# Department of Physics
# Weber State University

# Program Review
# Self-Study

February 6, 2008

# *Description of the Review Process:*

The Review Team members are listed below. Their resumes are included as Appendix 1 of this document.

- Dr. Paula Szkody, Professor, Department of Astronomy, University of Washington,
- Dr. D. Mark Riffe, Associate Professor, Department of Physics, Utah State University,
- Dr. Daniel Bedford, Assistant Professor, Department of Geography, Weber State University,
- Dr. H. Laine Berghout, Associate Professor, Department of Chemistry, Weber State University.

The Program Review Self-Study (this document) was prepared by the Chair of the Department of Physics in consultation with the departmental faculty members. Data and information within the document were obtained from the following sources:

1. Departmental Annual Summaries for the academic years 2002/03, 2003/04, 2004/05, 2005/06, and 2006/07.
2. Data provided by Weber State University's Division of Budget and Institutional Research.
3. Departmental assessment documents.
4. Department of Physics Program Review Self-Study document, May 2002.

As described in the *Semester Sequence of Program Review Activities* (revised June 2004), the steps that have been, or will be taken throughout the review process include:

1. The selection of the external Review Team by the Department of Physics. The Dean of the College of Science has approved the selection of the team members.
2. On November 15, 2007, the self-study document will be submitted to the Dean of the College of Science for review and approval.
3. The self-study will then be forwarded to the members of the external Review Team in preparation for their on-site visit during Spring Semester 2008. The self-study will take place between February 15 and March 15, 2008.
4. Following completion of the on-site visit, the Review Team will be asked to submit a three to five page report of program strengths, challenges, and recommendations for change to the Department of Physics, with a copy to the Dean of the College of Science.
5. The Department will then submit a brief response of two to three pages regarding the Review Team's report to the Dean.
6. The Dean in turn will comment on the Review Team's report and departmental response, providing a one to two page response to the Department.
7. The Dean forwards the Department's Executive Summary of the Self-Study, the Review Team's report, the Department's response, and the Dean's response to the Office of Academic Affairs for the Program Review Standing Committee.
8. The Program Review Standing Committee will then make its recommendations to the Provost with regard to the findings of the program review.
9. The Provost will prepare an institutional response to the Program Review that will be submitted to the Weber State University Board of Trustees.
10. The Provost will also submit to the Utah Board of Regents an institutional summary of all programs that have been reviewed during the current year.

The programs within the Department of Physics are not subject to discipline-specific professional accreditation requirements.

# Program Description:

## A. Program Mission Statement

The mission of the Department of Physics at Weber State University is to provide high-quality instruction in physics at the undergraduate level. This includes providing courses in the general education area of physical science, pre-professional and pre-engineering courses in physics, and courses and programs for those who want to major or minor in physics.

Further activities of the department include providing opportunities for research and other scholarly activities of both faculty and students, advising the students served by the department, and serving as a resource for the campus and the state of Utah in the areas of physics and astronomy.

*Last Reviewed: November 9, 2007.*

The Mission Statement of the Department of Physics was last reviewed on November 9, 2007 as a part of the Department's periodic review of its program.

### *Evaluation of the Mission Statement:*

The Department's mission statement is very explicit in its focus on undergraduate education at Weber State University. In particular, the mission statement identifies the three major groups of students served by the Department; general education students, service programs for majors in other disciplines, and physics majors and minors. The statement also directs the Department to serve as a general resource in physics and astronomy for the Weber State community and the state of Utah.

The Department's philosophy of striving to provide the highest-possible level of instruction in physics is explicitly stated in the opening sentence of the first paragraph. In the second paragraph, the mission statement also identifies a primary emphasis on research and scholarly activities within the Department. The Department emphasizes the role of undergraduate research in its curriculum. This aspect of the mission statement provides a powerful guiding force for educational opportunities and resource allocation within the Department.

It is anticipated that based on the emphases contained within our mission statement, students will graduate from Weber State University with a strong, positive experience in physics education, whether those students are general education students, majors in other scientific or technical programs, or physics majors or minors. In particular, it is expected that physics majors will be provided with significant opportunities to participate in research activities within the Department.

The mission statement of the Department of Physics supports the University's mission statement on a variety of levels. For instance, the University's mission statement calls for meeting "the

educational needs of Utah … in the liberal arts and sciences and a variety of vocations and professions. Primarily committed to quality undergraduate education, the university offers degree programs which include advanced professional preparation." Furthermore, the institutional mission statement states "instructional programs are designed to prepare students for immediate employment or further study, at the same time equipping them through liberal education for lifelong learning in a changing world." Within the highly scientific and technical environment of the early 21st century, it is critical that students develop the highest possible level of appreciation for and understanding of science in general, and physics in particular, in order to be informed citizens within today's society.

A primary strength of our departmental programs involves student opportunities for research in close collaboration with faculty members. This aspect of the Department's mission is also identified in the University's statement; "extensive personal contact and support among students, faculty and staff create an enriched learning environment both in and out of the classroom." In addition, "To insure vitality for effective teaching and service, the university engages in scholarship, research, artistic expression and other professional pursuits."

Overall, the mission statement of the Department of Physics reflects both the interests and emphases of the Department, as well as the focus of the University on quality undergraduate education. In support of its mission statement, the Department sets goals which are compiled and regularly revisited and updated. The Department's most recent list of goals may be found in Appendix F, together with a summary of the Department's highlights during the period covered by this report.

## *Student Statistical Summary:*

There are no formal admissions requirements for the various physics degree programs other than the general admissions requirements established by the University. However, students earning degrees in Physics Teaching or Physical Science Composite Teaching must meet the Teacher Education admission and certification requirements.

The Student Statistical Summary, using data supplied by Institutional Research, may be found in Appendix A. The data show a steady decline in SCHs for the first four years, and a more precipitous decline in 2006-07. It is worth noting that this decline has taken place almost entirely in our service and general education courses; the enrollment in our upper-division classes has grown during these five years, as shown below using data from taken from the Department's Annual Reports.

| | Enrollment in Selected Upper-Division Courses | | | | |
|---|---|---|---|---|---|
| | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
| Phys 3500 | 5 | 9 | 15 | 19 | 18 |
| Phys 3510 | 2 | 8 | 8 | 16 | 12 |
| Phys 3520 | 3 | 7 | 7 | 14 | 8 |
| Phys 4570* | 2 | 3 | 4 | 5 | 5 |
| Phys 4610** | 5 | 3 | 7 | 9 | 12 |
| Phys 4620** | 4 | 3 | 7 | 5 | 11 |

* Phys 4570 is required only for Physics Teaching and Physical Science Composite teaching majors.

