Analysis Questions and Analysis Answers

For Academic Programs

Informed by your assessment activities related to student learning, what changes have you made in your degree program in the last three to five years? Describe the changes (e.g., curriculum revision, new courses, faculty development), the general results that prompted the changes (e.g., student performance on an assessment measure), and any impact on student learning that you might attribute to these changes.

1) Our graduate students must take a Qualifying Exam over undergraduate physics in order to be formally admitted to our PhD program. In order to increase the fraction of graduate students who pass the Qualifying Exam by our departmental deadline, 2 years ago we started including undergraduate-level problems in the homework sets of some of our core graduate courses. This has led to a small increase in the average scores in the relevant areas of our Qualifying Exam, but not large enough to significantly increase the fraction of students passing these sections.

2) In response to a recommendation from our 8 year program review (which occurred 3 years ago), we significantly revised our graduate curriculum by: a) reducing the required number of formal courses; b) creating several sub-area course sequences; c) creating a Research Techniques course that can be customized to the research needs of each student. This revised curriculum was approved in Fall 2013 for implementation this Fall 2014.

Mission / Purpose

The mission of the Department of Physics and Astronomy at the University of Alabama is multi-fold. Through our undergraduate programs, we prepare students for graduate work in physics or astronomy, or for immediate employment in physics-related jobs. We play a vital role in the education of other science and engineering students, and promote the understanding of science through our general studies courses. Our graduate programs prepare students for teaching and/or research positions in colleges and universities, and research positions in government and industrial laboratories. Our research contributes new knowledge in the fields of physics and astronomy. It is part of our mission to secure adequate external funding to support departmental research activities. Through public outreach and involvement within our professions, we serve to improve the public understanding and promote the advancement of science.

Student Learning Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

SLO 1: Basic physics command

We expect our graduate students to demonstrate command of undergraduate-level physics before earning a Masters degree or formally entering our PhD program.

Connected Document

Physics MS Curriculum Maps

Relevant Associations:

Improvement action:
1) Faculty teaching core graduate courses will be encouraged to incorporate some undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the graduate students about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics).
2) We will increase the graduate stipends by introducing a variable scale of stipendiary supplements to: a) improve our recruitment of new graduate students; and b) to provide performance incentives for our existing GTAs, based on their performance as GTAs and on whether or not they have passed the PhD Qualifying Exam.

Related Measures

M 1: Qualifying Exam

Graduate students are required to pass our Qualifying Exam before formally entering our PhD program. The Qualifying Exam covers undergraduate-level physics and is offered annually. Masters-only students are also required to take our Qualifying Exam, in order to help us evaluate their progress. We monitor the fraction of students who pass the qualifying exam each year (addresses improvement action).

Source of Evidence: Academic direct measure of learning - other

Connected Document

Physics MS Curriculum Maps

Target:
No target established

Finding (2013-2014) - Target: Met
During 2013-14, a total of 9 students passed the Qualifier, 2 directly and 7 by the Physics GRE.
M 2: GRE Subject Exam
Physics GRE subject test. Attaining a Physics GRE score exceeding 60th percentile is considered equivalent to passing our Qualifying Exam. We monitor the fraction of students who exceed the 60th percentile each year (addresses improvement action).

Source of Evidence: Standardized test of subject matter knowledge

Connected Document
Physics MS Curriculum Maps

Target: No target established

Finding (2013-2014) - Target: Met
During 2013-14, a total of 9 students passed the Qualifier, 2 directly and 7 by the Physics GRE.

M 3: Time-to pass Qualifying exam
Students must pass the Qualifier by their 2nd year, or they risk losing their financial support. For a typical August entry, we expect students to pass the Qualifier by their 2nd January, or within 1.42 years. A student who fails to pass the Qualifying Exam may still be able to earn a terminal Masters degree if the student passes an oral examination over the core graduate courses in the curriculum (among other requirements). The core graduate courses of Electromagnetism, Quantum Mechanics, Mechanics, and Statistical Physics have considerable overlap with undergraduate-level physics. As a result, our graduate students' performance on our Qualifying Exam (or Physics GRE equivalent) can be considered a measure of the degree to which these core graduate courses reinforce undergraduate-level physics. The fraction of students who pass the Qualifier in any year and the time-to-Qualifier passage are used as measures of the efficacy of our core graduate course in reinforcing undergraduate-level physics (addresses improvement action).

Source of Evidence: Academic direct measure of learning - other

Connected Document
Physics MS Curriculum Maps

Target: 1.42 years

Finding (2013-2014) - Target: Met
The distribution of time-to-Qualifier-passage for the students passing the Qualifier was as follows: 0, 0, 0, 0, 0, 0.25, 1.33, 1.42, 1.42, 2.42, 2.75 years. The median time-to-passage was 0.25 years, less than our target of 1.42 years. 78% of these times are within our target of 1.42 years.

The figure below shows the fraction of each entering cohort of graduate students who passed the Qualifying Exam by our target time of 1.4 years. This year was the target passing year for the 2012-13 entering class, of which 29% passed the Qualifier within our target time. The following cohort (2013-14) will have at least 42% passing within our target time.

<img alt="Qual Pass" src="http://physics.ua.edu/weave/2013-14/QualPass.jpg" width="400">

Related Action Plans (by Established cycle, then alpha):

Continued feedback
Based on our assessment results in 2011-12 we will continue to encourage faculty teaching core graduate to incorporate some undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the graduate students about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics).

Established in Cycle: 2012-2013
Implementation Status: In-Progress
Priority: High

Relationships (Measure | Outcome/Objective):
Measure: Time-to pass Qualifying exam | Outcome/Objective: Basic physics command

SLO 2: Graduate level physics & astronomy command
We expect our Masters graduate students to demonstrate command of graduate-level physics before earning a Masters degree. We expect graduate students in our Masters program in Physics with Astronomy Specialization to demonstrate command of graduate-level physics and astronomy before earning a Masters degree.

