

## PROPOSAL TO CHANGE THE ACADEMIC MASTER PLAN

Proposed Name of Degree: Bachelor of Arts/ Bachelor of Sciences in  
Applied Physics

Faculty Proposing New Program: Geoff Dougherty, Ivona Grzegorzcyk, Peter  
Smith, William Wolfe, Ching-Hua Wang

### **Review and Approval:**

Date of Proposal: \_\_\_ 28<sup>th</sup> September 2004

**Signature** of Proposer : \_\_\_\_\_ ( Geoff Dougherty)

Date of Faculty Meeting: \_\_\_ 12<sup>th</sup> October 2004  
(Please attach announcement to faculty)

Date of Consultation with Academic Affairs Administration: \_\_\_ Early September, 2004

**Signature** of Academic Affairs Administration : \_\_\_\_\_

### 1. Curriculum Committee Approval:

Curriculum Chair: \_\_\_\_\_ Date: \_\_\_\_\_

### 2. Academic Senate Approval:

Chair, Academic Senate: \_\_\_\_\_ Date: \_\_\_\_\_

### 3. Administration Approval:

President (or designee): \_\_\_\_\_ Date: \_\_\_\_\_

**1. Definition of the Proposed Degree Major Programs**

**a. Name of the proposed degree major programs, and academic year of intended implementation.**

Bachelor of Arts in Applied Physics  
Bachelor of Science in Applied Physics

**b. Name of the department, departments, division or other unit of the campus that would offer the proposed degree major program. Identify the unit that will have primary responsibility.**

Academic Affairs/Biology and Natural Sciences/Physics  
Academic Affairs/Mathematics /Physics  
Academic Affairs/Computer Science /Physics

**c. Name, title, and rank of the individual(s) primarily responsible for drafting the proposed degree major program.**

Geoff Dougherty, Professor of Physics  
Ivona Grzegorzczuk, Professor of Math  
William Wolfe, Professor of Computer Science  
Ching-Hua Wang, Professor of Biology

**d. Objectives of the proposed degree major programs.**

General Objectives:

1. To provide students with a strong undergraduate educational preparation in Applied Physics.
2. To prepare students with the fundamental concepts of Physics and the transferable skills (such as analytical thinking and problem solving, oral and written communication skills, the ability to read and understand primary technical/scientific literature, computer literacy and cooperative learning) relevant to a changing work environment.
3. To give students the opportunity to explore selected area(s) in applied physics in greater depth.
4. To provide students with hands-on exposure to laboratory research in applied physics through internships and independent research.
- 5a. The **B.S. Applied Physics program** is designed for students who wish to pursue a career in physics-related research and development either in industry or in the public sector, or to prepare students for further study in graduate or professional schools in the physical sciences or engineering.
- 5b. The **B.A. Applied Physics program** is designed for students seeking a broad foundation in applied Physics as part of a liberal education in the arts and sciences: it is particularly appropriate for students interested in such careers as teaching, public service, business, or science journalism. This program does not include the advanced study needed by students who wish to prepare for

careers as physicists, but provides the breadth needed for many other innovative and challenging occupations.

Student Outcomes:

Through these degree programs students will be able to:

1. Demonstrate an understanding of the major concepts in physics.
2. Demonstrate an appropriate level of competency in both computer and research laboratory skills.
3. Formulate hypotheses and devise and perform experiments to test a hypothesis as individuals and in a team.
4. Effectively apply current technology and scientific methodologies for problem solving in various scientific, professional and community settings.
5. Effectively use and critically evaluate current technical/scientific research literature, online information, as well as information related to scientific issues in the mass media.
6. Integrate and relate scientific knowledge learned from classroom with real life situations.
7. Communicate in written and oral forms with interested citizens and professionals on key concepts in Physics and general scientific issues.
8. Maintain life-long learning in the sciences and incorporate new information into the existing body of knowledge.

**2. Justification for the Proposed Degree Major Programs**

- a. List of other California State University campuses currently offering or projecting the proposed degree major program; list of neighboring institutions, public and private, currently offering the proposed degree major program.**

Physics is a foundational program in the CSU system, and is offered at 15 of the 23 CSU campuses. The closest CSU program is at Northridge; the closest UC program is at UC Santa Barbara. In addition, three nearby private institutions (California Lutheran University, Pepperdine University and Westmont College) offer degrees in physics.

This proposal is to offer both BA and BS degrees in Applied Physics. The proposed programs are designed specifically to have a distinct applied emphasis (with connections to the majors in Math, Computer Science and Biology, and to the local job market), rather than a theoretical emphasis.

- b. Differences between the proposed program and programs listed in Section 2a above.**

1. These programs will provide an opportunity for residents in the local area to earn a state-supported CSU degree in Applied Physics.
2. The programs are distinctive in that they will emphasize the applied nature of Physics, and its interdisciplinary applications including medical technology.