** Phys 4610 and 4620 are required only for Physics majors (not Applied Physics or the two teaching majors).

The SCH data below, taken from the Department's Annual Reports, show the trends for our service and general education courses; it is followed by a description of the reasons for these trends. The number of sections offered for each course is in parentheses.

| | SCHs and (Number of Sections Offered) | | | | |
|---|---|---|---|---|---|
| | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
| Phys 1010 | 1611 (12) | 1656 (12) | 1629 (9) | 1560 (12) | 1455 (10) |
| Phys 1040 | 2532 (16) | 2073 (13) | 1563 (9) | 1377 (11) | 1404 (12) |
| Phys 2010 | 729 (3) | 1025 (3) | 1130 (5) | 1160 (5) | 1025 (5) |
| Phys 2020 | 488 (3) | 590 (3) | 530 (3) | 640 (4) | 575 (4) |
| Phys 2210 | 680 (3) | 865 (4) | 1005 (4) | 850 (3) | 610 (3) |
| Phys 2220 | 476 (3) | 545 (4) | 590 (4) | 585 (3) | 390 (3) |

1. In the Fall of 2003, at the request of the University, the Department assigned a faculty member to WSU's Davis campus and began offering a section of Phys 1010, 1030, and 2210/2220 (including labs). The enrollment in these courses, especially in Phys 2210/2220, was unusually low. The faculty members assigned to WSU Davis accounted only for 237 SCHs during 2003-04, and 293 SCHs during 2004-05. With the consent of the Dean, the Department then withdrew from teaching at WSU Davis.
2. The sudden retirement of Dr. Jay Phippen in June 2004, who was not replaced in 2004-05, put an additional strain on our teaching resources.
3. In 2005-06 our enrollment in Phys 2010/2020 peaked and required that we open an additional section of Phys 2010. Because we must open another lab section for every 21 new students in Phys 2010/2020, faculty had to be removed from the general education courses which generate more SCHs. This offset the hiring of a replacement for Dr. Phippen.
4. In 2006-07, one of our faculty members was relieved of 58% of her time to administer a $1M grant from NASA. A net new faculty member was hired this year as well.
5. The 11% decline in total SCHs in 2006-07 from the previous year reflected a sharp decline in the enrollment of our service and general education courses. Phys 2010/2020 was down 200 SCHs, and Phys 2210/2220 was down 435 SCHs. These, plus a decrease of 78 SCHs in Phys 1010 and 1040, account for almost all of the decline in SCHs. This decline was not due to a reduction in the number of courses offered. There were seats available, but students did not enroll. For example, in 2004-05 the average Phys 1040 class had an enrollment of 58 (out of 60 available seats); in 2006-07 the average enrollment in Phys 1040 dropped to 39. Students have started going elsewhere for their science general education courses, perhaps to the huge number of sections of Nutrition 1020 offered by the Jerry and Vickie Moyes College of Education.

The data also show that the numbers of majors and minors enrolled in and graduating from the various programs within the Department has remained more or less constant over the past five years. Between 2002-03 and 2006-07 there was an average of 62.8 physics majors, and an average of 6.8 majors graduated from the Department each year.

These data appear to be somewhat higher than national norms. According to the American Institute of Physics "Enrollments and Degrees Report" (AIP Publication Number R-151.42, August 2007), the total production of bachelor's degrees in the United States reached a 40-year low in 1999, with 3646 degrees conferred nationally. Since that time, it has increased 40.2% to 5113 in 2005. Among

exclusively bachelor's degree-granting departments, the average number of degrees per department was 4.1 with a median value of 3. Ph.D.-granting departments conferred an average of 14.7 bachelor's degrees in physics during that same year, with a median value of 11. Our average bachelor's degree production rate is above the rates for bachelor's degree-granting departments, but still below the rate for Ph.D.-granting institutions.

The enrollment growth in upper-division courses is attributed to the efforts of the Department's Recruitment and Retention Committee, which began in Fall 2002. Committee members visit our introductory classes near the end of every semester and give presentations on the opportunities and advantages of a career in physics. They have created three flyers, each directed to the type of course they are visiting. The flyers are "Moving on in Physics" for Phys 1010; "Moving on in Astronomy" for Phys 1040; and "Beyond Phys 2010/2210" for Phys 2010 and 2210. However, this upper-division enrollment growth has not translated into an increase in the number of majors or graduates. It may be that by the time students with other majors take their (required) physics courses, they are too far along in their own majors to switch to physics, although they are persuaded to take an upper division physics course. Or they may prefer their current major to a physics major for other reasons.

According to statistics provided by Weber State University's Office of Institutional Research, found in Appendix A, the number of female physics majors enrolled between 2002-03 and 2006-07 averaged 14.6%. Among graduates earning a degree in one of the physics programs over that same period, 23.5% were female. The national average in 2003 among bachelor's degree students was 22%.

The low numbers of females in physics at the bachelor's degree level may be due to the lack of role models in science (and particularly physics) at the elementary, secondary school, and university levels. Peer pressure and subtle forms of discrimination may also play significant roles. According to recent statistics from the American Institute of Physics (AIP Publication Number R-430.02, February 2005), the numbers of women in physics steadily decreases through the educational process. Although approximately 46% of the students taking physics in high school during 2001 were girls, only 22% graduated with bachelor's degrees in physics in 2003. In 2003-04, 21% of first-year physics graduate students were women. Women were awarded 18% of all physics Ph.D.s granted in 2003.

## B. Curriculum

### *Degrees Offered:*

The Physics Department offers both B.S. and B.A. degrees in the following major areas:

- Physics
- Applied Physics
- Physics Teaching
- Physical Science Composite Teaching (jointly with Chemistry and Geosciences)

In addition, the qualified student can elect to enroll in the General Honors Program and receive departmental honors in Physics, Applied Physics, or Physics Teaching if the necessary requirements are satisfied.

The Physics Department also offers two minor programs

Physics
Physics Teaching

and provides opportunities for students to choose physics as one of the three emphasis areas for the Bachelor of Integrated Studies major (BIS).

