HANDBOOK

FOR

GRADUATE STUDENTS

Department of Physics and Astronomy

MICHIGAN STATE UNIVERSITY

August 16, 2023

This handbook contains a description of the policies concerning graduate study and programs which are available in the Department of Physics and Astronomy

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Table of Contents

1. POLICIES AND GUIDELINES GOVERNING GRADUATE STUDIES

In the hierarchy of policies and requirements that govern graduate studies in the MSU Physics and Astronomy, there are:

1. The MSU Graduate School policies
2. The policies of the Physics and Astronomy (PA) Department
3. The requirements set down by the student's Guidance Committee (in the case of a M.S. with thesis candidate or a Ph.D. candidate).

University policies included in the following documents override all inconsistent provisions of the particular departmental handbooks. Details can be found in Ref [1]. Other important resources are:

- Academic Programs [2]
- Graduate Students Rights and Responsibilities (GSRR) [3]
- MSU/GEU Contract [4]
- Guidelines for Graduate Student Advising and Mentoring Relationships [5]
- Guidelines for Integrity in Research and Creative Activities [6]
- Policy on Relationship Violence and Sexual Misconduct [7]
- Anti-Discrimination Policy (ADP) [8]
- Consensual Amorous or Sexual Relationships with Students [9]
- Conflict of interest in Employment [10]

2. GRADUATE PROGRAMS IN PHYSICS/ASTRONOMY

The following degree programs are offered by the Physics and Astronomy Department at Michigan State University

- The M.S. and Ph.D. Degrees in Physics
- Interdisciplinary Ph.D. Degrees in Physics
- The M.S. and Ph.D. in Astrophysics and Astronomy
- Dual Ph.D. Degree in Physics and Mathematics
- Dual Ph.D. Degrees with Computational Mathematics Science and Engineering
- Dual Ph.D. Degree in Astrophysics and Computational Mathematics Science and Engineering
- Dual Ph.D. Degree in Physics and Quantitative Biology
- Dual Ph.D. Degree in Physics and Electrical and Computer Engineering
- M.S. Degree in Accelerator Science and Engineering
- Graduate Certificate in Accelerator Science and Engineering

In addition, the course requirements for interdisciplinary Ph.D. research in Physics and Biochemistry are slightly different than that of the regular Physics Ph.D., and should be discussed with the Director of Graduate Studies. Physics students may have joint advisors in other departments at MSU or at laboratories outside MSU, as negotiated with the Director of Graduate Studies.

Full-time status, tuition waivers, and AST/PHY999 credits

In order to be considered full-time for academic purposes, students must carry a minimum number of credits per semester or summer session. Details can be found in Ref. [11]. Please note that additional requirements may apply, depending on whether a student is on a visa or has a fellowship. For enrollment questions, please contact the Graduate Program Secretary or Graduate Program Director.

In general, Full-time enrollment in Fall and Spring semesters requires [11]:

- For Masters without assistantship: 9 credits per semester
- For Masters with assistantship: 6 credits per semester
- For Doctoral without assistantship (this category includes students with a fellowship, which is distinct from an assistantship): 6 credits per semester
- For Doctoral with assistantship: 3 credits per semester
- For Doctoral students who have passed all required comprehensive exams (subject exams and oral subject exam, and fully approved in grad plan): 1 credit per semester

Note that Tuition waivers for assistantships are 9 credits for both Fall and Spring Semesters. International students on a visa (e.g. F-1) must maintain full-time status in Fall and Spring Semesters. Teaching assistantships come with tuition waivers of 9 credits for fall and spring semesters. Research assistantships come with tuition waivers of 9 credits for fall and spring semesters.

For the summer semester, teaching assistantships come with a tuition waiver of 5 credits for summer. For students pursuing research in the summer, the appointment type varies:

- Students who are pursuing research with a faculty member at BPS and who have not completed their comprehensive exams are typically supported hourly. The student does not enroll for any classes in summer.
- Student who are pursuing research with a faculty member in BPS and who have completed their comprehensive exam (and showing that to be the case in GradPlan) enroll in 1 Non-Fringe credit research assistantship.

- Students who are pursuing research with a faculty member at FRIB/NSCL and who have not completed their comprehensive exams are regular research assistants in the summer
- Students who are pursuing research with a faculty member at FRIB/NSCL and who have completed their comprehensive exams (and showing that to be the case in GradPlan) enroll in 1 Non-Fringe credit research assistantship.

Once a Ph.D. student passes their comprehensive exams, a 1-credit enrollment is required for full-time status, but it is important to plan the uses of waiver credits for AST/PHY999 to achieve the minimum for graduation (24 credits) and to not exceed the maximum prior to graduation (36 credits). In general, once students start enrolling for AST/PHY999, they enroll for 3-6 credits in AST/PHY999 in early semesters, and reduce to 1 credit in AST/PHY999 when they approach the 24 credit limit. Of course, credits can also be used for other course work.

3. MENTORING PLAN

The MSU Graduate School has developed guidelines for fostering faculty-graduate student relationships that are characterized by honesty, courtesy, and professionalism and that provide students with intellectual support and guidance. The Department of Physics and Astronomy forms a community of scholars responsible for cultivating a stimulating intellectual environment and, through the joint efforts of all faculty members of the unit, for mentoring of graduate students. The foundational values and shared rights and responsibilities central to the guidelines and the graduate student handbook of the Department of Physics and Astronomy are summarized below. The full guidelines can be found in ref [5].

Foundational Values

Effective mentoring relationships are formed and sustained through principles of reciprocity and mutual responsibility. Mentors and mentees should respect one another both as researchers/scholars/creative practitioners and as individuals. That respect is formed through a shared commitment to scientific, creative and professional excellence, and a recognition of these common values:

- Commitment to respect and care
- Commitment to professionalism, ethics, and integrity
- Commitment to professional and personal growth and independence of the student

Shared Rights

Based on the underlying foundational values, members of the Department of Physics and Astronomy share the following rights:

- The right to a safe, supportive environment in which individuals can flourish and grow in their pursuit of knowledge
- The right to an environment that emphasizes tolerance, encourages respect for diverse viewpoints, and promotes civility toward others [12]
- The right to a diverse, equitable and inclusive learning environment
- The right to collegiality in scholarly interactions and sharing of resources
- The right to an environment that actively promotes research and creative excellence

Shared Responsibilities

Based on the underlying foundational values, members of the Department of Physics and Astronomy share the following responsibilities:

- The responsibility to hold one's self and one another accountable for integrity in educational and research practices, and for reporting behaviors and practices that violate policies
- The responsibility to know and adhere to federal, University and academic unit rules, procedures and policies applicable to teaching, graduate study, research, and creative activities (including those in FERPA, The Code of Teaching Responsibilities, Academic Programs, Graduate Student Rights and Responsibilities, Medical Student Rights and Responsibilities, Academic Freedom for Students at Michigan State University) and to ensure that they are followed at all levels of the university
- The responsibility to respect confidentiality

Additional faculty points of contacts

Graduate students in the department are encouraged to reach out to any faculty or staff member if they have questions or concerns, or seek advice. It is sometimes easier to be able to reach out to a person whom the student shares an experience, identity, and/or background. It is not always easy to find such a person or to know whether they'd be open to talk. To make this easier, the department maintains a list of faculty who volunteered to serve as points of contact and share part of their experience, identity, and/or background. This list can be found at Ref. [13]. One needs to be a graduate student in the Department of Physics and Astronomy and log into MSU Google Drive with the @msu.edu email address and password to access the list.

Mentoring Plan – Physics Ph.D. and M.S. programs

The following describes the mentoring plans for students pursuing a Ph.D. or M.S. Degree in Physics.

Initial Academic Mentoring Committee

The initial academic mentoring committee of a student consists of three people that will clearly identifiable to student:

- The Graduate Program Director (GPD)
- A member from the Graduate Recruiting and Advising Committee or another faculty member selected by the faculty members in the research area – this person is referred to as the Research Area Mentor in the following
- The initial faculty advisor

Graduate Program Director

The graduate program director (Associate Chairperson for Graduate Studies) serves as the primary point of contact for students and faculty for all aspects related to the education of students in the Physics Ph.D. and M.S. programs. The Graduate Program Director collaborates closely with the Graduate Program Coordinator to document, track, and support students' path through the graduate program. They shall also interface with the Departmental Chairperson, the other Associate Chairpersons, and leadership and staff of the College of Natural Science, the Graduate School, and other MSU staff, when beneficial.

Initial Faculty Advisor

It is important that students are embedded in a research group and have an (initial) faculty advisor, even if that group/advisor is different from the group/advisor the student will eventually pursue their Ph.D. research with. Therefore, students should pick an initial faculty advisor no later than by the start of the first spring semester into the program. This mentoring relationship does not necessarily indicate that the student will work long term with the faculty member on (thesis) research but the potential/interest for that is present, at the level that the student could pursue PHY800 research (3 credits) with that faculty advisor. The GPD will assist graduate students will identifying an initial faculty advisor, if necessary in collaboration with the research area mentor.

The (initial) faculty advisor serves as the day-to-day point of contact for the graduate student; the student and faculty advisor meet formally at least once per year (until the guidance committee is formed) to review the mentor and mentee shared-expectations document, and to discuss goals and progress.

The Research Area Mentor

The Research Area Mentor acts as third faculty point of contact who a) is/are familiar with the students goals, and b) has/have insight into practices for the specific research area, c) has no formal line management role for that student, and d) serves as point of contact for the GPD aside from the faculty advisor.

Graduate Program Coordinator

In addition to the initial academic mentoring committee, the **Graduate Program Coordinator** provides support to graduate students and faculty in all matters related to administrative and practical aspects of graduate students' path through the program.

Mentoring in the first years

During orientation, the mentoring committee provides advice to the students which courses to pursue in their first year. This advice is provided based on:

- The records provided by the students upon application and graduation

- A survey filled out by the students during orientation, after they have received information about the topics covered in the core course work
- A mentoring conversation (typically half an hour long) between the student, the GPD and research area mentor, taking into consideration advice provided by the initial faculty advisor, if the latter has already been selected prior to orientation. The emphasis of this conversation is to provide tailored advice to student, taking into consideration their previous experiences, their academic and research interests and plans, and the necessity to maintain a healthy work-life balance.

In addition, incoming graduate students will have an opportunity to meet with graduate students already in the program to discuss course and research opportunities.

In addition to the mentoring meeting during orientation, the GPD meets with all the first year students at least twice in the first academic year to discuss progress and potential changes to the planning (at the end of the fall semester and the end of the spring semester), and coordinates with initial faculty advisors and research area mentors when necessary. The advice provided to the student in the initial mentoring meeting and the subsequent meetings in the first year is documented in the student's folder maintained by the Graduate Program Coordinator. Additional meetings can be scheduled on the initiative by the student or members of the mentoring committee at any time during the students' enrollment in the graduate program.

Mentor-Mentee Expectations

Once students have identified an (initial) faculty advisor, they complete a Mentor-Mentee shared expectations document [14]. This document must be completed within the first semester of the student selecting an (initial) advisor and updated/reviewed annually. Students and their advisors are strongly encouraged to fill out and share the draft documents prior to meeting to discuss the consensus version in order to have a fruitful and efficient conversation. If a student switches (initial) advisors, a new document is created within the first semester after the switch. The document completed by the student and their advisor is reviewed by the GPD and kept in the student's folder maintained by the Graduate Program Coordinator. It serves as the official graduate student progress document until the guidance committee is formed.

Mentoring Plan – Astronomy Ph.D. and M.S. programs

Mentoring for newly matriculated students in the astronomy and astrophysics Ph.D. program is provided by the astronomy graduate director, who will meet individually with students before they begin their first semester, and then after the conclusion of each academic year. Students are encouraged to identify an initial research mentor as early as possible in their graduate careers, who will also provide academic and career mentoring; this typically happens no later than the spring semester of their first year. By the start of their second summer in the program (after the end of their second academic year), students are required to agree with their research mentor on a set of shared goals and expectations [14], though its use is possible and indeed encouraged as soon as a research project has begun. This document should be periodically revisited during committee meetings or if the advisor is changed, and revised appropriately. The astronomy group will also assign the student a senior graduate student or postdoctoral mentor through the "Stellar" mentoring program, who can provide peer or near-peer mentoring. Students considering a dual Ph.D. degree need additional academic and research mentoring early in their graduate careers, and should discuss their options with the astronomy graduate director and their research mentors as soon as is practicable.

Once the student has formed an official guidance committee, then that committee and its chair has primarily responsibility for student mentoring, though the astronomy graduate director remains available for additional mentoring if needed.

Selection of the thesis/dissertation advisor

The graduate student should choose their thesis/dissertation advisor before the end of their second academic year in the program but preferably earlier; this requires mutual consent between the professor and the student, and many factors go into this important decision. It is the collective responsibility of our faculty to advise graduate students in their research and professional development following the MSU Guidelines for Graduate Student Mentoring and Advising [5]). If the student has trouble in finding a willing faculty member to serve as the thesis/dissertation advisor, they should consult the members of their mentoring committee to help find a suitable match.

Graduate Program Brochures are available to highlight the research performed by faculty in the Department of Physics and Astronomy: [15]. In addition, students are strongly encouraged to talk to members of the Department (Director for Graduate Studies, faculty members, other students, and postdocs) about potential research opportunities that align with the student's interests. Participating in colloquia, seminars, and other activities are also excellent ways to get an overview of exciting research opportunities.

The thesis/dissertation advisor will usually be the chair of the student's Ph.D. guidance committee (see below) and, with the help of this committee, advise and mentor the student in their research and professional development.

The thesis/dissertation advisor will be a regular or jointly-appointed faculty member of the Department of Physics and Astronomy at Michigan State University. The Departmental Chairperson may approve a regular MSU faculty member from a different department who is an adjunct to the Department of Physics and Astronomy to serve as the Major Professor. Exceptions to these rules follow the Academic Programs Catalog [16] and require approval by the Dean of the Graduate School. Instructions about the administrative process for forming the guidance committee can be found at Ref. [17].