Connected Document
Physics MS Curriculum Maps

Related Measures

M 4: Oral Exams
Graduate students in our non-thesis Masters track (whether terminal or on their way to a PhD) must take an oral examination over the core graduate courses in physics. We will monitor the fraction of students who pass this exam on their first attempt.

Source of Evidence: Academic direct measure of learning - other
This year (August-May) we had 10 graduate students earn non-thesis MS degrees in part by passing oral exams. Eight of these students earned their Masters in part by taking their oral PhD Preliminary Exam, which we consider to be equivalent to the Masters oral exam. Two of these students had comprehensive oral exams over graduate coursework and passed after their first attempt.

**M 5: Oral Exams with Astronomy Focus**
Graduate students in our non-thesis Masters track with Astronomy Specialization (whether terminal or on their way to a PhD) must take an oral examination over the core graduate courses in physics and astronomy. For both the physics and astronomy part of the exam we will monitor the fraction of students who pass on their first attempt.

Source of Evidence: Academic direct measure of learning - other

**SLO 3: Research**
We expect our graduate students who are on the Masters-with-thesis track to engage in productive research with faculty.

**M 6: Research Defense**
We expect our graduate students who are on the Masters-with-thesis track to be able to describe their research at a professional level in an oral defense.

Source of Evidence: Senior thesis or culminating major project

**M 7: Publications and Presentations**
We expect our research Masters students to publish their research in refereed journals and give presentations at professional meetings.

Source of Evidence: Presentation, either individual or group

Other Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

**OthOtcm 4: Program Outcome: High Level of Recognized Quality**
The program will improve and sustain a high level of recognized quality.

**Related Measures**

**M 8: Program Strengths**
8-year program review strengths
 Finding (2013-2014) - Target: Met 
8-year review strengths of graduate program: Graduate students receive a comprehensive education in the area of physics. This is clearly required by the high number of classes that students must complete and the comprehensive qualifying exams.

M 9: Opportunities for Improvement 
8-year program review opportunities for improvement 
Source of Evidence: Evaluations 
Target: No target established 
Finding (2013-2014) - Target: Met 
Opportunities for Improvement 
Source of Evidence: Evaluations 
Target: No target established 
Finding (2013-2014) - Target: Met 
8-year review opportunities for improvement of graduate program: Nationwide (and even worldwide) the number of undergraduate students with the interest and ability to undertake graduate work in Physics and Astronomy is limited. The competition for the top (or even the second, and third) tier of graduate students is fierce. This is reflected in the steadily rising support offered to graduate students. The current stipends offered in Physics and Astronomy (and in MINT) are not particularly competitive. A relatively small investment would likely pay significant dividends in obtaining better quality students. These would produce higher quality research, which would increase the competitiveness of the faculty in competing for research funding (positively impacting RA support and numbers of graduate students). Higher quality students also positively impact the quality of undergraduate instruction.

M 30: Post-Graduation Plans 
We track the professional destinations of our MS recipients after they graduate. We use exit surveys, advising meetings and email surveys to obtain post-graduation plans of our MS recipients. 
Source of Evidence: Alumni survey or tracking of alumni achievements 
Target: No target established. 
Finding (2013-2014) - Target: Met 
Four of our 12 MS degrees granted were terminal; of these terminal graduates, 2 transferred to other graduate programs; 2 destinations are unknown.

OthOtm 5: Program Outcome: Sustain Optimal Level of Enrollment 
The program will build and sustain an optimal level of annual program enrollments and degree completions.

Related Measures 
M 10: Credit Hour Production 
Graduate semester credit hour production for the last 3 fall semesters 
Source of Evidence: Administrative measure - other 
Target: No target established 
Finding (2013-2014) - Target: Met 
ORA data provide the following account of graduate credit hour production for the last 3 fall semesters:<br> 430 – Fall 2013<br> 380 – Fall 2012<br> 440 – Fall 2011<br>

M 11: Number of Courses and Sections Offered 
Number of graduate courses & sections offered for the last 3 fall semesters 
Source of Evidence: Existing data 
Target: No target established 
Finding (2013-2014) - Target: Met 
graduate courses / sections<br> 11 / 11 Fall 2013<br> 14 / 14 Fall 2012<br> 12 / 12 Fall 2011<br>

M 12: Number of Graduate Students 
Number of graduate students for the last 3 fall semesters 
Source of Evidence: Existing data 
Target: ACHE viability threshold of 3.75
Finding (2013-2014) - Target: Met
OIRA data provide the following account of our MS and PhD students:<br>
MS / PhD / Total<br>
2 / 44 / 46 – Fall 2013<br>
6 / 37 / 43 – Fall 2012<br>
9 / 38 / 47 – Fall 2011

M 13: Number of MS Degrees Awarded
Number of MS degrees awarded (Aug-May) for the last 3 fall semesters

Source of Evidence: Existing data

Target:
ACHE viability threshold of 3.75

Finding (2013-2014) - Target: Met
Department and OIRA data provide the following account of our MS degrees conferred in the last 3 years:<br>
12 – 2013-14<br>
4 – 2012-13<br>
7 – 2011-12

M 14: Compare Number of Degrees Conferred to ACHE Standards
Comparison of number of MS degrees awarded to ACHE viability standards

Source of Evidence: Professional standards

Target:
ACHE viability threshold of 3.75

Finding (2013-2014) - Target: Met
Over the last 5 years we had an average of 6.8 MS degrees granted per year, exceeding the ACHE viability threshold of 3.75/yr.

M 18: MS Time-to-Degree
We compare the annual distribution of time-to-degree for our MS recipients to our target of 3.5 years.

Source of Evidence: Existing data

Target:
3.5 years.

Finding (2013-2014) - Target: Met
The time-to-degree distribution for those 12 receiving their MS degree was: 1.75, 2.0, 2.33, 3.0, 3.75, 3.75, 3.75, 4.0, 4.33, 4.58, 4.75, 4.75 years.
The average of 3.56 years (median of 3.75) slightly exceeds our target of 3.5 years.

