

# PHYSICS DEPARTMENT PROGRAM REVIEW, 2010

By William E. Keig

## Overview of the Physics Department

The Physics department offers lecture and laboratory sections in freshman-sophomore level physics. These courses are offered for general education, as required courses for other majors, and as the required introduction to a Physics major.

In 2007-2010 the following courses were offered. Physics 1A (Mechanics of Solids) is a calculus based introduction to mechanics. It is part of the 1A-1B-1C-1D sequence, which is transferable to both the CSU and UC system and if successfully completed is accepted as credit for their introductory physics with calculus sequence. Physics 1D (Optics and Modern Physics) is also calculus based. Physics 2A (General Physics) is a trigonometry based survey of mechanics, thermodynamics, and vibrations and waves. It is part of the 2A-2B sequence, which is CSU and UC transferable for students requiring introductory physics as part of another major such as architecture or biology. Physics 11 (Descriptive Introduction to Physics) is a conceptual physics course with no mathematics prerequisite. It is intended for general studies and for students with insufficient high school preparation in science to start Physics 1A. These courses have been offered on an irregular basis due to low enrollment. The 1A-1B-1C-1D sequence was especially hard hit by the loss of students in the CEC calculus classes.

These courses are offered in a laboratory facility next to a supply room that allows immediate access to equipment for laboratory exercises and lecture demonstrations.

## Status of previous recommendations

The twelve recommendations from the previous Program Review are listed below along with a summary of their status.

### 1. Promote Physics 12.

From 2007 to 2009 the CEC had only marginal success even in promoting Physics 11. In 2010 the CEC benefitted from students being sent over by the main campus after being turned down because of classes being full. However, although the Spring, 2010 Physics 11 class has 17 students at this writing, we were still unsuccessful in getting enough students to open a section of Physics 12. At the CEC our success in promoting Physics 12 is critically dependent on our success in reviving Physics 11.

**Recommendation:** The department should advertise Physics 11 and 12 in posted notices around the CEC campus before the registration starts.

### 2. Determine the need to add another section of Physics 2A.

A section of Physics 2A was offered for the first time at CEC in Winter Semester, 2010, and finished with 25 students. This represents sufficient success that the CEC should try offering it again.

**Recommendation:** The department should offer Physics 2A again and advertise it in posted notices around the CEC campus before the registration starts.

### 3. Determine the need to add another section of Physics 3A.

BCC offers two sections of Physics 3A. One section is offered in the spring semester and one in the fall semester. Since the CEC is a smaller institution, it is unlikely that Physics 3A will attract enough students for it to be offered at the CEC.

4. Determine the need to add another section of Physics 1D.

There is no need for Physics 1D at the CEC until a significant number of students at the CEC pass Physics 1A. Physics 1A is currently offered in the Spring, 2010 Semester and will be offered again in Fall.

5. We should consider offering Physics 13. Many instructors believe that Physics 11 and Physics 13 offer stronger preparation for Physics 1A than Physics 2A. Promoting Physics 13 would be necessary in order to have adequate enrollment.

There are no plans to offer Physics 13 at the CEC.

6. Submit the proposed change in prerequisite for Physics 3A to the curriculum committee. The prerequisite for Physics 3A currently is Mathematics 160 or Mathematics 190 with a minimum grade of C. The prerequisite should read: Mathematics 160 or Mathematics 190 with a minimum grade of C or concurrent enrollment.

This proposal has been completed.

7. Explore new technologies that will enable the instructor to interact more and in a more meaningful way with students.

We believe this recommendation has been and will continue to be fulfilled. This point is discussed further in connection with SLOs and with facilities, equipment and technology.

8. The need for more physics tutors should be addressed.

No progress has been made on this proposal at the CEC. More physics tutors will become available as students successfully complete Physics 1A.

9. Develop a plan to identify and replace older or antiquated equipment with more modern equipment.

This continues to be a priority item. The ballistic pendulum apparatus is superior to the old apparatus in that it has less friction and gives more accurate results. New optical equipment has been purchased which improves the accuracy and variety of available experiments in optics.

10. Install gas and water in the workshop.

This proposal does not apply to the CEC.

