Nielsen	jianliu@utk.edu
Liang, Junjien Research Scientist	Nuclear Physics	574-4109	JIHIR	liangjf@ornl.gov
Maier, Thomas Joint Faculty	Computational Quantum Many-Body Physics	576-3597	ORNL CNMS	maierta@ornl.gov
Mandrus, David G. Adjunct Professor	Electronic/Magnetic Materials	974-3609	362 Dougherty Engineering Bldg.	dmandrus@utk.edu
Mannella, Norman Associate Professor	Experimental Condensed Matter Physics	974-6123	407B Nielsen	nmannell@utk.edu
Mannik, Jaan Assistant Professor	Biophysics	974-6018	210 Nielsen	jmannik@utk.edu
Mason, Thomas Adjunct Associate Professor			ORNL	tmason@utk.edu
Melnichenko, Yuri Adjunct Associate Professor	Neutron Sciences	576-7746	ORNL	melnichenkoy@ornl.gov
Messer, Bronson Joint Faculty	Astrophysics	241-7340	ORNL	bronson@ornl.gov
Mezzacappa, Anthony Professor (Newton & Wilma Thomas Chair)	Computational Astrophysics	974-2621	206 South College	mezz@tennessee.edu

Name	Research Area	Telephone	Office	E-mail
Moersch, Jeffrey E. Adjunct Associate Professor	Earth and Planetary Sciences	974-0371	424 EPS	jmoersch@utk.edu
Moreo, Adriana Professor (Joint Faculty)	Theoretical Condensed Matter Physics	974-2084	303 South College	amoreo@utk.edu
Musfeldt, Jan Professor	Physical Chemistry	974-3392	615 Buehler Hall	musfeldt@utk.edu
Nattrass, Christine Assistant Professor	Experimental Nuclear Physics	974-9020	217B Nielsen	cnattras@utk.edu
Papenbrock, Thomas Professor	Theoretical Nuclear Physics	974-3128/574-4577	106 South College/ORNL	tpapenbr@utk.edu
Parigger, Christian Associate Professor	Laser, Atomic, Molecular and Optical Physics	931-393-7509	UTSI	cparigge@tennessee.edu
Passian, Ali Adjunct Associate Professor	Applied and Biological Physics	241-3204	ORNL	passian@utk.edu
Platter, Lucas Assistant Professor	Theoretical Nuclear Physics	974-4375	104 South College	lplatter@utk.edu
Pooser, Raphael Joint Faculty	Quantum Information	576-6658	ORNL	pooserrc@ornl.gov
Qi, Bing Joint Faculty	Quantum Information	576-5943	ORNL	qib1@ornl.gov
Read, Kenneth F. Professor (Joint Faculty)	Experimental Nuclear Physics	974-3027/574-5347	309 Nielsen	kfread@utk.edu
Riedinger, Lee Professor; Bredesen Center Director	Experimental Nuclear Physics	974-7998	441 Greve Hall	lrieding@utk.edu
Shen, Jian Research Associate Professor	Experimental Condensed Matter Physics	241-4828	ORNL	shenj@ornl.gov
Siopsis, George Professor	Theoretical High Energy Physics	974-7846	M104 Nielsen	gsiopsis@utk.edu

Name	Research Area	Telephone	Office	E-mail
Snijders, Paul Joint Faculty	Condensed Matter Physics	576-6718	ORNL	snijderspc@ornl.gov
Sokolov, Alexei Adjunct Professor; Governor's Chair	Soft Matter Physics	974-3852	563 Dabney-Buehler Hall	sokolov@utk.edu
Sorensen, Soren Professor	Experimental Nuclear Physics	974-7805	607 SERF	sorensen@utk.edu
Spanier, Stefan Professor	Experimental High Energy Physics	974-0597	502 Nielsen	spanier@utk.edu
Steiner, Andrew W. Assistant Professor	Theoretical Nuclear Astrophysics	974-5379	103 South College	awsteiner@utk.edu
Stone, Jirina Adjunct Professor	Nuclear Physics	974-9908	607 Nielsen	jstone12@utk.edu
Stone, Nicholas J. Research Professor	Experimental Nuclear Physics	576-8763	ORNL	stonenj@ornl.gov
Tennant, Alan Joint Faculty, JINS Director	Neutron Science	574-4160	ORNL	tennantda@ornl.gov
Tselev, Alexander Joint Faculty	Condensed Matter Physics	241-4806	ORNL	atselev@utk.edu
Ward, Zac Joint Faculty	Condensed Matter Physics	576-4278	ORNL	wardtz@ornl.gov
Weitering, Hanno Professor and Head (Joint Faculty)	Experimental Condensed Matter Physics	974-7841	401 Nielsen	hanno@utk.edu
Zhou, Haidong Assistant Professor	Experimental Condensed Matter Physics	974-3342	407A Nielsen	hzhou10@utk.edu
Ziock, Klaus-Peter Adjunct Professor	Nuclear Physics	574-0272	ORNL	kziock@utk.edu
Zucker, Alexander Adjunct Professor	Nuclear Physics	974-7822	312 Nielsen	zuckeraje@aol.com