

# Planetary Sciences Graduate Track Handbook

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## **1.0 Introduction**

### **1.1 Scope:**

This handbook provides supplemental information and guidelines to the Department of Physics Doctoral and Master's degree handbooks and contains information that is unique to the Planetary Sciences Track. The UCF Graduate Catalog descriptions in effect when a student was admitted take precedence over either handbook. This handbook is guidance, not a contract. Ultimately, the judgement of the advisor, Supervisory and Dissertation Committees, Planetary Graduate Committee, and Planetary Graduate Coordinator take precedence. However, major departures from the procedures outlined here require the concurrence of the advisor, Supervisory or Dissertation Committee, and Planetary Graduate Committee.

### **1.2 Introduction to the Program:**

Our goal is to foster a vibrant Planetary Sciences research environment that can attract top students, researchers, and faculty and contribute significantly to the exploration of space. The Planetary Sciences Graduate Ph.D. and Master's Tracks are designed to prepare students to be competitive in the global planetary sciences research community.

### **1.3 Admission to the Planetary Sciences Track:**

For information on general UCF graduate admissions requirements that apply to all prospective students, please visit the [Admissions](#) and [Registration](#) section of the Graduate Catalog and the [Physics Master's/Doctoral Handbook](#). Applicants must [apply online](#).

Information about admission to the Planetary Sciences track itself can be found in the Graduate Catalog's pages about the [Ph.D.](#) and [M.S.](#) programs. There is information also on the [Physics Department website](#) and on the [Planetary Sciences Group](#) website.

Note that students must be specifically admitted to the Graduate Planetary Sciences track. External applications and petitions to switch from the existing Physics graduate program are considered by the Planetary Graduate Committee.

## **2.0 Curriculum**

### **2.1 Ph.D. Requirements:**

The [Graduate Catalog](#) gives information on the Ph.D. program requirements, which we summarize here. We require a minimum of 72 credit hours beyond the Bachelor's degree or 42 hours beyond the Master's degree. This includes completion of 6 core courses (18 hours) listed below, 5 electives (15 hours) of regular coursework selected in consultation with the student's Supervisory Committee, a minimum of 15 hours of dissertation (AST and PHY 7980), and the remaining 24 hours of appropriately selected research, dissertation, and elective courses. Courses must be selected so that at least one-half of the

72 hours are at 6000 level or higher. No more than 12 hours of independent study (AST and PHY 6908) may be credited toward the Ph.D. degree. The Ph.D. includes a Candidacy Exam to be taken after the completion of the core courses, a written dissertation, and a dissertation defense before the student's Supervisory Committee.

## **2.2 Master's Requirements:**

The [Graduate Catalog](#) gives information on the M.S. program requirements, which we summarize here. Master's requirements include at least 33 hours of graduate course work as directed by the student's Supervisory Committee. This must include at least 15 hours of courses from the planetary core listed below and 6 hours of Thesis Preparation (PHY and AST 6971) with the remainder being electives and directed research classes chosen in consultation with the student's Supervisory Committee. At least half of the total credits must be at the 6000 level. No more than 6 hours of independent study (AST and PHY 6908) may be credited toward the M.S. degree. The Master's Degree in planetary sciences includes a thesis and its defense. There is no non-thesis Master's degree in the Planetary Sciences Track.

## **2.3 Planetary Sciences Core:**

The core is designed to give students a broad foundation in the planetary sciences and a rapid training in the data analysis techniques that will be necessary for a successful research and publications.

- AST 5151: Physics of Planetary Processes. Provides an overview of the physical basis of molecular spectroscopy, radiative transfer basics, thermodynamics and condensed matter physics from the perspective of planetary science.
- AST 5154: Advanced Planetary Geophysics. The physics of planetary evolution, planetary interiors, and planetary surface processes.
- AST 5263: Advanced Observational Astronomy. Design of scientific observing programs, acquiring astronomical data sets, applied astronomical data reduction, analysis of sources of observational error, publication of results.
- AST 5765C: Advanced Astronomical Data Analysis. Techniques for processing astronomical data including programming approaches for data analysis, probability, statistics, error propagation, astronomical detectors and their calibration, model fitting.
- AST 6165: Planetary Atmospheres. The physics and chemistry that govern the behavior of the atmospheres of Earth and other planets including atmospheric dynamics, vertical chemistry, radiative transfer, gas spectroscopy, and cloud microphysics.
- PHY 6246: Classical Mechanics. Variational principles. Lagrange, Hamiltonian, and Poisson bracket formulations of mechanics. Hamilton's principle of least action. Hamilton-Jacobi theory. Perturbation theory. Continuous systems. Chaos.