If the thesis/dissertation advisor leaves Michigan State University before the student completes their degree program the student should consult the Graduate Program Director and, if necessary, the Departmental Chairperson to identify a suitable thesis/dissertation advisor. It is the joint responsibility of the student, the Graduate Program Director and the Departmental Chairperson to make arrangements for the completion of the degree, and it requires mutual consent between the student and a new thesis/dissertation advisor.

If, after the formation of a guidance committee, the student desires to change his thesis/dissertation advisor for any reason, the change should be requested as early as possible in the graduate training program. Any plans for changing to a different thesis/dissertation advisor should be discussed with the Graduate Program Director (and, if necessary, the Departmental Chairperson), the current thesis/dissertation advisor and the student's prospective thesis/dissertation advisor (not necessarily together) prior to the initiation of any change. Before relations with the thesis/dissertation advisor are severed, the student should preferably make sure that another faculty member (regular, jointly appointed or approved adjunct faculty) will serve in that capacity. Research Assistantships are normally associated with specific research programs and are not automatically transferable from one faculty member to another.

Ph.D. Guidance Committee

The student's Ph.D. Guidance committee serves as the examination committee for the student's Ph.D. dissertation and is almost always be chaired by the thesis/dissertation advisor, selected following the guidelines described above. The Guidance Committee has to be approved by the Graduate program Director and the Chair of the Physics and Astronomy Department and must adhere to the graduate school guidelines [16] as well as the requirements listed in Section 4 for the different types of degrees. Guidance committee members who are not regular or jointly-appointed faculty members at MSU must be approved by the Dean of the Graduate School. The process is described in Ref. [18].

Guidelines for the graduate student mentoring and advising are described in Ref. [19], which includes a guide [20] that describes the roles and responsibilities of the Faculty Advisor, the other members of the guidance committee, and the graduate student.

The guidance committee membership must prevent conflicts of interest in the context of the students' committees, for example if a member of the committee is connected, in some fashion, with the source of funding for the student's project. Committee members will reveal such potential conflicts of interest to the Graduate Program Director and/or Departmental Chair when they arise so that appropriate steps to mitigate the conflict of interest can be taken.

To ensure fairness in the examination procedure and maintenance of academic standards, the dean of the college or the chair of the department may appoint an outside non-voting member to the examining committee. The outside member of the committee will read and critique the thesis/dissertation, will participate in the oral part of the exam, and will submit a report to the dean of the college and/or the chair/director of the academic unit.

The student must arrange to have a Guidance Committee meeting once a year. The student's progress and research plans are to be discussed and the Progress Report form must be signed by the committee members. The contents of the report are discussed with the student who receives a copy of the completed and signed form. Graduate students who wish to appeal any part of the faculty advisor's evaluation may do so in writing to the chair/director of the academic unit or the director of graduate studies, and this appeal will be filed together with the annual progress report.

The progress of the student will be assessed according to the following criteria:

i. performance in advanced courses in the department or outside the department as determined by the committee
ii. progress in research
iii. appreciation of the broader context of their research program
iv. successful communication of research results, orally and through written documents
v. interactions with their colleagues and faculty members in a collegial and professional manner.

If progress is not satisfactory the student receives a warning at this time. Any conflicts are resolved by the procedure outlined in Section 11. Copies of the blank forms (first meeting and subsequent meetings) are given in Appendices G, H, and I and can be downloaded [21]. Documents are reviewed by the graduate program director prior to being stored electronically with the students other records.

Student Information System

All doctoral students must use the Student Information System [22] to plan for and keep track of their academic progress. Online support and resources are found in Ref. [23] and [24].

4. DEGREE REQUIREMENTS

In this section the degree requirements for the degree programs in Physics and Astronomy at Michigan State University are provided. These include specific dual degree programs for which specific sets of rules exists. However, dual degree programs with other departments than listed here are also possible following the rules of the graduate school [25]. In addition, there is a general interdisciplinary Ph.D. in physics.

A. Ph.D. in Physics

To receive the Ph.D. in Physics a student must:

1. In coordination with the initial mentoring committee and guidance committee (see section 3) students select a course package in which they must maintain at least a 3.0 GPA and satisfy the other Graduate school requirements concerning grades.

   3 courses must be selected from the following 4 core courses, which will serve as the subject exam courses that count toward the comprehensive exam requirement. The subject exam grade is determined by the higher of the course grade and the final exam grade. If approved by the Graduate Program Director, for example on the basis of similar course work previously taken by the student, the student may demonstrate their ability in the material by scoring a 3.0 on the final exam without taking the course.

   - Classical Mechanics, PHY 820 (Fall)
   - Statistical Mechanics, PHY 831 (Fall)
   - Quantum Mechanics I, PHY 851 (Fall)
   - Electrodynamics I, PHY 841 (Spring)

   Newly enrolled students can choose to take the Classical Mechanics Subject Exam in August, just after their orientation. If the students pass the exam with a score of 3.0 the requirement to take the course is waived.

   The course Methods of Theoretical Physics, PHY 810 (Fall) is mandatory and must be passed with a 3.0 for students who have not taken an equivalent course previously or otherwise demonstrated that they have acquired the necessary skills.

   Based on the background required for the research pursued by the graduate student, the student's mentoring committee may require that the student takes all four courses PHY820, 831, 851, and 841 or that one or both of the following courses are added:

   - Quantum Mechanics II, PHY 852 (Spring)
   - Electrodynamics II, PHY 842 (Fall)

   However, these additional courses would not be required for meeting the comprehensive exam requirement.

2. DF-Deferred grades: The required work must be completed and a grade reported within 6 months (190 calendar days) from the last class day of the term of instruction with the option of a single six-month (190 calendar days) extension. If the required work is not completed within the time limit, the DF will become a U-Unfinished and will be changed to DF/U under the numerical and Pass-No Grade (P-N) grading systems, and to DF/NC under the Credit-No Credit system. This rule does not apply to graduate thesis or dissertation work.

3. Satisfy the Ph.D. Comprehensive Exam Requirement which in PA is fulfilled through a series of Subject Exams and an oral exam (see Section 5). A student will be given two attempts at each of the parts of this requirement. A third attempt may be approved by a faculty vote.

4. In addition to the basic courses listed above, the student in consultation with the Ph.D. Guidance Committee chooses a set of advanced courses in the student's area of research specialty, which could include courses administered by other units on campus or courses administered by another university. The student is encouraged to also select courses outside of the area of research specialty, especially if such courses are otherwise beneficial to the professional development of the student.

5. Students will be mentored and should aim to complete 30 credits of coursework that can count towards a M.S. degree (see section IV.B) after about 2 years of being enrolled into the program.

6. Form a Ph.D. Guidance Committee (see Section Ph.D. Guidance Committee) by the beginning of the third year if the Subject Exam requirement is fulfilled by the end of the second Fall semester. If the Subject Exam requirement is fulfilled later than fall of the second year, the Guidance Committee should be formed no later than six months after that happens. The Guidance Committee must meet with the student at least once every year. Prior to the formation of their Guidance Committee the students are mentored by the initial mentoring committee, as described in Section 3 .

7. For a Ph.D. in Physics, the committee consists of five members with at least four being regular and/or jointly-appointed faculty members of the Physics and Astronomy department. Additional members from in and outside the department may be selected, but following the graduate school guidelines [16]. The normal makeup of the committee is three members from the same research area as the student and two from outside of the student's research area. A sixth member may be added with the approval of the Director of Graduate Studies.

8. Write a dissertation on original research, followed by an oral examination based on the dissertation and related material. A student's research program is determined in consultation with the student's research advisor and guided by the student's Ph.D. Guidance Committee.

9. Register for a minimum of 24 credits of doctoral dissertation research (PHY 999) but no more than 36 credits or you must graduate within the semester that you have 36 credits worth of PHY999. Requests for overrides to exceed the maximum of 36 credits of PHY999 must be requested through the Graduate Program Secretary's office and require approval from the Graduate School.

10. The Department of Physics and Astronomy has no foreign language requirement.

11. Unless it is prohibited by the terms of an external fellowship that funds the student for the entirety of their Ph.D., the student must serve as a Teaching Assistant for at least one semester. The student should serve as a Teaching Assistant for at least one semester. This requirement may be satisfied by prior TA work at other universities. In order to be a TA, international students who are not native English speakers must meet certain requirements (see Section 12).

12. Students in the Virtual University VUBeam Ph.D. program are exempt from enrolling in the core courses mentioned in Requirement 1 at MSU and acquire the corresponding knowledge through equivalent studies and courses at local universities. They also do not have to satisfy the Requirement 11. All other requirements, in particular concerning the subject exams covering the core courses, hold unchanged. Written exams can be administered by mutually agreeable local proctors upon prior arrangements with the Director of Graduate Studies. The final student thesis defense must be at MSU.

13. For the Doctor of Philosophy degree, all of the comprehensive examinations (subject exams+oral exam) must be passed within five years after beginning the Ph.D. program. All remaining requirements for the degree

must be completed within eight years from the time when a student begins the first class at Michigan State University that appears on their doctoral program of study. Application for extensions of the eight year period of time toward degree must be submitted by the department/school for approval by the dean of the college and the Dean of the Graduate School. Upon approval of the extension, doctoral comprehensive examinations must be passed again.

B. M.S. in Physics

To receive the M.S. in Physics, a student must:

1. Earn 30 credits with a grade point average of at least 3.0 and satisfy the other graduate school requirements concerning grades. The 30 credits are subject to the following requirements:
    - A minimum of 16 credits must be at the graduate level (800- and 900-level courses).
    - Up to 14 credits of undergraduate senior level courses may be counted in the total of 30 credits needed for the M.S., provided these courses have not been used previously in the credit total toward another degree. Senior level courses include all of the Physics and Astronomy courses with course numbers in the 400-499 interval.
    - In addition to Physics and Astronomy courses, with specific approval by the Director of Graduate Studies or their designated representative, relevant courses at the 400-level and above from other department may be selected.
    - A maximum of 9 semester credits may be transferred from other accredited graduate schools.
2. If the student chooses Plan A (with thesis), they must complete 5 to 10 credits of thesis research (PHY 800, PHY 899) with the thesis supervisor. Students choosing Plan A must form a Guidance Committee of three regular or jointly appointed faculty members, including the student's Master's thesis advisor. This committee will meet with the student yearly and will act as examiners of the student's thesis and oral defense (see form in Appendix E).
3. In Plan B (without thesis) the student must have at least five credits of research coursework completed satisfactorily. This requirement is usually met by taking PHY800 (3 credits) twice. PHY899 and PHY999 credits cannot be utilized for a plan-B MS degree.
4. The Department of Physics and Astronomy has no foreign language requirement.
5. Students in the Virtual University VU Beam M.S. program have to satisfy the same requirements as other M.S. students. Usually the bulk of the credit requirements are satisfied via the VU Beam on-line courses PHY 861 and PHY 961 through PHY 964.
6. Unless otherwise specified, the time limit for the completion of the requirements for the master's degree is six calendar years from the date of enrollment in the first course included for degree certification.

C. Ph.D. in Astrophysics and Astronomy

The Astrophysics Ph.D. program is structured (1) to provide students with a thorough grounding in the tools of astronomy and the underlying physics used in astronomy, through a sequence of graduate level courses; but also (2) to stress an early entry of the student into research. The evaluation of students for advancement to candidacy for the Ph.D. will place significant weight on their potential as research scientists.

To receive the Ph.D. in Astrophysics and Astronomy a student must:

1. Pass the core physics courses or their subject exams, the core astronomy courses, and two elective courses, with a grade averaged over all of these courses of 3.375. The core and elective courses are described below.
2. Complete the two-semester AST 805 research project satisfactorily at the Ph.D. level. The research project is graded by a committee consisting of two faculty members of the astronomy group and one faculty member from outside the astronomy group, who examine the student on the research and on general knowledge pertinent to the research project. This oral examination will serve as the student's comprehensive examination. A Record of Completion Form (Appendix F) must be signed by the committee at the end of the oral examination. A proposal for this research project must be approved by the astronomy graduate advisor and the student's research advisor by the end of the first year of graduate study.
3. All Astrophysics Ph.D. students must complete the following courses. This normally will take two years. Two of the following physics courses:
    - PHY 820 Classical Mechanics
    - PHY 831 Statistical Mechanics
    - PHY 841 Classical Electrodynamics
    - PHY 851 Quantum mechanics

    All of the following astronomy courses:

    - AST 810 Radiation Astrophysics
    - AST 825 Galactic Astronomy
    - AST 835 Extragalactic Astronomy
    - AST 840 Stellar Astrophysics

    In addition to the six core physics and astronomy courses, students must also take 6 additional credits of elective courses at the 800-level or above in physics, astrophysics, computation, or related areas. These courses must be chosen in consultation with the astronomy graduate advisor.

5. Form a Ph.D. Guidance Committee (see Section 7) no later than six months after fulfilling the Comprehensive Exam Requirement. The Guidance Committee must meet with the student at least once every year. Prior to the formation of their Guidance Committee the students are mentored by the astronomy graduate advisor. The associate chair for graduate students and the graduate advising committee will provide additional advising as needed.

6. For a Ph.D. in Astrophysics and Astronomy, the committee consists of five members with at least four being regular and/or jointly-appointed faculty members of the Physics and Astronomy department. Additional members from in and outside the department may be selected, but following the graduate school guidelines [16]. The normal makeup of the committee is three members from the same research area as the student and two from outside of the student's research area. A sixth member may be added with the approval of the Director of Graduate Studies.

7. Write a dissertation on original research, followed by an oral examination based on the dissertation and related material. A student's research program is determined in consultation with the student's research advisor and guided by the student's Ph.D. Guidance Committee.