11. Write a department policy book.

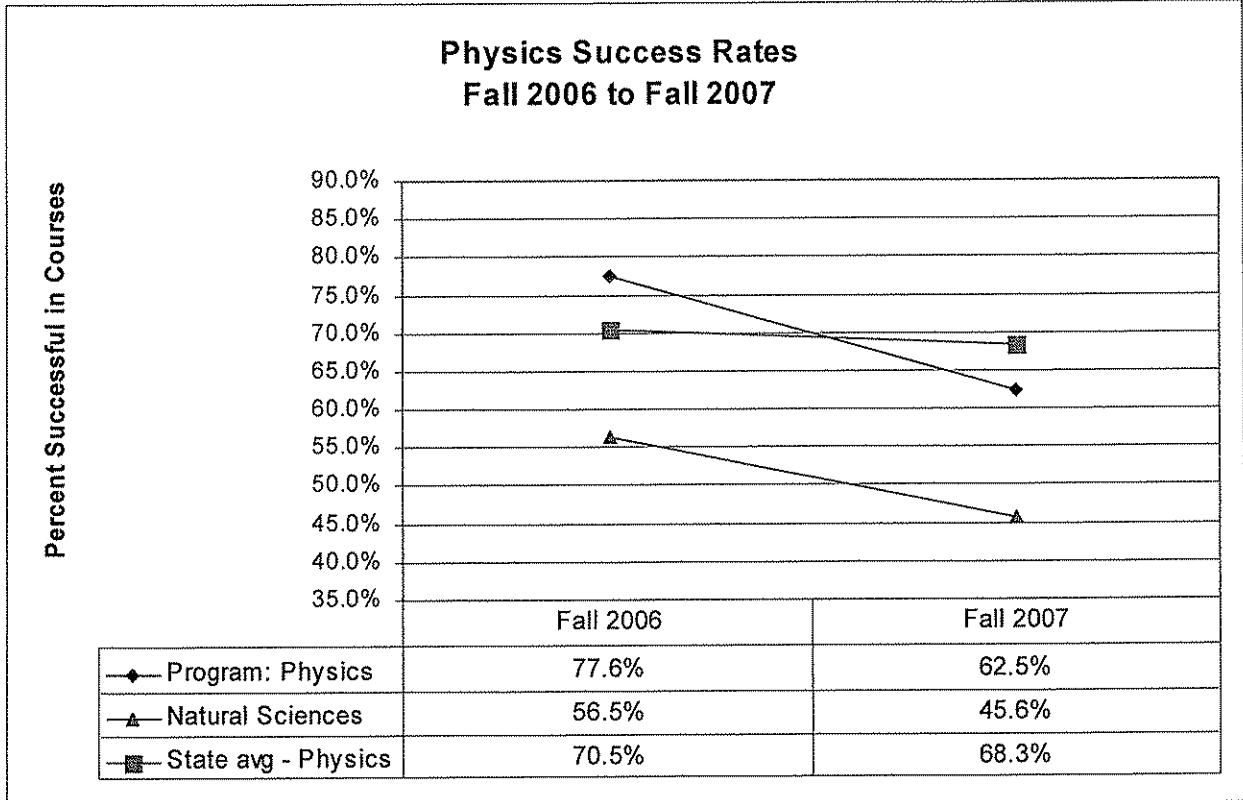
Leon Leonardo, along with Dan Wright, has completed the department policy book.

12. Improve communication with counselors working in areas other than science and mathematics.

Dr. Keig is currently working with Vanessa Haynes, who is a guidance counselor who also works in Human Development. We are partners in the Faculty Inquiry Partnership Program (FIPP) and frequently discuss issues in both teaching and counseling. We believe that the Physics faculty at CEC has made strong progress in improving communication with counselors working in areas other than science and mathematics.

