Physics

Program Mission

Foster small group active learning environment in which students explore and discover the laws of physics in a state of the art laboratory. Students develop connections that link fundamental concepts in physics with phenomena covered in their Biology, Chemistry and Earth Science classes. Provide out-of-classroom experiences in space science and teacher training through WOU's membership in the NASA/Oregon Space Grant Consortium.

Learning Outcomes

1. Develop reasoning and problem solving skills as applied to scientific investigations.
2. Gain experience in combining graphical and numeric information to produce mathematical models.
3. Attain proficiency in physics theory and applications suitable for high school physics teaching.

Program Description

The role of the Physics program at Western Oregon University is primarily one of service to the majors offered within the Division of Natural Science & Mathematics. Each year Physics offers two separate three term introductory sequences (one algebra based, the other calculus based); combined they account for more than 90% of students served. Either of the two sequences fulfills the physics requirement for the Chemistry major, the Chemistry minor, the Integrated Science major, the Physical Science minor, and a host of Pre-Professional Studies majors. The Molecular/Cell emphasis within the Biology major specifically requires the calculus-based sequence. These two sequences are also one of a number of options available to both Math and Earth Science majors in order to fulfill their LACC requirements. While there is no Physics major at WOU, completion of an additional two term sequence in modern physics enables students to earn a physics minor; or with coursework in Chemistry, the Natural Science major - Chemistry/Physics option.

Key Changes Since Last Accreditation Report

Both the 1988 and 1997 Self Study Report indicated the necessity of improving two key components of Western's Physics program. Physics laboratory equipment was described as being outdated and inadequate to prepare students for the scientific challenges of the 21st Century. The 1988 document suggested a staffing increase from 2 to 2.5 FTE in order to improve the frequency and depth of upper division course offerings. The 1997 report noted that instead of increased staffing, the reduction from two to one physicist "*has made it impossible to offer the upper division coursework required in a minor program*".

The first of these deficiencies has largely been eliminated. The introductory physics lab space was redesigned and renovated during the summer of 2004. It now hosts six student lab stations, each being fully equipped with computers and interfaces, which coupled with electronic sensors, enable students to perform a wide range of introductory investigations. A separate smaller modern physics lab space was also established during the 2004 remodel. In 2003 a dependable physics laboratory

budget was created, and steady progress towards upgrading the modern physic lab equipment continues to be made.

The staffing situation remains unchanged since the 1997 Self Study document. Since 1997 two physicists have left WOU (one tenure track, one adjunct), while an interim adjunct with a degree in electrical engineering did not have his contract renewed. The current physicist is in his fifth year at Western. During these last five years, two different adjuncts (neither with degrees in physics) have taught introductory physics lab and introductory astronomy. As stated in both the 1988 and 1997 reports, additional FTE dedicated to physics is necessary to continue to offer upper level coursework, as well as to maintain high quality and continuity in the introductory sequences.

Faculty and Staff

Associate professor: William Schoenfeld

Students

Number of Majors, Minors, and Graduates by Academic Year

Academic Year	Majors	Minors	Graduates
2002-2003	0	5	0
2003-2004	1	8	0
2004-2005	2	9	0
2005-2006	2	5	1
2006-2007	2	5	1

Outstanding Student Graduates from the Past Ten Years

Holly Grimes – Natural Science major, Biology minor - 2006, 3.99 GPA, NASA/Oregon Space Grant Scholarship winner, summer 2005 NSF-REU in superconductors at William & Mary Univ., currently studying Computer Science at Portland State University

Amanda Martin – Math major, Physics minor – 2005, two time winner of NASA/Oregon Space Grant Scholarship, 2004/2005 coordinated a joint WOU/OSU NASA Reduced Gravity Experiment that was flown on the "vomit comet" from Johnson Space Center, Texas, MAT degree from Portland State University, currently teaching high school mathematics in Eugene, Oregon

SWOT Overview and the Future

Three Primary Strengths

- The physics program offers small class size with opportunities for close student-faculty interaction. Upper level students engage in personalized independent studies.
- The physics laboratory has been upgraded to create a state of the art active learning environment.
- Students have opportunities to participate in a wide range of activities through our affiliation with the NASA/Oregon Space Grant Consortium.

Action Plan for Maintenance

While the physics laboratory has been physically transformed with numerous equipment upgrades, the modernization attempts now focuses on improving curricular methods. Physics Education Research indicates that traditional modes of instruction need to be replaced with activities and assignments that promote deeper conceptual understanding with an emphasis on model building. Developing carefully guided learning activities that promote the use of graphical, mathematical, and computational tools to achieve these goals is ongoing.

WOU students have taken advantage of a number of the NASA/Oregon Space Grant Consortium (OSGC) activities available to them. Four have received scholarships, one worked on a summer grant funded by OSGC, four traveled to Johnson Space Flight Center to fly their reduced gravity experiment aboard the NASA C-9. As the new associate director of OSGC the WOU physicist actively encourage students to get involved with these programs. Newly funded programs in the past year include LaunchWOU, a high altitude balloon program, as well as a Global Climate Change Workshop for Northwest K-12 Educators to be run in conjunction with faculty from the School of Education.

Three Primary Concerns

- Lack of second physicist translates directly to an inability to offer of upper division courses and to plan for programmatic upgrades.
- High number of weekly student contact hours (typically 15-16) prevents faculty from fully engaging in scholarly and professional activities.
- Many entering and transfer students are ill prepared for the problem solving demands that a university level physics class thrusts upon them.

Action Plan for Improvement

The most urgent problem faced by the physics program is the lack of a second physicist. The addition of a second physicist would garner the resources to in principle address all three primary concerns. The physics program is caught in a classic "Catch-22" predicament. Low enrollment in upper level physics courses ensures departmental and division discussions for future hires go to disciplines other than physics. The lack of a major in physics, and regular upper level course offerings prevent the already small number of interested students from actually choosing physics. Student enrollment numbers in physics courses outside of require engineering coursework across the country have been low for many years now. So, arguing for an additional physicist has been an extremely hard sell. The strategy currently being employed to argue for a second physicist is the critical shortage of qualified high school physics teachers. Exploration for the development of a joint Teacher of Mathematics & Physics degree program is on going. Such a program would require hiring of a second physicist.

The current policy of awarding 2/3 credit for an hour of laboratory time leads to increased faculty contact hours, thereby decreasing available time for scholarly activities.

When this is coupled with the absence of a lab technician, it leads to excessive laboratory hours. Physics is fundamentally an experimental science requiring lab observation and measurement, so short of a second physicist there is no way to reduce laboratory hours.

Noting the inability of many students to "use math" to solve problems in the sciences, the physics faculty member has proposed a freshman level course that reinforces the math skills incoming freshman have, and would teach students how to use those skills to solve scientific problems. The outline of this "Contextual Mathematics" course has been examined, however without release time to develop it, and a second physicist to pick up other load, it remains just a concept.