8. Register for a minimum of 24 credits and a maximum of 36 credits of doctoral dissertation research (AST 999). Requests for overrides to exceed the maximum of 36 credits of PHY999 must be requested through the Graduate Program Secretary's office and require approval from the Graduate School.

9. The Department of Physics and Astronomy has no foreign language requirement.

10. Unless it is prohibited by the terms of an external fellowship that funds the student for the entirety of their Ph.D., the student must serve as a Teaching Assistant for at least one semester. International students who are not native English speakers must meet certain requirements (see Section 12) in order to be a TA.

11. For the Doctor of Philosophy degree, all of the comprehensive examinations must be passed within five years and all remaining requirement for the degree must be completed within eight year from the time when a student begins the first class at Michigan State University that appears on their doctoral program of study. Application for extensions of the eight-year period of time toward degree must be submitted by the department/school for approval by the dean of the college and the Dean of the Graduate School. Upon approval of the extension, doctoral comprehensive examinations must be passed again.

D. M.S. in Astrophysics and Astronomy

Many of our Ph.D. students obtain a M.S. degree during the course of their studies. However, students will not normally be accepted into the Astrophysics graduate program unless their ultimate goal is to obtain a Ph.D. degree. To obtain a M.S. degree, students must take the same courses as for the Astrophysics Ph.D. degree. This includes taking the two-semester research course described for the Ph.D. program.

The requirements for the M.S. degree are:

1. Complete a total of 30 credits that satisfy either Plan A (with thesis) or Plan B (without thesis) of the general university requirements for a Master's degree.
2. Pass the core physics and astronomy courses (AST810, AST825, AST835, AST840, and two of PHY820, PHY831, PHY841, PHY851) with an average grade of 3.0 or better.
3. Under Plan A: complete 4 - 10 credits of AST 899 Master's Thesis Research, and pass a final oral examination in defense of the thesis; or, under Plan B: complete 6 credits in AST 805 Research Project and pass the examination on the research course at least at the M.S. level. Students choosing Plan A must form a Guidance Committee of three regular faculty members, including the student's Master's thesis advisor, one additional faculty member in the astronomy group, and one faculty member from outside the astronomy group. This committee will meet with the student yearly and will act as examiners of the student's thesis and oral defense (see form needed – Appendix E).
4. The Department of Physics and Astronomy has no foreign language requirement.
5. Unless otherwise specified, the time limit for the completion of the requirements for the master's degree is six calendar years from the date of enrollment in the first course included for degree certification.

E. Interdisciplinary Ph.D. in Physics

Many topical research areas lie at the boundary between physics and another discipline. Examples include biological physics, quantum optics electrical and computer engineering (ECE), materials science and nuclear chemistry. Students working in these areas may request to have their Ph.D. subject exam and course requirements modified in order to accommodate an increased course load in other disciplines. However this can be overly burdensome, so that the PA department has the option of an Interdisciplinary Ph.D. in which the student completes at most 120% of the normal required course load (including courses outside physics). The requirements for the Interdisciplinary Ph.D. are:

1. Complete a program of basic coursework. Graduate students must maintain at least a 3.0 GPA in coursework. The required courses for the physics component are (provided they have not been completed at another accredited graduate school):
   - Methods of Theoretical Physics, PHY 810 (Fall)

   And 3 of the 4 following courses (and corresponding subject exams, see item 3).

   - Classical Mechanics, PHY 820 (Fall)
   - Statistical Mechanics, PHY 831 (Fall)
   - Quantum Mechanics I, PHY 851 (Fall)
   - Electrodynamics I, PHY 841 (Spring)

   Newly enrolled students can choose to take the Classical Mechanics Subject Exam in August, just after their orientation. If the students pass the exam with a score of at least 3.0, the requirement to take the course is waived.
   The course Methods of Theoretical Physics can be waived by the Director of Graduate Studies if the student has taken a similar or more advanced coursework as an undergraduate.
2. Interdisciplinary Ph.D. students must complete at least 9 credits of graduate coursework outside of physics, in areas relevant to their research project.
3. A student will be given two attempts at each of the parts of this requirement. For the interdisciplinary programs, the student should pass three subject exams in Physics, with a grade of at least 3.0. The subject exam grade is the better of the course grade and the final exam grade. Students pursuing an interdisciplinary Ph.D. in Physics cannot be required, but may choose, to take a fourth core course. In addition to the physics courses, the student should satisfy the comprehensive exam requirements of the other department, as well. In the case where the primary department is not physics, then the student should pass two exams in physics instead of three with the same grade requirements as stated above..
4. In addition to these basic courses, the student's Ph.D. Guidance Committee may prescribe advanced courses, in a consultation with the student and the student's research advisor.
5. Form a Ph.D. Guidance Committee (see Section 3) by the beginning of the third year if the Subject Exam Requirement is fulfilled by the end of the second Fall semester. If the Subject Exam requirement is fulfilled later than fall of the second year, the Guidance Committee should be formed no later than six months after that happens. The Guidance Committee must meet with the student at least once every year. In the case of the Interdisciplinary degree in Physics, at least three members of the Ph. D. Guidance Committee will be regular or jointly-appointed PA faculty and two faculty members from the non-physics departments participating in the program.
6. Write a dissertation on original research, followed by an oral examination based on the dissertation and related material. A student's research program is determined in consultation with the student's research advisor and guided by the student's Ph.D. Guidance Committee.

7. Register for a minimum of 24 credits of doctoral dissertation research (PHY 999).

8. The Department of Physics and Astronomy has no foreign language requirement.

9. Unless it is prohibited by the terms of an external fellowship that funds the student for the entirety of their Ph.D., the student must serve as a Teaching Assistant for at least one semester. In order to be a TA, an International Student must meet certain requirements (see Section 12).

10. For the Doctor of Philosophy degree, all of the comprehensive examinations must be passed within five years and all remaining requirements for the degree must be completed within eight years from the time when a student begins the first class at Michigan State University that appears on their doctoral program of study. Application for extensions of the eight-year period of time toward degree must be submitted by the department for approval by the dean of the college and the Dean of the Graduate School. Upon approval of the extension, doctoral comprehensive examinations must be passed again.

F. Dual Ph.D. Degree in Physics and Mathematics

It is possible to pursue a dual degree in Physics and Mathematics. In order to do so, the student's dissertation must include significant research contributions in both disciplines (see the MSU guidelines on dual major doctoral thesis [26]. In case of a dual degree, the student should identify which of the degrees are the primary and secondary affiliations. This section contains the requirements for students who choose Physics as the primary affiliation. Students who choose Mathematics as the primary affiliation must refer to the Mathematics requirements [27]. Mathematics also sets requirements if it is the secondary affiliation – these requirements are included in the requirements stated below. Where this section is quiet, the requirements of Section A. Ph.D. in Physics apply.

Coursework requirements

- Pass 3 of the 4 Physics subject exam courses PHY 820, 831, 841, 851 , with a score of at least 3.0 for the subject exam, which is the best of the course grade and the final exam grade, as well as an oral subject exam with a score of 3.5 or better
- Two mathematics qualifying exams (see [27]) within the first three years of the student's enrollment at Michigan State University. The mathematical content of the two qualifying exams must be substantially different from the mathematical content of any exam taken to satisfy requirements in the Physics and Astronomy Department. The candidate will be allowed two attempts to pass each exam.
- The mathematics comprehensive exam should be fulfilled as specified for PhD candidates in mathematics with two possible exceptions: (1) The exam can be taken any time after the qualifying exam requirements have been met and before the end of the fourth year of the student's enrollment at Michigan State University. (2) The syllabus and questions prepared for the comprehensive exam by the student's guidance committee can include topics and questions from the dual program to allow the comprehensive exam to satisfy the requirements of the dual program. At least half the topics and questions should be in mathematics. The topics covered by the comprehensive exam must be approved by the mathematics graduate director and graduate studies committee.
- The remainder of their course requirements can be from any reasonable combination of courses from the two departments, ensuring that the students take a minimum of 15 credits of 800-900 level mathematics courses, excluding dissertation credits (Math 999) and mathematics qualifying exam course sequences. These courses must be approved by the student's guidance committee.

Guidance Committee membership

- A minimum of five faculty, at least three of whom must have non-0% appointments in Physics and Astronomy
- At least two tenure stream faculty who have a 50% or more appointment in mathematics.
- At least one of the three Physics and Astronomy faculty must be outside of the Department of Physics and Astronomy research area of the student Individual people can serve in more than one role (e.g. be in Physics and Astronomy and in Mathematics) but students must have a minimum of five faculty on their committees.

G. Dual Ph.D. Degree in Physics and Computational Mathematics Science and Engineering

It is possible to pursue a dual degree in Physics and Computational Mathematics Science and Engineering (CMSE). In order to do so, the student's dissertation must include significant research contributions in both disciplines (see the MSU guidelines on dual major doctoral thesis [26]. In case of a dual degree, the student should identify which of the degrees are the primary and secondary affiliations. This section contains the requirements for students who choose Physics as the primary affiliation. Students who choose CMSE as the primary affiliation must refer to the CMSE requirements [28]. CMSE also sets requirements if it is the secondary affiliation – these requirements are included in the requirements stated below. Where this section is quiet, the requirements of Section A. Ph.D. in Physics apply.

Coursework requirements

- Pass 3 of the 4 Physics subject exam courses PHY 820, 831, 841, 851 , with a score of at least 3.0 for the subject exam, which is the best of the course grade and the final exam grade, as well as an oral subject exam with a score of 3.5 or better
- 2 of the 4 core CMSE courses (See ref. [29]), and pass the corresponding subject exams with an average grade of 3.25
- The remainder of their course requirements can be from any reasonable combination of courses, ensuring that the students take a minimum of 12 credits of computationally-focused coursework to fulfill their CMSE cognate requirement with the maximum number of required credits being 120% of the credit requirement in the primary graduate program, excluding research credits.

Guidance Committee membership

- A minimum of five faculty, at least three of whom must have non-0% appointments in Physics and Astronomy
- At least one of the three Physics and Astronomy faculty must be outside of the Department of Physics and Astronomy research area in which the student performs research
- Of the minimum of two CMSE faculty, at least one must have their tenure home in CMSE.

Individual people can serve in more than one role (e.g. be in Physics and Astronomy and in CMSE) but students must have a minimum of five faculty on their committees.

H. Dual Ph.D. Degree in Astrophysics and Computational Mathematics Science and Engineering

It is possible to pursue a dual degree in Astrophysics and Computational Mathematics Science and Engineering (CMSE). In order to do so, the student's dissertation must include significant research contributions in both disciplines (see the MSU guidelines on dual major doctoral thesis [26]). In case of a dual degree, the student should identify which of the degrees are the primary and secondary affiliations. This section contains the basic requirements for students who choose Astrophysics as the primary affiliation. Students who choose CMSE as the primary affiliation must refer to the CMSE requirements [28]. CMSE also sets requirements if it is the secondary affiliation – these requirements are included in the requirements stated below. Where this section is quiet, the requirements of Section A. Ph.D. in Physics apply.

Coursework requirements

- 3 of the 4 core AST courses (see Section 4)
- 2 of the 4 core CMSE courses (See Ref. [29]), and pass the corresponding subject exams with an average grade of 3.25
- One of the core PHY graduate courses, excluding PHY 810 (so 820, 831, 841, 851)
- A GPA of 3.375 in the core AST/PHY courses, for which the higher grade of the course or subject exam is chosen for PHY courses
- The remainder of their course requirements can be from any reasonable combination of courses, ensuring that the students take a minimum of 12 credits of computationally-focused coursework to fulfill their CMSE cognate requirement with the maximum number of required credits being 120% of the credit requirement in the primary graduate program, excluding research credits.
- A minimum of 30 total credits of coursework, including 6 credits of AST 805

Guidance Committee membership

- A minimum of five faculty, at least three of whom must have non-0% appointments in Physics and Astronomy
- At least one of the three Physics and Astronomy faculty must be outside of astrophysics
- Of the minimum of two CMSE faculty, at least one must have their tenure home in CMSE.

Individual people can serve in more than one role (e.g. be in Physics and Astronomy, and in CMSE, and be Astrophysics Faculty) but students must have a minimum of five faculty on their committees.

I. Dual Ph.D. Degree in Physics and Quantitative Biology

It is possible to pursue a dual degree in Physics and Quantitative Biology (QB). In order to do so, the student's dissertation must include significant research contributions in both disciplines (see the MSU guidelines on dual major doctoral thesis [26]. In case of a dual degree with QB, physics is the primary affiliations. Most student pursuing a dual degree in Physics and QB choose the Molecular Biology research concentration in QB. Details can be found in Ref. [30]. Where this section is quiet, the requirements of Section A. Ph.D. in Physics apply.

Coursework requirements

- Pass 3 of the 4 Physics subject exam courses PHY 820, 831, 841, 851 , with a score of at least 3.0 for the subject exam, which is the best of the course grade and the final exam grade, as well as an oral subject exam with a score of 3.5 or better
- The courses listed in Ref. [30] with an average grade of 3.33
- The remainder of their course requirements can be from any reasonable combination of courses, with the maximum number of required credits being 120% of the credit requirement in the primary graduate program, excluding research credits.

Guidance Committee membership

- A minimum of five faculty, at least three of whom must have non-0% appointments in Physics and Astronomy
- At least one of the three Physics and Astronomy faculty must be outside of the Department of Physics and Astronomy research area in which the student performs research
- At least two faculty from outside Physics and Astronomy, including a secondary advisor on the student's research

Individual people can serve in more than one role (e.g. be in Physics and Astronomy and in another Department) but students must have a minimum of five faculty on their committees.