Related Action Plans (by Established cycle, then alpha):

Finish restructuring of graduate curriculum
Our recent 8-year academic program review has triggered a restructuring of our graduate curriculum in order to reduce the number of formal courses required, replacing some with area-specific research methods courses. Our revised graduate curriculum will be in effect starting Fall 2014.

Established in Cycle: 2013-2014
Implementation Status: Finished
Priority: High

Relationships (Measure | Outcome/Objective):
Measure: MS Time-to-Degree | Outcome/Objective: Program Outcome: Sustain Optimal Level of Enrollment

M 19: Number of GTA and GRA
We monitor our number of graduate students and compare it to our distant target of 75, which is based on a 2:1 ratio of GRAs to GTAs and our current number of 25 GTAs.

Source of Evidence: Existing data

Target:
75 graduate students

Finding (2013-2014) - Target: Partially Met
In 2013-14 we had 49 (44) graduate students in the Fall (Spring), 46 (41) of whom were in the Ph.D. program. We had 29 GTAs (including 4 soft-funded), 11 externally funded GRAs, and 3 Fellowships.

OthOtcm 6: Program Outcome: Highly Valued by Graduates and Constituencies
The program will be highly valued by its program graduates and other key constituencies it serves.

Related Measures

M 7: Publications and Presentations
We expect our research Masters students to publish their research in refereed journals and give presentations at professional meetings.
**M 30: Post-Graduation Plans**
We track the professional destinations of our MS recipients after they graduate. We use exit surveys, advising meetings and email surveys to obtain post-graduation plans of our MS recipients.

Source of Evidence: Alumni survey or tracking of alumni achievements

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**Details of Action Plans for This Cycle (by Established cycle, then alpha)**

**Continued feedback**
Based on our assessment results in 2011-12 we will continue to encourage faculty teaching core graduate to incorporate some undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the graduate students about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics).

*Established in Cycle:* 2012-2013  
*Implementation Status:* In-Progress  
*Priority:* High  

**Relationships (Measure | Outcome/Objective):**
- **Measure:** Time-to pass Qualifying exam  
- **Outcome/Objective:** Basic physics command

**Finish restructuring of graduate curriculum**
Our recent 8-year academic program review has triggered a restructuring of our graduate curriculum in order to reduce the number of formal courses required, replacing some with area-specific research methods courses. Our revised graduate curriculum will be in effect starting Fall 2014.

*Established in Cycle:* 2013-2014  
*Implementation Status:* Finished  
*Priority:* High  

**Relationships (Measure | Outcome/Objective):**
- **Measure:** MS Time-to-Degree  
- **Outcome/Objective:** Program Outcome: Sustain Optimal Level of Enrollment
Mission / Purpose

The mission of the Department of Physics and Astronomy at the University of Alabama is multi-fold. Through our undergraduate programs, we prepare students for graduate work in physics or astronomy, or for immediate employment in physics-related jobs. We play a vital role in the education of other science and engineering students, and promote the understanding of science through our general studies courses. Our graduate programs prepare students for teaching and/or research positions in colleges and universities, and research positions in government and industrial laboratories. Our research contributes new knowledge in the fields of physics and astronomy. It is part of our mission to secure adequate external funding to support departmental research activities. Through public outreach and involvement within our professions, we serve to improve the public understanding and promote the advancement of science.

Student Learning Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

SLO 1: Basic physics command
We expect our graduate students to demonstrate command of undergraduate-level physics before earning a Masters degree or formally entering our PhD program.

Source of Evidence: Academic direct measure of learning - other

Connected Document
Physics MS Curriculum Maps

Relevant Associations:
Improvement action:
1) Faculty teaching core graduate courses will be encouraged to incorporate some undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the graduate students about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics).
2) We will increase the graduate stipends by introducing a variable scale of stipendiary supplements to: a) improve our recruitment of new graduate students; and b) to provide performance incentives for our existing GTAs, based on their performance as GTAs and on whether or not they have passed the PhD Qualifying Exam.

Related Measures

M 1: Qualifying Exam
Graduate students are required to pass our Qualifying Exam before formally entering our PhD program. The Qualifying Exam covers undergraduate-level physics and is offered annually. Masters-only students are also required to take our Qualifying Exam, in order to help us evaluate their progress. We monitor the fraction of students who pass the qualifying exam each year (addresses improvement action).

Source of Evidence: Academic direct measure of learning - other

Connected Document
Physics MS Curriculum Maps

Target:
No target established

Finding (2012-2013) - Target: Partially Met
During 2012-13, a total of 5 students passed the Qualifying Exam, 1 directly and 4 by the Physics GRE.

Related Action Plans (by Established cycle, then alpha):

Continued feedback
Based on our assessment results in 2011-12 we will continue to encourage faculty teaching core graduate courses to incorporate some undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the graduate students about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics).

Established in Cycle: 2012-2013
Implementation Status: Planned
Priority: High

Relationships (Measure | Outcome/Objective):
Measure: Qualifying Exam | Outcome/Objective: Basic physics command
Measure: Time-to pass Qualifying exam | Outcome/Objective: Basic physics command

M 2: GRE Subject Exam
Physics GRE subject test. Attaining a Physics GRE score exceeding 60th percentile is considered equivalent to passing our Qualifying Exam. We monitor the fraction of students who exceed the 60th percentile each year (addresses improvement action).
Source of Evidence: Standardized test of subject matter knowledge

Connected Document: Physics MS Curriculum Maps

**Target:**
No target established

**Finding (2012-2013) - Target: Partially Met**
During 2012-13, a total of 5 students passed the PhD Qualifying Exam, 1 directly and 4 by the Physics GRE.

