

# Annual Goals for Physics and Earth Science

2011-2012

---

<b>Goal 1:</b>	Growing the Department
<b>Description:</b>	The Faculty members will participate in outreach activities to high school students in order to establish relationships between potential students and the Department of Physics and Earth Science.
<b>Budget:</b>	1.00
<b>University Goals Supported:</b>	1,4,5
<b>Strategic Goals Supported:</b>	
<b>Responsibility:</b>	Chair of the Department
<b>Participation:</b>	All Faculty
<b>Results:</b>	The entire faculty of the Physics and the Earth Science components of the department participated in Fall 2011-2012 Preview Day meeting and greeting high school students. Until this time, only a couple of faculty had participated in this annual event.
<b>Actions/Improvements:</b>	The faculty will continue to participate in this outreach activity. In the planning goals phase of departmental development (fall 2012) other out-reach activities will be identified.
<b>Future Actions/Improvements:</b>	The faculty will discuss other approaches to nurture a relationship with the schools in the 2012 Fall planning sessions.

---

<b>Goal 2:</b>	Securing Scholarships
<b>Description:</b>	Faculty members will seek NSF funds or other grants to advance the department's connections with regional high schools and to provide scholarships for students who enroll in either of the program areas of the Department.
<b>Budget:</b>	0.00
<b>University Goals Supported:</b>	1,2,3,4,5
<b>Strategic Goals</b>	

**Supported:**

**Responsibility:** Department Chair

**Participation:**

**Results:** Fundraising is a challenge for faculty due to academic and university responsibilities. Efforts to locate appropriate grants for scholarships were made and will continue to be made. It is the consensus of the department that scholarships are the foundation of growing the department from a student enrollment exercise. Some faculty contribute to

**Actions/Improvements:** None

**Future Actions/Improvements:** Additional plans/ actions to meet this goal need to occur.

---

**Goal 3:** Changes in Earth Science Offerings

**Description:** The Earth Science Faculty will critique and edit offerings, particularly adding what is perceived to be excellent courses with high levels of appeal to the undergraduate.

**Budget:** 0.00

**University Goals Supported:** 1,2,3,4,5

**Strategic Goals Supported:**

**Responsibility:** Department Chair

**Participation:**

**Results:** Through collaboration, the Earth Science faculty critiqued the current curriculum through two lenses: a) determining which courses needed adaptations and b) determining changes which would enhance the program to appeal to university students.

**Actions/Improvements:** These decisions will be proposed to the department chairs in the College of Arts and Sciences, and if approved, will move forward to appropriate curriculum committees by or at the beginning of fall 2012-2013. Courses Needing Adaptations 1. To divide ES 121 (Earth Science) into two courses to allow more attention to the areas covered in this course. The selected text then, could be used by students taking eight hours of ES--introductory levels. An expectation is expanded enrollment. 2. The action described in # 1, spending more time in each area, led to the decision to absorb ES

131 Physical Geology into ES 121 and the added course (not yet numbered or approved. Changing the Program 3. Consider returning to the minor of Earth Science rather than Geology to broaden the appeal to students--under consideration. 4. Offer a program that blends the two academic sides of the department. A proposal to add another option for physics majors: Geophysics will be submitted. 5. Created a proposed program for a major, in Sustainability grounded in the Earth Sciences but reaches across science disciplines and Colleges on campus.

**Future Actions/Improvements:** The Department is poised to continue the decisions and actions of the faculty by moving proposals forward.

**Goal 4:** Planetarium Improvements

**Description:** A greater effort will characterize the movement toward securing new planetarium chairs and scholarships. A major fundraiser, to be determined, will be held this academic year.

**Budget:** 1500.00

**University Goals Supported:** 1,2,4,5

**Strategic Goals Supported:**

**Responsibility:** Department Chair

**Participation:**

**Results:** A few special events were held at the planetarium to support current academic programming--part of the usual funding/ programming conducted. A major fundraiser was pushed forward and will be reviewed to determine if a more efficient way to involve faculty in fundraising is feasible.