J. Dual Ph.D. Degree in Physics and Electrical and Computer Engineering

It is possible to pursue a dual degree in Physics and Electrical and Computer Engineering (ECE). In order to do so, the student's dissertation must include significant research contributions in both disciplines (see the MSU guidelines on dual major doctoral thesis [26]. In case of a dual degree, the student should identify which of the degrees are the primary and secondary affiliations. This section contains the requirements for students who choose Physics as the primary affiliation. Students who choose ECE as the primary affiliation must refer to the ECE requirements [31]. ECE also sets requirements if it is the secondary affiliation – these requirements are included in the requirements stated below. Where this section is quiet, the requirements of Section A. Ph.D. in Physics apply.

Coursework requirements

- Pass 3 of the 4 Physics subject exam courses PHY 820, 831, 841, 851 , with a score of at least 3.0 for the subject exam, which is the best of the course grade and the final exam grade, as well as an oral subject exam with a score of 3.5 or better The advisor can be a faculty member of either the primary or secondary department; a co-advisor must be selected from the other department.
- Show proficiency in three of the four undergraduate courses ECE302, ECE305, ECE313, ECE366
- Four graduate level courses must be taken in Electrical and Computer Engineering and one must be a core course
- The Graduate Studies Committee in consultation with the Ph.D. Guidance Committee may require an Electrical and Computer Engineering Ph.D. qualifying exam and its format.
- Comprehensive examinations must be passed to the satisfaction of both departments.
- The remainder of their course requirements can be from any reasonable combination of courses with the maximum number of required credits being 120% of the credit requirement in the primary graduate program, excluding research credits.
- The academic program must be developed in consultation with the student. The guidance committee must be satisfied that the dissertation represents a contribution meeting the usual standards in both areas

Guidance Committee membership

- A minimum of five faculty, at least three of whom must have non-0% appointments in Physics and Astronomy
- At least one of the three Physics and Astronomy faculty must be outside of the Department of Physics and Astronomy research area in which the student performs research
- Two faculty must be from ECE

Individual people can serve in more than one role (e.g. be in Physics and Astronomy and in ECE but students must have a minimum of five faculty on their committees.

K. Graduate Certificate in Accelerator Science and Engineering

The Graduate Certificate in Accelerator Science and Engineering provides graduate students the opportunity to further their understanding of accelerator science and technology. Graduates will be certified, well trained, and ready for productive careers in Accelerator Science and Engineering. Research is supported by the Accelerator Science and Engineering Traineeship (ASET) Program. The certificate is available to masters or doctoral students at Michigan State University. Students can apply for the certificate at any time prior to receiving their graduate degree. Students who wish to complete the certificate must consult with the Graduate Program Director prior to beginning course work in the program.

The requirements for the Graduate Certificate in Accelerator Science and Engineering are:

Complete a minimum of 9 credits from the following with a grade-point average of 3.0:

1. The following course (3 credits):
   PHY 862 Accelerator Systems

2. At least two courses from the following or any other 800 or 900-level accelerator science-focused courses as approved by the Physics and Astronomy Graduate Program Director (6 credits):

- ECE 837 Computational Methods in Electromagnetics
- ECE 850 Electrodynamics of Plasmas
- ECE 989 Advanced Topics in Plasmas
- PHY 861 Beam Physics
- PHY 905 Special Problems
- PHY 961 Nonlinear Beam Dynamics
- PHY 962 Particle Accelerators
- PHY 963 U.S. Particle Accelerator School
- PHY 964 Seminar in Beam Physics Research

Students who enroll in PHY 905 must obtain approval of the Physics and Astronomy Graduate Program Director to ensure appropriate content. PHY 905 may be taken more than once as long as the topic taken is different.

L. M.S. in Accelerator Science and Engineering

To receive the M.S. in Accelerator Science and Engineering, a student must:

1. Earn 30 credits with a grade point average of at least 3.0 and satisfy the other graduate school requirements concerning grades. The 30 credits are subject to the following requirements:

    - A minimum of 16 credits must be at the graduate level (800- and 900-level courses).
    - Complete PHY862 Accelerator Systems (3 credits)
    - Complete at least 2 courses from the following or any other 800 or 900-level accelerator science-focused courses as approved by the Physics and Astronomy Graduate Program Director (6 credits):
        - ECE 837 Computational Methods in Electromagnetics
        - ECE 850 Electrodynamics of Plasmas
        - ECE 989 Advanced Topics in Plasmas
        - PHY 861 Beam Physics
        - PHY 905 Special Problems (Accelerator Physics)
        - PHY 864 Accelerator Technology
        - PHY 961 Nonlinear Beam Dynamics
        - PHY 962 Particle Accelerators
        - PHY 963 U.S. Particle Accelerator School (can be taken multiple times on different topics at advisor's discretion)
        - PHY 964 Seminar in Beam Physics Research
    - In addition to the above Physics and Astronomy, Electrical and Computer Engineering department courses, with specific approval by the Director of Graduate Studies or their designated representative, mathematics courses at the 400-level and above and other engineering courses, may be included in the 30-credit total.
    - Up to 14 credits of undergraduate senior level courses may be counted in the total of 30 credits needed for the M.S., provided these courses have not been used previously in the credit total toward another degree. Senior level courses include all of the Physics and Astronomy courses with course numbers in the 400-499 interval, with the exception of PHY405 (Directed Studies) and PHY490 (Physics Senior Thesis).
    - Research credits (PHY 800, PHY 899) contribute toward the degree. 3 PHY 800 credits per semester up to a total of 6 credits can be counted towards the 30 credits necessary for the M.S. degree in physics.
    - A maximum of 9 semester credits may be transferred from other accredited graduate schools.
2. The student must choose Plan A (with thesis) and complete 5 to 10 credits of thesis research with the thesis supervisor. The must complete 5 to 10 credits of thesis research (PHY 800, PHY 899) with the thesis supervisor. Students must form a Guidance Committee of three regular or jointly appointed faculty members, including the student's Master's thesis advisor. This committee will meet with the student yearly and will act as examiners of the student's thesis and oral defense (see form in Appendix E).
3. The Department of Physics and Astronomy has no foreign language requirement.
4. Unless otherwise specified, the time limit for the completion of the requirements for the master's degree is six calendar years from the date of enrollment in the first course included for degree certification.

5. COMPREHENSIVE EXAM REQUIREMENT (SUBJECT & ORAL EXAMS)

Michigan State University requires all students pursuing a Ph.D. program to pass a Comprehensive Examination. For the Physics Ph.D. Programs, the comprehensive examination requirement is satisfied by satisfactory completion of a set of subject exams and an oral exam.

Subject exams

For the physics Ph.D. program, students are required to pass 3 subject exams, selected from the following topics:

1. Classical Mechanics PHY820
2. Statistical Mechanics PHY831
3. Electrodynamics I PHY841
4. Quantum Mechanics sequence PHY 851

Details about these courses are provided in Appendix 14.B and a suggested sequence can be found in 14.A The selection of the courses for that will count towards the completion of the comprehensive exam must be done in coordination with the initial mentoring committee.A subject exam grade of at least 3.0 is necessary to pass. The subject exam grade shall be the better of the total course grade and the final exam grade. The final exam grade shall not count towards the total course grade for more than 35%.

The final exam in each course is set and then graded anonymously by a committee of three faculty members, including the instructor of the associated graduate course.

A student will be given two attempts at each of the final (subject) examinations. These exams are offered at the beginning and end of the associated graduate courses. The exam given at the beginning of a graduate course may be cancelled if there are not enough students signed up for taking the exam. The exam sequence is as follows:

- Classical Mechanics (PHY 820): August and December
- Quantum Mechanics (PHY 851): August andDecember
- Electricity and Magnetism (PHY 841): January and May
- Statistical Mechanics (PHY 831): August and December

Newly enrolled students can choose to take the Classical Mechanics Exam in August, just after their orientation. Taking this exam does not count against the two regular attempts for Classical Mechanics.

Oral exam

In addition, students are required to pass an oral examination, which is administered as part of their first guidance committee meeting. A presentation should be given about the student's research project, a project that the student worked on not directly related their research project or a literature study about a topic related to the students' research. The presentation is open and will be advertised within the department. It should last approximately 25 minutes and with an additional period for questions by the audience. The presentation is followed by a private session with members from the guidance committee, who can ask further questions and determine the grade. A grade of 3.5 or higher is required to pass the exam. The grade is based on the content of the presentation, the quality of the presentation, the mastery of the material presented, and the ability to answer questions from the audience and the guidance committee members. If a student does not pass the oral exam and has to retake it, the presentation will only be held for the member of the guidance committee.

To guide the grading of the oral subject exam and to provide detailed feedback to the student, a rubric is used [17]. The rubric is also a useful tool for students to prepare their oral subject exam.

The rubric is filled out by all guidance committee members to guide the discussion for the final grading of the oral exam. The rubric has a variety of categories, which each are ranked as either “unsatisfactory”, “satisfactory”, or “excellent”, roughly mapping on grades of 3.0, 3.5, and 4.0, respectively.

Students are encouraged to also solicit feedback from non-guidance-committee members in the audience by using the rubric. If chosen to do so, the advisor shall distribute and collect the forms from the audience and d

6. DISSERTATION DEFENSE, FINAL ORAL EXAMINATION AND FINAL TERM ENROLLMENT

To give the Ph.D. candidate's Guidance Committee and the faculty time to study the dissertation, it is the candidate's responsibility to circulate a final copy of the dissertation at least 2 weeks prior to the date of the dissertation defense. The student should provide either a printed or electronic version of the thesis to the members of the guidance committee, based on the preference of the individual committee members. The electronic version should be provided to the Physics & Astronomy Graduate Office, who will provide access to the Department by posting it online. The final dissertation defense and examination will then be scheduled for a date of ten or more business days after the examination copies have been distributed.

It is the expectation that students should schedule the defense and examination when all guidance committee members can be present in person. If this cannot be reasonably accomplished, one guidance committee member can join the defense/examination online or meet with the student at a different time. The online or delayed participation of more than one committee member requires consent from the Graduate Program Director, unless the MSU Graduate School mandates that online/delayed participation is acceptable under special circumstances.

The dissertation examination shall be open and all faculty, staff and students shall be welcome to attend and participate in questioning the candidate on the dissertation. However, the final deliberation (examination portion) of the guidance committee meeting shall be held in private. If the student fails the thesis examination there is a possibility of remediation in consultation with the Guidance Committee. In this case, the student will be required to submit a new thesis and undergo an examination based on the new thesis. If the student passes the dissertation examination but corrections or additions to the thesis are required, the student must provide a corrected copy of the thesis to the members of the Guidance Committee for approval. In cases of significant corrections, the student may be required to present a short oral defense of the corrected thesis.

The form of the thesis must conform to the guidelines set forth by the Graduate School. For details see ref. [32].

Once the oral dissertation is completed and approved, the student is responsible for binding their thesis and giving a bound copy to the PA department, and to the chairperson of their committee.

Final term enrollment. Normally students who are defending their thesis in Fall, Spring, or Summer terms must enroll with a minimum of 1 credit during the term they are planning to defend and submit their thesis. However, for students who were enrolled in the Spring and are defending their dissertations during the immediate Summer Semester, the department can request a waiver of the requirement that the student be enrolled for at least 1 credit the semester of the defense. These requests are to be directed to the Graduate School and must be endorsed by the student's department and college.

7. GRADUATE SCHOOL FUNDING AND DISSERTATION PUBLICATION

There are a wide variety of funding sources for graduate research. A general overview can be found at: https://grad.msu.edu/funding. Graduate students in the Department of Physics and Astronomy typically are funded through a combination of teaching assistantships and research assistantships while they pursue their Ph.D. degree. Research assistantship typically are supported through grants obtained by faculty members, while teaching assistantship require the student to carry out teaching duties. Details about teaching and research assistantships can be found at ref. [1].

Some students receive fellowships, which can be internal or external to MSU.

Receipt of externally funded fellowships by students who have written their own grant applications, university recruitment fellowships, and certain traineeships that are worth a certain amount can make the students eligible for in-state tuition rate. The details can be found at: [33].

The new publishing agreement for thesis/dissertations with ProQuest now provides an "Open Access Publishing Option" as an alternative to the traditional publishing option available to our students. Details can be found at: [34]. The Open Access option gives ProQuest the authorization to make the electronic version of the document accessible to all via the internet, including the selling of the document by commercial retailers and the accessibility to the work via search engines. A student selecting the Open Access option will not be eligible to receive royalties.

8. DEPARTMENTAL POLICIES: SAFETY IN RESEARCH AND CREATIVE ACTIVITIES

MSU, including the Department of Physics and Astronomy is committed to providing a safe environment for learning and working. Safety and high-quality work is a shared responsibility between the faculty advisor and the graduate student. Faculty advisors are responsible to understand the hazards, ensure that hazards are mitigated, make sure that graduate students are qualified, competent, and properly trained, and make sure that the students perform the work safely and with high quality. Graduate student are responsible for following procedures and trainings put in place to ensure a safe work environment and to communicate expeditiously with the advisor or Departmental leadership about safety issues and questions. All Department personnel must work closely with MSU Environmental Health and Safety [35] to ensure that activities are pursued in a safe manner.

All Department of Physics and Astronomy Graduate students working in a laboratory must complete the EHS Chemical Hygiene & Hazardous Waste Safety Training before they start working in the laboratory. They must also complete a refresher course each year. Information on safety training and regulations can be found at ref. [35]

Further safety training may be required for work in particular laboratories that the student does research in, whether on rotation or as a regular member of the laboratory. The student and the person supervising the work of the student will discuss the necessary training requirements and instructions prior to the commencement of the work by the student.

Information about health, wellness, and safety can be found at refs. [36] and [37].

