



SACRAMENTO STATE

Program Proposal Form B



Academic Group (College): Natural Sciences and Mathematics	Date of Submission to College Dean: October 21, 2008
Academic Organization (Department): Physics and Astronomy	Requested Effective: Fall <input checked="" type="checkbox"/> , Spring <input type="checkbox"/> , 2009.
Department Chair: Gary Shoemaker	Contact if not Department Chair: Vera Margoniner
Title of the Program (Please be specific; indicate minor, undergraduate or graduate degree, etc.): Teacher Preparation Concentration	

Type of Program Proposal:

- _____ **Modification in Existing Program:**
- ___ Substantive Change
 - ___ Non-Substantive Change
 - ___ Deletion of Existing Program

- _____ **New Programs**
- ___ Initiation (Projection) of New Program on to Master Plan
 - ___ New Degree Programs
 - ___ Regular Process
 - ___ Fast Track Process
 - ___ Pilot Process
 - New Minor, Concentration, Option, Specialization, Emphasis
 - ___ New Certificate Program

PLEASE NOTE: Form B is to be used only as a Cover Form. Additional information is requested for each of the above as noted in the corresponding procedure in the Policies and Procedures for Initiation, Modification, Review and Approval of Courses and Academic Programs found at <http://www.csus.edu/umannual/acad.htm>

Briefly describe the program proposal (new or change) and provide a justification.

The Department of Physics and Astronomy proposes to create a "Teacher Preparation Concentration" as an option under our current Bachelor of Arts Degree in Physics. The reason for developing the concentration at this time is to increase the number of our majors pursuing a career in the teaching of science in middle and high schools. California State University, Sacramento is committed to strengthening the quality of STEM (Science, Technology, Engineering and Mathematics) research and education in our state, and the preparation of well-qualified teachers is key to assuring the success of this initiative. Our specific goal is to develop a comprehensive career tract for our majors including recruitment, financial support, and professional growth of future physics teachers. The curriculum that is proposed is based on the subject matter content preparation required by the California Commission on Teaching Credential (CCTC) for the Single Subject Credential in Science with an emphasis in Physics. The Credential qualifies a teacher to teach all general science courses in grades 8th – 12th and all levels of physics typically offered in high school. Students will complete a newly proposed concentration that will be listed under the existing BA Major Program in Physics. This Concentration will not affect the required upper division core units (22-23 units) in the existing BA Major Program in Physics including the Senior Project. However, the Concentration does recommend some additional lower division units in Biology, Astronomy, and Geology, and requires participation in professional teaching related activities, ideally starting early in their academic program.

Approvals:

Department Chair: Mary H. Shoemaker **Date:** 12/3/08

College Dean: Laurel Hopper **Date:** 12/9/08

University Committee: _____ **Date:** _____

Associate Vice President and Dean for Academic Affairs: _____ **Date:** _____

1. **Form B is attached.**
2. **Name of the campus submitting the request, the full and exact title of the proposed aggregate of courses, and whether it is an option, concentration, special emphasis, or minor.**

California State University, Sacramento
Department of Physics and Astronomy
Concentration: Teacher Preparation Concentration

3. **Full and exact title of the degree major program under which the aggregate of courses will be offered.**

A student will satisfy the requirements for the Teacher Preparation Concentration in conjunction with the Bachelor of Art in Physics.

4. **Options, concentrations, or special emphases already existing under the degree major program for which the new aggregate of courses is proposed.**

None.

5. **Department(s) to offer the aggregate of courses and name of contact person.**

Department of Physics and Astronomy
Contact: Gary Shoemaker, Chair
Vera Margoniner, Coordinator for the Teacher Preparation Concentration

6. **Purpose of the proposed aggregate of courses.**

There is a shortage of qualified teachers at the elementary and secondary levels in California and in the nation generally. WestEd, a nonprofit education research group in San Francisco, analyzed data from the 2005/06 school year on student enrollment and teacher retirements and showed that Sacramento county alone will need to hire about 7,000 teachers in the next 10 years. This number represents 58% of the current workforce of about 12,000 K-12 teachers. To add to the problem, the number of teacher credentials issued by California is decreasing. The trend can be seen right here on our campus, where in the last three years, there has been a 12% decrease in the number of teacher credentials issued.