**Actions/Improvements:** No other actions have occurred. See below.

**Future Actions/Improvements:** The goal of purchasing appropriately designed seats for viewing the planetarium screen and for conducting classes in the facility remains. The department plans to seek multiple sources for funding this project. Resources will be identified as goal setting occurs in the fall 2012-2013. The assessment indicates that faculty members are extremely heavily engaged in academic, university committee work and in university events. As a group they

# Long-Term Goals for Physics and Earth Science

2011-2012

---

<b>Title:</b>	Departmental Growth
<b>Description:</b>	The Department of Physics and Earth Science established the goal of growth in the number of majors for Physics and minors for the Earth Science programs.
<b>Budget:</b>	2000
<b>University Goals:</b>	1,2,3,4,5
<b>Accomplished:</b>	As of this report, June 28, 2012, there are seven declared physics majors (ARGOS report). If the trend holds, declared majors are increasing slowly.
<b>Spent:</b>	\$0.00

# Student Learning Outcomes for Physics and Earth Science

2011-2012

---

<b>Outcome 1:</b>	Physics Major Research Skill Development
<b>Description:</b>	Students will be engaged in investigations of mechanics, electricity, magnetism, heat, sound, optics, and modern physics.
<b>Budget:</b>	\$0.00
<b>Core Competencies Supported:</b>	1,2,4,5
<b>Assessed How Often:</b>	Every year
<b>Assessed this Year?</b>	
<b>Responsibility:</b>	Program Coordinator
<b>Participation:</b>	Department Chair
<b>Direct Assessments</b>	

## Indirect Assessments

**Results:** This year, the first year of the implementation, UNA's QEP, "Building Success through Discovery," was a focus for the Department. Assessing the goals and components of the QEP in the context of the conceptual framework for physics majors, it was determined that the Department already had in place a good fit for the QEP especially as it is assessed through student learning outcomes. As indicated in other sections of this report, the three levels of developmental research skill development required of physics majors is complementary/reflection of the University's articulated process of skill development. This assessment report reflects the outcomes of these three levels and whether or not these

are effective in assisting students to develop the appropriate research and communication skills for the discipline. A review of the outcomes of each level, tracking three graduates this year, reported in other sections document that the process developed by the physics faculty are effective. Among the three students, all presented at the Alabama Academy of sciences. One was the overall winner for the undergraduate division and he received the University Phi kappa Phi Chapter's research paper first place award. One student recently presented research at an International conference. One student is working in the discipline; two will be attending graduate school at Auburn University in the Fall 2012.

**Curriculum  
Actions/Improvements:** None

**Other  
Actions/Improvements:** None

**Future Actions:** None

**Outcome 2:** Physics Majors--Selected Topics

**Description:** Students will demonstrate comprehension and skills in investigating electric fields, electric potential, magnetic fields, and electromagnetic fields through problem-solving applications.

**Budget:** \$0.00

**Core Competencies  
Supported:** 2,3,4,5

**Assessed How Often:** Every year

**Assessed this Year?** Yes

**Responsibility:** Faculty member Teaching this Course

**Participation:** Department Chair

**Direct Assessments**

Faculty created and standardized formats

**Indirect Assessments**

**Results:** The course selected for reporting is PH 444--Quantum Mechanics. This report is prepared by the faculty member teaching the course and is edited by the Department Chair. The course starts from a trial test or pretest administered on the first day of classes. Then, some of the same or very similar problems are given to students within various intermediate tests. The same problems as in the trial test are given to students on the final test. Data concerning the correct answers are collected following each test to determine students' performance in regards to the learning outcomes. Specifically, no one gave a correct answer to any of the 10 questions & problems. Later, Problem-1 and Problem-2 were repeated both on intermediate tests (with correct/incorrect scores as 0/3 and 1/3, respectively) and the Final Exam (with correct/incorrect scores as 1/3 and 1/3, respectively). Scores other questions on [intermediate][final] tests: Q7 [1/4][2/3], Q9a [1/3][3/3], Q12 [3/4][2/3], Q16 [2/4][3/3], Q18 [1/3][2/3], Q6 [2/4][2/3], ...

**Curriculum Actions/Improvements:** If students did not demonstrate comprehension of the concepts assessed by questions on the final exam, these will become a focus for more comprehensive coverage as documented. For example, topics related to Q9a and Problem-1 and Problem-2 will require a more comprehensive coverage. As for the other listed questions, judging by the steady increase in the rate of correct answers, no crucial change in their coverage is necessary.