## *Comparison of General Education and Service Course Offerings with Major/Minor Course Offerings:*

As is true of most predominately undergraduate colleges and universities, the amount of effort expended in teaching general education and service courses significantly exceeds the amount of effort involved in courses provided for majors and minors in physics. As one measure of the relative effort involved, the number of student credit hours (SCHs) in the general education and service courses can be compared to those of all other courses offered in the Department. A second measure of effort associated with general education and service course production versus major and minor coursework is the number to teaching credit hours (TCHs) expended to offer the courses. Data for both categories are given below for the academic year 2006-07:

Primarily General Education:

| Course Number | Course Name | SCHs | TCHs |
|---|---|---|---|
| Phys PS/SI1010 | Elementary Physics | 1455 | 30 |
| Phys PS/SI1040 | Elementary Astronomy | 1404 | 36 |
| Hnrs PS/SI1500 | Perspectives in the Physical Sciences | 33 | 3 |
| | Total | 2892 | 69 |
| | | (46.7%) | (26.2%) |

Primarily Service (some courses also satisfy the general education requirement):

| Course Number | Course Name | SCHs | TCHs |
|---|---|---|---|
| Phys PS/SI1360 | Principles of Physical Science | 30 | 3 |
| Phys PS/SI1360L | Principles of Physical Science Lab | 0 | 1.5 |
| Phys PS/SI2010 | College Physics I | 1025 | 25 |
| Phys 2019 | College Physics I Lab | 0 | 22.5 |
| Phys SI2020 | College Physics II | 575 | 20 |
| Phys 2029 | College Physics II Lab | 0 | 15 |
| Phys PS/SI2210 | Physics for Scientists & Engineers I | 610 | 15 |
| Phys 2219 | Physics for Scientists & Engineers I Lab | 0 | 15 |
| Phys SI2220 | Physics for Scientists & Engineers II | 390 | 15 |
| Phys 2229 | Physics for Scientists & Engineers II Lab | 0 | 12 |
| | Total | 2630 | 144 |
| | | (42.4%) | (54.8%) |

| | | | |
|---|---|---|---|
| All other courses offered in Physics | Total | 675 | 50 |
| | | (10.9%) | (19.0%) |

The total number of student credit hours associated with physical science general education and service courses taught by the Physics Department during the 2006-07 academic year was 5522 SCH. This compares to 6197 SCH, the total number of student credit hours generated by the

Physics Department during that same period of time. As a result general education and service course SCH production was 89.1% of the total number generated during that year.

The total number of teaching credit hours directly related to general education and service courses offered by the Physics Department during academic year 2006-07 was 213. The total number of TCHs associated with in-class instruction for all courses offered by the Department during that same period was 263. Thus general education and service course TCHs represented 81.0% of the total number of TCHs directly associated with in-class instruction (not including reassigned time).

## *Course Rotation, 2004-06 – 2006-07:*

The grid on the next page identifies the courses offered each term over a three-year period, beginning with the academic year 2004-06 and culminating with 2006-07.

Note: Su = summer, F = fall, S = spring

| Course | 04/05 | 05/06 | 06/07 | Current schedule |
|---|---|---|---|---|
| Phys PS/SI1010 | Su, F, S | Su, F, S | F, S | |
| Phys PS/SI1040 | F, S | Su, F, S | F, S | |
| Phys PS/SI2010 | Su, F, S | Su, F, S | Su, F, S | |
| Phys 2019 | Su, F, S | Su, F, S | Su, F, S | |
| Phys SI/2020 | Su, F, S | Su, F, S | Su, F, S | |
| Phys 2029 | Su, F, S | Su, F, S | Su, F, S | |
| Phys 2090 | | | | |
| Phys PS/SI2210 | F, S | F, S | F, S | |
| Phys 2219 | F, S | F, S | F, S | |
| Phys SI2220 | F, S | F, S | F, S | |
| Phys 2229 | F, S | F, S | F, S | |
| Phys 2300 | F | F | F | |
| Phys 2600 | F, S | F, S | F, S | |
| Phys 2710 | S | S | S | |
| Phys 2800 | Su, F, S | Su, F, S | Su, F, S | |
| Phys 2830 | Su, F, S | Su, F, S | Su, F, S | |
| Phys 2890 | | | | |
| Phys 2920 | | | | |
| Phys 3160 | F | F | F | |
| Phys 3180 | S | S | S | |
| Phys 3190 | F | F | F | |
| Phys 3200 | | S | | Alternate years even |
| Phys 3300 | | | S | Alternate years even |
| Phys 3410 | F | F | F | |
| Phys 3420 | S | | S | Alternate years odd |
| Phys 3500 | F | F | F | |
| Phys 3510 | F | F | F | |
| Phys 3540 | S | S | S | |
| Phys 3640 | S | S | S | |
| Phys 4570 | F | F | F | |
| Phys 4610 | F | F | F | |
| Phys 4620 | S | S | S | |
| Phys 4800 | Su, F, S | Su, F, S | Su, F, S | |
| Phys 4830 | Su, F, S | Su, F, S | Su, F, S | |
| Phys 4890 | | | | |
| Phys 4920 | | | | |
| Phys 4970 | F, S | F, S | F, S | |
| Phys 4990 | F, S | F, S | F, S | |
| Phys 5030 | | | | |
| Hnrs PS/SI1500 | F, S | F, S | F, S | |

## *WSU Online and WSU's Davis Campus:*

The Department currently offers only Phys 1010 online. This is a rigorous course, and includes physics animations and simulations, and at-home experiments for the student to do and write-up. Some 50 students complete the course every semester.

As described above, during the 2003-04 and 2004-05 years, the Department assigned a faculty member to WSU's Davis campus and began offering a section of Phys 1010, 1030, and 2210/2220 (including labs). The enrollment in these courses, especially in Phys 2210/2220, was unusually low. With the consent of the Dean, the Department withdrew from teaching at WSU Davis.

## *Unique Aspects of the Physics Department Curriculum:*

The Department's emphasis on undergraduate research has grown to such an extent that it has become part of the culture of our majors. Students expect and look forward to a high-quality undergraduate research experience. In addition to presenting their seminar for Phys 4990, many students present their results at WSU's Undergraduate Research Symposium, or at regional or national meetings of professional physics and astronomy organizations. In the years covered by this report, students have presented papers at national meetings of the American Association of Physics Teachers, the American Astronomical Society, and the 6th International Topical Meeting on Industrial Radiation and Radioisotope Measurement; students have also presented papers at regional meetings of the Four Corners section of the American Physical Society, the Idaho/Utah section of the American Association of Physics Teachers, and the Idaho Academy of Science. Students also co-authored papers published in the professional journals *Astronomy Education Review*, *Geophysical Research Letters*, *Hydrological Science and Technology*, *Journal of Chemical Physics*, and *Materials Research Society Symposium Proceedings*.