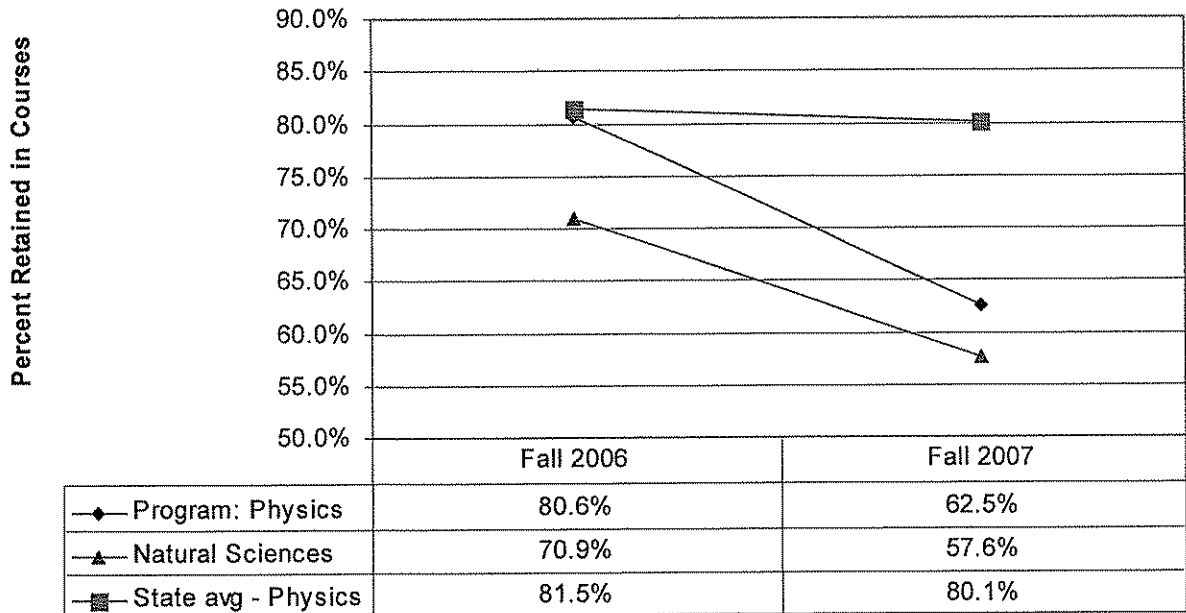
## Course grade distribution; success and retention rates

The Physics success rates from Fall, 2006, to Fall, 2007, are shown below.



The s retention rates for 2006-2007 are shown below. These data are mostly from an instructor that currently is not actively teaching at CEC. The total number of individuals will be higher for Winter and Spring, 2010 but are not yet available as of this writing.

**Physics Retention Rates  
Fall 2006 to Fall 2007**



**Enrollment statistics with section and seat counts; fill rates**

Both seat counts and fill rates were low in 2006 to 2009. Both are higher in Winter and Spring, 2010, but the data are not yet available as of this writing.

## Curriculum—Course, Content, and Articulation

As the table below shows, all of our courses have been reviewed and the course outline updated within the last three years.

Course Number	Course Title	Course Outline Date
Phys 11	Descriptive Introduction to Physics	July 2009
Phys 12	Laboratory for Introductory Physics	Dec 2008
Phys 13	Quantitative Aspects of Elementary Physics	July 2009
Phys 1A	Mechanics of Solids	Spring 2009
Phys 1B	Fluids, Heat and Sound	Feb 2009
Phys 1C	Electricity and Magnetism	Feb 2009
Phys 1D	Optics and Modern Physics	Spring 2009
Phys 2A	General Physics	July 2009
Phys 2B	General Physics	April 2009
Phys 3A	General Physics with Calculus	Oct 2006
Phys 3B	General Physics with Calculus	Feb 2007

### Concerns and Recommendations

a) Physics 13 has not been offered in the last three semesters. Enrollment in this class is usually low and class is generally either cancelled, or not offered. A decision needs to be made on whether to promote Physics 13 or to permanently delete this course from the list of courses offered. I suggest the latter, as mentioned above.

b) Physics 1D (Optics and Modern Physics), a 3-unit course with 3 hours of lecture and 2 hours of lab should be changed to a 4-unit course with 4 hours of lecture and 2 hours of lab. Physics 1D covers three major subject areas: optics, special relativity, and quantum mechanics. While the time allowed by the official course outline for covering optics and special relativity is adequate, and in line with time allotments at other institutions, the time allotted to quantum mechanics allows only for very superficial coverage of the material, and does not allow us to provide our science and engineering students with the training in quantum mechanics that they would receive in the equivalent courses at most transfer institutions. The current time allotment of 15 hours is inherited from the 1965 course outline. Such a limited presentation of the material can no longer be considered adequate or appropriate. What do other schools do?