The problem of scientific illiteracy has been acknowledged by many, and the lack of qualified science teachers makes the problem very hard to solve. In fact, the National Science Foundation's 2007 report "A National Action Plan for Addressing the Critical Needs of the U.S. Science, Technology, Engineering, and Mathematics (STEM) Education System" identified the STEM teacher supply as one of two central challenges. The action plan emphasizes "preparing STEM teachers to teach STEM content effectively" and "providing resources for the preparation of future STEM teachers."

The Department of Physics and Astronomy, with the goal of increasing the number of our majors pursuing a career in the teaching of science in middle and high schools, proposes to

create a Teacher Preparation Concentration as an option under our current Bachelor of Art Degree in Physics. Our specific goal is to grow a comprehensive career tract for our majors including the recruitment, financial support, and professional growth of future science teachers with an emphasis in physics.

7. Need for the proposed aggregate of courses.

The curriculum that is proposed is based on the subject matter content preparation required by the California Commission on Teaching Credential (CCTC) for the Single Subject Credential in Science with an emphasis in Physics. The Credential qualifies a teacher to teach all general science courses in grades 8th – 12th and all levels of physics typically offered in high schools.

The Concentration will not affect the required upper division core units (22-23 units) in the existing BA Major Program in Physics including the Senior Project. However, the Concentration requires some additional lower division units in Biology, Astronomy, and Geology and encourages participation in professional teaching related activities, ideally starting early in their academic program. At the time of graduation, the student will be prepared to take the three exams that are required by the state of California for a teaching credential in science with emphasis on Physics; and will be eligible to enter a teacher credential program.

8. List of the courses, by catalog number, title, and units of credit, as well as total units to be required under the proposed aggregate of courses.

A. **Required lower division courses:** same as for BA degree in Physics (37 units), with the addition of 5 other courses listed below (15 units).

Course Number	Course Name	Units
BIO 001	Biodiversity, Evolution and Ecology	5
ASTR 004	Introduction to Astronomy	3
GEO 010	Physical Geology	3
GEO 010L	Physical Geology Lab	1
PHYS 030	Science and Pseudoscience	3
Lower division requirements for BA degree in Physics	CHEM 1A; CHEM 1B MATH 30; MATH 31; MATH 32; MATH 45 PHYS 11A; PHYS 11B; PHYS 11C	37
Total lower division units		52

B. **Required upper division courses:** Same as for BA degree in Physics (22-23 units)

C. **Elective upper division requirements:** The upper division elective requirements will be customized to meet the needs of the individual students in consultation with an advisor in the department as they prepare for a career in the teaching of physics. Elective options are: upper division physics and astronomy courses drawn from our menu of BA elective

courses; PHYS 195; and/and PHYS 197. Those two last elective options were developed for the concentration and are detailed next. (6 units)

D. **Total number of units required for the concentration:** 80-81 units

9. **New courses to be developed. Include proposed catalog descriptions and course classifications.**

PHYS 195. *Teaching Internship.* Supervised teaching internship for a high-school physics class, or for one of the following courses: PHYS002, 005A-B, 010, 011A-B-C, 107, or ASTR004. The student will meet weekly with the faculty teaching this class, and with their supervisor/mentor to help prepare and teach the class. **Prerequisites:** Completion of all math and physics lower division courses required for the B.A. in Physics. Approval from the *Teacher Preparation Concentration* Coordinator. **Graded:** Graded Student. **Units:** 1.0-2.0.

PHYS 197. *Laboratory Teaching Assistant.* Student will be a supervised laboratory teaching assistant for one of the following courses: PHYS002, 005A-B, 010, 011A-B-C, 107 or ASTR006. The student will meet weekly with the faculty teaching this class, and with their supervisor/mentor to help prepare and teach the laboratory. **Prerequisites:** Completion of all math and physics lower division courses required for the B.A. in Physics. Consent from the *Teacher Preparation Concentration* Coordinator. **Graded:** Graded Student. **Units:** 1.0-2.0.

