Physics Department Academic Program Assessment Plan 2023

Graduate (M.S. and Ph.D.) Program Goals

In recent years, the main focus of our graduate programs has been to progress our students through the core curriculum quickly and on to research by their second year of graduate study. The overarching goal here is to expose students to quality research experiences to prepare them for future research or teaching careers in physics or related subjects.

Student Learning Outcomes

Broadly, each of our core requirements and elective courses are designed to help students further develop problem solving skills and build research abilities, including

- Understanding of complex physical principles
- Application of principles to complex physical systems
- Analytical thinking and logical reasoning
- Mastery of computational skills required to analyze complex systems
- Ability to design research questions and programs
- Analysis of results
- Presentation of results in both written and oral forms

Assessment of Student Learning

1. <u>Direct Methods - Clear and compelling evidence of that students are learning</u>
   A. Coursework
   B. Candidacy Exam (Ph.D. program)
   C. Annual Reviews
   D. Final Thesis or Dissertation presentation and defense

A. <u>Coursework</u>

Graduate physics students must complete a carefully designed series of courses, both required and elected, which are taught by department faculty. It is the duty department's Graduate Affairs Committee (GAC) to monitor these courses, making changes from time to time to improve student preparation and to respond to faculty research programs. The chair and the vice-chair work with the GAC closely in this aspect of their work, coordinating with the committee in curriculum development. Students must earn a grade of "B" or better in each core course to continue in the program.

B. <u>Ph.D. Candidacy Exam</u>

Several years ago, the department moved away from written candidacy exams to a research based exam, where students develop, present, and defend their proposed Ph.D. research project. Before this change, students spent a considerable amount of time studying for the written exam, which ~30% of them failed, delaying their entering a research lab and progressing towards their degrees. Students must still pass their core courses, which include a comprehensive final exam, with a grade of

"B" or better, but changing to a research based exam gets students involved in their research programs at a much earlier time in their graduate careers, allowing them to develop needed research skills at an earlier time. Students now "fail" out of the program at a much lower rate, although roughly 10% per cohort still leave the program in the first two years due to grades in core courses. This past academic 2022-23 year, 7 students took and passed their Ph.D. candidacy exams. The faculty members that make up a student's candidacy committee are different from their final Ph.D. defense committee and the research advisor does not serve as the committee chair. The idea being that they serve as an independent body to evaluate the research project and the student's demonstrated ability to conduct and complete the project.

C. Annual Reviews

All students are required to undergo an annual review during which they present to their thesis or dissertation committee a summary of the work they have done over the year, both academic and in research. This is an opportunity for the committee to evaluate their academic trajectory, their general understanding of their research area (and related physics subjects) and their presentation skills. The review is regularly used to identify possible problems or areas that need improvement. The responsibility for that action typically lies with the advisor, although occasionally the Chair or vice-Chair may feel the need to address a particularly serious situation (such as a conflict between the advisor and the student). Sample questions for student evaluation after the presentation are:

question (iv), "Please rank the student's progress made toward [graduation] over the past year."
question (v), "Please rank the overall quality of presentation."

This last question is important because one of our stated goals for the Physics graduate program is to "Develop the ability to communicate their work to a broad range of audiences."

D. Final Thesis or Dissertation presentation and defense

Over the period 2005-2015, the average enrollment in our Ph.D. program was 36.7 with an average number of Ph.D. degrees awarded per year of 3.2. From 2015 to 2023, we have seen a dramatic increase in our Ph.D. program enrollment, with ~60 enrolled students at any given time in the last several years. Over the last 2022-23 academic year, we graduated nine (9) Ph.D. students and three (3) M.S. students. The students along with their future plans are listed in the table below.

2. Indirect Methods – Planned exit interview

Completing a graduate degree is a unique experience - each student has their own perspective on how the program has prepared them for their future careers. Exit interviews can be a value instrument for assessing program strengths and weaknesses. We will develop a robust exit interview form and formalize our exit interview process. Exit interviews will be conducted by the Chair or their designee.

Timelines for Data Collection and Analysis

Student evaluation happens over the course of the year. Exit forms and interviews will be administered as students complete the necessary steps for graduation. Evaluation of exit interviews and student outcomes will be evaluated yearly by the GAC with assistance from the Chair.

Use of Results

Based on student feedback about the physics graduate program and the growth of faculty numbers in several subfields of physics over the last few years, we have developed and launched three new Ph.D. physics concentrations in the fields of astrophysics, biophysics, and neuroscience. This has led to changes in core program requirements with the addition of elective courses in these subfields.

Physics Ph.D. and M.S. graduates AY 2022-23					
#	**Graduation Term**	**Name**	**Program**	**Faculty Advisor**	**Position after Graduation**
1	FA22	[redacted]	PHYSPH	Kumar	Secondary school teacher
2	FA22	[redacted]	PHYSPH	J Kennefick	Postdoctoral Researcher with the SETI organization
3	FA22	[redacted]	PHYSPH	Lehmer	Medical School
4	FA22	[redacted]	PHYSPH	Churchill	Postdoctoral Researcher, U Arkansas, Fayetteville
5	SP23	[redacted]	PHYSPH	Hu	Postdoctoral Researcher, UAPB
6	SP23	[redacted]	PHYSPH	Lehmer	Postdoctoral Researcher at Penn State
7	SP23	[redacted]	PHYSPH	Fu	Assistant Professor, Southern Utah University
8	SP23	[redacted]	PHYSPH	Kumar	Seeking employment/family break
9	SP23	[redacted]	PHYSMS		Seeking employment
10	SU23	[redacted]	PHYSPH	Thibado	Lafayette College, Easton PA
11	SU23	[redacted]	PHYSMS	Thibado	DOD/Navy, China Lake, CA
12	SU23	[redacted]	PHYSMS	Singh/Vyas	Graduate School at U Toronto