Dr. Adam Johnston, with a colleague at the University of Connecticut, has initiated a new national conference, *Science Education at the Crossroads*. The conference has been held three times to date, once at WSU, and has attracted science educators from across the nation. Dr. Johnston has received funding from the National Science Foundation to support this conference for the next two years.

The Physics Department is unique in having a half-time position devoted to teaching in WSU's Honors Program (although by mutual agreement this is satisfied by a 0.25 FTE). Five members of the faculty have taught Honors 1500 (Perspectives in the Physical Sciences), and three physics faculty members have been honored with the Honors Cortez Professor of the Year award.

The Physics Department influences the curricula of schools worldwide with the publication by faculty members of textbooks and other instructional materials. These include

- *Exploration of Physical Science Simulation Library Volume II*, v.2.0 by Dr. Farhang Amiri and Dr. Brad Carroll (software), published by Physics Curriculum and Instruction (2007)
- *An Introduction to Modern Astrophysics*, 2nd edition, by Dr. Brad Carroll and Dr. Dale Ostlie, published by Addison Wesley (2007) in three versions
- *Demonstrations in Physics Videos* (2 DVDs) by Dr. Ron Galli and Dr. Farhang Amiri, published by PASCO (2008)
- *Schaum's Outline of Astronomy* by Dr. Stacy Palen, published by McGraw-Hill (2001)

- *An Introduction to Thermal Physics* by Dr. Dan Schroeder, published by Addison-Wesley (1999)
- *An Introduction to Quantum Field Theory* by Dr. Michael Peskin (Stanford U.) and Dr. Dan Schroeder, published by Westview (1995).

## *Procedures for Modifying and Updating the Curriculum:*

The Physics Department's Curriculum Committee examines curricular issues that arise within the Department and makes recommendations to the Department as a whole. The Curriculum Committee receives its charges from the Chair at the beginning of the year. The Department may generate additional charges in the course of its meetings and discussions. The impetus for these charges may have several origins; they may arise from

- data collected in association with student learning outcomes assessment,
- statistical data on physics programs nationwide provided by the American Institute of Physics or other sources,
- a comparison with the physics curricula at other institutions,
- the suggestions of physics alumni who have entered graduate school or the workplace in industry.

After the Department discusses and approves changes in its curriculum, these changes must be approved by the College of Science and University Curriculum Committees, and by the Faculty Senate.

A significant number of revisions have occurred within the programs offered by the Physics Department at Weber State University since the last program review took place in 2002 – 2003.

Students' proficiency with Mathematica software was found to be questionable, despite Mathematica being a pre-requisite for taking calculus. As a result, students' success on their computational assignments in several courses was problematic, and the faculty were unable to fully utilize this computation tool in their courses. The Curriculum Committee recommended that the Department require Math 1200 (Mathematics Computer Laboratory, covering the basics of Mathematica) as a pre-requisite most of its upper-division courses. This change was discussed and approved by a vote of the faculty.

Some change is evolutionary and involves a sort of "mission creep," as the course content slowly diverges from the official course description previously approved by the department. This occurred with former courses Electronics I and Electronics II. Electronics I was an introductory electronics course that included a brief review of A.C. circuit analysis using complex impedances and covered basic principles of semiconductor operation, transistor switching, analog and digital integrated circuits, analog-digital conversion techniques used in computer interfacing, and noise. Electronics II was an intermediate-level course that included power supplies and voltage regulation, analog transistor operation, silicon-controlled rectifiers, phototransistors, LEDs, uni-junction transistors, active filters, oscillators, phase-locked loops, and computer modeling of circuit operation. With time, Electronics II evolved to place an increasing emphasis on data acquisition and analysis. Acting on the recommendation of the Curriculum Committee, the Department voted to combine the content of the old Electronics I and Electronics II into a new course, Electronics for Scientists (Phys

3410), which includes D.C. and A.C. circuit analysis using complex impedances and covers basic principles of semiconductor operation, transistors, analog and digital integrated circuits, analog-to-digital conversion techniques used in computer interfacing, and noise. The second new course, Data Acquisition and Analysis (Phys 3420), covers data acquisition with industry-standard software packages, computerized test and measurement, analog-to-digital and digital-to-analog conversion, data acquisition electronics, electronic sensors (thermal sensors, light sensors, etc.), least squares curve fitting, fast Fourier transforms (FFT), Nyquist's theorem, and noisy and weak signals.

Phys 2300 was formerly called Scientific Computing in C++ and Fortran, and was an introduction to the C, C++, and Fortran programming languages, and included general programming theory and practice. Phys 3300 was titled Computational Physics; it covered a variety of computational techniques in the context of important physical problems. There was no formal coordination between the two courses. The Curriculum Committee was charged with re-evaluating the role of computational physics with the physics curriculum. After careful consideration, the Curriculum Committee recommended that Phys 2300 become Scientific Computing for Physical Systems, which is an introduction to computer programming and fundamental numerical algorithms as used for problem solving and visualization in the natural sciences. Less emphasis was placed on particular programming languages, and more time devoted to problem solving and visualization. The Curriculum Committee recommended that Phys 3300 should extend the computational skills developed in Phys 2300 to address a wider range of problems in modern physics. The instructors of Phys 2300 and 3300 now collaborate to ensure a smooth transition between the two courses.

A college-wide effort led to the creation of a new course that is cross-listed for every science teaching major program in the College of Science. The new course in physics is Phys 3570, Foundations of Science Education. It involves a thorough investigation of research in science learning and curricular standards at the state and national levels, and includes the foundations of the philosophy of science and scientific inquiry as applicable to science teaching at the secondary level. This course serves as a foundation to a preservice science teacher's education coursework. Phys 3570 was taught for the first time during the Fall 2007 semester.

## *Evaluation of the Curriculum:*

The Department's curriculum is evaluated on a regular basis to determine if it satisfies the needs of the various constituencies that the Department serves (general education courses, service courses, and major/minor programs). The major/minor programs and associated coursework offered by the Department are also reviewed on a regular basis as a direct result of the Department's ongoing assessment effort.

The curriculum of the Physics Department is fully consistent with its mission statement. The mission statement directs the Department to offer high-quality courses for general education, pre-professional, and pre-engineering students, as well as for those who major or minor in the various physics programs. The mission statement also indicates that opportunities should also be provided for students to participate in departmental research activities.

As is evident from the statistical evaluation of the amount of effort and teaching resource that is allocated to the various courses within the Physics Department, the vast majority of all SCHs that are generated are associated with general education and service courses (89.1%). Furthermore, a significant majority of all TCHs expended in in-class teaching are also allocated to general

education and service courses (81.0%). (The discrepancy in percentages reflects the fact that general education and service courses generally have higher enrollments than do the Department's other courses, so they generate more SCHs per TCH.)