**Other Actions/Improvements:** In view of a generally low calculus background of students taken the course, some basic principles of theory of complex numbers, integration, differential equations, etc., will have to be reminded to students as time allows. Also the derivation of quantum mechanics equations will have to be done in greater detail.

#### **Future Actions:**

---

<b>Outcome 3:</b>	Physics Majors--Conservative Forces
<b>Description:</b>	Students will be able to understand and apply the unifying principle of Conservative Forces (Potential Energy, Conservation of Energy)
<b>Budget:</b>	\$0.00
<b>Core Competencies Supported:</b>	2,3,4,5
<b>Assessed How Often:</b>	Every year
<b>Assessed this Year?</b>	Yes

**Responsibility:** Program Coordinator

**Participation:** Department Chair

**Direct Assessments**

**Indirect Assessments**

**Results:** PH 252 Spring 2012 The PH 252 Technical Physics II course is the second course for physics majors. To evaluate student progress in physics courses, physics professors have decided to examine two general topics. The first topic consists of Work, Kinetic and Potential Energies, and Conservation of Energy. The second topic consists of Electromagnetic Fields and Potentials. At least one of these two topics is covered in every physics course. The primary focus of PH 252 is introducing the topics of Electromagnetic Fields and Potentials. This year, these topics are the subject of the first six hour exams, and then the natural evolution of electromagnetic fields - light – is the subject of the last three hour exams. Emphasis is placed on applying concepts in these topics to problem-solving strategies for solving both quantitative problems requiring numerical calculations and qualitative (or conceptual) problems requiring comparison between physical quantities. All the questions on the standardized final exam, called the Concept Survey in Electricity and Magnetism (CSEM), cover these topics. The first two exams in previous courses, which cover electric fields, usually result in the lowest scores all semester; the past average on these two exams has been about 65%. As a result of previous assessments, an effort was made to reduce the topical coverage of these first two exams, consolidating the topics into one exam. So in preparation for the summer version of this class, I condensed the material from two exams into a single exam, by covering only the topics believed to be absolutely essential. The result from the summer session was a class average of 65%, no better and no worse than before. But at least it was only one exam, and not two. With this experience, faculty continued to compress these topics in the Spring 2012 course. Scores, predicted to improve since students, have much more time to assimilate the topics in the fall than during the summer session, scored an average of 56%. This served as a

possible warning that the overall class might have more difficulty than usual with this course. However a couple students were very strong; so the material level was maintained. The average test scores of subsequent exams were consistently lower than those of previous semesters by about 8 percentage points. The only bright spot was that, with the condensation of the first two exams into one, I was able to add an additional topic on optics at semester end. As it turns out, students seemed to enjoy this topic the most (which I find fitting for end of semester) and the average exam score was a course high of 87%. With regards to the CSEM, the average score for the class was 44%. This is about 10 percentage points lower than previous semesters.

**Curriculum**

**Actions/Improvements:**

The class as a whole struggled with the material. Except for the first exam, material coverage was identical to previous semester. The conclusion? This class, as a whole, was weaker than other classes enrolled for a while, and that the especially low score seen from the first exam carried through the rest of the semester. Currently, no changes in the presentaion of the curriculum are planned-- especially in the condensation of topics that begins the semester.

**Other**

**Actions/Improvements:**

Comments from faculty member and program coordinator D. Brian Thompson: "One last point worth noting is that this year I volunteered this class [PH 252]to participate in AP exam question testing. The national AP exam, administered by Educational Testing Services ([ETS], sends a set of trial exam questions to selected professors. Then, they [ETS ]collect the student answers to these questions to evaluate whether or not they will be included on future AP exams. Of interest to me was how my topical coverage compared to the topics from which the exam drew the questions. It is my belief that one cannot cover all possible topics in the textbook effectively in a one-semester course, and so I have pared the course down to what I think is the minimum necessary. As it turns out, 80% of the AP exam questions were drawn from the course topics I chose. I'll take that percentage any day of the week."