10. **List of courses, by catalog number, title, course classification, and units of credit as well as total units to be required for the major in which the proposed aggregate of courses is to be included. Show a two-year scheduling pattern of these courses and indicate the number of additional courses and sections of classes that will be required to implement the program.**

Please see the current 2006-2008 Catalog for a complete listing of courses. A summary of requirements for the BA degree in Physics and for the BA degree in Physics with Teacher Preparation Concentration is showed side-by-side.

Bachelor of Arts in Physics

Required Lower Division (37 units)

Chemistry 1A, 1B (10 units total)
Math 30, 31, 32 (12 units total)
Math 45 (3)
Physics 11A, 11B, 11C (12 units total)

Bachelor of Arts in Physics with Teacher Preparation Concentration

Required Lower Division (52 units)

Astronomy 4 (3 units)
Biology 1 (5 units)
Chemistry 1A, 1B (10 units total)
Geology 10 (3 units)
Geology 10L (1 unit)
Math 30, 31, 32 (12 units total)
Math 45 (3)
Physics 11A, 11B, 11C (12 units total)
Physics 30 (3 units)

Bachelor of Arts in Physics (Continued)

**Bachelor of Arts in Physics with Teacher
Preparation Concentration (Continued)**

Required Upper Division Core (22-23 units)

Required Upper Division Core (22-23 units)

Physics 105 – Mathematical Methods (3)
Physics 106 – Modern Physics (3)
Physics 110 – Classical Mechanics (3)
Physics 115 – Electronics and Instrumentation
(4) or Physics 145 – Optics (3)
Physics 124 – Thermodynamics and Statistical
Mechanics (3)
Physics 135 – Electricity and Magnetism (3)
Physics 175 – Advanced Physics Laboratory
(2)
Physics 191 – Senior Project (2)*

Physics 105 – Mathematical Methods (3)
Physics 106 – Modern Physics (3)
Physics 110 – Classical Mechanics (3)
Physics 115 – Electronics and Instrumentation
(4) or Physics 145 – Optics (3)
Physics 124 – Thermodynamics and Statistical
Mechanics (3)
Physics 135 – Electricity and Magnetism (3)
Physics 175 – Advanced Physics Laboratory
(2)
Physics 191 – Senior Project (2)*

Upper Division Electives (6 Units)

Upper Division Electives (6 Units)

Physics 115 or 145, whichever not used above
for core requirements.
Physics 116 – Advanced Electronics and
Instrumentation (3)
Physics 130 – Acoustics (3)
Physics 136 – Electrodynamics of Waves,
Radiation, and Materials (3)
Physics 142 – Applied Solid State Physics (3)
Physics 150 – Quantum Mechanics (3)
Physics 151 – Advanced Modern Physics (3)
Physics 156 – Advanced Classical Physics (3)
Physics 162 – Computational Physics (3)
Physics 195 – Teaching Internship (1-2 units
per semester; 4 units maximum)
Physics 196 – Experimental Offerings in
Physics (1-3 units per semester; 4 units
maximum)
Physics 197 – Laboratory Teaching Assistant
(1-2 units per semester; 4 units maximum)
Physics 198 – Co-curricular Activities (1-3
units per semester; 4 units maximum)
Physics 199 – Special Problems (1-3 units per
semester; 4 units maximum)

Physics 115 or 145, whichever not used above
for core requirements.
Physics 116 – Advanced Electronics and
Instrumentation (3)
Physics 130 – Acoustics (3)
Physics 136 – Electrodynamics of Waves,
Radiation, and Materials (3)
Physics 142 – Applied Solid State Physics (3)
Physics 150 – Quantum Mechanics (3)
Physics 151 – Advanced Modern Physics (3)
Physics 156 – Advanced Classical Physics (3)
Physics 162 – Computational Physics (3)
Physics 195 – Teaching Internship (1-2 units
per semester; 4 units maximum)
Physics 196 – Experimental Offerings in
Physics (1-3 units per semester; 4 units
maximum)
Physics 197 – Laboratory Teaching Assistant
(1-2 units per semester; 4 units maximum)
Physics 198 – Co-curricular Activities (1-3
units per semester; 4 units maximum)
Physics 199 – Special Problems (1-3 units per
semester; 4 units maximum)

**It is expected, but not required, that the Senior Project for students enrolled in this concentration will be related to developing an understanding and/or knowledge about the teaching of science based upon guidelines established in the Department.*

The upper division elective requirements will be customized to meet the needs of the individual students in consultation with an advisory in the Department as they prepare for a

career in the teaching of physics. Physics 195 and Physics 197 will be strongly encouraged for students in the Teacher Preparation Concentration.