9. RESPONSIBLE CONDUCT OF RESEARCH

Each faculty advisor and graduate student should be aware of the document "Guidelines for Integrity in Research and Creative Activities" [6]. Criteria for dismissal due to unethical or dishonest behavior is described in the Procedures Concerning Allegations of Misconduct in Research And Creative Activities [38]. Graduate students are required to follow an education program about Responsible Conduct of Research, Scholarship, and Creative Activities. The details of the program can be found at [39], including a set of resources related to specific topics [40]. MSU guidelines on authorship can be found at Ref. [41]. The MSU institutional data policy [42] establishes minimum requirements for the appropriate stewardship of Institutional Data.

Training in Responsible Conduct of Research (RCR) is essential to the preparation of future scholars and professionals. An understanding of the issues concerning the conduct of research in an increasingly complex world has become critical in successfully navigating the research landscape. To help prepare MSU graduate students for their future scholarly work, a plan for providing the foundation of responsible conduct has been developed in coordination with the Graduate School, the Vice President for Research and Graduate Studies Office, and college associate deans for graduate education. The plan is predicated on the principles that a basic understanding of issues is necessary through didactic training and a periodic reinforcement of the principles through discussion. This plan will provide a foundation for all graduate students pursuing a career in research and will offer the basic information to meet most federal agency granting requirements. The following plan for the Department of Physics and Astronomy (PA) meets the university-level requirements and goes into effect for all graduate students entering the PA program in Fall 2020 and later. This an updated version of the RCR plan created in 2017.

The following table gives an overview of the RCR training throughout the Department of Physics and Astronomy M.S. and Ph.D. programs. Detailed descriptions of the elements are provided below the table.

Ph.D. only

All

M.S. Plan A & Ph.D.

Students meet requirements set by Graduate School for comprehensive exam

Year 1	Year 2	Year 3 and beyond
4 CITI modules*	3 CITI Modules**	3 hrs per year by combining: i) 1.5 hr discussion based training in group meeting, ii) 1.5 hr VERITIES discussion based training, iii) 1.5 hrs of RCR workshop(s) by the Graduate School, iv) two CITI modules (0.75 hrs each) not previously completed v) other RCR opportunities upon approval from the Graduate Program Director
1.5 hr discussion based training during orientation	1.5 hrs RCR workshop (discussion-based) by Graduate School	
1.5 hr VERITIES discussion-based training	1.5 hr VERITIES discussion-based training	

*	**
Introduction-3588	Collaborative Research-2102
Authorship-2101	Conflicts of Interest-2103
Plagiarism-2883	Data Management-2104
Research Misconduct-2107	

Graduate Student Training:

All graduate students (master's and doctoral) must complete a set of CITI online modules as well as complete 6 hours of discussion-based training by the completion of their comprehensive exam. Doctoral students must also complete 3 hours of refresher training annually starting in their third year until completion of their degree. The CITI modules and any Graduate School RCR Workshops will be tracked in Gradplan. The completion of the discussion-based training will be recorded in Gradplan.

Year 1:

- All graduate students will complete the 4 following CITI online modules:
    - Introduction to the Responsible Conduct of Research
    - Authorship
    - Plagiarism
    - Research Misconduct
        - Information on how to complete the CITI modules can be found at https://grad.msu.edu/rcr.
- (1.5 hour discussion-based training) During orientation week, all incoming students will attend a 1.5-hour discussion within the PA department covering the following topics:
        - Honesty, accuracy, efficiency and objectivity

        - Authorship, publication, and data ownership and sharing policies
        - Research documentation and reproducibility of results
- All incoming students will participate in 1.5 hours of training provided as part of the VERITIES (Virtue-Based Education for Responsibility and Integrity To Increase Excellence in STEM) initiative

Year 2:

- Master's Plan A and doctoral students will complete the 3 following CITI modules:
    - CITI Collaborative Research
    - CITI Conflicts of Interest
    - CITI Data Management
- All master's (both Plan A and Plan B) students must have 3.0 more hours of discussion-based training to satisfy the university requirement of a total of 6 hours. This must be fulfilled by a combination of the following::
    - (1.5 hours) Attend a 1.5-hour RCR workshop offered by the Graduate School (see https://grad.msu.edu/rcr).
    - (1.5 hours) Attend training aimed at 2nd year students provided as part of the VERITIES (Virtue-Based Education for Responsibility and Integrity To Increase Excellence in STEM) initiative (https://veritiesinitiative.msu.edu/). These trainings will be announced through department-wide emails.

Year 3 and Onward:

- Doctoral students must complete 3 hours of **refresher** training annually which is fulfilled by the following:
    - (1.5 hours) Attend a 1.5-hour RCR workshop offered by the Graduate School (see https://grad.msu.edu/rcr) **OR** complete one CITI online module that has not been completed before such as:
        - CITI Financial Responsibility
        - CITI Mentoring
        - CITI Peer Review
    - (1.5 hrs) Attend training aimed at students beyond their 2nd year provided as part of the VERITIES (Virtue-Based Education for Responsibility and Integrity To Increase Excellence in STEM) initiative (https://veritiesinitiative.msu.edu/) **OR** participate in training provided by the Advisor of the student, for example as part of group meetings.

By the end of Year 2, doctoral students will have at least 6 hours of discussion-based training even. Note that annual refresher training is mandatory even after achieving the requirements at the time that the comprehensive exam has been passed.

10. GRADUATE STUDENT TRAVEL

All MSU related travel by graduate students (workshops, schools, conferences, experiments at other institutions, etc) must be authorized prior to the travel taking place. It is important that all travel is planned sufficiently far in advance for the authorization and all necessary procedures to be completed. Especially for students who travel for the first time, it is important to discuss the procedures with the faculty advisor. Detailed resources about preparing for travel, including resources about traveler safety, visas, travel health and insurance, and administrative procedures can be found on the website of the MSU Office of the Controller [43].

The MSU graduate school provides information about travel funding [44]

11. DEPARTMENTAL POLICIES: ACADEMIC PERFORMANCE

When a student is admitted into graduate program in the Department of Physics and Astronomy, it is with the full expectations that they will thrive academically as scholars and developing scientists. However, sometimes a student's academic performance does not meet the expectations that the student and our faculty have. This section deals with problems and standards for academic performance.

A 3.0 cumulative grade point average (GPA) is the minimum University standard. Research credits are not considered in determining the GPA. Attainment of the minimum GPA, is however, an insufficient indicator of potential for success in other aspects of the program and in the research field. The student's Guidance committee is responsible for evaluation of the student's competency and the rate of progress.

The accumulation of grades below 3.0 in more than three courses of three or more credits or "deferred" in more than three courses of three or more credits at any given time, or a combination of the above in excess of four courses automatically removes the student from candidacy for the degree. Until the first official Guidance Committee report is filed, all courses on the student's record are considered part of the required program.

To remain in good standing the student also needs to follow Departmental as well as University rules for completing their degree requirements in a timely manner. First year students will meet with the Graduate Program Director after their first spring semester to discuss progress and to plan further course and research work, including the steps to mitigate issues that negatively affected progress. In addition, the Graduate Program Director will meet with more senior students whose progress through the program requires additional attention and support, or who have not found a research group to start research in.

It is a disservice to permit a student to continue toward the advanced degree without the necessary qualifications for retention, including a high level of motivation, commitment, and aptitude. Judgment regarding retention is made by the student's Major Professor and/or the Guidance Committee, in consultation with the Graduate Program Director and if needed the Department Chairperson. If a majority of the Guidance Committee (or the examining committee for the AST 805 in case of Astronomy and Astrophysics graduate students) decides that a student lacks such standards, they may be asked to withdraw according to the procedures as defined in the Graduate Student Rights and Responsibilities document [3].

The student has a right to receive a warning when academic performance is judged to be unsatisfactory (see ref. [3], sections 2.4.8.1 and 2.4.8.2). The student has a right to access their educational records including the academic file the department keeps on them (ref. [3], 3.2.3). Request to view and/or copy the file should be made through the department Graduate Secretary.

If the student fails to pass in the Ph.D. Comprehensive examination (see Section 5), the student will be dismissed from the program. The final oral examinations for the Master's and Ph.D. degrees have pass/fail grades. A student who fails the Master's Dissertation Defense or Ph.D. Dissertation Defense will be given one opportunity to repeat the examination within six months (to be decided by the Guidance Committee). If the student fails the exam a second time, they will be dismissed from the program.

Further information on rights and responsibilities of graduate students can be found at the website of the University Ombudsperson [45].

12. POLICIES GOVERNING TA AND RA APPOINTMENTS

Most Ph.D. students are employed by the Physics and Astronomy department, either as assistants in our teaching programs (TA's) or as assistants in one of the research groups within the department (RA's). Professional behavior is expected from students in these positions and students in our program carry out their duties at a high level of performance. The TA's are governed by the MSU/GEU [46] contract [4]. Incoming students are usually supported first by a TA and then by a RA and are most often supported throughout their Ph.D. program.

International students who are not native speakers of English must meet certain requirements in order to be appointed as TA. These requirements are detailed at ref. [47]. If a student does not meet these requirements, the student will receive an assignment that does not require in-person teaching of students (e.g. serve as grader). In consultation with the Graduate Program Director, a plan to meet the requirements is developed.

Decisions on TA appointments are made by the director of graduate studies. Students will be informed as soon as reasonably possible whether they will have a TA position for the following academic year, subject to continued progress in their Ph.D. program, subject to continued adequate performance of their TA duties, and subject to the budgetary considerations.

Important factors in making these decisions are:

- Progress through the core physics or astronomy/astrophysics courses
- Professional and courteous performance of TA duties
- Identifying research opportunities and making adequate progress towards their degree

Students should seek an advisor with a RA opening before the end of their second year in the program, but are strongly encouraged to engage with potential advisors much earlier, for example for research during the summer sessions in their first year.

Decisions on RA appointments are made by individual faculty or by faculty groups involved in group research projects. Students will be informed as soon as reasonably possible whether their RA will be continued for the following academic year, subject to satisfactory performance of their RA duties and subject to the budgetary considerations.

The students who are appointed as a TA or a RA are expected to devote their time to their academic studies and to their TA/RA responsibilities. No outside work for pay can be undertaken without discussing with the Graduate Program Director (in the case of RA and TA's) and with their research advisors (in the case of RA's).

Tutoring can benefit graduate students intellectually as well as financially. It can help solidify your ideas about physics or chemistry and make you a better teacher. You should discuss the decision to tutor with your advisor (or Graduate Program Director if you haven't formed your guidance committee yet). Tutoring should not interfere with your research duties and thesis completion. As such, tutoring should be kept to a minimum, not to exceed an average of 5 hours per week.

If you are a TA, you are not allowed to act as a paid tutor for a student in the course you are assigned to. Such behavior would constitute a conflict of interest because you are being paid by the Department to provide office hours and direct contact support (recitation, lab, etc.) to students for that course. You may act as a paid tutor for a course to which you are not assigned as a TA in any given semester.

TA's and RA's should make themselves aware of the policies on Consensual Amorous or Sexual Relationships with Students [9] and Conflict of interest in Employment [10]. The former policy states that an instructor may not, under any circumstances, be in a relationship with a student for whom they have educational responsibility. The term "instructor" applies to faculty, academic staff, and graduate teaching assistants who have educational responsibilities for students. The latter policy requires that the department discloses relationship between

members in the department, whether they are a concern with respect to a conflict of interest or not. Here, a relationship between individuals or "relatives" is defined as a connection between persons by blood, marriage, adoption, domestic partnership, or other personal relationship in which objectivity might be impaired.

If students are sick or otherwise unable to complete their TA or RA duties, they must inform their TA or RA advisor immediately. Students who fail to carry out their duties and who fail to give an adequate reason for their absence will be sent a warning letter immediately. If the student fails to respond appropriately, the student's stipend will be stopped 10 days after the warning letter is sent. TA's should refer to article 18 of the GEU CBU [4] regarding medical and other types of leave, such as Jury Duty.

Grief absences: it is the responsibility of the student to: a) notify their advisor/major professor and faculty of the courses in which they are enrolled of the need for a grief absence in a timely manner, but no later than one week from the student's initial knowledge of the situation, b) provide appropriate verification of the grief absence as specified by the advisor/major professor and faculty, and c) complete all missed work as determined in consultation with the advisor/major professor and faculty. It is the responsibility of the advisor/major professor to: a) determine with the student the expected period of absence – it is expected that some bereavement processes may be more extensive than others depending on individual circumstances, b) receive verification of the authenticity of a grief absence request upon the student's return, and c) make reasonable accommodations so that the student is not penalized due to a verified grief absence. If employed as a RA or TE, the graduate student must also notify their employer. Both employer and student will swiftly communicate to determine how the student's responsibilities will be covered during their absence. Graduate teaching assistants (TAs) should refer to the bereavement policy in GEU CBU Article 18 [4].

13. POLICIES GOVERNING STUDENT RESPONSIBILITY, CONDUCT AND CONFLICT RESOLUTION

There are several departmental, college level and university level deadlines. It is the responsibility of the students to find out about these deadlines from the Graduate Secretary and/or the Graduate Program Director and make sure that these deadlines are met.

Graduate students are an integral and highly valued part of the department's research and teaching programs. Professional behavior is expected from all students and it is expected that students in our program to carry out their duties at a high level of performance. Departmental resources provided to the students for studying, teaching and research (e.g. computers, office supplies, copying etc) cannot be used for personal purposes.

Occasionally problems involving students, teaching assistants, research assistants and faculty do arise. Many of these problems are resolved by informal discussions with the associate chair for graduate studies or with the department chair. In rare cases, the issues remain unresolved and the department's procedure to handle such grievances is as follows, based on a template from the University Ombudsperson. The website from the University Ombudsperson has additional information about grievance procedures [48], including specifically for graduate students [49].

