Graduate Program in Applied Physics: Learning Goals and Assessment

PhD Program
The doctoral program in Applied Physics at Rutgers-Newark, run collaboratively with the New Jersey Institute of Technology (NJIT), trains students at the highest level for successful independent careers in physics in academia, industry, or education, by providing a thorough knowledge-base in physics and by developing individual and collaborative research skills through extensive research work.

Learning Goal 1:
Master the fundamental knowledge of the field and develop the problem solving skills and analytical thinking required to begin research.

Assessment of student achievement of Goal 1:
- Performance on homework, exams, class participation in graduate courses
- Five written qualifying exams on core subjects (Analytical Dynamics, Classical Mechanics, Statistical Mechanics, Quantum Mechanics, Math) to assess knowledge of physics, problem solving skills, and analytical thinking

Role of the program in helping students to achieve Goal 1:
- Assure that students are being prepared in a coherent and academically rigorous fashion in required physics courses at the graduate level
- Effective monitoring of student progress through regular meetings with their research advisor
- Annual review by the faculty of the student’s progress, including a report from the research advisor
- Provide guidance on preparing for the qualifier exams
- Evaluations of teaching effectiveness of instructors in graduate courses. If effectiveness is below expectations, work with instructors to improve effectiveness
- Periodic review of curricular offerings and assessment tools

Learning Goal 2:
Engage in and conduct original research

Assessment of graduate student achievement of Goal 2:
- Annual review by the faculty of the student’s progress, including a report from the research advisor
- Oral candidacy exam in student’s research field, to assess performance on initial research for degree, and understanding of open problems and challenges in the research field
- Preparation of and defense of Candidacy exam and Ph.D. dissertation
• Assessment of quality of Ph.D. dissertation, including public defense of dissertation, critical reading of dissertation by a committee consisting of graduate faculty members and someone from outside of the Graduate Program in Applied Physics, and submission and acceptance of conference presentations and peer-reviewed articles based on the dissertation
• Achievement of students as evidenced by selection to give conference presentations, peer-reviewed publications, and the awarding of individual grants and fellowships

Role of graduate program in helping students achieve Goal 2:
• The research advisor together with the student assemble a PhD thesis committee to evaluate the candidacy exam and the PhD defense
• The research advisor guides and advises student on research field background, methods of research, finding thesis topic, and completion of research
• Acquaint students with research outside field through department seminar participation
• Provide opportunities to present research and receive feedback, and expose students to broader research in the field, such as through departmental or research group presentation or participation in external conferences and workshops
• Provide guidance toward the timely completion of the degree, for preparing the Candidacy exam and the PhD thesis defense

Learning Goal 3:
Master the skills required for careers in basic and applied research in academia and/or industry, and/or teaching.

Assessment of graduate student achievement of Goal 3:
• Review evidence of papers presented, publications, and professional networking
• Evaluations of teaching effectiveness of graduate student instructors from teaching faculty and from undergraduate student evaluations.
• Achievement of students as evidenced by professional placements
• Survey graduates

Role of the program in helping students achieve Goal 3:
• Help students develop effective presentation and communication skills through presentations at group meetings, committee meetings, conferences, and other forums
• Run department seminars/workshops related to job and networking skills inside and outside of academia and encourage participation in related university-run events
• Mentoring and hands-on experience in research-based cutting-edge pedagogical methods for teaching used in our undergraduate introductory physics courses.
• Acquaint students with career opportunities outside of physics and astronomy
The leadership of the Graduate Program will regularly review the structure and content of the program and feedback received from assessments and surveys. These reviews are used to help improve the program so that it provides the best possible education for our students.

**MS Program**

The masters of science program in Applied Physics trains students at an advanced level for successful professional careers in applied physics, physics education, and/or data science, by providing a knowledge-base in physics beyond the undergraduate level and by developing individual and collaborative research skills through research work or a focused study.

**Learning Goal 1:**
Master the fundamental knowledge of the field.

Assessment of student achievement of Goal 1:
- Performance on homework, examinations, and class participation in courses

Role of the program in helping students to achieve Goal 1:
- Assure that students are being prepared in a coherent and academically rigorous fashion
- Effective monitoring of student progress by department’s Graduate Advisor and research advisor
- If applicable, evaluations of teaching effectiveness of instructors in graduate courses. If effectiveness below expectations, work with instructors to improve effectiveness.
- Periodic review of curricular offerings and assessment tools

**Learning Goal 2:**
Engage in and conduct original research for Master’s degrees with thesis, or engage in focused study in research field for Master’s degree with project.

Assessment of student achievement of Goal 2:
- Essay on a current topic in the field or a research thesis evaluated by faculty (for Master’s degree with project)
- Assessment of quality of Master’s thesis, including public defense of thesis, critical reading of dissertation by a committee of graduate faculty members, and submission and acceptance of conference presentations and of peer-reviewed articles based on this work.
- Achievement of students as evidenced by selection to give conference presentations, peer-reviewed publications, and the awarding of individual grants
Role of graduate program in helping students achieve Goal 2:

- Provide an early introduction to research methods and opportunities for research
- Provide opportunities to present research and receive feedback, inside the university and in the broader research field
- For masters with thesis, effectively monitor student progress through regular meetings with their research advisor
- For masters with thesis, the research advisor together with the student, assembles a master thesis committee
- For masters with project, assign a research advisor who oversees the student’s work

**Learning Goal 3:**
Prepare to be professionals in Applied Physics, Physics Education, or Data Science.

Assessment of graduate student achievement of Goal 3:

- Evaluations of teaching effectiveness of graduate student instructors
- Achievement of students as evidenced by professional placements or continuation of graduate study that requires ability in physics, physics education, or data science.

Role of the program in helping students achieve Goal 3:

- Help students develop effective presentation and communication skills through presentations at group meetings, committee meetings, conferences, and other forums.
- Run department seminars/workshops related to job and networking skills inside and outside of academia, and encourage participation in related university-run events.
- Mentoring and hands-on experience in research-based cutting-edge pedagogical methods for teaching used in our undergraduate introductory physics courses.
- Acquaint students with career opportunities outside of physics and academia

The leadership of the Graduate Program of the Department of Physics will regularly review the structure and content of the program and feedback received from assessments and surveys. These reviews are used to help improve the program so that it provides the best possible education for our students.