**M 3: Time-to pass Qualifying exam**
Students must pass the Qualifier by their 2nd year, or they risk losing their financial support. For a typical August entry, we expect students to pass the Qualifier by their 2nd January, or within 1.42 years. A student who fails to pass the Qualifying Exam may still be able to earn a terminal Masters degree if the student passes an oral examination over the core graduate courses in the curriculum (among other requirements). The core graduate courses of Electromagnetism, Quantum Mechanics, Mechanics, and Statistical Physics have considerable overlap with undergraduate-level physics. As a result, our graduate students’ performance on our Qualifying Exam (or Physics GRE equivalent) can be considered a measure of the degree to which these core graduate courses reinforce undergraduate-level physics. The fraction of students who pass the Qualifier in any year and the time-to-Qualifier passage are used as measures of the efficacy of our core graduate course in reinforcing undergraduate-level physics (addresses improvement action).

Source of Evidence: Academic direct measure of learning - other

Connected Document: Physics MS Curriculum Maps

**Target:**
1.42 years

**Finding (2012-2013) - Target: Partially Met**

**Finding (2012-2013) - Target: Partially Met**

**Finding (2012-2013) - Target: Partially Met**

The distribution of time-to-Qualifier-passage for the students passing the Qualifier was as follows: 0, 0.83, 1.25, 1.25, 2.42 years. The median time-to-passage was 1.25 years, less than our target of 1.42 years. 80% of these times are within our target of 1.42 years.

The figure below shows the fraction of each entering cohort of graduate students who passed the Qualifying Exam by our target time of 1.4 years. This year was the target passing year for the 2011-12 entering class, of which 44% passed the Qualifier within our target time.

**Related Action Plans (by Established cycle, then alpha):**

**Feedback & stipends**

The distribution of time-to-Qualifier-passage for the students passing the Qualifier was as follows: 0, 1.25, 1.42, 1.42, 2.42, 2.42, 3.00, 3.42 years. The median time-to-passage was 1.92 years, greater than our target of 1.42 years. 50% of these times are within our target of 1.42 years.

**Established in Cycle:** 2011-2012
**Implementation Status:** In-Progress
**Priority:** High

**Relationships (Measure | Outcome/Objective):**

**Implementation Description:**
1) Faculty teaching core graduate courses will be encouraged to incorporate some undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the graduate students about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics).
2) We will increase the graduate stipends by introducing a variable scale of stipendiary supplements to: a) improve our recruitment of new graduate students; and b) to provide performance incentives for continued feedback.

**Established in Cycle:** 2012-2013
**Implementation Status:** Planned
**Priority:** High

**Relationships (Measure | Outcome/Objective):**

**SLO 2: Graduate level physics & astronomy command**

We expect our Masters graduate students to demonstrate command of graduate-level physics before earning a Masters degree. We expect graduate students in our Masters program in Physics with Astronomy Specialization to demonstrate command of graduate-level physics and astronomy before earning a Masters degree.

Connected Document
Related Measures

**M 4: Oral Exams**
Graduate students in our non-thesis Masters track (whether terminal or on their way to a PhD) must take an oral examination over the core graduate courses in physics. We will monitor the fraction of students who pass this exam on their first attempt.

Source of Evidence: Academic direct measure of learning - other

**Connected Document**
Physics MS Curriculum Maps

**Target:**
No target established

**Finding (2012-2013) - Target: Met**
This year (June-May) we had 4 graduate students pass oral exams for the MS degrees. 2 of these students earned their Masters in part by taking their oral PhD Preliminary Exam, which we consider to be equivalent to the Masters oral exam. Two students had comprehensive oral exams over graduate coursework.

**M 5: Oral Exams with Astronomy Focus**
Graduate students in our non-thesis Masters track with Astronomy Specialization (whether terminal or on their way to a PhD) must take an oral examination over the core graduate courses in physics and astronomy. For both the physics and astronomy part of the exam we will monitor the fraction of students who pass on their first attempt.

Source of Evidence: Academic direct measure of learning - other

**Connected Document**
Physics MS Curriculum Maps

**Target:**
No target established

**Finding (2012-2013) - Target: Met**
This year we had no non-thesis Masters students in Astronomy. The graduate course preparation appears to be adequate for our graduate students to pass comprehensive oral exams.

**SLO 3: Research**
We expect our graduate students who are on the Masters-with-thesis track to engage in productive research with faculty.

**Connected Document**
Physics MS Curriculum Maps

Related Measures

**M 6: Research Defense**
We expect our graduate students who are on the Masters-with-thesis track to be able to describe their research at a professional level in an oral defense.

Source of Evidence: Senior thesis or culminating major project

**Connected Document**
Physics MS Curriculum Maps

**Target:**
No target established

**Finding (2012-2013) - Target: Met**
This year we had no Masters-with-thesis students earn their degrees.

**M 7: Publications and Presentations**
We expect our research Masters students to publish their research in refereed journals and give presentations at professional meetings.

Source of Evidence: Presentation, either individual or group

**Connected Document**
Physics MS Curriculum Maps

**Target:**
No target established

**Finding (2012-2013) - Target: Met**
Many of our graduate students participated in research which was published, accepted, or submitted to refereed journals this year: 7 graduate students were co-authors on 21 refereed papers with 5 faculty. In addition, 8 graduate students were co-authors with 7 faculty on 8 submitted or accepted papers. 8 graduate students were co-authors on 9 professional presentations with 6 faculty this year.

We are pleased with the current level of research productivity of our graduate students.
Other Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

OthOtcm 4: Program Outcome: High Level of Recognized Quality
The program will improve and sustain a high level of recognized quality.

Related Measures

M 8: Program Strengths
8-year program review strengths

Source of Evidence: Evaluations
Target: No target established

Finding (2012-2013) - Target: Met
8-year review strengths of graduate program: Graduate students receive a comprehensive education in the area of physics. This is clearly required by the high number of classes that students must complete and the comprehensive qualifying exams.

M 9: Post-Graduation Plans
We track the professional destinations of our MS recipients after they graduate. We use exit surveys, advising meetings and email surveys to obtain post-graduation plans of our MS recipients.

Source of Evidence: Alumni survey or tracking of alumni achievements
Target: No target established

Finding (2012-2013) - Target: Met
Two of our four MS degrees granted were terminal; of these terminal graduates, one went to grad school at UC Irvine and one switched to another PhD program at UA. The majority of our recent Masters have been able to find good jobs immediately upon graduation.