The Department has instituted a lab fee for students taking Phys 2019, 2029, 2219, and 2229. This $20 per semester fee has allowed the Department to buy new equipment and supplies for its lower-division labs. This lab fee, plus funds from the Department's annual budget, ensures that there is an appropriate allocation of funding for the Department's general education and service courses.

In support of the Department's commitment to general education and service courses, many sections of Phys 1010 and Phys 1040 are offered each Fall and Spring semester. This includes a section of Phys 1040 that is offered in the evening during the Fall and Spring semesters, Phys 2210/2220 that is offered in the evening during the Fall and Spring semesters, and a section of Phys 2010 that is offered in the evening during the Spring semester. These evening courses, and the accompanying labs, are offered primarily to accommodate the students from the College of Applied Science and Technology. In addition, at least one section of Phys 2010/2020 is offered during the Summer term. In the coming years, the Department will offer more evening sections of Phys 2210/2220 and Phys 2710, some at WSU Davis, as part of the joint WSU/USU electrical engineering major. The Physics Department's increasing role as a provider of service courses will pose special challenges over the next several years in terms of both faculty and equipment.

The special-audience general education course, Phys 1360, is also offered annually to pre-service elementary teachers in support of the elementary education program at Weber State University. In addition, two sections of the Honors course, Hnrs 1500 are also offered each year.

As demand for all of these courses increases, the Department is experiencing a growing crisis in space availability. The Department has only four classrooms and three student lab rooms. Due to space restrictions, the Department has effectively reached a limit in the number of sections of each lower-division course that can be offered during prime hours. Enrollments in the many sections of Phys 1040 are generally very near or at the limit of seating available in our planetarium (LL203). (The past two years are an exception, as previously noted.) In addition, our Fall semester sections of Phys 2010 and Phys 2210 are also approaching the available seating in our large lecture hall (LL121). Although the addition of new lecture and laboratory facilities in the Davis Campus building may help to alleviate some of the short-term demand, as the student population of the University continues to grow, additional sections of each of these courses will need to be added, especially if the anticipated WSU engineering major is realized. If new facilities are not built before the anticipated enrollment surge, it will become necessary to begin turning some students away.

The scheduling of courses for Physics, Applied Physics, and Physics Teaching majors has been carefully structured to insure that our students can progress through the program in a timely fashion. Given the significant number of pre- and co-requisite courses that exist for most of our offerings (including courses in both Physics and Mathematics), it is important that students are adequately advised regarding course scheduling throughout their undergraduate careers. It is worth noting that due to the unusual number of pre- and co-requisite courses in the sciences in general, and physics in particular, it is generally a disadvantage to our students to complete their general education coursework prior to beginning their studies in physics. Because of the sequencing and intensity of courses in physics, it is impossible to complete all necessary physics and mathematics coursework

(including the Phys 2210 and Phys 2220 series) in only two years, and it is very difficult to do so in three years.

## C. Student Learning Outcomes and Assessment

Student learning outcomes and assessment measures were formally developed and approved by the Department of Physics during the 1998-99 academic year. This formal effort was a part of the University's overall program of program assessment that began during that year.

### *Student Learning Outcomes:*

The following outcomes were approved by the Department on October 22, 1998, with minor revisions made for this report (item 2c) by including changes in the Department's curriculum since the document was approved. It is expected that:

1. At graduation, physics majors should have a thorough knowledge and comprehension of the core concepts of classical and modern physics, as assessed by
    a. student success in passing the required and elective courses for their physics major.
    b. student scores on the GRE Physics Exam (in comparison with nationwide results from the American Institute of Physics and the American Association of Physics Teachers).
    c. student acceptance rates for graduate school and/or job placement.
    d. a comparison of WSU's physics curriculum with the curricula of 1) physics programs in schools with a comparable student profile, and 2) the best physics programs.

2. At graduation, physics majors should have a set of fundamental skills that can be applied to a variety of situations. These skills should include the following:
    a. *Presentation skills*. Physics majors should be able to express (orally and in writing) their understanding of core physical principles, the results of experiments, and their analysis of physical problems, as assessed by their success in the Physics capstone presentation required of all majors and in other courses which require a written or oral report.
    b. *Laboratory skills*. Physics majors should be competent experimentalists. They should be able to design and set up an experiment, collect and analyze data, identify sources of error, and interpret their result and connect it to related areas of physics, as assessed by student performance in physics laboratory courses and faculty-supervised research projects. Students should have a basic understanding of laboratory safety issues, and follow safe practices in their own laboratories.
    c. *Computer skills*. Physics majors should be competent users of basic software, such as word processing, spreadsheet, and graphing programs, and Mathematica software. Physics majors should have an understanding of computer programming and fundamental numerical algorithms as used for problem solving and visualization in the natural sciences, as assessed by student performance in the computing components of courses in the physics curriculum.
    d. *Problem-solving skills*. Physics majors should be competent problem-solvers. They should be able to identify the essential aspects of a problem and formulate a strategy for solving the problem. They should be able to estimate the solution to a problem,

apply appropriate techniques to arrive at a solution, test the correctness of their solution, interpret their result and connect it to related areas of physics, as assessed by student performance in the problem-solving components of courses in the physics curriculum.

3. Physics majors should be adequately trained to apply their physics experience and knowledge to analyze new situations, as assessed by
    a. student acceptance rates and success in academic and industrial intern positions.
    b. post-graduation student success in graduate school, industry, or teaching – in physics or otherwise – as established by questionnaires and interviews of graduates, employers, and graduate faculty. This should include a "long-term" evaluation to obtain feedback from majors of 5 – 10 years ago.

4. All physics students (majors, minors, support, and Gen Ed students) should understand the nature of science, as assessed by exams, questionnaires, interviews, and student focus groups.

5. General Education students should understand several core concepts of physics, as assessed by nationally reviewed pre- and post-tests (for example, the Hestenes Force Concept Inventory and the Hestenes Mechanics Baseline Test for Newton's laws) and interviews.

6. Physics Teaching majors and Elementary Teaching majors should have an appropriate knowledge of physics and a variety of teaching strategies to accommodate the multiple learning styles of their students, as assessed by
    a. a comparison of the WSU Physics Teaching major with the Utah State Core Curriculum.
    b. classroom observation of student teachers.
    c. interviews with physics teachers and pre-teachers.
    d. job placement in major teaching field.