## 2.4 Planetary Sciences Electives:

- AST 5145: Advanced Asteroids, Comets, and Meteorites. An advanced study of physical, chemical, mineralogical and orbital characteristics of asteroids, comets, and meteorites, with an emphasis on the origin of our solar system.
- AST 6112: Origin and Evolution of Planetary Systems. Formation of planetary systems beginning with the proto-stellar clouds, collapse, condensation, particle-disk interactions, accretion models, formation of satellites, what has been learned from observations of extra-solar planets, and the physics of magnetic fields generated by planetary bodies.
- AST 5334: Extra-Solar Planets and Brown Dwarfs. An advanced course on the physics of substellar-mass objects, their formation, evolution, dynamics, detection, and environments. This includes the gravitational collapse of molecular clouds, the dynamics of planetary evolution in extrasolar systems, the evolution of Brown Dwarfs, and the habitability of extrasolar worlds.
- AST 5xxx: Astrobiology. Interdisciplinary branch of science that deals with the origins, development, and fate of life on Earth and in extraterrestrial environments.
- AST 6156: Current Topics in Planetary Sciences. Also known as “Planetary Astronomy Seminar.” Review and analyze current advances in planetary science, particularly science results from recent discoveries. The focus of the course will vary depending on current discoveries. This course may be repeated for credit; it may be used in the degree program a maximum of 3 times.
- AST 5937 or AST 6938: Special Topics. Advanced, topical, seminar course focused on major new developments in planetary astronomy including recent results from NASA/ESA missions. This course would be taught with a new topic each time. This course may be repeated for credit.

## 2.5 Other Potential Electives:

A range of graduate physics, chemistry, optical sciences, and mathematics courses useful for the student’s area of research can be taken as electives. Electives should be chosen with the advice and consent of the student’s advisor and Supervisory Committee.

## 2.6 Other Planetary Science Academic Activities:

Integral to becoming a professional Planetary Scientist are a range of related academic activities outside the classroom that are essential to developing the broad background, critical thinking, and public speaking skills required for success in this field. These include Journal Club, the CLASS/FSI seminar, outreach events, and the Physics Department Colloquium. Attendance and active participation at these events is either mandatory or strongly encouraged for students.

- **Planetary Seminar/Journal Club:** A weekly forum that provides students with the opportunity to hone their skills while helping everyone keep current with the latest research. Typically, students pick an interesting recent scientific paper and

present the research outlined. Students are expected to lead at least one journal club session per year. Journal clubs are also often used by faculty and visiting scientists to present current research results. Lively discussion and critical questions are journal club traditions. Attendance is mandatory.

- **CLASS/FSI Seminar:** An international forum that brings some of the leading researchers in planetary science to UCF. The seminar is usually broadcast, and speakers are often in remote locations, so students can participate remotely as well. Participation is strongly encouraged.
- **Department Colloquium:** The Physics Department sponsors weekly colloquia, some of which are focused on planetary science, geophysics, or astrophysics topics. Attendance is strongly encouraged for these colloquia.
- **Outreach:** Part of planetary science is active outreach to the general community to communicate the excitement of planetary exploration to the taxpayers who make it possible. Graduate students are strongly encouraged to participate in such outreach events. For example, Robinson Observatory organizes periodic public and private stargazing events (e.g. “Knights Under The Stars”). Graduate students can also propose new outreach ideas and carry them out.

