

Qualifier Exam and Ph.D. Dissertation Proposal Defense Guidelines for Faculty

The qualifier exam and the Ph.D. dissertation proposal defense are two distinct exams that are taken one immediately following the other. Both exams are taken after the student has completed most of their course work and before the end of the 2nd year.

The purpose of the defense of the dissertation proposal is to ensure the student is ready to commence the dissertation phase of their Ph.D. program. The student should demonstrate a clear understanding of a credible proposal for original research and have sufficient knowledge of the background material to begin the research.

The purpose of the qualifier exam is to determine if the student has an acceptable level of understanding of general astronomy, physics and astrophysics at the undergraduate astronomy majors level and a graduate level understanding of fields related to the proposed thesis research.

Preparation

- At least one month before the date(s) of the exams, the supervisor, the student, and graduate coordinator select an examining committee consisting of the supervisor, and three fulltime faculty. Note that the thesis committee (also known as the supervisory committee), which is formed after the student commences their dissertation research, is a separate entity.
- In consultation with the student and the committee, the supervisor sets the date for the exam, reserves a room, and notifies the graduate coordinator.
- The committee appoints a chair (not the supervisor).
- At least *three* weeks before the exam, the student distributes a written thesis proposal to the committee members. The thesis proposal should be up to approximately 10 double-space pages in length plus additional figures, tables, and bibliography. Committee members should review the proposal immediately and should consult with the supervisor if they have any serious concerns, which should be dealt with *before* the defense of the proposal even if it means delaying the defense of proposal exam.

Defense of Proposal Exam

- The presentation is closed to all but those directly involved in the exam.
- The chair ensures that the exam is fair to the student and that the proceedings are conducted professionally without favoritism or prejudice. The chair controls the timing and discussion and ensures that the purpose of the exam (above) is maintained.
- The student has a maximum of 20 minutes to orally present their proposed research plan and will be cut off by the chair if they exceed the allotted time.
- Following the presentation by the student the defense of proposal exam begins. It should last 70 minutes. The structure of the exam is controlled by the chair and should be agreed upon by the committee in advance of the exam. An example of a reasonable structure consists of an initial round of questions from each committee member lasting no more than 15 minutes each, with the understanding that under normal circumstances the supervisor will require less time. The balance of time would be open for questions from all members of the committee.

- Questions should be directly related to the thesis proposal. The questions should test the student's understanding of the project. The supervisor is not permitted to assist the student in any way during the exam even if the questions themselves are poorly posed and/or their presumption is known to be false. Only the chair may intervene on the student's behalf. Problems with the research proposal itself can be identified, but time should not be spent trying to resolve them. The supervisor may ask questions.
- The student should be given the opportunity to take a break, typically 5 minutes, before starting the qualifier exam.
- Following the end of the exams, the chair leads the discussion. The following questions should be considered: Does the student understand the project? Does the student have a reasonable grasp of the background material, enough to begin the project? Is the project well defined and reasonable? Does the project constitute original research and is it likely to lead to a defensible Ph.D. thesis?
- The proposal itself can be approved, approved with minor modifications overseen by supervisor, approved with major modifications overseen by examining committee. Ultimately, it is the responsibility of the supervisor to see that the proposal is acceptable.
- The student's defense of the proposal can be passed or failed. If the student fails, the student is offered one opportunity to re-take the defense of the proposal. If the student declines they will be asked to leave the program immediately. Students do not need to retake the defense of the proposal if it is just the proposal itself that requires modification.
- The student passes when a majority of the committee passes the student. The student fails when a majority of the committee fails the student. In the event of a tie vote the supervisor considers all comments made by other members of the committee and the supervisor's own involvement with the student and determines the outcome.
- The chair should immediately report the outcome of the exam to the graduate coordinator.

Qualifier Exam

- The chair ensures that the exam is fair to the student and that the proceedings are conducted professionally without favoritism or prejudice. The chair controls the timing and discussion and ensures that the purpose of the exam (above) is maintained.
- The exam should last from 90 minutes.
- Members of the committee take turns asking questions. While they have the floor, other members should not interrupt or interfere in any way. Incorrectly posed questions should be discussed by the committee after the exam is over. The chair may intervene if they feel a question is inappropriate or if the student has clearly misunderstood the question.
- The structure of the exam is controlled by the chair and should be agreed upon by the committee in advance of the exam. An example of a reasonable structure is to divide the time up into two rounds of questioning (e.g., 15 minutes for round one plus 7 minutes for round two) from each committee member, thereby, enabling follow-up questions. Guidelines for the makeup of the questions are given below.
- Each member of the committee should keep a brief record of the questions asked and their rating of the responses by the student. This is a public record. It should be kept

short with just a couple of words used to note each general area of questioning by each examiner, along with a P (pass) or (F) fail. Personal comments, notes, or reminders should be made in a separate document, which is kept private. Here is an example of the public record from one examiner:

Round 1

Kracker asked: absorption line definition (P); broadening mechanisms (P); abundances (P); how produce C and O (F).