Graduate Student Academic Grievance Hearing Procedures For the Ph.D. and M.S. Programs in the Department of Physics and Astronomy

Each right of an individual places a reciprocal duty upon others: the duty to permit the individual to exercise the right. The student, as a member of the academic community, has both rights and duties. Within that community, the student's most essential right is the right to learn. The University has a duty to provide for the student those privileges, opportunities, and protections which best promote the learning process in all its aspects. The student also has duties to other members of the academic community, the most important of which is to refrain from interference with those rights of others which are equally essential to the purposes and processes of the University. (GSRR Article 1.2)

The *Michigan State University Student Rights and Responsibilities (SRR)* and the *Graduate Student Rights and Responsibilities* (GSRR) documents establish the rights and responsibilities of MSU students and prescribe procedures to resolve allegations of violations of those rights through formal grievance hearings. In accordance with the SRR and the GSRR, the PhD and MS Programs has established the following Hearing Board procedures for adjudicating graduate student academic grievances and complaints. (See GSRR 5.4.)

I. JURISDICTION OF THE PHD and MS PROGRAMS HEARING BOARD:

A. The Hearing Board serves as the initial Hearing Board for academic grievance hearings involving graduate students who allege violations of academic rights or seek to contest an allegation of academic misconduct (academic dishonesty, violations of professional standards or falsifying admission and academic records). (See GSRR 2.3 and 5.1.1.)

B. Students may not request an academic grievance hearing based on an allegation of incompetent instruction. (See GSRR 2.2.2)

II. COMPOSITION OF THE PHD and MS PROGRAMS HEARING BOARD:

A. The Program shall constitute a Hearing Board pool no later than the end of the tenth week of the spring semester according to established Program procedures. Hearing Board members serve one year terms with reappointment possible. The Hearing Board pool should include both faculty and graduate students. (See GSRR 5.1.2 and 5.1.6.)

B. The Chair of the Hearing Board shall be the faculty member with rank who shall vote only in the event of a tie. In addition to the Chair, the Hearing Board shall include an equal number of voting graduate students and faculty. (See GSRR 5.1.2, and 5.1.5.)

C. The Program will train hearing board members about these procedures and the applicable sections of the GSRR. (See GSRR 5.1.3.)

III. REFERRAL TO THE HEARING BOARD:

A. After consulting with the instructor and appropriate unit administrator, graduate students who remain dissatisfied with their attempt to resolve an allegation of a violation of student academic rights or an allegation of academic misconduct (academic dishonesty, violations of professional standards or falsifying admission and academic records) may request an academic grievance hearing. When appropriate, the Department Chair, in consultation with the Dean, may waive jurisdiction and refer the request for an initial hearing to the College Hearing Board. (See GSRR 5.3.6.2.)

B. At any time in the grievance process, either party may consult with the University Ombudsperson. (See GSRR 5.3.2.)

C. In cases of ambiguous jurisdiction, the Dean of The Graduate School will select the appropriate Hearing Board for cases involving graduate students. (See GSRR 5.3.5.)

D. Generally, the deadline for submitting the written request for a hearing is the middle of the next semester in which the student is enrolled (including Summer). In cases in which a student seeks to contest an allegation of academic misconduct and the student's dean has called for an academic disciplinary hearing, the student has **10** class days to request an academic grievance to contest the allegation. (See GSRR 5.3.6.1 and 5.5.2.2.)

E. If either the student (the complainant) or the respondent (usually, the instructor or an administrator) is absent from the university during that semester, or if other appropriate reasons emerge, the Hearing Board may grant an extension of this deadline. If the university no longer employs the respondent before the grievance hearing commences, the hearing may proceed. (See GSRR 5.4.9.)

F. A written request for an academic grievance hearing must (1) specify the specific bases for the grievance, including the alleged violation(s), (2) identify the individual against whom the grievance is filed (the respondent) and (3) state the desired redress. Anonymous grievances will not be accepted. (See GSRR 5.1 and 5.3.6.)

IV. PRE-HEARING PROCEDURES

A. After receiving a graduate student's written request for a hearing, the Chair of the Department will promptly refer the grievance to the Chair of the Hearing Board. (See GSRR 5.3.2, 5.4.3.)

B. Within **5** class days, the Chair of the Hearing Board will:

1. forward the request for a hearing to the respondent and ask for a written response;

2. send the names of the Hearing Board members to both parties and, to avoid conflicts of interest between the two parties and the Hearing Board members, request written challenges, if any, within **3** class days of this notification. In addition to conflict of interest challenges, either party can challenge two hearing board members without cause (GSRR 5.1.7.c);

3. rule promptly on any challenges, impanel a Hearing Board and send each party the names of the Hearing Board members. If the Chair of the Hearing Board is the subject of a challenge, the challenge shall be filed with the Dean of the College, or designee (See GSRR 5.1.7.). Decisions by the Hearing Board chair or the College Dean (or designee) on conflict of interest challenges are final;

4. send the Hearing Board members a copy of the request for a hearing and the respondent's written response, and send all parties a copy of these procedures.

C. Within **5** class days of being established, the Hearing Board shall review the request, and, after considering all requested and submitted information:

1. accept the request, in full or in part, and promptly schedule a hearing.

2. reject the request and provide a written explanation to appropriate parties; e.g., lack of jurisdiction. (The student may appeal this decision.)

3. the GSRR allows the hearing board to invite the two parties to meet with the Hearing Board in an informal session to try to resolve the matter. Such a meeting does not preclude a later hearing. However, by the time a grievance is requested all informal

methods of conflict resolution should have been exhausted so this option is rarely used. (See GSRR 5.4.6.)

D. If the Hearing Board calls for a hearing, the Chair of the Hearing Board shall promptly negotiate a hearing date, schedule an additional meeting only for the Hearing Board should additional deliberations on the findings become necessary, and request a written response to the grievance from the respondent.

E. At least **5** class days before the scheduled hearing, the Chair of the Hearing Board shall notify the respondent and the complainant in writing of the (1) time, date, and place of the hearing; (2) the names of the parties to the grievance; (3) a copy of the hearing request and the respondent's reply; and (4) the names of the Hearing Board members after any challenges. (See GSRR 5.4.7.)

F. At least **3** class days before the scheduled hearing, the parties must notify the Chair of the Hearing Board the names of their witnesses and advisor, if any, and request permission for the advisor to have voice at the hearing. The chair may grant or deny this request. The Chair will promptly forward the names given by the complainant to the respondent and visa versa. (See GSRR 5.4.7.1.)

G. The Chair of the Hearing Board may accept written statements from either party's witnesses at least **3** class days before the hearing. (See GSRR 5.4.9.)

H. In unusual circumstances and in lieu of a personal appearance, either party may request permission to submit a written statement to the Hearing Board or request permission to participate in the hearing through an electronic communication channel. Written statements must be submitted to the Hearing Board at least **3** class days before the scheduled hearing. (See GSRR 5.4.9c.)

I. Either party to the grievance hearing may request a postponement of the hearing. The Hearing Board may either grant or deny the request. (See GSRR 5.4.8.)

J. At its discretion, the Hearing Board may set a reasonable time limit for each party to present its case, and the Chair of the Hearing Board must inform the parties of such a time limit in the written notification of the hearing.

K. Hearings are closed unless the student requests an open hearing, which would be open to all members of the MSU community. The Hearing Board may close an open hearing to protect the confidentiality of information or to maintain order. (See GSRR 5.4.10.4.)

L. Members of the Hearing Board are expected to respect the confidentiality of the hearing process. (See GSRR 5.4.10.4.and 5.4.11.)

V. HEARING PROCEDURES:

A. The Hearing will proceed as follows:

1. Introductory remarks by the Chair of the Hearing Board: The Chair of the Hearing Board introduces hearing panel members, the complainant, the respondent and advisors, if any. The Chair reviews the hearing procedures, including announced time restraints for presentations by each party and the witnesses, and informs the parties if their advisors may have a voice in the hearings and if the proceedings are being

recorded. Witnesses shall be excluded from the proceedings except when testifying. The Chair also explains:

- In academic grievance hearings in which a graduate student alleges a violation of academic rights, the student bears the burden of proof.
- In hearings in which a graduate students seeks to contest allegations of academic misconduct, the instructor bears the burden of proof.
- All Hearing Board decisions must be reached by a majority of the Hearing Board, based on a "clear and convincing evidence." (See GSRR 5.4.10.1 and 8.1.18.) For various other definitions, see GSRR Article 8.)

2. If the complainant fails to appear in person or via an electronic channel at a scheduled hearing, the Hearing Board may postpone the hearing for demonstrated cause. (See GSRR 5.4.9a.)

3. If the respondent fails to appear in person or via an electronic channel at a scheduled hearing, the Hearing Board may postpone the hearing or, only in unusual circumstances, hear the case in his or her absence. (See GSRR 5.4.9-b.)

4. If the respondent is absent from the University during the semester of the grievance hearing or no longer employed by the University before the grievance procedure concludes, the hearing process may still proceed. (See GSRR 5.3.6.1.)

5. To assure orderly questioning, the Chair of the Hearing Board will recognize individuals before they speak. All parties have a right to speak without interruption. Each party has a right to question the other party and to rebut any oral or written statements submitted to the Hearing Board. (See GSRR 5.4.10.2.)

6. Presentation by the Complainant: The Chair recognizes the complainant to present without interruption any statements relevant to the complainant's case, including the redress sought. The Chair then recognizes questions directed at the complainant by the Hearing Board, the respondent and the respondent's advisor, if any.

7. Presentation by the Complainant's Witnesses: The Chair recognizes the complainant's witnesses, if any, to present, without interruption, any statement directly relevant to the complainant's case. The Chair then recognizes questions directed at the witnesses by the Hearing Board, the respondent, and the respondent's advisor, if any.

8. Presentation by the Respondent: The Chair recognizes the respondent to present without interruption any statements relevant to the respondent's case. The Chair then recognizes questions directed at the respondent by the Hearing Board, the complainant, and the complainant's advisor, if any.

9. Presentation by the Respondent's Witnesses: The Chair recognizes the respondent's witnesses, if any, to present, without interruption, and statement directly relevant to the respondent's case. The Chair then recognizes questions directed at the witnesses by the Hearing Board, the complainant, and the complainant's advisor, if any.

10. Rebuttal and Closing Statement by Complainant: The complainant refutes statements by the respondent, the respondent's witnesses and advisor, if any, and presents a final summary statement.

11. Rebuttal and Closing Statement by Respondent: The respondent refutes statements by the complainant, the complainant's witnesses and advisor, if any, and presents a final summary statement.

12. Final questions by the Hearing Board: The Hearing Board asks questions of any of the participants in the hearing.

VI. POST-HEARING PROCEDURES

A. Deliberation:

After all evidence has been presented, with full opportunity for explanations, questions and rebuttal, the Chair of the Hearing Board shall excuse all parties to the grievance and convene the Hearing Board to determine its findings in executive session. When possible, deliberations should take place directly following the hearing and/or at the previously scheduled follow-up meeting. (See Section IV.D above.)

B. Decision:

1. In grievance (non-disciplinary) hearings involving graduate students in which a majority of the Hearing Board finds, based on "clear and convincing evidence," that a violation of the student's academic rights has occurred and that redress is possible, it shall recommend an appropriate remedy to the Department Chair or School Director. Upon receiving the Hearing Board's recommendation, the Department Chair or School Director shall implement an appropriate remedy, in consultation with the Hearing Board, within **3** class days. If the Hearing Board finds that no violation of academic rights has occurred, it shall so inform the Chair or Director. The Chair of the Hearing Board shall promptly forward copies of the final decision to parties and the University Ombudsperson. (See GSRR 5.4.11.)

2. In grievance (non-disciplinary) hearings involving graduate students in which the Hearing Board serves as the initial hearing body to adjudicate an allegation of academic dishonesty and, based on "clear and convincing evidence," the Hearing Board finds for the student, the Hearing Board shall recommend to the Department Chair or School Director that the penalty grade be removed, the Academic Dishonesty Report be removed from the student's records and a "good faith judgment" of the student's academic performance in the course take place. If the Hearing Board finds for the instructor, the penalty grade shall stand and the Academic Dishonesty Report regarding the allegation will remain on file, pending an appeal, if any to the College Hearing Board within **5** class days of the Hearing Board's decision. If an academic disciplinary hearing is pending, and the Hearing Board decides for the instructor, the graduate student's disciplinary hearing before either the College Hearing Board or the Dean of The Graduate School would promptly follow, pending an appeal, if any, within **5** class days. (See GSRR 5.5.2.2 and 5.4.12.3)

C. Written Report:

The Chair of the Hearing Board shall prepare a written report of the Hearing Board's findings, including recommended redress or sanctions for the complainant, if applicable, and forward a copy of the decision to the appropriate unit administrator within **3** class days of the hearing. The report shall indicate the rationale for the decision and the major elements of evidence, or lack thereof, that support the Hearing Board's decision. The administrator, in consultation with the Hearing Board, shall then implement an appropriate remedy. The report also should inform the parties of the right to appeal within **5** class days following notice of the decision, or **5** class days if an academic disciplinary hearing is pending. The Chair shall forward copies of the Hearing Board's report and the administrator's redress, if applicable, to the parties involved, the responsible administrators, the University Ombudsperson and the Dean of The Graduate School. All recipients must respect the confidentiality of the report and of the hearing board's deliberations resulting in a decision. (See GSRR 5.4.12 and 5.5.2.2)

VII. APPEAL OF THE HEARING BOARD DECISION:

A. Either party may appeal a decision by the Hearing Board to the College Hearing Board for cases involving (1) academic grievances alleging violations of student rights and (2) alleged violations of regulations involving academic misconduct (academic dishonesty, professional standards or falsification of admission and academic records.) (See GSRR 5.4.12.)

B. All appeals must be in writing, signed and submitted to the Chair of the College Hearing Board within **5** class days following notification of the Hearing Board's decision. While under appeal, the original decision of the Hearing Board will be held in abeyance. (See GSRR 5.4.12, 5.4.12.2 and 5.4.12.3.)