### **3.0 Committees and Defenses**

#### **3.1 Supervisory Committee:**

Within the first half-semester of admission to the Planetary Sciences Track, each student must select, by mutual agreement, a faculty advisor and at least two other faculty members to serve on the Supervisory Committee. A quorum for Supervisory Committee meetings is three faculty members. UCF faculty (including teaching and research faculty) and non-UCF planetary scientists who are qualified to be Graduate Faculty Scholars are eligible to serve on Supervisory Committees. Scientists in other disciplines are also eligible to serve if they bring relevant expertise (and are qualified to be a Graduate Faculty Scholar). Creation of and changes in the membership of a Supervisory Committee must be approved by the Planetary Graduate Committee. The advisor is expected to meet regularly with the student. The full Committee shall meet with the student at least once per year to review and make recommendations regarding the student’s academic progress. Refer to Section 3.7 for guidelines on meetings.

#### **3.2 Master’s Defense:**

The Planetary Sciences Track Master’s requirements include a written thesis and its oral defense after the completion of the Master’s course work and research. The thesis is a journal-level research paper. The oral defense is in two parts: (1) A public presentation of the research contained in the paper; and (2) private questioning on the detail of the presented research as well as the topics covered in the student’s preparation and course work. The written and oral components will be administrated by the student’s Supervisory Committee. A student must submit the written thesis to the Supervisory Committee 14 calendar days before the scheduled oral defense. Committee members are expected to read it and give a preliminary indication to the Committee chair as to its

acceptability four days after receipt. The preliminary indication of acceptability for a written examination paper is noncommittal. Rather, it is intended to avoid obvious failures. By the start of the eighth day before the examination, the official version of the thesis is due, and the Committee must decide whether to allow the oral defense to proceed. If the defense does not proceed, either due to decision of the Supervisory Committee or that of the student, the student is deemed not to have defended. If the defense will proceed, the student must then post notices of the presentation through the Departmental Program Assistant, following departmental procedures. The following outcomes are possible for the defense:

- *Pass*
- *Pass conditioned on revisions and/or additional coursework*
- *Retake*
- *Retake after additional coursework*
- *Fail*

Passes conditioned on revisions are handled as follows: all Committee members sign the appropriate paperwork except the advisor. The advisor signs the paperwork when satisfied with the revisions. Students may only retake a defense once, and must do so within one year, or immediately after the next offering of a required course, whichever occurs later. If the student fails examination a second time or fails to retake the examination within the specified period, the student is dropped from the program. Refer to Section 3.7 for guidelines on the defense.

### **3.3 Ph.D. Candidacy Exam:**

The Planetary Sciences Track requires a Candidacy Exam to be taken after the completion of the core courses. Ideally, this exam will be taken at the end of second year in the Planetary Graduate program, and no later than the end of the third year. The student must have given a minimum of two Planetary Sciences Journal Club presentations, Department Colloquia, or international scientific meeting presentations prior to Candidacy. This exam is composed of a written component and an oral exam. The written component is a journal-level original research paper that has either been accepted for publication or submitted for publication. The student must be the first author of the paper. The Supervisory Committee may allow an exception for a paper that is ready for submission but not yet submitted for a reason beyond the student's control (e.g., there is a co-author who has promised but not delivered comments). A substantial portion of the paper must be wholly original with the student (including any underlying software), so that the Committee may evaluate whether the student can produce original work for the Dissertation. The oral component is in two parts: (1) A public presentation of the research contained in the paper, including the traditional question and answer period of a scientific presentation; and (2) private questioning on the detail of the presented research as well as the topics covered in the student's preparation and coursework. The written and oral components will be administrated by the student's Supervisory Committee. The following outcomes are possible for either examination:

- *Pass*
- *Pass conditioned on revisions or additional coursework*
- *Retake*
- *Retake after additional coursework*
- *Fail with option for Master's Degree*
- *Fail without option for Master's Degree*

Passes conditioned on revisions are handled as follows: all Committee members sign the appropriate paperwork except the advisor. The advisor signs the paperwork when satisfied with the revisions. Students may only retake an examination once, and must do so within one year, or immediately after the next offering of a required course, whichever occurs later. If the student fails examination a second time or fails to retake the examination within the specified period, the student is dropped from the program. Refer to Section 3.7 for guidelines on the Candidacy Exam.