Additional courses required to implement the program: Physics 195 and 197.

Two-year schedule:

- PHYS 195 and PHYS 197 will be available each semester.
- BIO 001; ASTR 004; GEO 010; GEO 010L are General Education courses offered every semester.
- PHYS 030 is offered every Fall semester.
- All other courses are part of the required and elective courses for the BA degree in Physics.

The availability of courses will in no way delay the graduation of our students.

11. List of all present faculty members, with rank, appointment status, highest degree earned, date and field of highest degree, and professional experience, who would teach in the proposed aggregate of courses.

Physics 195 and Physics 197 will likely be taught by Prof. Vera Margoniner. Other members of the faculty, such as Prof. Lynn Tashiro also have the expertise to teach these courses at any moment. All other required courses are part of the B.A. in Physics degree currently in place.

Burki, Jerome, Ph.D. Assistant Professor
Expertise: Nanophysics, theoretical condensed matter, computational tools.

DeGraffenreid, William, Ph.D. Associate Professor
Expertise: Laser spectroscopy, atomic physics, instrumentation, scientific professionalism.

Mahajan, Sukhbir, Ph.D. Professor
Expertise: Elementary particle physics, environmental noise, energy conservation in buildings.

Margoniner, Vera, Ph.D. Assistant Professor
Expertise: Extragalactic astronomy and observational cosmology.

Ndlela, Zolili, Ph.D. Associate Professor
Expertise: Experimental solid state physics, electronic transport measurements, laser physics.

Partovi, Hossein, Ph.D. Professor
Expertise: Theoretical physics, economic theory.

Phelps, James, Ph.D. Professor
Expertise: Experimental atomic physics, optics.

Sergan, Tatiana, Ph.D. Assistant Professor
Expertise: Liquid Crystals.

Sergan, Vassili, Ph.D. Associate Professor
Expertise: Physics of anisotropic fluids and ordered layers. Application to liquid crystal devices.

Shoemaker, Gary, Ph.D. Professor and Department Chair
Expertise: Experimental gravitational physics, theoretical physics, biophysics.

Tashiro, Lynn, Ph.D. Professor
Expertise: Science education, laser spectroscopy, nonlinear optics.

Taylor, Chris, Ph.D. Assistant Professor
Expertise: Astronomy, astrophysics, radio astronomy.

Urone, Peter, Ph.D. Professor
Expertise: Low-energy experimental nuclear physics, medical physics.

12. Indicate according to the questions below the resources needed to implement the program change.

a) How will the above changes be accommodated within the department/College existing fiscal resources?

The projected size of this program concentration is likely to average around 8 students total at any time, resulting from two students per year entering the program. Almost all of the changes proposed can be accommodated within existing resources. The Physics 195 and 197 courses will require a program coordinator to supervise and evaluate the students. It is expected that about 4 students would be involved in this course during any given semester. Some administration of the program would also be required, particularly in the first few years to get the program started and to create and put in place the necessary coordination and recruitment, placement and supervision work in schools, and preparing students to take the required state credentialing exams. We believe that 3 WTUs of release time per semester would be adequate to manage the duties of a program coordinator appointed for the initial phase of the program. Maintenance of the program beyond the initial phase will probably require less release time but is difficult to estimate at the present time.

b) If the proposed changes will require additional resources, describe the level and nature of additional funding the College will seek.

We are receiving external support for the first year of this program for release time for the concentration coordinator of 3 WTU per semester. There are good prospects for continuing outside support once the program is established. However, in the worst-case scenario, we may require 1-2 WTU per semester of release time from the College of Natural Sciences and Mathematics after the first year. Note that the *Professional Experiences* courses (Physics 195 and 197) could be used to cover, in part, our instructional expenses for certain lower-division laboratory courses and thus offset the additional expenses for funding the proposed program coordinator

c) What additional space, equipment, operating expenses, library, computer, or media resources, clerical/technical support, or other resources will be needed? Estimate the cost and indicate how these resource needs will be accommodated.