UNIVERSITY OF WISCONSIN-WHITEWATER
FIVE YEAR REVIEW (1997-2002) OF THE BACHELOR OF SCIENCE/BACHELOR OF ARTS DEGREE IN PHYSICS

Prepared July 2002

I. Academic Assessment

A. Highlights/Initiatives

1. *Overview* The Physics curriculum is now divided into four distinct emphases, although approval of the Engineering emphasis was obtained in November 2001 so that no assessment of its efficacy can be made at this time. The four emphases are:

a. Graduate School: The coursework emphasizes preparation in mathematics and physics concepts to prepare the student to understand and excel in graduate level courses. Students also receive training in laboratory techniques to prepare them as future experimental scientists.

b. Industry: The coursework is aimed at preparing the student for a career in industrial research and development. Besides a core of physics major courses the student is required to take introductory chemistry, computer programming (FORTRAN), economics, and accounting.

c. Engineering: The coursework is aimed at preparing the student for admission into a school of engineering or for an entry-level engineering position. The engineering mechanics two course sequence replaces the physics theory oriented mechanics course. The course sequence is arranged so that most students can finish the basic courses required for admission into engineering school in their first two years at UW-Whitewater. The student can then decide to transfer or to remain here and complete a physics degree. There is also a 3-2 agreement with UW -Milwaukee whereby students in the engineering emphasis can obtain degrees from both institutions in just five years.

d. Education: The coursework is aimed at preparing the student for teaching physics in a secondary school. The students must complete licensure courses in the College of Education as well as 34 credits in physics. Students can also choose from the General Science -Broadfield Physical Science and General Science -Broadfield Physics emphases that combine physics coursework with courses in other disciplines to complement the licensure courses. Students interested in elementary education can choose the General Science Elementary minor that includes 5 credits of physics and/or astronomy.

2. *Assessment Initiatives* In this document we report the first results from the implementation of the Major Field Test administered by Educational Testing Services. This test allows comparison of our students with peers across the country. In a new curriculum initiative approved November 2001, the PHYSCS 489 *Physics Senior Seminar* course has been expanded to 2 credits to allow for review of prior coursework and mandates the MFT as the final exam of the course. The change is effective spring 2003. Yearly data from this test will be very helpful in evaluating how well the program trains students in physics theory.

3. Advisement Reports. The physics program's Advisement Reports are attached as Appendix A.

B. Educational Objectives and Assessment Techniques

1. *Program Objectives* The following are the subject matter, cognitive development, and skill objectives for the three emphases that were in place during the period of this review. These goals were adapted from the 1994-95 Physics Department Assessment Report.

a. Graduate School Emphasis

Key goal: Prepare the student to succeed in graduate school.

i. Subject matter: Understand the basic theoretical concepts of physics and be able to apply the necessary mathematical tools to make correct predictions and interpretations.

ii. Cognitive development: Be able to formulate a physical problem in mathematical terms and arrive at an appropriate solution.

iii. Skills: Design experimental arrangements with an understanding and appreciation of the feasibility and reliability of the experimental outcomes.

b. Industry Emphasis

Key goal: Prepare the student to succeed in industrial research and development.

i. Subject matter: Understand the basic theoretical concepts of physics as well the basic concepts of business economics.

ii. Cognitive development: Be able to formulate a physical problem in mathematical terms and arrive at an appropriate solution.

iii. Skills: Design experimental arrangements with an understanding and appreciation of the feasibility and reliability of the experimental outcome. Acquire proficiency in the FORTRAN computer programming language.

c. Education Emphasis

Key goal: Prepare the student to teach high school physics.

i. Subject matter: Understand the basic theoretical concepts of physics and their application to everyday life.

ii. Cognitive development: Be able to formulate a physical problem in mathematical terms and arrive at an appropriate solution.

iii. Skills: Be able to use a broad range of laboratory equipment for the student laboratory. Be able to make classroom demonstrations of physical phenomena.

2. *Data Collection* The data collection techniques that are used to determine if the program has been successful in achieving the desired outcome for each objective above remain rather rudimentary.

a. A post-graduation questionnaire was deferred in 1994 to allow physics participation in a university-wide survey. That survey apparently never materialized as a useful assessment tool.

b. Occasional reports of our graduates' activities give some indication of their successful vocational preparation but are more anecdotal than quantitative. Successful completion of the PHYSCS 489 *Physics Senior Seminar* course indicates the acquisition of skill in understanding professional physics literature and in making technical presentations. However, these are not key skill objectives for any track, and it is not clear whether an "A" in the course means the student is well prepared for their vocation. The utility of the PHYSCS 489 *Physics Senior Seminar* course as an assessment tool will greatly increase when it is expanded to include a review of all undergraduate physics material and culminates in the Major Field Test.

c. In the 1999-2000 annual report it was proposed that the department attempt a combination of exit interviews, GRE scores, and contact-intensive longitudinal studies of graduates one and five years after their departure from Whitewater for assessment purposes. Such studies have not been initiated to date.

d. The department has initiated a plan to collect information useful for assessing a student's development during their time at UW -Whitewater. The plan consists of assembling a portfolio for each physics major that consists of three kinds of items: (i) An initial advising sheet on which the student indicates their educational and career objectives, (ii) A copy of a paper, project, exam, homework assignment, etc. that represents the student's best work in a major-related course for each semester they studied at UW -Whitewater, and (iii) a 25 question exit interview to be given to them during their final semester before graduation. The plan was approved in fall 2001 and implementation began immediately with the distribution of the advising sheets listed in (i) above to each physics major at or near the beginning of their studies.

If some portfolios are successfully assembled then this effort should yield some useful information about how the physics program (as opposed to the individual student) can be improved. For instance, if a large percentage of portfolios show a decline in the quality of work over the students' careers, we might conclude that the upper level courses aren't helping our students develop themselves academically. If common themes of criticisms appear in the exit interviews (such as certain courses the students felt were unhelpful or courses they wish were available), programmatic changes can be made in response to them. If there is little correlation between what career students say they wish to pursue as incoming freshmen with what they say they will pursue as graduating seniors, we might begin a careful evaluation of our career advising efforts.

e. The single most helpful assessment indicator for the period of review is the Major Field Test administered to five physics seniors in spring of2000. The results of that test are discussed in section C below.

3. *Course Relations* See Appendix B for the relationship between the physics undergraduate courses and the student outcome based educational objectives listed above.

4. Graduate Courses See Appendix B 1 for a list of dual-level courses in physics and astronomy along with a description of the requirements for graduate credit.

No students have taken any physics or astronomy course for graduate credit since before 1997. Furthermore, little documentation exists on how course content, pedagogical processes, assignments, etc. create different educational experiences for graduate and undergraduate students. Procedures similar to those listed under the astronomy courses would most likely be applied to the other dual-listed courses but these requirements have not been included in course syllabi as they ought to have been.