3. The programs are organized to include the lower-division core, upper-division core, service learning and capstone courses, whilst maintaining a large number of electives so that students can choose to concentrate in area(s) that particularly interest them.
4. The programs have been designed so that they can each be completed in 120 units, with the required academic rigor, which ensures that students can graduate within 4 years. This is possible because many of the courses are made available as electives, so that the student can modify the program to a large extent to satisfy his/her own needs and interests.
5. In line with the University Mission, the approach taken in these programs will be interdisciplinary. Physics concepts will be taught using examples and applications from other disciplines (e.g. practical optics will be taught in PHYS 208 The Physics of Art and Visual Perception, and wave concepts in PHYS 335 The Physics of Music). The large number of interdisciplinary courses testifies to the rich intersection of physics with other disciplines.
6. Modern applied physics can be taught using the computer and state-of-the-art software as a teaching tool. Prime examples of this are PHYS 345 Digital Image Processing and COMP 432 Computational Bioinformatics. Blackboard is in widespread use: students benefit from have a lesson plan that incorporates a variety of teaching activities, which they can access before, during and after class sessions.
7. The programs contain service learning, independent research and capstone courses (PHYS 490 Topics in Physics and PHYS 499 Senior Capstone Colloquium), all useful vehicles for incorporating community service, learning community activities and outcomes assessment.
8. One of the emphases within the B.S. program will be Medical Imaging, which corresponds with the considerable expertise of our faculty and would be facilitated by the courses already in place for the Medical Imaging Emphasis within the Biology Major. It would also have ties with the new BSIT (Information Technology) program (by virtue of the shared interest in imaging technology), and the planned Nursing program.
9. The programs are supported by local companies such as Rockwell Scientific, who see them as a local source of future applied scientists and engineers, and who have pledged to provide internships and visiting speakers: and Los Robles Medical Center, which has a continuing need to recruit medical imaging specialists.
10. The programs include an elective in PHYS 338 Science and Conscience (team-taught with faculty from the English Department), which explores the ethical responsibilities of scientists to society. This course attracts students from a variety of disciplines and incorporates learning community activities.

11. The BS program facilitates students who are interested in doing a double major with Math, Computer Science or Biology by using many courses which are cross-listed with these disciplines: the B.A. program allows students to do a double major with non-science programs such as Business or Art.
12. The programs are strongly computer-oriented and are expected to draw on a different population than other physics programs in the region/state.
13. The programs are designed to constantly engage students as well as faculty to the real issues and concerns of the local communities and the rest of the world through learning community activities, inviting guest lecturers with special experiences and global perspectives, communicating and exchanging with professional scientists.

**c. Professional uses of the proposed degree major programs.**

About 75% of physics graduates work in science-related jobs, including software, engineering, high school teachers, and managers in technical fields, while the remainder successfully cross into a myriad of occupations which value their numeracy and logical approach to problem-solving.

The BA program in Applied Physics offers preparation for careers in teaching or for careers which combine physics with other disciplines. Careers along both these avenues are in demand locally.

The BS program in Applied Physics offers preparation for careers in industrial and public-sector research and development in such areas as physics, engineering, medical physics, imaging technology, computer science and energy resource management; and for graduate work in physical science or related subjects such as medicine. Such careers are in demand locally. Specialization in various applications can be accomplished by the appropriate selection of electives. Initiatives are underway with other universities to facilitate our graduates in progressing on to postgraduate courses.

**d. Community/Regional/Statewide need for the proposed programs.**

1. Due to the rapid growth of science and technology based industries locally and nationally, there is a tremendous need for people with a strong training in science, transferable skills and a cross-disciplinary outlook.
2. Locally, CSUCI is located in the center of the high-tech corridor in the Ventura County and near several military bases, which have a high demand for employees with scientific and technological grounding. Due to the high cost of living in Ventura County, companies are concentrating on looking for local graduates.

3. Regionally, CSUCI is one of the CSU campuses within Southern California, which has the largest clusters of high-tech, military and national security services. High-tech companies in this region are experiencing a severe shortage of people with training in science/technology and in medical technology.
4. The program is interdisciplinary in nature and will strengthen and enhance the offerings of existing programs.
5. There have been a number of enquiries from the local community colleges about the possibility of doing a degree in Physics at CSUCI, rather than having to travel further afield or incur large expenses.
6. The program is expected to generate outside funding in the form of grants and contracts, hence bringing additional resources to the university.

**e. The expected number of majors in the year of initiation and three years and five years thereafter. The expected number of graduates in the year of initiation and three years and five years thereafter.**

	<u>Number of Majors</u>	<u>Number of Graduates</u>
Initiation Year	8 – 12	0
Third year	12 -16	6 - 8
Fifth year	20 - 25	10 -14

**3. Resources Needs for the Proposed Degree Major Programs (faculty, instructional, library, other)**

**a. Existing.**

- One tenured physics faculty member with five affiliated faculty from mathematics and computer science
- An undergraduate Physics teaching Lab with computers
- Some library resources

**b. Future.**

The Physics program currently only has one faculty member and relies on adjunct lecturers to assist in meeting its current commitments. CSUCI is committed to supporting Physics as a subject area, and to hiring new faculty members. The number of new courses required to implement these programs is very modest: some upper division courses will be offered in alternate years.

Since all students are going to be technology literate, some of the courses (or parts thereof) could be offered on-line. This would give an opportunity for local working professionals to participate in the programs.

The programs require no additional lecture or laboratory space to initiate and sustain them over the next five years beyond the existing facilities in the Science Building, and the future facilities earmarked in the Science Annex (viz., two Physics labs and access to additional classrooms).

No additional library resources needed above the existing CSUCI Library acquisition program. The faculty is working with the Library staff to assure an appropriate level and subject distribution of library resources.

The expected CSUCI budget, state support and the standard lab fees will be able to cover the normal operational expenses. Group II funds from the Science Annex building will be used to purchase equipment needs for the first two years after initiation of the program.