### **3.4 Candidacy Status and Dissertation Committee:**

After passing the Candidacy Exam, completing all required pre-candidacy coursework (including the minimum number of elective credits), and assembling an acceptable Dissertation Committee, the student is declared a PhD Candidate. Candidates may register for Dissertation Research credits and are required to take fewer credits to maintain continuous registration (i.e, full time status). Additional courses may still be taken as a candidate, in consultation with the Dissertation Committee and advisor. It is thus desirable to be designated as a candidate as soon as possible after passing the Candidacy Exam.

As the Examination is frequently taken immediately before a new semester begins, students are advised to look at the requirements closely and do as many tasks as possible in advance of the Examination. This includes identifying Dissertation Committee members, getting the program's approval for the proposed Committee, collecting the CVs of members who are not yet UCF Graduate Faculty Scholars, and registering them as such with Graduate Studies.

Generally, the Dissertation Committee consists of the Supervisory Committee plus a planetary scientist outside of UCF who has a substantial and creditable research record. This is a program requirement that satisfies the Graduate Studies requirement for a member outside the UCF Planetary Sciences Graduate Field. Scientists in other disciplines are also eligible to serve if they bring relevant expertise (and are qualified to be a Graduate Faculty Scholar). The Dissertation Committee Chair is the research advisor; co-chairs are allowed. The Committee must have at least four members. Sometimes more members are valuable, but note that scheduling meetings and satisfying members becomes increasingly difficult with more members.

The Dissertation Committee should meet at least annually, fulfilling the duties and following the procedures of Supervisory Committees. In addition, career mentoring and

post-degree plans should be part of the Committee's and advisor's discussions with the student.

### **3.5 Dissertation Proposal:**

The Dissertation Proposal may be presented immediately after the Candidacy Exam or in a separate meeting not more than one semester thereafter. It is presented to the Dissertation Committee; all members must attend (in person or remotely). The Dissertation proposal is not formally an examination in the Planetary Sciences Track. The Committee may direct any form of presentation it desires and may question the student. Before substantial work is done on the dissertation, the Dissertation Committee must approve the proposal and must also assess whether additional coursework is necessary to begin the dissertation. Such coursework should be completed at the earliest opportunity. The Dissertation Proposal should be approximately 15 pages and shall contain the following:

- A title.
- The student's name and degree program.
- An abstract.
- A listing of the Supervisory Committee identifying the advisor, chair (generally the same person as the advisor, unless the advisor is external to UCF), and external member (by affiliation).
- The scientific background of the proposed work. This should include work already done by the student prior to Candidacy.
- A listing of science questions to be addressed.
- A statement of scientific objectives.
- A dissertation outline that includes a list of chapters along with a brief summary of the chapter contents and the status of the work that will be included in that chapter (i.e. complete, in progress, TBD).
- A work plan that includes methods, data or computational requirements, schedule, and proposed defense date.
- List of the candidate's relevant publications and scientific presentations.
- Cited references.

### **3.6 Ph.D. Dissertation Defense:**

The following outcomes are possible:

- *Approval of the dissertation*
- *Approval subject to revisions to be approved by the advisor*
- *Required re-defense*

A re-defense must occur within one year. At the second defense the re-defense option is replaced by options for a Master's Degree or failure and removal from the program without a conferred degree. Refer to Section 3.7 for guidelines on the dissertation defense.