C. Assessment Data

1. *Summary* The best assessment data available regarding student outcomes in the areas of content knowledge and cognitive development comes from the results of the Major Field Test *Physics II* administered by Educational Testing Service and given to five physics seniors on May 10, 2000. The test was given as the final examination for the PHYSCS 489 *Physics Senior* Seminar course. Prior to that the students had completed weekly multiple-choice homework assignments taken from practice Graduate Records Examinations in order to review the undergraduate curriculum and prepare them for the MFT. ETS reported the test results and broke them down by student and by subject matter. The scores were then compared against other institutions around the nation that gave the identical exam.

Results of the Spring 2000 Major Field Test
Administered to senior physics majors

Description	Percent Below
Overall Score	53
Level of Difficulty:	
Introductory Physics	80
Advanced Physics	47
Subject Matter:	
Classical Kinematics and Dynamics	40
Electricity and Magnetism	93
Thermodynamics	67
Quantum Mechanics	40
Special Topics	47

The results indicate that the five students who took the test in spring 2000 scored above average when compared with their peers around the country. When one takes in to account that top-ranked schools also participate in the exam, the results are quite encouraging. The best student of the five scored higher overall than 85% of his peers around the nation! The other scores were at 79%, 55%, 52%, and 6%. While the statistical sample is quite small, the first implementation of this exam is encouraging evidence that the UW -Whitewater program is doing a solid job of training the students in the subject matter and in cognitive development.

Because the above results are from a single test of five students, no programmatic changes are recommended based upon them until future tests confirm strengths and weaknesses of our curriculum. However, some preliminary comments can be made for the record. The students seemed to do best in Electricity and Magnetism, possibly because three of the five were concurrently enrolled in PHYSCS 320 *Electricity* & *Magnetism I* and the material was fresh in their minds. Dr. Menningen has taught that course since 1996 and has worked at improving its content and pedagogy as well. The students were weakest in classical and quantum mechanics. The faculty agree that the PHYSCS 310 *Mechanics I* course needs improvement, although there

is not presently agreement about how to change it. The course content is both challenging and rather dry an uninteresting, a recipe for diminished pedagogical success. The course has been taught with various different instructors over the past few years, undermining continuity and preventing the successive improvements that a single instructor would make if he/she taught the course multiple times. The course title suggests that it once was the first in a two-course series, and as a single course it usually fails to cover Lagrangian and Hamiltonian mechanics, material that is covered on the MFT. Possible avenues for improving this course need to b considered carefully, especially if UWW students were to perform below average in this section of the MFT again. No quantum mechanics course is offered at UW-Whitewater. Instead, the material is taught together with other topics in our PHYSCS 410 *Modern Physics I* and PHYSCS 412 *Modern Physics II* courses. Combining course topics may diminish the depth of coverage of quantum mechanics, leading to the lower scores on the exams.

Another difficulty is that the Modem Physics courses are not required for any physics major, and a number of students graduate without taking one or both of the courses (despite the encouragement of faculty advisors to take them). Curricular changes for this course sequence should also be considered, especially if future MFT scores reveal the same weakness and especially after a tenure-track faculty member is hired to teach the modem physics sequence. The search for such a person failed in spring 2002 and an academic staff member will teach it in the 2002-2003 academic year.

A second set of assessment data comes from occasional correspondence by previous students indicating their vocational activities and usually communicating gratitude for the solid preparation they receive from UW-Whitewater. Such information could become a way of assessing job placement rates and the adequacy of vocational preparation for physics graduates. However, such a detailed study has not been undertaken to date.

D. Program Improvement Resulting from Assessment Efforts

1. *Curriculum* There have recently been some important changes in the department curriculum. In 2001 three new courses were added: PHYSCS 100 *Energy,* PHYSCS 110 *Light and Color*, and PHYSCS 150 *From Einstein to Star Trek.* These were added to give students more choices in general education physics courses and not to address any deficiencies perceived through assessment data.

   A new major emphasis, Physics Engineering Emphasis, was added to the program as well. This gives students more options in their preparation for a career in engineering, allows for the introduction of a 3-2 agreement with UW Milwaukee, and encourages some students to stay who might otherwise transfer to an engineering school after two years. The emphasis was created out of a perception of sub-standard service to pre-engineering students, and not as a response to any assessment data.

   Most importantly, the PHYSCS 489 *Physics Senior Seminar* course was revised and expanded to two credits. This allows for both training students not only in understanding the professional literature and making presentations but also in reviewing the undergraduate curriculum in preparation for the Major Field Test. The change improves the course as a capstone for the major because the one credit version offered previously left little time for topical review and homework discussion. It also aids the department in its assessment because the Major Field Test is now mandated as the final exam for the course, and the enhanced preparation for the exam should make the results an accurate reflection of the adequacy of student preparation in the subject matter and in cognitive development.

Assessment objectives The assessment objectives have not changed substantially and ought to be reviewed by the department. They should be focused better on student outcomes than they are at present.

Data collection techniques/processes The major change here is the introduction of the Major Field Test, as outlined above. Regular implementation of this exam in the Physics Senior Seminar course beginning spring 2003 should provide helpful assessment data in the years to come.

In summary, important changes have been made but they have not been linked to the assessment data, both because little assessment data has been collected and the best data is preliminary. Once more students have taken the exam and the statistical sample becomes larger, some trends can be identified and responses formulated from them.

2. *Assessment Responses* The most recent Audit and Review Evaluation Report is from 1992-1993 and doe not contain recommendations relative to assessment. The last assessment report available was prepare in May 1995. It contained two proposed actions *for* program improvement: (a) required participation in the PHYSCS 489 Physics Senior Seminar course, and (b) the hiring of two new tenure-track faculty to expand research opportunities *for* students. The first has been implemented, as the senior seminar course is required *for* graduation in each track of the program. The second was also implemented, as Elizabeth George and Ken Menningen were hired in fall 1995 and immediately began involving undergraduate students in research. The spring 2000 annual report also contains an assessment section.

E. Information Shared with Constituencies

1. The results of the Major Field Test have only been shared with departmental faculty. The occasional communications from alumni have been shared in a newsletters that have been published every two years. During the period of this review newsletters have been written in spring 1998 and spring 2000. In addition, during the 2000-2001 academic year the physics department began assembling an Advisory Board consisting of representatives from schools and industries outside of UW-Whitewater. The purpose of the board is to give the department advice and suggestions about its mission and methodologies from an objective, external perspective. We hope the Advisory Board will make the department more sensitive to the interests of prospective employers of our students, will enhance our vision and refine our goals, and possible lead to improvement in our physical resources. At this time a list of names has been assembled but no meeting has yet been held.

Strategic Purposes and Performance

A. Centrality

1. The Physics Department is central to the mission of UW-Whitewater as stated in the catalog (http://www.uww.edu/catalog2000/Intro/4mission.html):

   - University of Wisconsin System Mission: The physics department extends the knowledge of students in the principles of physics and develops in them heightened intellectual sensitivity as well as scientific, professional, and technological expertise. The physics department is active in public outreach designed to educate people and encourages students to participate.