The physics faculty has submitted a proposal to Dr. Arce requesting the increase of the number of units for Physics 1D from 3 units to 4 units. Implementation is on hold until college curriculum and budget issues are resolved.

## Student Learning Outcomes (SLOs)

As of this writing, one SLO has been done at the CEC in Physics 11 in Winter, 2009.

### Physics 11 – Descriptive Introduction to Physics

SLO: Given a description of a physical situation (floating ice cube, falling body,...) the student should be able to recognize the basic physical principles involved and explain how they are manifested in, and influence the behavior of the situation.

Assessment instrument: The final exam in Physics 11.

Assessment results:: Based on a rubric the students were graded 0-4 on their analysis of an object in free fall. The results were

Students earning 4 points 40%  
Students earning 3 points 60%

All the students correctly labeled and described the forces involved. They also correctly stated that the downward force decreases as the velocity increases until the velocity becomes constant. However 60% of the students lost a point by failing to distinguish correctly between velocity and acceleration. These students did not have a lab because not enough students signed up for it. However, distinguishing velocity from acceleration is important enough that students should be able to experience the difference in a lecture demonstration even if they do not take the laboratory class. A motion detector would also enhance the learning experience in Physics 1A and 2A.

**Recommendation:** The department should acquire at least one audio motion detector for lecture demonstration and preferably five for the laboratory. (*Estimated cost \$75 each or 5 for \$375*)

## Facilities, Equipment, and Technology

### Facilities, equipment, and technology used by the program/department

The major facility used by the Physics department is the Astronomy Lab. The Astronomy Lab serves also as a lab for Astronomy, Biology, and Health Sciences. It has direct access to the Laboratory Storage Room, where equipment is stored that is useful for labs and lecture demonstrations. Because it is designed to be used as a lab it contains considerable storage space and twelve laboratory tables, eight of which seat two students each and four of which seat one student each.

### Adequacy and currency of these facilities, equipment, and technology

There is enough mechanics equipment available for at least three laboratory stations in Physics 11 or 1A or 2A. There is enough optics equipment for up to eight laboratory stations in Physics 11 or 1D or 2B. However, given the expectation that a class must have at least 20 students to be offered, we should have enough equipment for at least eight laboratory stations in all the physics courses that are offered. The "biggest bang for the buck" would be achieved by buying more small slotted masses. We have enough large slotted masses to set up a dozen lab stations for a large number of standard labs in mechanics. However an extensive search through the storage room only turned up enough 1, 2 and 5 gram masses for three setups. My experience with having students share small masses is that it is a good way for them to get lost. It is better to give each group the same set of masses and hold them responsible for returning all of them.

**Recommendation:** The department should acquire ten 5 gram slotted masses, twenty 2 gram slotted masses, and ten 1 gram slotted masses. (*Estimated cost \$56*)

**Recommendation:** The department should acquire five more ballistic pendulums. (*Estimated cost \$565 each. Total is \$2825*)

A rotational motion apparatus would also help in astronomy in allowing students to experience equatorial bulge as well as enhancing Physics student learning in mechanics.

**Recommendation:** The department should acquire five more rotational motion experiments. (*Estimated cost \$275 each. Total is \$1375*)

## Staffing

### Current staffing

The Physics/Astronomy department currently has one full-time faculty member, who is able to teach most of the astronomy and physics courses, and currently (Spring 2010) only one physics course is taught by a part-time instructor and one by a full time instructor. As the Astronomy and Physics programs expand it is anticipated that in the short term reliance on part-time faculty will increase.

## Conclusion and Summary

**Prioritized recommendations and needs of your program/department.**

Non-facilities needs:

Facilities needs:

1. The department should acquire at least one audio motion detector for lecture demonstration and preferably five for the laboratory. *(Estimated cost \$75 each or 5 for \$375)*
2. The department should acquire ten 5 gram slotted masses, twenty 2 gram slotted masses, and ten 1 gram slotted masses. *(Estimated cost \$56)*
3. The department should acquire five more rotational motion experiments.. *(Estimated cost \$275 each. Total is \$1375)*
4. The department should acquire five more ballistic pendulums. *(Estimated cost \$565 each. Total is \$2825)*

**Physics Success Rates  
Fall 2006 to Fall 2007**

**Percent Successful in Courses**