C. A request for an appeal of a Hearing Board decision to the College Hearing Board must allege, in sufficient particularity to justify a hearing, that the initial Hearing Board failed to follow applicable procedures for adjudicating the hearing or that findings of the Hearing Board were not supported by "clear and convincing evidence." The request also must include the redress sought. Presentation of new evidence normally will be inappropriate. (See GSRR 5.4.12.1, 5.4.12.2 and 5.4.12.4.)

VIII. RECONSIDERATION:

If new evidence should arise, either party to a hearing may request the appropriate Hearing Board to reconsider the case within **30** days upon receipt of the hearing outcome. The written request for reconsideration is to be sent to the Chair of the Hearing Board, who shall promptly convene the Hearing Board to review the new material and render a decision on a new hearing. (See GSRR 5.4.13.)

IX. FILE COPY:

The Chair of the Department shall file a copy of these procedures with the Office of the Ombudsperson and with the Dean of The Graduate School. (See GSRR 5.4.1.)

Approved by Faculty (April, 2015)

14. APPENDICES

A. A SUGGESTED COURSE SEQUENCE FOR GRADUATE STUDENTS IN PHYSICS

Note that this course sequence is just one of several paths that students can take and an individualized plan must be made for each student on the basis of prior experiences and advising meetings between each student and theirmentoring committee, as discussed in Section 3. In addition, the course sequence shown here assumes the student takes all the core courses, and at an early stage. In practice, not all core courses are necessarily required, and substitutions can be made to pursue research (e.g. through PHY800 coursework).

It is perfectly reasonable to take a different path that is more suitable for the student, including the need to take advanced undergraduate courses, if beneficial.

1st Fall Semester:

Physics 810 (3 credits)	Methods of Theoretical Physics	
Physics 820 (3 credits)	Classical Mechanics	SUBJECT EXAM
Physics 851 (3 credits)	Quantum Mechanics I	

1st Spring Semester:

Physics 852 (3 credits)	Quantum Mechanics II	SUBJECT EXAM
Physics 841 (3 credits)	Classical Electrodynamics I	SUBJECT EXAM
Physics 801 (3 credits) OR	Survey of Atomic and CMP	
802 (3 credits) OR	Survey of Nuclear Physics	
803 (3 credits)	Survey of Elementary Particle Physics	

1st Summer Semester:

Physics 800 (3 credits)	Research Experience

2nd Fall Semester:

Physics 831 (3 credits)	Statistical Mechanics	SUBJECT EXAM
Physics 842 (3 credits)	Classical Electrodynamics II	

2nd Summer Semester:

Physics 800 (3 credits)	Research Experience

Suggested Course Sequence for Astronomy and Astrophysics Graduate Students

The core courses for the Astronomy and Astrophysics Ph.D. students are detailed in Section 4. The courses are normally completed in two years, following a schedule determined by consultation with the astronomy graduate advisor.

B. SYLLABI FOR REQUIRED PHYSICS COURSES

The following short syllabi sketch the core materials that are covered in the required courses in Physics. Instructors might provide lecture notes as part of the instructional materials and there will some minor variations on the materials covered depending on the instructor. Also note that for the instruction of these courses some prior coding or computational experience might be expected, e.g. by using Python, Mathematica, or Matlab.

Methods of Theoretical Physics - PHY810

Typical Textbook: M. L. Boas: "Mathematical Methods in the Physical Sciences"

Prerequisites:

- Standard undergraduate math
- Taylor series expansion
- Vector calculus (grad, div, curl)
- Integrals using spherical or cylindrical coordinates
- Basic ordinary differential equations

Topics:

1. Series
   - Infinite series, convergence
   - Taylor series
2. Linear Algebra
   - Matrices
   - Eigenvalues and eigenvectors
3. Integrals
   - Dirac's delta function
   - Volume integrals
   - Surface integrals
4. Tensor Analysis
   - Vector operators
   - Tensors
   - Curvilinear (local) coordinates
5. Fourier Transform
   - Fourier transform and series
   - Vector spaces for functions
6. Partial Differential Equations
   - 2nd order ordinary diff. eqs.
   - Separation of variables
   - Series solutions
7. Complex Functions
   - Analytic functions
   - Laurent series
   - Residue theorem
8. Lie Groups (Intro)
   - Group, exponential map
   - Representations

Classical Mechanics - PHY820

Typical Textbooks:

- Lemos, Analytical Mechanics, Cambridge Univ. Press (2018)
- Goldstein, Poole, Safko, Classical Mechanics 3rd Ed., Addison-Wesley/Pearson (2002)

Prerequisites:

- Being able to solve common ordinary differential equations
- Basic vector calculus (grad, div, curl)
- Basic eigenvalue problems
- Newtonian mechanics

Topics

1. Lagrangian Formalism
   - Constraints, Constraint Forces, Configuration Manifolds
   - D'Alembert's Principle
   - Lagrange Equations
   - Variational Calculus, Principle of Least Action
   - Lagrange Multipliers and Lagrange Formalism with Explicit Constraints
   - Symmetries and Noether's Theorem
   - Velocity-Dependent Potentials
   - Dissipation
2. Central Forces
   - Motion in a Central Force Field
   - Effective Potentials
   - Orbits, Stability and Bertrand's Theorem
   - The Kepler Problem
   - Central Force Scattering
   - Orbital Dynamics, Transfer Orbits
   - The Three-Body Problem
3. The Rigid Body
   - Rotations, Euler Angles
   - Rotating Frames
   - Moment of Inertia Tensor, Principal Axes, Parallel- and Perpendicular-Axis Theorems
   - Rigid Body Dynamics, Euler Equations
   - Intermediate-Axis Theorem
   - Free and Heavy Symmetric Spinning Top, Precession, Nutation
4. Coupled Oscillators
   - Generalized Eigenvalue Problems
   - Normal Coordinates, Normal Modes
   - Driven Coupled Oscillators
5. Hamiltonian Mechanics
   - Hamilton's Equations
   - Phase Space
   - Poisson Brackets
   - Canonical Transformations
   - Action-Angle Variables

6. Further Topics (time permitting)
    - Perturbation Theory
    - Secular Perturbations
    - Poincaré-Lindstedt Method
    - Perturbative Canonical Transformations
    - Hamilton-Jacobi Theory
    - Relativity and Classical Field Theory
    - Continuous Systems
    - Lagrangian and Hamiltonian Field Theory
    - Noether's Theorem

Classical Electrodynamics I - PHY 841

Typical textbooks:

- J. D. Jackson: "Classical Electrodynamics" (3rd edition or later !)
- Zangwill: "Modern Electrodynamics"

Prerequisites: Undergraduate electrodynamics (2 semester, or equivalent), classical mechanics (PHY820), Methods of Theoretical Physics (PHY810)

- Use vector calculus (grad, div, curl, ...)
- Express a function in terms of basis functions
- Standard differential equations (ordinary and partial)
- Calculate with Dirac's delta "function", local coordinate systems, ...
- Apply the laws of Gauss, Ampere, Biot-Savart to physical problems
- Derive electric and magnetic fields for given charges or currents, ...

Topics:

1. Special Relativity, Classical Field Theory
    - Relativity Principle, Michelson-Morley
    - Lorentz Transformations
    - Consequences of Lorentz Transformation
    - Minkowski Space
    - Relativistic Kinematics
    - Poincare Group, Lorentz Group, Tensors
    - Charges in External E and B Fields
    - Maxwell's Equations
    - Continuity Equation
2. Electrostatics
    - Gauss Law
    - Electrostatic Potential
    - Cartesian Multipole Expansion
    - Laplace Equation in Spherical Coordinates
    - Spherical Harmonics
    - Spherical Multipole Expansion
    - Poisson Equation
    - Green's Functions for General Boundaries
3. Magnetostatics

- Laws of Ampere and Biot-Savart
- Vector Potential and its Poisson Equation
- Magnetic Dipoles
- Larmor Precession

4. Electrodynamics
    - Fields due to a Moving Charge
    - Plane Waves
    - Energy and Momentum Conservation
    - Retarded Green's Functions
    - Radiation

Quantum Mechanics - PHY851/852

Typical Textbooks:

- Sakurai, Modern QM, 2nd Ed., for most of PHY851
- Baym, Lectures on QM, also recommended

Preparation: 2 semesters of undergraduate Quantum mechanics

Course: PHY851

- States and Operators
- Coordinate and Momentum Space
- Charged Particles in EM fields
- Angular Momentum and Central Potentials
- Symmetries and Conservation Laws
- Approximations
- Perturbative Approaches to Scattering
- Low-energy scattering (phase shifts)

Course: PHY852

- 2nd Quantization and Radiation
- Angular Momentum
- Wigner-Eckart theorem, Isospin
- Fermions and Zero-Temperature Fermi Gases
- Non-perturbative approaches for Fermi Systems
- Hartree-Fock, Cooper Pairs, Landau Levels…
- Relativistic Quantum Mechanics
- States without Conserved Quantum Numbers

Statistical Mechanics - PHY31

Typical Textbooks:

- Pathria and Beale, Statistical Mechanics, 4th ed., Academic Press (2020)
- Huang, Statistical Mechanics, 2nd ed., John Wiley & Sons (1987)
- Kardar, Statistical Mechanics of Particles, Cambridge University Press (2007)
- Kardar, Statistical Mechanics of Fields, Cambridge University Press (2007)

Prerequisites:

- 1 semester undergraduate Stat. Mech./Thermal Physics course
- 2 semesters of undergraduate QM or PHY 851
- At least some familiarity with Hamiltonian formulation of mechanics or PHY 820

Topics:

1) Classical Thermodynamics Review
   - 0th, 1st, 2nd, 3rd laws
2) Statistical Mechanics Foundations
   - microscopic definition of entropy
   - ensembles (Micro, canonical, grand canonical)
   - fluctuations
   - classical phase space distributions, Liouville's theorem
   - quantum density matrix, quantum Liouville's theorem
   - derivation of classical thermodynamics
3) Non-interacting gases
   - identical particles
   - bosons (photons, Bose Einstein condensation, …)
   - fermions (degeneracy, white dwarf stars, …)
   - Boltzmann gases (chemical equilibria, equipartition, …)
4) Interacting systems
   - thermodynamic perturbation theory
   - virial/cluster expansions
   - Kinetic theory (n-particle distribution functions, correlations, Boltzmann transport equation, hydrodynamics)
5) Phase Transitions and Critical
   - Phenomena
   - TD of liquid-gas transition
   - Ising model
   - Numerical methods (Monte Carlo/Metropolis algorithm)
   - Critical exponents and universality
   - Landau-Ginzburg theory
   - linear response theory
   - discrete and continuous symmetries; spontaneous symmetry breaking
   - renormalization group approach

C. INTRODUCTION TO RESEARCH ASTRONOMY 800 OR PHYSICS 800

All incoming graduate students, unless otherwise involved in a research program, may enroll in Physics 800 or Astronomy 800 (3 credits), "Introduction to Research". Student can consider taking this course in one of the early semesters, or in their first summer in the program, or in their second year. In general, it is useful to take PHY800 twice by the end of the second year in the program, as this would make it possible for the student to obtain thei M.S. degree within a reasonable amount of time, guaranteeing an advanced degree even if a student decides not to pursue a Ph.D. degree.

The general procedure is that each student, who has no particular research preference, will spend each of two semesters in different major areas of Physics represented in the department. After two such semesters, the student should thereby get an intelligent view of what goes on in these areas. However, if a student has a strong preference for a particular area, their early deeper involvement with the research in that area should certainly take precedence over getting a quick and broad view of everything. This procedure will (1) assist Ph.D. candidates and faculty to get better acquainted with each other before making long term commitments, (2) solve the problem of how to get Ph.D. students involved with research early, and (3) give M.S. students that modicum of research experience that may make them more employable.

A student enrolling for Physics or Astronomy 800 for the 3 credits per semester will spend a minimum of 10 hours per week in the laboratory of a faculty member, learning all that (s)he can by just being there, learning from the more advanced graduate students, assisting in data taking, computer work, etc. Interested students should make contact with faculty members before enrolling for the course, and make the necessary arrangements for the affiliation. Physics 800 is offered only on the Pass-No Pass (P-N) grade basis.

As part of the PHY800 course, students and their advisors for PHY800 will fill out a short form at the beginning of the semester that describes the following:

1) The goal of the project
2) The research work that will be pursued as part of the project, including:
    a. What materials to review (e.g. research papers)
    b. What skills to acquire (e.g. some technical or computational skill)
    c. What trainings to take (e.g. safety)
    d. Whom the student will be working with besides the advisor
3) Expectations for meetings between the advisor and student (e.g. participation in group meetings) and for when and how long student should spend on their project. If the student takes PHY800 as part of a larger commitment to research (e.g. during the summer or later semester when appointed as RA), this should be considered in the description

At the end of the semester, the student and advisor will together complete the form and make an assessment of whether the goals have been achieved and necessary skills acquired and the students is provided with some feedback about overall accomplishments and progress.

The completed form must be submitted to the Graduate Program Coordinator and the Graduate Program Director by the end of the Monday at the start of finals week of the semester the PHY800 course was taken to obtain academic credit for the completion of the PHY800 course.

D. PHYSICS GRADUATE STUDENT BYLAWS

I. Nature, Name and Purpose

A. The graduate students of the Physics Department comprise a group to be called the Physics Graduate Organization (PGO)

B. The elected officers of the PGO, including those in non-representatives roles, constitute a body called the Physics Graduate Council (PGC). Their principal functions include:

1. Representing the views of the physics graduate students to the administration of the department, college and university, and to inform their constituents of their own representative actions and administrative decisions that affect graduate students.
2. Organizing and running services and events benefitting the PGO, including but not limited to social events, and maintaining websites and web services.