   - Core Mission of the University Cluster Institutions: The physics department offers several baccalaureate degrees, emphasises teaching excellence and service to students, provides liberal

studies in the sciences to nonmajors, offers pre-professional training to students in engineering and optometry, expects scholarly activity of its faculty, and participates in an interinstitutional relationship with UW -Milwaukee (the 3-2 engineering agreement) to help satisfy missions a, b, c, d, e, and g.

- Select Mission of the University of Wisconsin- Whitewater: The physics department offers a unique undergraduate program, provides graduate classes for teachers, expects scholarly activity of its faculty, and provides public outreach activities to help satisfy missions a, b, c, and g.

The physics department supports the goals of the UW-Whitewater Strategic Plan as stated on the web page htm://www.uww.edu/Admin/s!mlan/contents.htm by encouraging undergraduate research (goals l.1a and 6.3a), providing extensive and timely academic advising information (goals l.1b and 1.1e), emphasizing active learning strategies in the classroom (goal 1.1c), reviewing faculty teaching frequently (goal l.1d), assessing student progress by the Major Field test (goall.3a), encouraging student involvement in research (goals 1.3b and 1.3c), training students in critical thinking and problem solving (goal l.4a), and providing frequent colloquia and lectures to supplement classroom instruction (goal l.4d). The department provides a high quality curriculum that is continuously reviewed and clearly communicates degree requirements (goals 2.1a through 2.1d). It has remodeled labs, built computer labs, and upgraded or replaced aging equipment to enhance the quality of instruction (goals 2.3b and 2.3f). The department has worked hard to recruit a diverse group of dedicated instructors who are reviewed regularly (goals 3.la through 3.ld, 3.lh, and 4.2b). It has created a number of outreach events and activities for the community, including special guest lectures open to the public and hologram workshops for elementary schools (goals 5.lf, 5.lh, 5.li, and 5.2b). Finally, the department actively recruits academically talented students and provides scholarships to reward academic excellence (goal 6.lb).

2. The Physics Department is most closely tied with the Mathematical and Computer Sciences Department because is both the most fundamental and the most mathematically intensive of the science majors. It is not uncommon for math majors to become physics majors and vice versa, and double majors in physics usually declare math as their second major. Applied mathematics courses appropriate for physics students are offered regularly by the math department, and the physics department provides second major, minor, or elective courses for math majors wishing to enhance their applied mathematics skills. A physics faculty member (P. Rybski) has been collaborating with a math faculty member in scholarly research activities. In the near future at least two joint positions will be created to strengthen the ties between the two departments.

   The physics department supports the students majoring in any of the sciences by coordinating the scheduling of classes to provide introductory and advanced physics courses at convenient times. The science departments share specialized equipment, from sling psychrometers and other small equipment to the x-ray diffraction and electron microscopy facility in the basement of Upham Hall. The science departments cooperate in providing general education courses and courses to support broadfield science majors. Safety education and pre-professional health sciences are also supported by the physics department's course offerings. Physics and astronomy courses are offered for those preparing to teach at either elementary or secondary schools. The department is an indispensable part of the science program at UW –Whitewater.

B. Goals and Objectives

1. Several goals and objectives for the physics department were outlined in the previous audit and review report:

a. The primary objective of the physics department is to provide high quality instruction to students of physics, irrespective of their level and motivation.

- This instruction prepares majors and minors for graduate school, engineering school, industrial jobs, and teaching, while grounding nonmajors in the fundamental principles of physics in an accessible and engaging manner.

- Within the general studies program, this instruction provides hands-on experience in scientific methods, critical thinking and reasoning, use of computers, and laboratory experimentation.

- This instruction reflects current knowledge of the physical universe and improves scientific literacy.

b. A second objective of the department is to encourage students and faculty to participate in research activities either on or off campus. This objective is intended to increase both breadth and depth of knowledge in physics, to train students as future scientists, and to stimulate excitement in both students and faculty.

c. A third objective is to actively encourage women and minorities to major or minor in physics, physics education, or engineering to help provide better balance in the disciplines while serving the national need for more qualified scientists.

d. There were some specific goals outlined in the last audit and review report:

i. Nurture an internship program for physics industry emphasis majors.

ii. Incorporate a seminar program into the curriculum that encourages students of various curriculum tracks and levels to interact in a professional setting.

iii. Revision of the General Science Minor for Elementary Education

iv. Modernization of facilities by the addition of a storage/preparation room, a combined computerized/reference classroom, and by obtaining new laboratory equipment.

2. Good progress has been made in fulfilling the stated goals and objectives for the program beyond the assessment program:

a. A large number of retirements have occurred in the physics department during the past 5 years, creating a swing from 6 veteran and 2 new professors in 1997 to 2 veteran and 4 new instructors in spring 2002. However, each of the newly hired faculty have demonstrated a deep commitment to high quality instruction, and many of the veteran faculty worked hard to mentor younger faculty before departing. Top notch teaching is still the highest priority fo the physics department.

b. Good progress has been made toward expanding undergraduate research opportunities for physic students. During the period of review a number of students have worked with E. George, K. Hilll-Malvick, K. Menningen, and P .Rybski, resulting in several publications with students as co-author. However, E. George and K. Hill-Malvick have both resigned, and we look forward to hiring new faculty who will set up active undergraduate research laboratories in the department.

c. Some progress has been made in encouraging women and minorities to major in physics or related fields. Of the 21 graduates during the period of review, 3 are minorities and 1 is female. One woman and one minority male graduated in December 2001, and are not included in the trend data show below. Of the 29 students currently majoring in physics (as of spring 2002), 4 are women and 1 is minority male. There is obviously room for improvement in accomplishing this objective. On reason for the failure to make significant progress is the lack of any systematic programs aimed at increasing interest in science for women and minorities. J. Constantinescu has been an advocate for women in science during the past two years, organizing several guest lectures by prominent female scientists, and attending several meetings on encouraging women in science. However, no consistent policies or programs are in place to attract women and minorities to the physics major. Secondly, there is little societal encouragement for women and minorities to pursue scientific careers. Thirdly, the recruiting efforts of the department have been weak on all fronts, including specific recruiting of women and minorities.

d. Some of the specific goals outlined in the previous report have been met, others have not.

i. No progress has been made in creating an internship program for physics industry emphasis majors. It is not clear why this goal was not achieved.

ii. .Although no formal seminar program is in place, the department has been taking advantage of the live satellite broadcasts of UW-Madison physics department colloquia over the past several years, with an encouraging turnout of students. A number of faculty promote the events by offering incentives for students to expose themselves to these cutting-edge physics talks.

iii. The General Science Minor for Elementary Education has been revised as planned.

iv. The storage/preparation room has been created (UH 131) and is used extensively, the combined computerized/reference classroom has been created (UH 127) and is used heavily by science majors from every department, and a substantial amount of new laboratory equipment has been obtained during the period of review, especially through the College of Letters & Sciences Capital Exercise program.