M 10: Opportunities for Improvement
8-year program review opportunities for improvement

Source of Evidence: Evaluations
Target: No target established

Finding (2012-2013) - Target: Met
8-year review opportunities for improvement of graduate program: Nationwide (and even worldwide) the number of undergraduate students with the interest and ability to undertake graduate work in Physics and Astronomy is limited. The competition for the top (or even the second, and third) tier of graduate students is fierce. This is reflected in the steadily rising support offered to graduate students. The current stipends offered in Physics and Astronomy (and in MINT) are not particularly competitive. A relatively small investment would likely pay significant dividends in obtaining better quality students. These would produce higher quality research, which would increase the competitiveness of the faculty in competing for research funding (positively impacting RA support and numbers of graduate students). Higher quality students also positively impact the quality of undergraduate instruction.

OthOtcm 5: Program Outcome: Sustain Optimal Level of Enrollment
The program will build and sustain an optimal level of annual program enrollments and degree completions.

Relevant Associations:
Program Outcome #2 Improvement Action(s) to be advanced.
The 2010-2011 assessment results and our recent 8-year academic program review have triggered discussions in the department to reduce the amount of formal coursework required of our graduate students. We will also more aggressively monitor how quickly our graduate students attain their MS degrees, in order to bring the typical time-to-degree to 3.5 years or less.

Related Measures

M 11: Credit Hour Production
Graduate semester credit hour production for the last 3 fall semesters

Source of Evidence: Administrative measure - other
Target: No target established

M 12: Number of Courses and Sections Offered
Number of graduate courses & sections offered for the last 3 fall semesters

Source of Evidence: Existing data
Target: No target established

M 13: Number of Graduate Students
Number of graduate students for the last 3 fall semesters

Source of Evidence: Existing data
Target: ACHE viability threshold of 3.75

Finding (2012-2013) - Target: Met
In 2012-13 we had 43 graduate students, 6 of whom were MS-only students. There were 4 MS degrees awarded (Aug-May), 2 of which were terminal. Over the last 5 years we had an average of 5.2 MS degrees granted per year, exceeding the ACHE viability threshold of 3.75

M 14: Number of MS Degrees Awarded
Number of MS degrees awarded (Aug-May) for the last 3 fall semesters

Source of Evidence: Existing data

Target: ACHE viability threshold of 3.75
Finding (2012-2013) - Target: Met
In 2012-13 we had 43 graduate students, 6 of whom were MS-only students. There were 4 MS degrees awarded (Aug-May), 2 of which were terminal. Over the last 5 years we had an average of 5.2 MS degrees granted per year, exceeding the ACHE viability threshold of 3.75

M 15: Compare Number of Degrees Conferred to ACHE Standards
Comparison of number of MS degrees awarded to ACHE viability standards

Source of Evidence: Professional standards

Target: ACHE viability threshold of 3.75
Finding (2012-2013) - Target: Met
In 2012-13 we had 43 graduate students, 6 of whom were MS-only students. There were 4 MS degrees awarded (Aug-May), 2 of which were terminal. Over the last 5 years we had an average of 5.2 MS degrees granted per year, exceeding the ACHE viability threshold of 3.75

M 16: MS Time-to-Degree
We compare the annual distribution of time-to-degree for our MS recipients to our target of 3.5 years.

Source of Evidence: Existing data

Target: 3.5 years.
Finding (2012-2013) - Target: Partially Met
The time-to-degree distribution for those 4 receiving their MS degree was: 3.0, 3.75, 4.0, 4.0 years. The average of 3.69 years (median of 3.88) slightly exceeds our target of 3.5 years.

M 17: Number of GTA and GRA
We monitor our number of graduate students and compare it to our distant target of 75, which is based on a 2:1 ratio of GRAs to GTAs and our current number of 25 GTAs.

Source of Evidence: Existing data

Target: 75 graduate students
Finding (2012-2013) - Target: Partially Met
In 2012-13 we had 43 graduate students, 37 of whom were in the Ph.D. program. We had 29 GTAs (including 4 soft-funded), 9 externally funded GRAs, and 4 Fellowships. We are successful in maintaining a robust graduate program but have not reached our target of 75 graduate students.

OthOtcm 6: Program Outcome: Highly Valued by Graduates and Constituencies
The program will be highly valued by its program graduates and other key constituencies it serves.

Related Measures

M 18: Post-Graduation Placement
We track the professional destinations of our MS recipients after they graduate. We use exit surveys, advising meetings and email surveys to obtain post-graduation plans of our MS recipients.

Source of Evidence: Alumni survey or tracking of alumni achievements

Target: No target established.
Finding (2012-2013) - Target: Met
Two of our four MS degrees granted were terminal; of these terminal graduates, one went to grad school at UC Irvine and one switched to another PhD program at UA. The majority of our recent Masters have been able to find good jobs immediately upon graduation.

M 19: Exit Surveys
Results from departmental exit survey for MS graduates

Source of Evidence: Academic indirect indicator of learning - other

Target: No target.
Finding (2012-2013) - Target: Not Reported This Cycle
To few responses to report.

M 20: Publications and Funding
We track the annual number of refereed publications, professional presentations, and the amount of external funding awarded to our faculty.

Source of Evidence: Existing data
Target:
No target established.

Finding (2012-2013) - Target: Met
This year 22 of 25 (88%) of our faculty had refereed publications, which totaled 300 (12 per FTE); 18 of 25
(72%) faculty had 2 or more refereed publications. Our faculty had 63 presentations at national and
international meetings. Faculty were awarded approximately $3.5 million in new funding, leading to a total of
about $6.4 million in force.

Details of Action Plans for This Cycle (by Established cycle, then alpha)

Feedback & stipends
The distribution of time-to-Qualifier-passage for the students passing the Qualifier was as follows:
0, 1.25, 1.42, 1.42, 2.42, 2.42, 3.00, 3.42 years. The median time-to-passage was 1.92 years, greater than our
target of 1.42 years. 50% of these times are within our target of 1.42 years.