## *Measures of Assessment for Student Learning Outcomes:*

A formal process of collecting and evaluating data associated with student learning outcomes has also been developed. The Department formally adopted these measures on January 22, 1999. (Note: Minor revisions were made for this report by including courses that have been added to the Department's curriculum or revised since the measures document was approved. The newly added or revised courses are Phys 2300, 2800, 2830, 3410, 3420, and 3570.)

The following abbreviations will be used to identify the measures of student learning for each outcome:

Direct Measures:

WE = written exams (standardized or locally-developed)
OE = oral exams
LAB = laboratory activities
REP = reports/writing samples
CAP = capstone projects
IEX = inside examiners

CO = comparisons with external programs or standards
OEX = outside examiners
INT = internship experiences

Indirect Measures:

EI = exit interviews
GR = graduate school acceptance
JOB = job placement
PO = participant observation
FG = focus groups
PGS = survey of post-graduation success
JP = reported job performance

1. At graduation, Physics majors should have a thorough knowledge and comprehension of the core concepts of classical and modern physics, as assessed by
   a. student success in passing the required and elective courses for their physics major. [WE, OE, LAB, REP]

      *Courses:* Phys 2210, 2219, 2220, 2229, 2300, 2600, 2710, 2800, 2830, 3160, 3180, 3190, 3200, 3300, 3410, 3420, 3500, 3510, 3540, 3640, 4610, 4620, 4800, 4830, 4970, 4990.

   b. student scores on the GRE Physics Exam (in comparison with nationwide results from the American Institute of Physics and the American Association of Physics Teachers). [OEX]

      *Extra-curricular experience:* GRE Physics Exam.

   c. student acceptance rates for graduate school and/or job placement (in comparison with nationwide results from AIP, AAPT). [GR, JOB]

      *Extra-curricular experiences:* application for graduate school and/or employment.

   d. a comparison of WSU's physics curriculum with the curricula of 1) physics programs in schools with a comparable student profile, and 2) the best physics programs. [CO]

      *Courses:* Phys 2210, 2219, 2220, 2229, 2300, 2600, 2710, 2800, 2830, 3160, 3180, 3190, 3200, 3300, 3410, 3420, 3500, 3510, 3540, 3640, 4610, 4620, 4800, 4830, 4970, 4990.

2. At graduation, physics majors should have a set of fundamental skills that can be applied to a variety of situations. These skills should include the following:
   a. Presentation skills. Physics majors should be able to express (orally and in writing) their understanding of core physical principles, the results of experiments, and their analysis of physical problems, as assessed by their success in the Physics capstone presentation required of all majors and in other courses which require a written or oral report. [CAP, REP]

*Courses:* Phys 3190, 3410, 3640, 4830, 4970, 4990.

b. Laboratory skills. Physics majors should be competent experimentalists. They should be able to design and set up an experiment, collect and analyze data, identify sources of error, and interpret their result and connect it to related areas of physics, as assessed by student performance in physics laboratory courses and faculty-supervised research projects. Students should have a basic understanding of laboratory safety issues, and follow safe practices in their own laboratories. [LAB, WE, OE, REP, PO]

*Courses:* Phys 2219, 2229, 2600, 3190, 3410, 3420, 3640, 4800, 4970.

c. Computer skills. Physics majors should be competent users of basic software, such as word processing, spreadsheet, and graphing programs, and Mathematica software. Physics majors should have an understanding of computer programming and fundamental numerical algorithms as used for problem solving and visualization in the natural sciences, as assessed by student performance in the computing components of courses in the physics curriculum. [WE, REP]

*Courses:* Phys 2219, 2229, 2300, 3160, 3180, 3300, 3420, 3510, 3640, 4610, 4620, 4800, 4830, 4970, 4990.

d. Problem-solving skills. Physics majors should be competent problem-solvers. They should be able to identify the essential aspects of a problem and formulate a strategy for solving the problem. They should be able to estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of their solution, interpret their result and connect it to related areas of physics, as assessed by student performance in the problem-solving components of courses in the physics curriculum. [WE, REP]

*Courses:* Phys 2210, 2219, 2220, 2229, 2710, 3160, 3180, 3190, 3200, 3300, 3410, 3420, 3500, 3510, 3540, 3570, 3640, 4570, 4610, 4620, 4800, 4830, 4970.

3. Physics majors should be adequately trained to apply their physics experience and knowledge to analyze new situations, as assessed by

a. student acceptance rates and success in academic and industrial intern positions. [JP, INT]

*Extra-curricular experiences:* application for summer research appointments and intern positions.

b. post-graduation student success in graduate school, industry, or teaching --- in physics or otherwise -- as established by questionnaires and interviews of graduates, employers, and graduate faculty. This should include a “long-term” evaluation to obtain feedback from majors of 5 - 10 years ago. [PGS, JP]

*Extra-curricular experiences:* opportunities for career advancement and promotion.

4. All physics students (majors, minors, support, and Gen Ed students) should understand the nature of science, as assessed by exams, questionnaires, interviews, and student focus groups. [WE, OE, FG, EI, IEX]

   *Courses:* Phys 1010, 1040, 1360, 2010, 2019, 2020, 2029, 2210, 2219, 2220, 2229, 2710, 3160, 3180, 3190, 3200, 3300, 3410, 3420, 3500, 3510, 3540, 3570, 3640, 4570, 4610, 4620, 4800, 4830, 4970, 4990; Hnrs 1500

5. General Education students should understand several core concepts of physics, as assessed by nationally reviewed pre- and post-tests (for example, the Hestenes Force Concept Inventory and the Hestenes Mechanics Baseline Test for Newton's laws) and interviews. [WE, EI, IEX]

   *Courses:* Phys 1010, 1040, 1360, 2010, 2019, 2210, 2219; Hnrs 1500

6. Physics Teaching majors and Elementary Teaching majors should have an appropriate knowledge of physics and a variety of teaching strategies to accommodate the multiple learning styles of their students, as assessed by
   a. a comparison of the WSU Physics Teaching major with the Utah State Core Curriculum. [CO]

      *Courses:* Phys 1010, 1040, 1360, 2210, 2219, 2220, 2229, 2300, 2600, 2710, 3160, 3180, 3190, 3200, 3300, 3410, 3420, 3570, 4570.
   b. classroom observation of student teachers. [PO]

      *Extra-curricular experience:* student teaching.

   c. interviews with physics teachers and pre-teachers. [EI, PGS]

      *Extra-curricular experiences:* preparation and employment experiences of teachers and pre-teachers.

   d. job placement in major teaching field as compared with statewide averages. [JOB]

      *Extra-curricular experience:* application for employment with public or private schools.