### **3.7 Committee and Defense Procedures:**

#### **3.7.1 General Meeting Procedures:**

1. Students should present the following information to the Committee during annual meetings: program of study form, listing of publications, listing of presentations and scientific meetings attended, schedule of courses to be taken.
2. Students should present an overview of their research program and a work plan for achieving their research goals. This plan should include a schedule of the work and a list of planned publications.
3. Students should briefly present the results and progress of their research since their last Committee meeting. The Committee members are expected to give advice and direction for the student's research, coursework, and other experiences in graduate school.
4. The presentation is the student's responsibility. The student should:
  - Be SURE that the presentation actually runs on the computer/projection system in the meeting room.
  - Be SURE that the plots and presentation materials are easily visible and of publication quality.
  - Be SURE that the spelling, punctuation, and grammar are of publication quality.
  - Be SURE to have a working pointer, working markers and eraser, and necessary presentation materials.
  - Be SURE to have the necessary paperwork for Committee signature.
  - If you have a "remote" Committee member, be SURE to reserve a room where such remote access will be feasible. Note that there are often setup and connection issues that need to be resolved, so plan on starting the connection process at least 30 minutes prior to the start of the exam/meeting.
5. The student should review the timeline presented at the previous meeting and show how planned work has translated into progress.
6. Students in post-candidacy status should present a dissertation plan that includes the chapters of their proposed dissertation. They should also outline their plans for 1-2 years beyond the PhD for the work, if any portion of it is to carry beyond the PhD defense, and for employment. The Committee members are expected to give career advice. Following this advice is at the discretion of the student and will not affect the decisions of the Committee.

#### **3.7.2 Candidacy Exam Procedures:**

1. Meeting procedures in 3.7.1 apply to Candidacy exams.
2. A student must give the written examination paper to the Supervisory Committee 14 calendar days before the scheduled oral examination. Committee members are expected to read it and give a preliminary indication to the Committee chair as to its acceptability four days thereafter. The preliminary indication of acceptability

- for a written examination paper is noncommittal. Rather, it is intended to avoid obvious failures. By the start of the eighth day before the examination, the official version of the paper is due, and the Committee must decide whether to allow the oral examination to proceed. If the examination does not proceed, either due to decision of the Supervisory Committee or that of the student, the student is deemed not to have taken either part of the examination. If the exam will proceed, the student must then post notices of the presentation through the Departmental Program Assistant, following departmental procedures. Both the written and oral Candidacy examinations are deemed to take place at the time of the oral examination. The committee must decide on the result of the exam at the end of the exam. If there are comments to the student and/or conditions for the student to satisfy, they must be delivered to the student within three days after the exam.
3. The student is responsible for all scheduling and logistical arrangements for the exam. The student must reserve a room for the exam for no less than 3 hours. Notices of the public portion of the exam detailing the time, place, and title must be posted through the department 1 week and 1 day in advance, through the department manner similar to that for a departmental colloquium which includes e-mails to the department list. Note that these notices should be sent to researchers in the Florida Space Institute and at Arecibo Observatory as well. It is the student's responsibility to make sure they are notified.
  4. The Supervisory Committee will question the student on any of the topics covered in the student's course work. This questioning should be at least 15 minutes from each member of the Committee.
  5. It is the job of the Committee to determine whether the paper, the research done by the student, the presentation, the responses to questions, and their experience with the student sufficiently demonstrate that the student is prepared to conduct independent research at the PhD level. Journal acceptance or rejection and the content of reviews may inform the Committee's decision, but the ultimate decision rests with the Committee.
  6. A substantial component (20% or more by some measure, as assessed by the Supervisory Committee) of the Candidacy paper must represent original, master's-level, creative work of the student that is not merely repetitive of work done by someone else in the same research group. Successful examples include: writing original data analysis code, doing new theoretical or predictive calculations, writing or extending a theoretical model, converting a large analysis code between languages (including testing, documentation, and description in the paper), and making a discovery and following up its implications. The Committee will assess the student's capacity to do independent scientific research, and thus the likelihood of a successful dissertation. Students, advisors, and Supervisory Committees should discuss and assess how this requirement will be satisfied throughout the pre-candidacy period.