Established in Cycle: 2011-2012
Implementation Status: In-Progress
Priority: High

Relationships (Measure | Outcome/Objective):
Measure: Time-to pass Qualifying exam | Outcome/Objective: Basic physics command

Implementation Description: 1) Faculty teaching core graduate courses will be encouraged to incorporate some
undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the graduate students
about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics). 2) We will increase
the graduate stipends by introducing a variable scale of stipendiary supplements to: a) improve our recruitment of new
graduate students; and b) to provide performance incentives for

Continued feedback
Based on our assessment results in 2011-12 we will continue to encourage faculty teaching core graduate courses to
incorporate some undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the
graduate students about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics).

Established in Cycle: 2012-2013
Implementation Status: Planned
Priority: High

Relationships (Measure | Outcome/Objective):
Measure: Qualifying Exam | Outcome/Objective: Basic physics command
Measure: Time-to pass Qualifying exam | Outcome/Objective: Basic physics command
Mission / Purpose

The mission of the Department of Physics and Astronomy at the University of Alabama is multi-fold. Through our undergraduate programs, we prepare students for graduate work in physics or astronomy, or for immediate employment in physics-related jobs. We play a vital role in the education of other science and engineering students, and promote the understanding of science through our general studies courses. Our graduate programs prepare students for teaching and/or research positions in colleges and universities, and research positions in government and industrial laboratories. Our research contributes new knowledge in the fields of physics and astronomy. It is part of our mission to secure adequate external funding to support departmental research activities. Through public outreach and involvement within our professions, we serve to improve the public understanding and promote the advancement of science.

Student Learning Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

SLO 1: Basic physics command

We expect our graduate students to demonstrate command of undergraduate-level physics before earning a Masters degree or formally entering our PhD program.

Connected Document

Physics MS Curriculum Maps

Relevant Associations:

Improvement action:
1) Faculty teaching core graduate courses will be encouraged to incorporate some undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the graduate students about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics).
2) We will increase the graduate stipends by introducing a variable scale of stipendiary supplements to: a) improve our recruitment of new graduate students; and b) to provide performance incentives for our existing GTAs, based on their performance as GTAs and on whether or not they have passed the PhD Qualifying Exam.

Related Measures

M 1: Qualifying Exam

Graduate students are required to pass our Qualifying Exam before formally entering our PhD program. The Qualifying Exam covers undergraduate-level physics and is offered annually. Masters-only students are also required to take our Qualifying Exam, in order to help us evaluate their progress. We monitor the fraction of students who pass the qualifying exam each year (addresses improvement action).

Source of Evidence: Academic direct measure of learning - other

Connected Document

Physics MS Curriculum Maps

Target:
No target established

Finding (2011-2012) - Target: Partially Met
During 2011-12, a total of 8 students passed the Qualifying Exam, 6 directly and 2 by the Physics GRE.

M 2: GRE Subject Exam

Physics GRE subject test. Attaining a Physics GRE score exceeding 60th percentile is considered equivalent to passing our Qualifying Exam. We monitor the fraction of students who exceed the 60th percentile each year (addresses improvement action).

Source of Evidence: Standardized test of subject matter knowledge

Connected Document

Physics MS Curriculum Maps

Target:
No target established

Finding (2011-2012) - Target: Partially Met
During 2011-12, a total of 8 students passed the PhD Qualifying Exam, 6 directly and 2 by the Physics GRE.

M 3: Time-to pass Qualifying exam

Students must pass the Qualifier by their 2nd year, or they risk losing their financial support. For a typical August entry, we expect students to pass the Qualifier by their 2nd January, or within 1.42 years. A student who fails to pass
the Qualifying Exam may still be able to earn a terminal Masters degree if the student passes an oral examination over the core graduate courses in the curriculum (among other requirements). The core graduate courses of Electromagnetism, Quantum Mechanics, Mechanics, and Statistical Physics have considerable overlap with undergraduate-level physics. As a result, our graduate students’ performance on our Qualifying Exam (or Physics GRE equivalent) can be considered a measure of the degree to which these core graduate courses reinforce undergraduate-level physics. The fraction of students who pass the Qualifier in any year and the time-to-Qualifier passage are used as measures of the efficacy of our core graduate course in reinforcing undergraduate-level physics (addresses improvement action).

Source of Evidence: Academic direct measure of learning - other

Connected Document
Physics MS Curriculum Maps

Target:
1.42 years

Finding (2011-2012) - Target: Partially Met
The distribution of time-to-Qualifier-passage for the students passing the Qualifier was as follows:
0, 1.25, 1.42, 1.42, 2.42, 2.42, 3.00, 3.42 years. The median time-to-passage was 1.92 years, greater than our target of 1.42 years. 50% of these times are within our target of 1.42 years.

The figure “2012 MS&PhD time to pass qualifying exam” shows the fraction of each entering cohort of graduate students who passed the Qualifying Exam by our target time of 1.4 years. This year was the target passing year for the 2010-11 entering class, of which 67% passed the Qualifier within our target time.

Connected Document
2012 MS&PhD time to pass qualifying exam

Related Action Plans (by Established cycle, then alpha):
Feedback & stipends
Established in Cycle: 2011-2012
Implementation Status: In-Progress
Priority: High

Relationships (Measure | Outcome/Objective):
Measure: Time-to pass Qualifying exam
Outcome/Objective: Basic physics command

Implementation Description: 1) Faculty teaching core graduate courses will be encouraged to incorporate some undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the graduate students about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics). 2) We will increase the graduate stipends by introducing a variable scale of stipendiary supplements to: a) improve our recruitment of new graduate students; and b) to provide performance incentives for...

SLO 2: Graduate level physics & astronomy command
We expect our Masters graduate students to demonstrate command of graduate-level physics before earning a Masters degree. We expect graduate students in our Masters program in Physics with Astronomy Specialization to demonstrate command of graduate-level physics and astronomy before earning a Masters degree.