3. The physics program contributes to the state of Wisconsin's need for highly trained workers in the technical fields (see http://www.isonline.com/bym/career/dec01/4700.asp, an article that appeared in the Milwaukee Journal Sentinel on December 12, 2001.) The local demand in Wisconsin reflects a similar shortage of highly educated workers throughout the US.

4. The three objectives outlined above remain the primary focus of the physics department. The recommendations from the previous audit and review report have produced minimal response by the department. A photocopy of the report is attached as Appendix C.

a. Retirements have led to the hiring of younger faculty who are much more active in undergraduate research. However, two young tenure-track faculty have resigned and other positions remain as academic staff, leaving only two tenured faculty to provide research opportunities to students in summer 2002. Hopefully the searches for new tenure-track faculty will be successful and the new professors will establish long-term research programs in the physics department.

b. The recommendation to "narrow the scope" of faculty efforts was not well understood and no action was taken.

c. The recommendation to modernize equipment was heeded as a large number of computers, electronic instruments, optics, modem physics experiments, and supplies have been obtained to improve the pedagogical resources of the department. Most of the funding obtained was internal to the UW System.

d. The recommendation to resolve the shortage of space for research and instruction will be addressed in the planned renovation of Upham Hall. Currently research is carried out in rooms 21, 132, and 103, and 334. The renovation will provide a specific room for individual faculty to carry out their research. There is currently no shortage of instructional space. In fact, the renovation will provide close to a 40% decrease in square feet assigned to the physics department. This will have little impact on the program because we are currently underusing our laboratory space.

e. The recommendation to drop the Bachelor of Arts in Physics was not heeded. The rationale for both the recommendation and the failure to act upon it is not clear. The BA degree in physics is rarely obtained, but dropping the BA option would neither enhance the program nor save any resources for the university. Both the chemistry and biology departments have retained the BA options.

C. Trend Data

1. The following is trend data for the physics program from institutional research:

Fall Enrollment by Major/Emphases (5-Year Trend)					
Number of Majors (Including Double Majors)					
	1996-97	**1997-98**	**1998-99**	**1999-00**	**2000-01**
College of Arts & Comm.	1073	1157	1276	1301	1248
College of Bus & Econ	3195	3195	3297	3290	3251
College of Education	2314	2332	2334	2204	2206
College of L & S	2955	3034	2918	2974	2881
University totals	9537	9718	9825	9769	9586
GENERAL SCI P SC PHY	0	0	0	1	0
PHYSICS	16	22	16	19	19
PHYS GRD	7	7	6	7	8
PHYS IND	7	12	8	8	7
PHYS ED	2	3	2	4	4

- Physics majors often do not declare a physics major as a freshman, and later discover a talent/desire for the subject and change their major. Changing majors often means unnecessary coursework.

- Physics education students have to take a large number of credits to complete the licensure requirement as well as the major and minor requirements. A recent evaluation

(see http://academics.uww.edu/physics/Major/Educ4yr.html) concluded that about 141 credits are required and it is impossible to complete them in only four years.

- The physics industry emphasis requires extra courses to introduce the majors to the fundamental concepts of business and computer science. The total credits required to satisfy the major, minor, and general degree requirements is 135, fewer if the student places out of MATH 152 and/or ENGLISH 101.

2. We have incomplete information about placement of graduates, but we know that of the 10 graduate track students that graduated during the period of this review, 3 were accepted into graduate school (in engineering, math, and medical physics), 3 are employed full time in nonscientific jobs, 1 taught high school and then went into graduate school in physics, 1 teaches high school, 1 is in the air force, and 1 is unknown. We have no data on the 7 industry track majors. All we know is that one of them was applying for acceptance into engineering school. Three of them were from Tanzania and may have returned to their country. Of the 4 students in either the physics BSE program or the general science –physics emphasis program, 2 are known to be teaching in a secondary school and 2 are unknown.

D. Demand for Graduates

1. There are some placement statistics that suggest a favorable demand for physics graduates:

   a. The Bureau of Labor Statistics projection for "physicists and astronomers" (see http://www.bls.gov/oco/ocos052.htm) is for employment of physicists and astronomers to grow about as fast as the average (increase 10 to 20 percent). The need to replace physicists and astronomers who retire will account for most expected job openings.

   b. The Wisconsin Department of Workforce Development lists "secondary school teachers" and "computer support specialists" among its "30 Occupations with the Most Annual Job Openings" (http:/ /www.dwd.state. wi.us/lmi/proj.occmostopen.htm). These are positions a physics major might compete well for, but specific occupations for physicists were not listed. The DWD projects a 21.4% growth in "professional specialty" jobs, a category that includes 214 occupations such as accountants, biologists, chemical engineers, and lab technicians.

   c. The American Institute of Physics publishes employment statistics (http://www.aip.org/statistics/trends/emptrends.htm) that indicate a solid employment outlook. One interesting fact is that the average starting salary offered by campus recruiters to new physics bachelors in 2000, $42,500, is higher than the average 9 month salary of assistant physics professors at 4 year colleges ($42,300) during the same period! (see ht ://www.aip.org/statistics/trends/r orts/winter02.pdf and http://www.aip.org/statistics/trends/reports/spring01c.pdf)

E. Accreditation

1. The physics major is not an accredited program.

*PRE-PROF'L	111	114	113	109	100

*UNDECLARED	868	981	869	884	759	

Undergraduate Degrees and percentages by Major/Emphasis (5-Year Trend)											
Major/Emphasis		1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
GENERAL SCIENCE	B Sc Phy	1	0	0	0	1	0.06%	0.00%	0.00%	0.00%	0.07%
PHYSICS		3	3	4	3	4	0.19%	0.20%	0.26%	0.18%	0.26%
	Phys Grd	3	0	1	1	3	0.19%	0.00%	0.07%	0.06%	0.20%
	Phys Ind	0	1	3	2	1	0.00%	0.07%	0.20%	0.12%	0.07%
	Phys Ed	0	2	0	0	0	0.00%	0.13%	0.00%	0.00%	0.00%
University total:		1542	1520	1520	1658	1535	100%	100%	100%	100%	100%

Completed Credits to degree by Major/Emphasis (5-Year Trend)											
			Fiscal Years								
			Number of Majors				Average Credits to Degree				
Major/Emphasis		1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
GENERAL SCIENCE	B Sc Phy	1	0	0	0	1	160	0	0	0	169
PHYSICS		3	3	4	3	5	135	155	130	158	142
	Phys Grd	3	0	1	1	4	135	0	134	158	147
	Phys Ind	0	1	3	2	1	0	137	129	158	123
	Phys Ed	0	2	0	0	0	0	164	0	0	0
University Average		1542	1520	1520	1658	1761	134	134	135	134	???