### **3.7.3 Thesis and Dissertation Defense Procedures:**

1. Meeting procedures in 3.7.1 apply to defenses.

2. The Dissertation Defense is the final requirement for the PhD and consists of a public presentation of the dissertation, typically lasting 60 minutes including the traditional question and answer period of a scientific presentation, followed by private questioning by the Dissertation Committee (lasting another 60-120 minutes). Revisions to the dissertation may be required as part of the defense.
3. The Thesis Defense is the final requirement for the M.S. and consists of a public presentation of the Thesis, typically lasting 45-60 minutes including the traditional question and answer period of a scientific presentation, followed by private questioning by the Supervisory Committee. Revisions to the thesis may be required as part of the defense.
4. There are specific university deadlines related to the final semester and the dissertation defense listed in the [College of Graduate Studies' Thesis/Dissertation website](#). The critical deadlines are the format deadline, the defense deadline, and the final completion date. It is the student's responsibility to meet all of Graduate Studies' requirements and deadlines.
5. It is the responsibility of the chair of the Dissertation/Supervisory Committee to have the dissertation/thesis reviewed through Turnitin.com in conformance to Graduate Studies requirements.
6. The defense version of the dissertation/thesis must be presented to the Dissertation/Supervisory Committee 14 calendar days before the scheduled defense. Committee members are expected to read it and give a preliminary indication to the Committee chair as to its acceptability four days after receipt. The preliminary indication of acceptability for a dissertation/thesis is noncommittal. Rather, it is intended to avoid obvious failures. By the start of the eighth day before the defense, the official version of the dissertation/thesis is due, and the Committee must decide whether to allow the oral defense to proceed.
7. If the defense does not proceed, either due to decision of the Committee or that of the student, the student is deemed not to have defended.
8. If the defense will proceed, the student must then post notices of the presentation through the Departmental Program Assistant, following departmental procedures. The committee must decide on the result of the defense at the end of the defense. If there are comments to the student and/or conditions for the student to satisfy, they must be delivered to the student within three days after the defense.
9. The dissertation/thesis must comply with all Graduate Studies style requirements. Any subsequent revision, no matter when presented, must be accompanied by a list of all changes (including trivial corrections of spelling, etc.) made since the prior official submission to the Dissertation Committee. A separate electronic "redline" version of the dissertation is acceptable for this purpose (deletions are indicated by red or strike-through text; green or boxed text indicates insertions; and marginal change bars indicate lines containing changes, to help find small alterations that might otherwise be missed). Committees will generally not accept revisions between the defense submission and the defense itself, but may choose to do so in exceptional circumstances.
10. The student is responsible for all scheduling and logistical arrangements for the defense. The student must reserve a room for the defense for no less than 3 hours. Notices of the public portion of the defense detailing the time, place, and title

must be posted through the department 2 weeks, 1 week, and 1 day in advance, through the department manner similar to that for a departmental colloquium which includes e-mails to the department list. Note that these notices should be sent to researchers in the Florida Space Institute and at Arecibo Observatory as well. It is the student's responsibility to make sure they are notified.

11. The student is responsible for bringing to the defense the "Thesis and Dissertation Approval form" for the Committee's signature.
12. Students should present the following information to the Committee at the defense: Degree audit showing that all requirements up to the defense have been satisfied, listing of publications, listing of presentations, and scientific meetings attended.
13. The possible outcomes are listed in 3.2 and 3.6. In the case of decision of re-defense of a Ph.D. dissertation, the re-defense must occur within one year. At the second defense, if it is not successful, the Committee will decide if the student may be given the option for a Master's degree or failure and removal from the program without a conferred degree.

#### **4.0 Participating Faculty**

- Chief Scientist Space Medicine and Life Sciences Dr. Esther Beltran (FSI)
- Assistant Professor Dr. Christopher Bennett
- Associate Scientist Dr. Julie Brisset (FSI)
- Pegasus Professor Dr. Daniel Britt
- Pegasus Professor Dr. Humberto Campins
- Pegasus Professor Dr. Joshua Colwell
- Associate Lecturer Dr. James Cooney
- Assistant Professor Dr. Kerri Donaldson Hanna
- Associate Professor Dr. Joseph Donoghue
- Assistant Professor Dr. Adrienne Dove
- Professor Dr. Yanga Fernandez
- Professor Dr. Joseph Harrington
- Assistant Professor Dr. Theodora Karalidi
- Lecturer Dr. Zoe Landsman
- Associate Scientist Dr. Philip Metzger (FSI)
- Associate Scientist Dr. Noemi Pinilla-Alonso (FSI)
- Observatory Scientist Dr. Flaviane Venditti (AO)
- Observatory Scientist Dr. Anne Virkki (AO)