# Physics Courses

| | |
|---|---|
| PS1010. | Elementary Physics |
| PS1040. | Elementary Astronomy |
| PS1360. | Principles of Physical Science |
| PS2010. | College Physics I |
| PS2019. | College Physics Laboratory I |
| 2020. | College Physics II |
| 2029. | College Physics Laboratory II |
| 2090. | Environmental Physics - Energy and Power |
| PS2210. | Physics for Scientists and Engineers I |
| PS2219. | Laboratory Physics |
| 2220. | Physics for Scientists and Engineers II |
| 2229. | Laboratory Physics II |
| 2300. | Scientific Computing for Physical Systems |
| 2600. | Laboratory Safety |
| 2710. | Introductory Modern Physics |
| 2800. | Introductory Individual Research Problems |
| 2830. | Introductory Readings in Physics |
| 2890. | Cooperative Work Experience |
| 2920. | Short Courses, Workshops, Institutes and Special Programs |
| 3160. | Astrophysics |
| 3180. | Thermal Physics |
| 3190. | Applied Optics |
| 3200. | Solid State Physics |
| 3300. | Advanced Computational Physics |
| 3410. | Electronics for Scientists |
| 3420. | Data Acquisition and Analysis |
| 3500. | Analytical Mechanics |
| 3510. | Electromagnetic Theory |
| 3540. | Mechanical and Electromagnetic Waves |
| 3570. | Foundations of Science Education |
| 3640. | Advanced Physics Laboratory |
| 4570. | Secondary School Science Teaching Methods |
| 4610. | Quantum Mechanics |
| 4620. | Atomic, Nuclear, and Particle Physics |
| 4800. | Individual Research Problems |
| 4830. | Readings in Physics |
| 4890. | Cooperative Work Experience |
| 4920. | Short Courses, Workshops, Institutes and Special Programs |
| 4970. | Senior Thesis |
| 4990. | Seminar in Physics |
| 5030. | Physics for Teachers |

| | |
|---|---|
| Hnrs 1500 | Perspectives in the Physical Sciences |

*Assessment Plan Timetable:*

The following assessment plan timetable was approved by the Department of Physics on April 2, 1999. Following the original timetable, a comment will indicate the progress to date.

The Department of Physics has established a Standing Committee on Assessment to carry out the department's assessment plan. This committee will carry out a longitudinal survey of physics students (majors, minors, support, and general education), tracking the performance and success of current and previous years' students. The criteria for evaluating student performance and success will be based – as much as is practical – on established and recognized nationwide norms.

Activities in support of many of the assessment goals described below are already in place. The department will continue with these previously established activities, and has decided to initiate efforts with respect to several other items in its assessment plan.

Each of the desired learning outcomes listed above is articulated with curricular and extracurricular experiences that support that learning outcome. Furthermore, appropriate measures of student learning have been identified for each outcome. From this list, the department has elected to carry out the following assessment activities:

1a. "At graduation, Physics majors should have a thorough knowledge and comprehension of the core concepts of classical and modern physics, as assessed by student success in passing the required and elective courses for their physics majors."

This will be assessed on an annual basis by the Physics Department's Assessment Committee. The committee will analyze student grades to identify weaknesses in its curriculum.

*Timetable*: This assessment will take several years to get started while sufficient numbers of grades are collected to provide reliable baseline data.

Comment: This has been assessed as part of the process of evaluating applicants for Departmental scholarships, and by noting the performance by students in their capstone seminar (Phys 4990). To date, no systematic weaknesses in the curriculum have been uncovered.

1d. "At graduation, Physics majors should have a thorough knowledge and comprehension of the core concepts of classical and modern physics, as assessed by a comparison of WSU's physics curriculum with the curricula of 1) physics programs in schools with a comparable student profile, and 2) the best physics programs."

This assessment was completed as part of the semester conversion process.

*Timetable*: This assessment will be repeated approximately every five years.

Comment: This is routinely assessed by the Department's Curriculum Committee, which compares WSU's physics curriculum with that of other institutions when considering changes in the Department's curriculum.

2a - d "At graduation, physics majors should have a set of fundamental skills that can be applied to a variety of situations. These skills should include the following: a) presentation skills; b) laboratory skills; c) computer skills; and d) problem-solving skills."

This will be assessed using data provided to the Physics Department's Assessment Committee. The committee will analyze student grades and artifacts of student performance (written assignments, lab reports, senior presentation, etc) to identify weaknesses in its curriculum.

*Timetable*: This assessment will be repeated annually, but will take several years to get started while sufficient baseline data is collected.

Comment: As a comprehensive assessment, the collection of student performance artifacts has languished. Of course, evaluating student performance is accomplished in every individual course.

3a, b. "Physics majors should be adequately trained to apply their physics experience and knowledge to analyze new situations, as assessed by a) student acceptance rates and success in academic and industrial intern positions; and b) post-graduation student success in graduate school, industry, or teaching – in physics or otherwise – as established by questionnaires and interviews of graduates, employers, and graduate faculty."

Instruments for assessing the outcomes are being developed and will be used to collect data on the immediate and long-term success of physics majors.

*Timetable*: This annual assessment will be underway by the end of the next academic year.

Comment: It has proven difficult to attain an adequate response rate from physics alumni. Anecdotal evidence consistently indicates that almost all students who apply for an academic or industrial intern position are accepted somewhere (although perhaps not at the location of first choice). Almost all students who seek employment after graduation are successful, and almost all students who apply to graduate school are accepted. Many physics alumni have received advanced degrees. The Department is attempting to develop a method to better track the success of its graduates.

4. "All physics students (majors, minors, support, and Gen Ed students) should understand the nature of science, as assessed by exams, questionnaires, interviews, and student focus groups."

During the next academic year, physics faculty member Adam Johnston will be carrying out this assessment as part of his Ph.D. thesis in Physics Education (awarded by the University of Utah).

*Timetable*: This assessment should be repeated every five years.

Comment: Dr. Johnston has completed his research which indicates the difficulty students have in trying to integrate their new understanding about the nature of science with their own previously held misconceptions. This problem plagues all students of science, and extends beyond the topic of the nature of science. These results call the claimed success of general education programs into question. There are two factors that limit the effectiveness of our current physics general education courses: 1) the lack of a hands-on laboratory component (not possible with our present limited facilities), and 2) the lack of a math pre-requisite (Snow College has a math pre-requisite, for example).

5. "General Education students should understand several core concepts of physics, as assessed by nationally reviewed pre- and post-tests (for example, the Hestenes Force Concept Inventory and the Hestenes Mechanics Baseline Test for Newton's laws) and interviews."