The number of physics majors is low, as historically been the case, although the problem has worsened recently nationwide. Low numbers of physics majors is due to the difficulty of the coursework, negative perceptions among students about the subject, lack of awareness about career opportunities for physics graduates, and recent tendency of talented students to pursue computer- related professions. The number of physics majors at UW Whitewater will increase substantially with the introduction of the engineering emphasis to the physics major that will replace the pre- engineering program, and with the introduction of the 3-2 agreement with UW-Milwaukee that will attract students with the prospect of two degrees earned in five years. There may be counting errors in the above charts due to second majors; from our records there should be 4 physics graduates in 2000 (2 graduate track, 2 industry track) and 5 in 2001 (4 graduate track, 1 industry). Not included in the chart are the 2 majors that graduated in December 2001 (1 general science -physics and 1 graduate track) and the 4 that graduated in May 2002 (2 graduate track, 2 engineering track). The average number of total credits completed by those earning

degrees is higher than the target of 120. Detailed research has not been undertaken to determine the actual cause of these elevated numbers. However, some hypotheses can be formulated.

F. Location Advantage

1. The University of Wisconsin-Whitewater is located near several large universities and research facilities for physics faculty and students. During the period of this review, UWW physics faculty and students have used facilities at UW -Milwaukee, UW -Madison, Northwestern University, and the Synchrotron Radiation Center in Stoughton. Dr. Menningen visited Argonne National Laboratory in December 2000. Fermi National Accelerator Laboratory and Yerkes Observatory are also within a few hours driving distance. However, there are few local resources (less than 10 miles away) that make Whitewater an especially good location to study physics or conduct research.

G. Comparative Advantage

1. Of the 10 four-year regional campuses in the UW system that are peers to UW-Whitewater, 7 offer baccalareate degrees in physics. The number of physics degrees conferred at UW-Whitewater is approximately average among the peer institutions. The UWW program does not focus on a specific population, does not have a concentration of faculty expertise in a particular area of physics. It has not been very successful in identifying and promoting internship opportunities for physics majors with regional industries. However, our program is unique in three aspects:

a. **Hologram outreach project**: Students and faculty travel to area elementary schools and giving the children a simple workshop on holography. Other campuses such as Ripon college do have educational outreach programs but not in holography. The program is an enriching experience for the physics majors who volunteer to participate.

b. **Major emphases:** Three other campuses (Oshkosh, River Falls, and Stevens Point) also have physics teacher certification programs, but UW -Whitewater is unique in its graduate school, industry, and engineering tracks.

c**. Location:** The proximity of UW -Whitewater to UW -Madison, UW -Milwaukee, Chicago area universities, the Synchrotron Radiation Center in Stoughton, Yerkes Observatory, Fermi National Accelerator Laboratory, and Argonne National Laboratory give UW- Whitewater physics students unique access to a large number of nearby physics-related research institutions.

B. Community Impact

1. The primary impact the physics department has on the surrounding community is its educational outreach activities. The department has been active in many such activities:

a. Public lecture events such as Lawrence Krauss "The Physics of Star Trek" (spring 2000) and Roger Feeley "The Wonders of Physics Traveling Show" (spring 2002), usually occuring at our annual National Physics Day celebration in mid-April.

b. The hologram outreach program where students and faculty travel to area elementary schools and giving the children a simple workshop on holography.

c. Visits from area high school physics classes such as Barrington High School, in which

faculty present special lectures and help the students make holograms.

d. Special guest lectures by faculty such as the Fairhaven Lecture Series.

e. Special appearances by faculty such as at cub scout, girl scout, and church group meetings. We have also had groups of children visit the campus and the observatory.

All of these events serve to spark interest n physics by the general public, especially children. A future goal is to establish an external advisory board by which we can identify ways to improve our program as well as our outreach to the community. At the time of writing some names have been identified and a tentative date of September 28, 2002 has been established for the first meeting.

C. Strategic Planning

1. There are a number of curriculum initiatives that might be taken over the next review period in response to trends in the physics community:

a. The new engineering emphasis and the 3-2 agreement with the College of Engineering at UW-Milwaukee will be promoted not only because it is an attractive option for students but also because of a projected increased demand for scientists and engineers in the years ahead.

b. Possible modifications to the curriculum to suit specific needs of the US Air Force will be considered. During a May 30, 2002 speech Alan Garscadden of the Air Force Research Laboratory indicated that nearly half of the scientists at the USAF labs are expected to retire in the next five years, making 150 physics research jobs available. Several students from UW -Whitewater have gone on to research jobs in the USAF, including Robert Pulliam (spring 2000), and two more in summer/fall 2002 (outside the review period).

c. Coursework in materials science or solid state physics might be introduced. Material science represents the fastest growing segment of physics-related research and will likely remain the frontier specialty of physics for some time to come.

d. The 170 series introductory physics sequence might be reworked into a two-semester, 10 credit sequence instead of a three-semester, 11 credit sequence as it is now. This will make the program more similar to comparable programs at other universities. However, careful attention will be given to ensuring the development of our students in the course before making sweeping changes. The present three semester sequence was crafted to give students extra time to develop mathematical skills in preparation for the more demanding electricity & magnetism and modern physics topics at the end of the sequence, as well as the upper-level physics courses they will subsequently take.

II. Resource Availability and Development

A. Faculty and Staff Characteristics

1. The physics department faculty and staff has been changing rapidly during the period of review. In fall 1996 there were six tenured faculty (R. Helwig, P. Rybski, F. Steke1, S. Stekel, N. Stone, and H. Tschanack) and two tenure-track faculty (E. George and K. Menningen). By the spring of 2002 there were two tenured faculty (K. Menningen and P. Rybski) and four academic staff (J. Constantinescu, P. Ramalingam, S. Sahyun, S.

Watchorn). The departure of faculty by retirement and resignation, with the subsequent replacement by academic staff, and the loss of two full-time positions, has destroyed the cohesiveness of the department and greatly diminished the continuity and experience that senior faculty can provide. At this point there is a unique opportunity to build the program with carefully chosen, new tenure-track faculty that will hopefully stay and contribute long and productive careers at UW -Whitewater. This is an opportunity to shape the future direction of the department. The following are some brief comments on faculty and staff characteristics over the period or review, with detailed descriptions in Appendix F.

a. **Level of professional preparation**: Three faculty or staff during the period of review had Master's degrees (J. Constantinescu, S. Stekel, N. Stone) and nine had Ph.D. degrees (E. George, R. Helwig, K. Hill-Malvick, K. Menningen, P. Ramalingam, J. Rufinus, P. Rybski, F. Stekel, H. Tscharnack). Most of the degrees were in physics or astronomy.

b. **Expertise:** The department does not now enjoy a great deal of expertise because of the dramatic turnover of faculty. E. George and K. Hill-Malvick had promising starts as productive researchers and very capable teachers but took their talents to other universities. K. Menningen remains active in research and is developing himself as an accomplished teacher. P. Rybski is the most experienced and accomplished teacher in the department, and remains active in astronomical research. However, the retirements of F. Stekel and S. Stekel gutted the department's expertise in physics education, a gaping hole filled only in part by the hire of S. Sahyun (who will be tenure-track in the fall of 2002). The retirements of R. Helwig, N. Stone, and H. Tscharnack meant the loss of a great deal of teaching expertise to the department. It will take at least five years, and probably more, to build a faculty that together have expertise comparable to what these senior faculty had.