Connected Document
Physics MS Curriculum Maps

Related Measures
M 4: Oral Exams
Graduate students in our non-thesis Masters track (whether terminal or on their way to a PhD) must take an oral examination over the core graduate courses in physics. We will monitor the fraction of students who pass this exam on their first attempt.

Source of Evidence: Academic direct measure of learning - other

Connected Document
Physics MS Curriculum Maps

Target:
No target established

Finding (2011-2012) - Target: Met
This year (June-May) we had 7 graduate students pass oral exams for the MS degrees. 3 of these students earned their Masters in part by taking their oral PhD Preliminary Exam, which we consider to be equivalent to the Masters oral exam. An additional 3 had thesis defenses for their oral exam. One student had a comprehensive oral exam over graduate coursework.

The graduate course preparation appears to be adequate for our graduate students to pass comprehensive oral exams.

M 5: Oral Exams with Astronomy Focus
Graduate students in our non-thesis Masters track with Astronomy Specialization (whether terminal or on their way to a PhD) must take an oral examination over the core graduate courses in physics and astronomy. For both the
physics and astronomy part of the exam we will monitor the fraction of students who pass on their first attempt.

Source of Evidence: Academic direct measure of learning - other

Connected Document
Physics MS Curriculum Maps

Target: No target established

Finding (2011-2012) - Target: Met
This year we had no non-thesis Masters students in Astronomy.

The graduate course preparation appears to be adequate for our graduate students to pass comprehensive oral exams.

SLO 3: Research
We expect our graduate students who are on the Masters-with-thesis track to engage in productive research with faculty.

Connected Document
Physics MS Curriculum Maps

Related Measures

M 6: Research Defense
We expect our graduate students who are on the Masters-with-thesis track to be able to describe their research at a professional level in an oral defense.

Source of Evidence: Senior thesis or culminating major project

Connected Document
Physics MS Curriculum Maps

Target: No target established

Finding (2011-2012) - Target: Met
This year we had 3 Masters-with-thesis students earn their degrees.

M 7: Publications and Presentations
We expect our research Masters students to publish their research in refereed journals and give presentations at professional meetings.

Source of Evidence: Presentation, either individual or group

Connected Document
Physics MS Curriculum Maps

Target: No target established

Finding (2011-2012) - Target: Met
Many of our graduate students participated in research which was published, accepted, or submitted to refereed journals this year: 12 graduate students were co-authors on 33 refereed papers with 12 faculty. In addition, 5 graduate students were co-authors with 5 faculty on 6 submitted or accepted papers. 12 graduate students were co-authors on 14 professional presentations with 11 faculty this year.

We are pleased with the current level of research productivity of our graduate students.

Other Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

OthOtcm 4: Program Outcome: High Level of Recognized Quality
The program will improve and sustain a high level of recognized quality.

Related Measures

M 8: Program Strengths
8-year program review strengths

Source of Evidence: Evaluations

Target: No target established

Finding (2011-2012) - Target: Met
8-year review strengths of graduate program:
Graduate students receive a comprehensive education in the area of physics. This is clearly required by the high number of classes that students must complete and the comprehensive qualifying exams.

M 9: Opportunities for Improvement
8-year program review opportunities for improvement

Source of Evidence: Evaluations

Target:
**Finding (2011-2012) - Target: Met**

8-year review opportunities for improvement of graduate program:
Nationwide (and even worldwide) the number of undergraduate students with the interest and ability to
undertake graduate work in Physics and Astronomy is limited. The competition for the top (or even the
second, and third) tier of graduate students is fierce. This is reflected in the steadily rising support offered to
graduate students. The current stipends offered in Physics and Astronomy (and in MINT) are not particularly
competitive. A relatively small investment would likely pay significant dividends in obtaining better quality
students. These would produce higher quality research, which would increase the competitiveness of the
faculty in competing for research funding (positively impacting RA support and numbers of graduate students).
Higher quality students also positively impact the quality of undergraduate instruction.

**M 9: Post-Graduation Plans**

We track the professional destinations of our MS recipients after they graduate. We use exit surveys, advising
meetings and email surveys to obtain post-graduation plans of our MS recipients.

**Source of Evidence:** Alumni survey or tracking of alumni achievements

**Target:**
No target established.

**OthOtcm 5: Program Outcome: Sustain Optimal Level of Enrollment**

The program will build and sustain an optimal level of annual program enrollments and degree completions.

**Relevant Associations:**

Program Outcome #2 Improvement Action(s) to be advanced.
The 2010-2011 assessment results and our recent 8-year academic program review have triggered discussions in the
department to reduce the amount of formal coursework required of our graduate students. We will also more
aggressively monitor how quickly our graduate students attain their MS degrees, in order to bring the typical time-to-
degree to 3.5 years or less.

**Related Measures**

**M 10: Credit Hour Production**

Graduate semester credit hour production for the last 3 fall semesters

**Source of Evidence:** Administrative measure - other

**Target:**
No target established

**Finding (2011-2012) - Target: Met**
The table "2012 MS credit hour production" shows that our total credit hour production (13493) increased 5%
over last year (12813). Gains in physics credit hour production more than compensated for losses in
astronomy credit hour production (see enrollment trends above). The graph below shows our annual credit
hour production over the last 10 years. Our current production is 68% greater than in 2004-5.

**Connected Document**

2012 MS credit hour production

**M 11: Number of Courses and Sections Offered**

Number of graduate courses & sections offered for the last 3 fall semesters

**Source of Evidence:** Existing data

**Target:**
No target established

**Finding (2011-2012) - Target: Met**
The tables "2012 MS AY enrollment" and "2012 MS PH enrollment" show the number of courses and sections offered
together with the enrollment.