Kringle asked: Hubble's constant definition (P); Freeman topology (P); Microwave blackbody radiation cause (F);

Etc.

- Following the final round of questions the chair asks the student to leave and wait for the results in the student's office.
- The chair leads the discussion, first covering the defense of proposal (above), then the qualifier exam.
- The chair invites each member in turn to discuss *their* questions and *their* evaluations of the student's response to *their* questions. Then the chair invites discussion by all on all questions and all evaluations. Each member can change their ratings to question areas recorded in their public record if the discussion sways them to do so.
- After the discussion, the chair asks each member to cast a vote of pass or fail for the exam. Each member should base their decision solely on their own evaluations as recorded in their public record. Since the difficulty of questions can vary, each examiner must weigh their own evaluations accordingly, but it should be kept in mind that their vote must be consistent with their public record.
- The student passes when a majority of the committee passes the student. The student fails when a majority of the committee fails the student. In the event of a tie vote the supervisor considers all comments made by other members of the committee and the supervisor's own involvement with the student and determines the outcome.
- If the student fails the exam then the student is offered one opportunity to retake the exam. If the student declines they will be asked to leave the program immediately.
- The committee members should keep their public record of evaluations on file for at least one year.
- The chair should immediately report the outcome of the exam to the graduate coordinator.

Qualifier Exam Question Guidelines

- It is the responsibility of each committee member to come to the exam well prepared with a diverse selection of appropriate questions.
- Questions should be set at a level expected of students in undergraduate astronomy and physics courses.
- Graduate level questions in the area of the proposed dissertation research area are also acceptable.

- Examiners should be sensitive to students who are overly nervous and should make allowances if they can. For example, one could start with easier definition type questions before moving onto more challenging tests of the student's understanding.
- Questions should vary in difficulty level, ranging from simple definitions, e.g., what is a color index, through deeper levels of understanding, e.g., why do some color indices depend on temperature, to expert level questions, e.g., how would you go about designing and calibrating a new color filter system.
- Questions from the committee should cover a variety of subject areas. To ensure this, for example, members of the committee could indicate to each other sometime before the exam, the topic areas that they will try to cover, or the chair could assign topic areas to members of the committee, or members could come prepared to ask questions in all topic areas and then choose their questions from areas not yet brought up.
- Extra consideration and sensitivity should be given to the student when asking graduate level questions. Consider if your fellow faculty can answer the questions. Questions should be restricted to areas that you know the student covered in their core graduate level courses.
- Because it is not possible to predict what the fundamental background areas of astronomy will be in our program far into the future, the following guide is meant only to be "in the spirit of" and common sense should be exercised when selecting topics. A sample of topics to aid in your preparation of a diverse set of questions but not meant to be definitive or complete are given here:
 - Mechanics and Positional Astronomy: Newton's Laws, Kepler's Laws, Planetary motions, tides, conservation laws of physics, RA and Dec., time, etc.
 - Stars: populations, structure, evolution, atmospheres, observables (spectra, magnitudes, color, mass, metallicity), clusters, distance scale, variable, binaries, ages, novae, radiative processes, etc.
 - Galaxies: The Galaxy, classification, structure, the interstellar medium, evolution, populations, colors, distance scale, dynamics, AGN, clusters, etc.
 - Cosmology: Hubble flow, microwave background, redshifts, superclusters and voids, structure formation, early universe, cosmological nucleosynthesis, etc.
 - Other: solar system, current items in the news, space exploration, instrumentation, computational methods, etc.
- Needless to say, if the student is fairing well and not at any risk of failure, then one can increase the level difficulty of the questions to give the student an opportunity to impress.

Retake Guidelines

- If the student failed the defense of their thesis proposal, then a defense of proposal exam of 70 minutes duration should be scheduled no later than 3 months following the initial defense of proposal. The student only has to redo their presentation if the committee decides it is necessary. In which case, the duration of the exam should be extended to a full 90 minutes to allow for a 20 minute presentation. The supervisor is responsible for the rescheduling and should notify the graduate coordinator when the date is set.

- If the student failed the qualifier exam then a re-take exam of 90 minutes duration should be scheduled no later than 3 months following the initial qualifier exam. The supervisor is responsible for the rescheduling and should notify the graduate coordinator when the date is set.
- Both exams are conducted in accordance to the guidelines given above and their results immediately reported to the graduate coordinator.
- If the student fails the re-take of proposal defense or fails the re-take of the qualifier exam, then the student is asked to leave the program immediately.