c. **Cohesiveness**: The department cohesiveness in enhancing program quality has been greatly diminished by the departure of both senior and tenure-track faculty and the hiring of temporary academic staff. Regardless, each faculty or academic staff member share a common commitment to provide a high quality education to our students, both major and non-major alike. Once a more permanent faculty is established, each member can identify key areas in which they wish to take the lead to improve the program. Working together to achieve common long-term goals will produce a sense of teamwork and greatly enhance the cohesiveness of the faculty.

d. **Affirmative action**: The physics department has been fortunate to enjoy a disproportionately large number of female faculty compared with the physics community as a whole. During the span of fall 1999 through spring 2001 there were three female faculty (J. Constantinescu, K. Hill-Malvick, and S. Stekel). However, only J. Rufinus was non-Caucasian. As we search for new faculty we will pay close attention to increasing the ethnic and gender diversity of the department.

2. See Appendix F for a list of the courses each faculty member taught during the period of review.

3. Some staffing changes will be required to adequately teach the courses for which there is currently student demand as well as to make the department attractive to prospective candidates and tolerable for the present faculty:

a. Add a 1.00 FTE tenure-track position. Frank Stekel's position was moved to a different department upon his retirement. The physics department compensated for the loss of his position by reducing the number of sections of PHYSCS 130, PHYSCS 160, and ASTRONMY 114 that were offered. This was tolerable for the 2001-2002 academic year but caused some difficulty for students as they tried to get into the limited number of available sections. For fall 2002 the demand for PHYSCS 160 required us to open a second section, creating a mild overload for two faculty. Such arrangements will quickly become intolerable for faculty, as the teaching load is already quite heavy at UW-Whitewater and particularly burdensome for physics faculty because of the laboratory courses (see below). In addition, we are trying to introduce 3 new general education courses to develop interest in physics and to provide 4-credit laboratory (GL) course options in physics. If the new courses generate appreciable student demand we will be unable to teach all the general education courses with only six faculty. General education is the bread and butter of the physics department, and Frank Stekel's position was at the core of our general education program. We will need that position back in order to provide the courses the students want and to allow the department to prosper.

b. **Hire a 0.50 FTE (or more) Laboratory Technician**. Physics faculty at UW-Whitewater carry the same teaching loads as everyone else, including chemistry and biology faculty. Unlike chemistry and biology, however, physics faculty must set up, take down, and maintain the laboratory equipment. The other sciences with integral laboratory courses have a technician to handle (at least in part) these responsibilities. Physics departments at many other universities nationwide, and in particular UW - Madison, UW -Milwaukee, UW- Eau Claire, UW-Green Bay, UW-Platteville, UW-Stout, and UW-Oshkosh, have technicians to assist with the laboratory equipment. Physics laboratory experiments have becoming increasingly complex in recent decades, and computer interfaces, oscilloscopes, diffraction grating spectrometers, interferometers, lasers, and other such sophisticated equipment are commonplace. The equipment is not stored in an organized fashion and not well maintained because faculty do not have adequate time to devote to these matters above and beyond the other teaching, research, and service duties. The addition of a laboratory assistant to handle these concerns will make a world of difference in the level of job satisfaction among physics faculty and will free up a substantial amount of time (2 to 5 hours/week, depending upon the courses taught) that can be devoted to other efforts such as undergraduate research. The addition will also help recruit faculty as prospective candidates compare the required workloads among physics departments.

A. Teaching and Learning Enhancement

1. Physics faculty make quality teaching their top priority. Several faculty have regularly attended on-campus teaching enhancement workshops such as those provided by the LEARN center, and at least two have attended off-campus Chautaqua short courses for teaching enhancement during the period of this review. All tenured or tenure-track faculty are engaged in academic advising, and Menningen has recently expanded both web and paper resources to aid faculty advisors and students alike. Four faculty have actively involved students in undergraduate research, two of them publishing articles in scholarly journals with students as coauthors. Three new general education courses were developed during the period of this review: PHYSCS 100 *Energy*, PHYSCS 110 *Light and Color*, PHYSCS 150 *From Einstein to Star Trek.* Two of them (100 and 150) will be offered for the first time in fall 2002. Finally, at least four faculty taught sections of the interdisciplinary course GENED 150 *Science and Technology in Society.* Physics faculty work hard at improving their teaching and contributing to general education.

B. Research and other Scholarly/Creative Activities

1. Only a few faculty have been actively involved in undergraduate research, and only two have published in scholarly journals with students as coauthors. Others have actively involved students in individual research projects that were not suited for publication. A few faculty actively travelled to professional conferences to make presentations. Still others were not active at all. This is mainly due to the decreased expectation of older faculty to be involved in research. When more tenure track faculty are hired there will be a substantial increase in the scholarly activities of the department.

C. External Funding

1. Relatively few faculty have actively sought external funding for research. Menningen has successfully won four grants, but none of the awards exceeded $35,000. Several much larger proposals were submitted but not awarded. No faculty during the period of review managed to win a substantial, multi-year award. Again this deficiency can be attributed in part to a large component of senior faculty and to a substantial number of temporary academic staff appointments. When more tenure-track faculty are hired there will be a substantial increase in the external funding efforts of the department. The problem is also due in part to the intense competition for federal research dollars.

D. Professional and Public Service

1. There have not been many faculty active in professional organizations, and none have served as an officer in such an organization. A number of faculty are active members of the Wisconsin Association of Physics Teachers. P. Rybski served as a contributing editor for *CCD Astronomy Magazine* (a professional but not scholarly journal) for one semester. Several faculty were active members or chairs of university committees. By far the largest component of professional and public service by the faculty was the public outreach events and activities outlined in the Community Impact section above.

E. Resources for Students in the Program

1. With an average of 30 majors (including pre-engineers) the student/faculty ratio is about 5. There is an adequate amount of funds to purchase equipment, student help, services and supplies to support the program. When costly equipment is needed there has almost always been sufficient support from the College of Letters and Sciences to purchase it. There are also adequate computing resources available. The availability of resources is not a major impediment to the quality of education for our physics majors.

F. Facilities, Equipment, and Library Holdings

1. The major deficiency in facilities is the lack of faculty research space in Upham Hall, a deficiency that will be addressed very well by the upcoming renovation project. The newly renovated building should be a terrific asset for scholarly work and teaching, and should greatly improve the morale and enthusiasm of the faculty and students alike. The library holdings of physics-related scholarly journals is rather thin. This has been addressed somewhat by the acquisition of rights to several online journals, but faculty are usually forced to accomplish any substantial library work at either UW-Madison or UW-Milwaukee.