**Connected Documents**

2012 MS AY enrollment
2012 MS PH enrollment

**M 12: Number of Graduate Students**

Number of graduate students for the last 3 fall semesters

**Source of Evidence:** Existing data

**Target:**
ACHE viability threshold of 3.75

**Finding (2011-2012) - Target: Met**
In 2011-12 we had 47 graduate students, 8 of which were MS-only students. There were 7 MS degrees
awarded (Aug-May), 3 of which were terminal. Over the last 5 years we had an average of 6.0 MS degrees
granted per year, exceeding the ACHE viability threshold of 3.75.

**M 13: Number of MS Degrees Awarded**

Number of MS degrees awarded (Aug-May) for the last 3 fall semesters

**Source of Evidence:** Existing data

**Target:**
ACHE viability threshold of 3.75
Finding (2011-2012) - Target: Met
In 2011-12 we had 47 graduate students, 8 of which were MS-only students. There were 7 MS degrees awarded (Aug-May), 3 of which were terminal. Over the last 5 years we had an average of 6.0 MS degrees granted per year, exceeding the ACHE viability threshold of 3.75.

M 14: Compare Number of Degrees Conferred to ACHE Standards
Comparison of number of MS degrees awarded to ACHE viability standards
Source of Evidence: Professional standards
Target:
ACHE viability threshold of 3.75
Finding (2011-2012) - Target: Met
In 2011-12 we had 47 graduate students, 8 of which were MS-only students. There were 7 MS degrees awarded (Aug-May), 3 of which were terminal. Over the last 5 years we had an average of 6.0 MS degrees granted per year, exceeding the ACHE viability threshold of 3.75.

OthOtm 6: Program Outcome: Highly Valued by Graduates and Constituencies
The program will be highly valued by its program graduates and other key constituencies it serves.

Related Measures

M 15: Exit Surveys
Results from departmental exit survey for MS graduates
Source of Evidence: Academic indirect indicator of learning - other

M 16: Post-Graduation Placement
We track the professional destinations of our MS recipients after they graduate. We use exit surveys, advising meetings and email surveys to obtain post-graduation plans of our MS recipients.
Source of Evidence: Alumni survey or tracking of alumni achievements
Target:
No target established.

Details of Action Plans for This Cycle (by Established cycle, then alpha)

Feedback & stipends
The distribution of time-to-Qualifier-passage for the students passing the Qualifier was as follows: 0, 1.25, 1.42, 1.42, 2.42, 2.42, 3.00, 3.42 years. The median time-to-passage was 1.92 years, greater than our target of 1.42 years. 50% of these times are within our target of 1.42 years.
Established in Cycle: 2011-2012
Implementation Status: In-Progress
Priority: High
Relationships (Measure | Outcome/Objective):
Measure: Time-to-pass Qualifying exam
Outcome/Objective: Basic physics command
Implementation Description: 1) Faculty teaching core graduate courses will be encouraged to incorporate some undergraduate-level material in their reviews, problem sets, and exams, to provide feedback to the graduate students about their preparedness for the PhD Qualifying Exam (which covers undergraduate-level Physics). 2) We will increase the graduate stipends by introducing a variable scale of stipendiary supplements to: a) improve our recruitment of new graduate students; and b) to provide performance incentives fo...
### Curriculum Map I (Student Learning Outcomes)

<table>
<thead>
<tr>
<th>Student Learning Outcome 1</th>
<th>Student Learning Outcome 2</th>
<th>Student Learning Outcome 3</th>
<th>Student Learning Outcome 4</th>
<th>Student Learning Outcome 5</th>
<th>Student Learning Outcome n</th>
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</thead>
<tbody>
<tr>
<td>Basic physics command</td>
<td>Graduate level physics &amp; astronomy command</td>
<td>Research</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Course 1  | PH 501 | ✔ | ✔ |          |          |
| Course 2  | PH 531/PH 532 | ✔ | ✔ |          |          |
| Course 3  | PH 541/PH 542 | ✔ | ✔ |          |          |
| Course 4  | PH 571 | ✔ | ✔ |          |          |
| Common Experience | PH 597/AY597 | ✔ | ✔ |          |          |
| Required Experience | PH 599 | ✔ | ✔ |          |          |
| Required Task | AY 501/521/533/550/570/620 (min 3) | ✔ | |          |          |
| Required Task | PH 551/561/581 (min 2) | | | | | |

### Curriculum Map II (Assessment Measures)

<table>
<thead>
<tr>
<th>Student Learning Outcome 1</th>
<th>Student Learning Outcome 2</th>
<th>Student Learning Outcome 3</th>
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<tbody>
<tr>
<td>Basic physics command</td>
<td>Graduate level physics &amp; astronomy command</td>
<td>Research</td>
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</tbody>
</table>

<p>| Course 1  | PH 501 | Measure 1.1: Summative assessment; qualifying Exam, administered annually | Measure 2.1: Summative assessment; Oral physics exam, administered before graduation |          |          |
| Course 2  | PH 531/PH 532 | Measure 1.1: Summative assessment; qualifying Exam, administered annually | Measure 2.1: Summative assessment; Oral physics exam, administered before graduation |          |          |</p>
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<tr>
<th>Course 3</th>
<th>PH 541/PH 542</th>
<th>Measure 1.1: Summative assessment; qualifying Exam, administered annually</th>
<th>Measure 2.1: Summative assessment; Oral physics exam, administered before graduation</th>
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<tbody>
<tr>
<td></td>
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<td>Measure 1.2: Summative assessment; Physics GRE subject test, administered annually</td>
<td>Measure 1.3: Time to pass qualifying Exam.</td>
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<td>Measure 1.2: Summative assessment; Physics GRE subject test, administered annually</td>
<td>Measure 1.3: Time to pass qualifying Exam.</td>
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<td>Measure 2.1: Summative assessment; Oral physics exam, administered before graduation</td>
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<td>Measure 1.2: Summative assessment; Physics GRE subject test, administered annually</td>
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<td>Common Experience</td>
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<td>Required Task</td>
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Qualifier Passed after 1.4 yrs

Cohort

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- 2005-6
- 2006-7
- 2007-8
- 2008-9
- 2009-10
- 2010-11
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