**Future Actions:**

---

**Outcome 4:**

Inquiry, Analysis, and Communication QEP--Level II

**Description:**

Students will demonstrate inquiry,analysis, and communication of the outcomes of laboratory-based activities through writing in a discipline-based style.

**Budget:**

\$0.00

**Core Competencies**

1,2,3,4,5

**Supported:**

**Assessed How Often:** Every year

**Assessed this Year?** Yes

**Responsibility:** Program Coordinator

**Participation:** Department Chair

**Direct Assessments**

Faculty developed exams

presentations; oral and written communication through reports

**Indirect Assessments****Results:**

QEP Level II — Intermediate Laboratory Learning Outcomes: The Intermediate Laboratory course (PH 356W) engages students in their first direct research experience. The laboratory inquiries include building experimental setups, conducting experimental measurements, processing and analyzing the data using discipline-specific software, comparing results to theory or measurement standards, and writing a final report. Students have to work through two of a variety of inquiries. For example, each graduating major student was engaged in inquiries which differed from those experienced by the other two students. Primary assessments for each inquiry included a final written report and an oral report to the class. All three students performed competently in their two inquiries, in following through the process, in writing to communicate their research outcomes, and in communicating orally their research outcomes. One student's written reports were exemplary on a consistent basis, and are now used as a standard for what is possible.

**Curriculum  
Actions/Improvements:**

The students' successful progression through the QEP process, indicated that the developmental approach which evolved over time (a process implemented prior to the QEP adoption) is effective in preparing students in developing knowledge and skills to engage in research and communicate the outcomes of that research. Again, the QEP process was a great fit for the 3-level process developed by faculty in the Department. This allowed a formalized tracking of

	student progress over time during the first year of the QEP implementation.
<b>Other Actions/Improvements:</b>	None at this time.
<b>Future Actions:</b>	None at this time.

<b>Outcome 5:</b>	Capstone--Senior Research Project--QEP Level III
<b>Description:</b>	Students will move through the research-writing continuum which is established as the capstone project for physics majors. In this project they demonstrate an effective literature review, research inquiry, analysis of outcomes, and opportunities to write research outcomes in discipline-related style. Students will participate in an oral presentation of research at the University. An expectation also is that they will present in a state or national professional meeting.
<b>Budget:</b>	\$0.00
<b>Core Competencies Supported:</b>	1,2,3,4,5
<b>Assessed How Often:</b>	Every year
<b>Assessed this Year?</b>	Yes
<b>Responsibility:</b>	Program Coordinator
<b>Participation:</b>	Department Chair
<b>Direct Assessments</b>	
	Faculty-developed exams

#### **Indirect Assessments**

<b>Results:</b>	QEP Level III — Directed Research Learning Outcomes: The senior Directed Research course (PH 495), long-established in the Department of Physics and Earth Science, became the Department's Level III in the QEP Plan. In this two-hour course, students participate in original research under the direction of a
-----------------	--

physics faculty mentor. This course can be repeated voluntarily for another semester, but note that this repetition does not replace another required major course, because all other physics courses are at least three hours. Initially, the primary assessment for this course required either a written report submitted to the faculty mentor or an oral report presented to invited science faculty. However, over the last few years the assessment standard has been stretched to include more rigorous presentations, including oral or poster presentations at regional and national conferences, written reports for UNA Phi Kappa Phi research paper competitions, and poster presentations at the UNA research day. Tracking the three graduating seniors, each successfully engaged in conducting research. In fact, each signed up to take the course again for a second semester. This demonstrates our majors' interest in working on original research. Each of the graduates performed well in communicating his research outcomes through writing and through presentations. One student received first place in the Phi Kappa Phi competition for research papers and also received first place for his oral presentation at the annual meeting of the Alabama Academy of Science. All three made oral presentations at this conference, and one student also made an oral presentation at the national American Physical Society conference known by the acronym DAMOP. All three students presented posters at the University of North Alabama Research Day.

**Curriculum**

**Actions/Improvements:**

Based on the performance and learning outcomes of three graduating students who were tracked through the physics program with the culminating experience of Level III of the QEP Plan, no changes in curriculum are planned at this time.

**Other**

**Actions/Improvements:**

Informed by the assessment, no other actions are planned.

**Future Actions:**

Informed by the assessment, no other actions are planned