Appendix A: Advising Reports-not include

Appendix B: List Linking Courses to Assessment Objectives

Appendix B1: List of Dual-Listed Courses and Graduate Requirements

Appendix C: Audit and Review Evaluation Report from the Last Review

Appendix D: Trend data-included beginning on p. 11

Appendix E: Accreditation Report: does not apply-program is not accredited

Appendix F: Faculty/Staff accomplishments in teaching, research and creative activities, and service

Appendix B: List Linking Courses to Assessment Objectives

The following courses are either general education courses (not intended for physics majors), are offered infrequently, or do not directly support the program in terms of preparing and training physics majors.

PHYSCS 100 *Energy*
PHYSCS 130 *Light & Color*
PHYSCS 130 *Physics Foundations*
PHYSCS 150 *From Einstein to Star Trek*
PHYSCS 210 *Descriptive Physics*
PHYSCS 240 *Physics of Sound & Music*
PHYSCS 490/690 *Physics Workshop*
PHYSCS 496 *Special Studies*
PHYSCS 799 *Individual Studies*
ASTRONMY 112 *Introduction to Astronomy*
ASTRONMY 114 *Descriptive Astronomy*
ASTRONMY 350 *Astrophotography*
ASTRONMY 498 *Independent Study*

Course	Graduate School			Industry			Education		
	Subject Matter	Cognitive Devel.	Skills	Subject Matter	Cognitive Devel.	Skills	Subject Matter	Cognitive Devel.	Skills
PHYSCS 160 *Gen Physics I*	X	X		X	X		X	X	
PHYSCS 161 *Gen Physics Lab I*		X	X		X	X		X	X
PHYSCS 162 *Gen Physics II*	X	X		X	X		X	X	
PHYSCS 163 *Gen Physics Lab II*		X	X		X	X		X	X
PHYSCS 170 *Intro Physics I*	X	X		X	X		X	X	
PHYSCS 172 *Intro Physics II*	X	X		X	X		X	X	
PHYSCS 173 *Intro Physics Lab I*		X	X		X	X		X	X
PHYSCS 174 *Intro Physics III*	X	X		X	X		X	X	
PHYSCS 175 *Intro Physics Lab II*		X	X		X	X		X	X
PHYSCS 221 *Intermediate Lab*		X	X		X	X		X	X
PHYSCS 280 *Eng Mech - Statics*	X	X		X	X		X	X	
PHYSCS 282 *Eng Mech -Dynamics*	X	X		X	X		X	X	
PHYSCS 303 *Microprocessor Lab*		X	X		X	X		X	X
PHYSCS 310 *Mechanics*	X	X		X	X		X	X	
PHYSGS 320 *Elect & Magnetism I*	X	X		X	X		X	X	
PHYSCS 322 *Elect & Magnetism II*	X	X		X	X		X	X	
PHYSCS 330 *Anal & Digit Electron*		X			X			X	
PHYSCS 331 *A & D Electron Lab*		X	X		X	X		X	X
PHYSCS 354 *Optics*	X	X		X	X		X	X	
PHYSCS 355 *Optics Laboratory*	X	X	X	X	X	X	X	X	X
PHYSCS 364 *Thermal Physics*	X	X		X	X		X	X	
PHYSCS 410 *Modern Physics I*	X	X		X	X		X	X	
PHYSCS 411 *Modern Physics Lab I*		X	X		X	X		X	X
PHYSCS 412 *Modern Physics II*	X	X		X	X		X	X	
PHYSCS 413 *Modern Phys Lab II*		X	X		X	X		X	X
PHYSCS 489 *Physics Senior Seminar*	X	X	X	X	X	X	X	X	X
PHYSCS 498 *Independent Study*	X	X	X	X	X	X	X	X	X

Appendix B1: List of Dual-Listed Courses and Graduate Requirements

The following are the Physics department's dual-level courses:

PHYSCS 303/503 *Microprocessor Laboratory*
Documentation unavailable on distinguishing between undergraduate and graduate work.

PHYSCS 410/610 *Modern Physics I*
Documentation unavailable on distinguishing between undergraduate and graduate work.

PHYSCS 411/611 *Modern Physics Laboratory I*
Documentation unavailable on distinguishing between undergraduate and graduate work.

PHYSCS 412/612 *Modern Physics II*
Documentation unavailable on distinguishing between undergraduate and graduate work.

PHYSCS 490/690 *Physics Workshop*
Documentation unavailable on distinguishing between undergraduate and graduate work.

PHYSCS 491/691 *Travel Study*
Documentation unavailable on distinguishing between undergraduate and graduate work.

ASTRONMY 350/550 *Astrophotography for the Amateur*
Graduate students will be required to complete all work assigned to undergraduate students. In addition, graduate students will also complete the following requirements:

a. A photographic project involving an in-depth study of a particular astrophotographic subject;
b. A paper on the selected project, including current literature; and
c. A seminar program using slides or photos of celestial objects taken personally.

ASTRONMY 430/630 *Astronomy for Teachers*
Written project reports are required and these reports are presented a seminar at the end of the semester. It is the scope of these projects that would be used to distinguish between the students enrolling for undergraduate credit and those enrolled for graduate credit. Those students receiving graduate credit would be expected to submit projects of significantly greater depth and/or breadth than is expected for those students enrolled for undergraduate credit.

AUDIT AND REVIEW REPORT
1992-93
MAJOR AND MINOR IN PHYSICS
(APPENDIX C)

The University of Wisconsin System extends to the University of Wisconsin- Whitewater entitlement to offer a Bachelor of Arts Major in Physics; Bachelor of Science Major and Minor in Physics, Bachelor of Science in Education Physics Major, Bachelor of Science in Education Broadfield Science Physics Major and Physical Science Major, and Physics Minor for Secondary Education. The minor is administered by the Department of Physics in the College of Letters and Sciences.

The program provides instruction in Physics and Astronomy. The faculty supporting the program are heavily involved in the general education program and participate in pre-engineering preparation.

The Physics Major requires 34 credits plus an advanced composition or technical writing course in the English Department. There are three major tracks, Physics-Education, Physics Industry, Physics-Graduate School. The Physics Minor requires 24 credits.

The program has a small enrollment. Twenty-six Physics Majors graduated during the previous five years. The program has tracks the career choices of graduates. In addition, 9 of the 26 students who graduated are attending or completed graduate programs.

Nine faculty members support the program, six possess the terminal degree. One faculty member is assigned part-time to the Mathematics Department and one is the Director of the campus Observatory. Faculty members are active in service activities and working with science teachers in the area. The department's student honor society is very active.

The University Audit and Review Committee makes the following observations about the Major and Minor in Physics and work with the college dean prior to the next audit and review.

1. The faculty will be undergoing a change with several anticipated retirements. This may provide an opportunity to reverse the relative inactivity of the department in the areas of seeking extramural funding or research publication.