II. Composition of the PGC: Duties and Prerogatives

A. The PGC shall have at least the following members:

1. President, who shall also be a representative to the Advisory Committee.
2. Vice-President, who shall serve as the second representative to the Advisory Committee.
3. One Representative, to the Council of Graduate Students.
4. Dean's SAC Rep, representative to the NatSci Student Advisory Council (SAC).
5. Inclusion Director, representative to the Diversity Equity and Inclusion Committee.
6. Three Representatives, to the Graduate Program Committee.
7. Three Representatives, to the Graduate Employee Union.
8. One Representative, to serve on both the Space Utilization and Remodeling committee, and the P-A Shop and related technical services
9. Two Representatives, to the Colloquium Committee.
10. One Representative, to the Graduate Recruitment and Admissions Committee.

B. The same person may not simultaneously fill the positions of President, Vice President, or the Council of Graduate Students representative.

C. Members of the PGC can be removed from their roles by a no less than two-thirds vote of the full PGC. These votes can be called for by members of the PGC at any time, or by the extended PGO body at any meeting of the PGO. A snap election for the role shall be called, as detailed in Section IV.

D. The representatives shall have power to initiate and second motions and to vote in the committees on which they sit. They shall, at the same time, be ready to assume committee work. Officers can submit statements on behalf of the PGO to department and ad-hoc committees.

E. The President, in consultation with the Council of Graduate Students representative, shall make or delegate decisions and responsibilities of routine nature or minor importance, including placing acting members on the PGC before a snap election can be concluded.

F. The Council of Graduate Students representative shall serve as the primary substitute for either the President or Vice President when neither can attend the Advisory Committee Meeting.

III. Meetings

A. Meetings of the PGO shall be called by the President, or upon the request of at least two members of the PGC. A meeting must be called upon the written request of at least five members of the PGO.

B. The following two meetings must occur every academic year:

1. October Meeting, where PGC members in representative roles will present summaries of the committees they are on. This includes committee composition, function of the committee, and planned goals/actions for the coming year.
2. April Meeting, where PGC members will present end of year summaries of the committees work, and any continuing goals or actions for those committees. Elections for the new PGC for the coming academic year shall be held or concluded at this meeting.

IV. Elections

A. The PGC shall select an officer to run the standard election, or snap election following Section II Subsection F.

1. The eligible voters shall be the entire body of the PGO.
2. The full election must be concluded at the April Meeting, before the end of the Spring Semester.
3. Snap elections must be held within one month (31 days) of the role becoming vacant.

B. When soliciting for nominations each current member of PGC will provide a brief description of their role.

C. Any student who accepts a nomination will have the opportunity to submit an optional brief statement to be circulated before votes are collected.

D. Elections shall be run using a ranked choice voting system.

E. The newly elected PGC will take over responsibilities on July 1st.

E. M.S. THESIS COMPLETION FORM
Department of Physics and Astronomy

M.S. THESIS COMPLETION FORM

Student's Name: _____

Thesis Title: _____

_____

_____

Thesis has been: _____ Accepted _____ Rejected

_____ Accepted subject to revisions (beyond minor editorial changes)

Oral Examination in defense of the thesis was conducted on:

_____

EXAMINING COMMITTEE:

_____ _____

Committee Chairperson Date Department Chairperson Date

_____ _____

Date Dean Date

_____

Date

F. ASTROPHYSICS COMPREHENSIVE EXAM COMPLETION FORM

ASTROPHYSICS COMPREHENSIVE EXAM COMPLETION FORM

Student's Name: _____

Thesis has been: _____ Accepted _____ Rejected

_____ Accepted subject to revisions (beyond minor editorial changes)

Oral Examination in defense of the thesis was conducted on:

_____

EXAMINING COMMITTEE:

_____ _____

Committee Chairperson Date Department Chairperson Date

_____ _____

Date Dean Date

_____

Date

G. PHYSICS Ph.D. GUIDANCE COMMITTEE REPORT FORM I

See: https://pa.msu.edu/academics/graduate-program/current-graduate-students/forms/

H. ASTROPHYSICS Ph.D. GUIDANCE COMMITTEE REPORT FORM I

Student Name: _____ Date _____

Research Advisor: _____

Qualifier exam passed: ____ PhD level ____ MS level

Core courses/subject exams completed (enter grade):

____ Mechanics ____ E&M ____ Stat.Mech. ____ Rad.Processes

____ Stars ____ Galactic ____ Extragalactic ____ Nuc.Astro.

____ GPA for core courses (3.375 required)

2nd Yr Project: ____ Proposal submitted ____ Semesters AST805 ____ Oral Exam

Guidance comm. form completed: ___ Yes ___ No

Research plan presented: ___Yes ___No, tentative date _____

If yes: ___ Satisfactory

___ Not satisfactory, reschedule for: _____

Reason: _____

_____

Goals for next year: _____

_____

Progress and continuing support recommendation:

_____

_____

_____

Approved by the Guidance Committee:

Name: Signature:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Student (Signature): Department Chair:

_____ _____

cc: Student, Advisor, Department Chair

I. Ph.D. GUIDANCE COMMITTEE REPORT FORM II

https://pa.msu.edu/academics/graduate-program/current-graduate-students/forms/

15. References

[1] "Policies and Procedures," [Online]. Available: https://grad.msu.edu/policies-and-procedures. [Accessed 30 03 2020].

[2] "Academic Programs," [Online]. Available: https://reg.msu.edu/AcademicPrograms/ . [Accessed 30 03 2020].

[3] "Graduate Student Rights and Responsibilities," [Online]. Available: https://grad.msu.edu/gsrr . [Accessed 30 03 2020].

[4] "MSU/GEU Contract," [Online]. Available: https://hr.msu.edu/contracts/documents/geu-2019-2023.pdf . [Accessed 30 03 2020].

[5] "Guidelines for Graduate Student Advising and Mentoring Relationships," [Online]. Available: https://grad.msu.edu/sites/default/files/content/mentoring/MSU%20Guidelines%20for%20Graduate%20Student%20Mentoring%20and%20Advising.pdf . [Accessed 30 03 2020].

[6] "Guidelines for Integrity in Research and Creative Activities," [Online]. Available: https://grad.msu.edu/sites/default/files/content/researchintegrity/guidelines.pdf. [Accessed 30 03 2020].

[7] "Policy on Relationship Violence and Sexual Misconduct," [Online]. Available: http://www.hr.msu.edu/documents/uwidepolproc/RVSM_Policy.htm. [Accessed 30 03 2020].

[8] "Anti-Discrimination Policy," [Online]. Available: https://oie.msu.edu/policies/adp.html. [Accessed 30 03 2020].

[9] "Consensual Amorous or Sexual Relationships with Students," [Online]. Available: https://hr.msu.edu/policies-procedures/faculty-academic-staff/faculty-handbook/consensual_relationship_students.html. [Accessed 25 August 2020].

[10] "Conflict of interest in employment," [Online]. Available: https://hr.msu.edu/policies-procedures/university-wide/conflict_of_interest.html. [Accessed 25 August 2020].

[11] "Full Time Students," [Online]. Available: https://reg.msu.edu/AcademicPrograms/Text.aspx?Section=111#s349. [Accessed 30 03 2020].

[12] "MSU Statement on Tolerance and Civility," [Online]. Available: https://hr.msu.edu/policies-procedures/university-wide/tolerance_civility.html. [Accessed 30 03 2020].

[13] "Wellness Resources for Graduate Students," [Online]. Available: https://drive.google.com/file/d/15x9eEGLyDNnmSDNuCwR-V3wMHyj5ka57/view?usp=sharing . [Accessed 8 March 2022].

[14] "Developing Shared Expectations - Physics and Astronomy," [Online]. Available: TBD.

[15] "Graduate Program Brochures," [Online]. Available: https://pa.msu.edu/academics/graduate-program/brochures/. [Accessed 30 03 2020].

[16] "Guidance Committee," [Online]. Available: https://reg.msu.edu/AcademicPrograms/Text.aspx?Section=111#s394. [Accessed 30 03 2020].

[17] "Graduate Student Forms," [Online]. Available: https://pa.msu.edu/academics/graduate-program/current-graduate-students/forms/. [Accessed 8 March 2022].

[18] "Procedure for requesting persons who are not regular MSU faculty to serve on guidance committees," [Online]. Available: https://pa.msu.edu/academics/graduate-program/procedure-for-requesting-persons-who-are-not-regular-msu-faculty-to-serve-on-guidance-committees/. [Accessed 8 March 2022].

[19] "MSU GUIDELINES FOR GRADUATE STUDENT MENTORING & ADVISING," [Online]. Available: https://grad.msu.edu/msu-guidelines-graduate-student-mentoring-advising. [Accessed 8 March 2022].

[20] "MSU Guidelines for Graduate Student Mentoring and Advising," [Online]. Available: https://grad.msu.edu/sites/default/files/content/mentoring/MSU%20Guidelines%20for%20Graduate%20Student%20Mentoring%20and%20Advising.pdf. [Accessed 08 March 2022].

[21] "Physics and Astronomy Graduate Student website," [Online]. Available: http:/www.pa.msu.edu/grad/. [Accessed 30 03 2020].

[22] "Student Information System," [Online]. Available: student.msu.edu. [Accessed 8 03 2022].

[23] "SIS Training," [Online]. Available: https://sis.msu.edu/training/index.html. [Accessed 8 03 2022].

[24] "SIS Help," [Online]. Available: https://sis.msu.edu/help/index.html. [Accessed 8 03 2022].

[25] "Interdisciplinary Programs," [Online]. Available: https://grad.msu.edu/interdisciplinaryprograms/. [Accessed 18 August 2020].

[26] "Dual Majors Doctoral Program," [Online]. Available: https://reg.msu.edu/AcademicPrograms/Text.aspx?Section=111#s407.

[27] "Mathematics Graduate Handbook," [Online]. Available: https://math.msu.edu/graduate/files/handbook/Graduate_Student_Handbook.pdf. [Accessed 30 03 2020].

[28] "CMSE Degree requirements," [Online]. Available: https://cmse.msu.edu/academics/graduate-program/dual-phd-in-cmse/requirements/. [Accessed 30 03 2020].

[29] "CMSE Graduate Handbook," [Online]. Available: https://cmse.msu.edu/academics/graduate-program/graduate-handbook/.

[30] "Quantitative Biology & Modeling Initiative," [Online]. Available: https://qbi.natsci.msu.edu/grad-research/. [Accessed 27 7 2020].

[31] "ECE Graduate Handbook," [Online]. Available: https://ece.msu.edu/sites/default/files/content/ECE%20Graduate%20Handbook%20-%20August%202020_0.pdf. [Accessed 22 8 2020].

[32] "Theses and Dissertation Submission," [Online]. Available: https://grad.msu.edu/etd . [Accessed 30 03 2020].

[33] "Out-of-state tuiton waivers," [Online]. Available: https://grad.msu.edu/out-state-tuition-waiver-external-fellowships. [Accessed 30 03 20].

[34] "ProQuest," [Online]. Available: https://grad.msu.edu/etd/electronic-submission-to-proquest. [Accessed 30 03 2020].

[35] "MSU EHS," [Online]. Available: https://ehs.msu.edu/occ/index.html. [Accessed 30 03 2020].

[36] "Graduate Student Health, Wellness, and Safety," [Online]. Available: https://studentaffairs.msu.edu/health-wellness-safety/index.html. [Accessed 30 03 2020].

[37] "Graduate Student Safety and Security," [Online]. Available: https://grad.msu.edu/safety-and-security. [Accessed 30 03 2020].

[38] "Procedures concerning allegations of misconduct in research and creative activities," [Online]. Available: https://grad.msu.edu/etd/electronic-submission-to-proquest. [Accessed 30 03 2020].

[39] "Research Integrity," [Online]. Available: https://grad.msu.edu/researchintegrity/. [Accessed 30 03 2020].

[40] "Resources related to RCR," [Online]. Available: https://grad.msu.edu/researchintegrity/resources. [Accessed 30 03 2020].

[41] "MSU Guidelines for authorship," [Online]. Available: https://vp.research.msu.edu/michigan-state-university-guidelines-authorship.. [Accessed 30 03 2020].

[42] "MSU Institutional Data Policy," [Online]. Available: https://tech.msu.edu/about/guidelines-policies/msu-institutional-data-policy/. [Accessed 30 03 2020].

[43] "Travel Procedures - MSU Office if the Controller," [Online]. Available: http://ctlr.msu.edu/COTravelNew/TravelerSupport.aspx. [Accessed 30 03 2020].

[44] "Travel Funding," [Online]. Available: https://grad.msu.edu/travel . [Accessed 30 03 2020].

[45] "Office of the University Ombudsperson," [Online]. Available: http://www.msu.edu/unit/ombud/ . [Accessed 30 03 2020].

[46] "MSU GEU," [Online]. Available: http://grad.msu.edu/geu/. [Accessed 30 03 2020].

[47] "MSU Policy Affecting International teaching Assistants," [Online]. Available: https://grad.msu.edu/tap/speak. [Accessed 30 03 2020].

[48] "Conflict and Grievance Systems at MSU," [Online]. Available: https://ombud.msu.edu/resources-self-help/conflict-grievance-systems. [Accessed 30 03 2020].

[49] "Grievance Procedures - Graduate Students," [Online]. Available: https://ombud.msu.edu/resources-self-help/for-graduate-students. [Accessed 30 03 2020].

[50] "MSU Student Rights and Responsibilities," [Online]. Available: http://splife.studentlife.msu.edu/rights-and-responsibilities. [Accessed 30 03 2020].

[51] "Registrar's Online Forms Menu," [Online]. Available: https://www.reg.msu.edu/Forms/FormsMenu.aspx . [Accessed 30 03 2020].

[52] "Physics and Astronomy RCR Plan," [Online]. Available: https://grad.msu.edu/sites/default/files/content/researchintegrity/rcrplans/PA_RCR_Plan_2016.pdf . [Accessed 30 03 2020].