2. The program has three tracks for its majors, and faculty state that they cover twenty-five specialty areas within physics. Given the small size of the major program and the heavy demands to support the general education program, the faculty may wish to narrow the scope of their efforts. They need to make strategic decisions about the areas in which they wish to concentrate efforts and build strengths to(?) areas that cannot be adequately covered.

3. The equipment needed instruction in the program is barely adequate. The faculty needs to work closely within their college and utilize the laboratory modernization program to build a foundation of equipment that is realistic *for* the size and scope of the program. Plans can then be developed to aggressively seek external funding to build on the foundation.

4. There is a need to work closely with other science departments in the same building and the college dean's office to resolve the shortage of space *for* research and instruction.

Creative ways to use existing space and improved communication with campus space planning officials may be necessary.

5. The department should consider dropping the Bachelor of Arts in Physics.

The University Audit and Review Committee recommends continuation of the Bachelor of Science Physics Majors and Minors. This recommendation is based on the following observations:

1. The program provides strong support to the general education program and liberal arts mission of UW-Whitewater.

2. The faculty are active in working with science teachers and the community

3. The program is well-structured and provides pre-engineering education for students who wish to transfer to another institution to complete their degree.

Appendix F: Table of Faculty and Staff

Note: the following tables are not intended to be comprehensive. Many of the faculty listed have retired or left UW-Whitewater, and limited information is available concerning all of their activities. The tables were filled out to the best of the knowledge of the preparer of this report (K. Menningen).

Name	Years	Highest degree	Courses taught	Teaching Enhancement
Juliana Constantinescu	fall 1998 - present	M.S. Geophysics	PHYSCS 280, 282 ASTRONMY 112, 114	• Attended NSF Chautauqua short course Aug 2002 • Various UWW workshops
Elizabeth George	fall 1995-spring 1998	Ph.D. Physics	PHYSCS 170s, 221 GENED 150	• Attended several UWW workshops • Advised students • Involved students in research • Taught interdisciplinary course GENED 150
Russell Helwig	spring 1965-spring 1998	Ph.D. Physics	PHYSCS 280, 282 GENED 150	• Advised students • Taught interdisciplinary course GENED 150
Kimberly Hill-Malvick	fall 1999-spring 2001	Ph.D. Physics	PHYSCS 160s, 170s, 310 GENED 150	• Attended several UWW workshops • Advised students • Involved students in research • Developed a new course • Taught interdisciplinary course GENED 150
Kenneth Menningen	fall 1995-present	Ph.D. Physics	PHYSCS 130, 170s, 320, 354, 364, 489	• Attended several UWW workshops • Advised students, enhanced web resources for advising • Involved students in research • Developed new courses
P. Ramalingam	spring 2002 only	Ph.D. Physics	PHYSCS 172, 173, 221, 364	
Jeffery Rufinus	fall 1998 - spring 2000	Ph.D. Physics	PHYSCS 221, 280, 282, 310, GENED 150	• Taught interdisciplinary course GENED 150
Paul Rybski	spring 1987-present	Ph.D. Astronomy	PHYSCS 310, 489 ASTRONMY 112, 114	• Attended several UWW workshops • Advised students • Involved students in research
Steven Sahyun	fall 2001 - present	Ph.D. Physics	PHYSCS 130, 160s, 210	• Advised students
Frank Stekel	fall 1965 - spring 2001	Ed.D. Physics	PHYSCS 160s, 280 ASTRONMY 112 GENED 150	• Attended several UWW workshops • Advised students • Taught interdisciplinary course GENED 150

Appendix F: Table of Faculty and Staff (continued)

Name	Years	Highest degree	Courses taught	Teaching Enhancement
Shirley Stekel	spring 1964 - spring 2001	M.A. Physics	PHYSCS 160s, 170, 210, 240 ASTRONMY 114, 430	• Advised students
Neil Stone	fall 1967 - spring 1999	M.S. Astronomy	ASTRONMY 112, 114, 430	• Advised students
Hugo Tscharnack	fall 1965 - fall 2001	Ph.D. Physics	PHYSCS 130, 170s, 364, 410s, 489	• Advised students • Developed new courses
Steven Watchorn	fall 2001 - spring 2002	Ph.D. Physics	PHYSCS 160s, 240 ASTRONMY 114	

Appendix F: Table of Faculty and Staff (continued)

Name	Research Activities	Grant Applicationss	Service
Juliana Constantinescu		• UWW Acad. Staff Develop. 2000 $880, funded	• Invited several guest lecturers
Elizabeth George	• Supervised undergraduate students • Several conference presentations • 2 publications in peer-reviewed journals during period of this review.	• WI Space Grant Consort. 1996 $500, funded • UWW Research 1996 $2175 funded.	• Gave a Fairhaven lecture • Served on university committees
Russell Helwig			• Active in Physics Club of Milwaukee
Kimberly Hill-Malvick	• Supervised undergraduate students • Several conference presentations • 3 publications in peer-reviewed journals during period of this review.	• Kimberly Clark Corp. consultation work, funded • NSF 2000 $264,826 denied • UWW Faculty Devel. 2001 $6960 funded	• Served on university committees • Spearheaded development of 3-2 agreement with UW-Milwaukee • Gave several public presentations
Kenneth Menningen	• Supervised undergraduate students • Several conference presentations • 4 publications in peer-reviewed journals during period of this review.	• NASA/U.Toledo 1998 U. Toledo, $24,184 funded • NSF 1998 $264,826 denied • UWW Research 1999 $1,750 funded • NASA 1999 $242,835 denied • NSF 1999 $252,460 denied • NASA 2000 subcontract U. Toledo $37,925 denied • UWW Faculty Devel. 2001 $6,000 denied • NASA/UW Madison 2001 $64,482 denied • NSF 2001 $47,726 denied • NASA/EPRI/UW Madison 2001 $24,090 funded • UW System LTDC 2002 $ 1,500 denied • UWW Faculty Devel. 2002 $5,800 pending	• Served on university committees • Wrote/maintained dept web page • Maintained liquid nitrogen supply • Gave several public presentations
P. Ramalingam			
Jeffery Rufinus			
Paul Rybski	• Supervised undergraduate students	• UW System ARG 2001 $49,994 denied • NSF 2000 $490,000 denied • NASA 2000 $226,000 denied	• Served on university committees • Edited for *CCD Astronomy Magazine* spring 1998 • Managed several email listservers • Gave many public presentations
Steven Sahyun	• Several conference presentations		
Frank Stekel	• Published two test banks for texts	• UWS Eng. & Tech Fund 1996 $35,720 denied	• Served on university committees • Gave several public presentations • Made numerous cabinets, carts, etc.
Shirley Stekel			• Served on university committees • Gave several public presentations
Neil Stone			

Appendix F: Table of Faculty and Staff (continued)

Name	Research Activities	Grant Applicationss	Service
Hugo Tscharnack			• Faculty Athletics Representative to the WIAC, Athletic Hall of Fame • Served as SPS advisor • Led the hologram outreach project and National Physics Day activities • Active in high school recruitment
Steven Watchorn			