   The department has agreed to administer the Hestenes Force Concept Inventory and/or the Hestenes Mechanics Baseline Test for Newton's laws (pre- and post-tests) to its Gen Ed students. The results will be compared with nationwide averages for these tests.

   *Timetable*: This annual assessment will be implemented by the end of the next academic year.

   Comment: The Hestenes Force Concept Inventory (pre- and post-test) and the Hestenes Mechanics Baseline Test for Newton's laws was administered to several sections of Phys 2010 and Phys 2210. Students, mostly non-majors, in these courses recorded gains in conceptual understanding that were greater than average gains for students in comparable courses across the nation.

## *Update to the Department's Assessment Plan:*

The following is taken from the Physics Department's 2006-2007 Annual Report:

> The Department of Physics continually places an emphasis on assessment of its program outcomes. This takes place on two different levels. First, the Department evaluates the experiences of its majors (Physics, Applied Physics, Physics Teaching, and Physical Science Composite Teaching) in their respective programs. Second, the Department has an Assessment Committee, chaired by a physics education researcher, to evaluate various aspects of specific coursework and/or activities engaged in by all students, both majors and non-majors. We are pleased to report that our current assessments describe our graduates as satisfied with their degree and capable of graduate coursework and employment upon graduation; and students in our service learning opportunities in the planetarium.

Students graduating from the department with any of the four degrees complete an anonymous exit survey as a part of graduation sign-off. In addition, these students complete an exit interview with either the Department Chair or the Physics Teaching Advisor to obtain additional impressions of the program. Whenever possible, students' GRE exam data is collected, however this data is limited to students who take this exam and who are willing to share their results with the department. Finally, the department chair maintains records, when possible, of where students become employed or enter graduate school.

This year, a line of research has begun in which we consider the outcomes of service learning opportunities in the department, such as in the planetarium. Data have been collected regarding how students are drawn to these opportunities, what they seek from them, what they like about them, and how these opportunities fit with their long-term goals.

Additionally, other previous assessment efforts have manifested themselves in program changes for the upcoming year, specifically for our teaching program.

**Assessment Results:**

As is traditionally the case, students graduating from our programs described high levels of satisfaction with the program. As described in a later section, our graduates are successfully finding employment and/or positions in graduate school upon graduation.

Students queried regarding their service learning experiences in the department (specifically, the planetarium) describe the following general themes. First, they enjoy the community and mentorship that this service affords them. Second, they see a connection between what they are doing in the planetarium and what their long term goals are, even though their goals are especially diverse and only loosely connected to planetariums and informal science education. Finally, students in these experiences describe a scaffolding that takes place in their work, so that they can begin work in the planetarium, specializing in things that they are already skilled at or already have an interest in. This allows them to be introduced to the planetarium community and the department in a manner that welcomes them, as well as their extant skill sets. This places a different role on the service learning, as compared to undergraduate research opportunities or standard coursework.

**Planned improvements based on assessment data:**

This past year, specific changes have been made to our teaching programs (in addition to other College of Science teaching programs) that have been based on previous years' assessment efforts. In summary, these changes reduce the requirements in coursework taken in the College of Education, but increase specific science education related coursework and independent research. These program changes will take effect during the next academic year.

Lower division labs, having been assessed for student-reported efficacy in previous years, have been a lingering area of concern for many faculty. This fall, a one course reduction for one faculty member is being utilized for further lab program assessment and improvement.

Finally, based on an experimental course in computation taught by one of our faculty and new facilities and expertise in the department, curricular changes to computational physics courses have been made. These will continue to be monitored by the department and its faculty.

## *Evaluation:*

Despite the limited availability of data to date it appears that Physics and Applied Physics majors are well prepared to continue with their chosen professions upon graduation from Weber State University. This tentative conclusion is based on success rates in student employment and acceptance into graduate programs. It also appears that Physics, Applied Physics, and Physics Teaching majors graduate from Weber State University with a very positive view of their educational opportunities and experiences within our programs. These conclusions are based on anonymous exit surveys that have been conducted with our graduating seniors.

The student learning outcomes identified above are a direct outgrowth of the mission statement of the Department of Physics. Furthermore, since the departmental mission statement ties directly to the mission statement of the University, the identified outcomes are also directly applicable to the University's mission of offering a "quality undergraduate education" and providing an opportunity for students to engage in scholarship and research through "extensive personal contact and support among students, faculty, and staff."

Special care was taken in drafting our departmental student learning outcomes so that they indeed reflect expected outcomes rather than processes. The articulated outcomes contain a great deal of specificity regarding what is expected of the student upon graduation. The outcomes also allow the Department to identify quantitative measures that can be (and are being) used to assess the success of the identified outcome.

The Physics Department at Weber State is committed to setting high standards for all academic work within the Department, including general education, service, and major and minor coursework. The ability to evaluate these standards is based on acceptance rates in graduate schools, performance on standardized national assessment tools and examinations (Hestenes and GRE), and the ability of students to correctly solve standard sets of problems. In addition students should have developed an understanding of the nature of science.

As indicated in the list of student learning outcomes, students graduating with degrees in Physics, Applied Physics, or Physics Teaching are expected to be able to apply their knowledge and comprehension of core physical concepts on a variety of levels, including though use of developed problem-solving skills, computer skills, and laboratory skills. In addition, we expect that our students will be able to effectively present their ideas through writing, the use of graphical representations, and oral presentations.

Through our continuing assessment activities, it is anticipated that the results of those efforts will provide us with important information that will allow us to critically evaluate our programs at a variety of levels. This information and critical analysis will be used to modify our programs as needed to provide the highest possible quality in physics education at Weber State University.

# D. Academic Advising

*Departmental Academic Advisors and the Advising Process:*
Academic advising exists on several levels within the Department of Physics and the College of Science. Primary responsibility for advising Physics majors, Applied Physics majors, Physics minors, and BIS students with physics emphases rests with the Department Chair, Dr. Brad Carroll. In addition, advisement of Physics Teaching majors, Physical Science Composite Teaching majors, and Physics Teaching minors is assigned to Dr. Adam Johnston, our departmental specialist in physics education and our liaison to the Center for Science and Mathematics Education.

The departmental academic advisors are responsible for providing initial advisement regarding courses of study at the time the student chooses to declare his/her major, minor, or BIS emphasis. At the time of graduation clearance it is also the responsibility of the academic advisors to certify that all requirements for the major or minor degree program, or the BIS emphasis, have been met. Additionally, the academic advisors are available for, and strongly encourage, majors, minors, and BIS students to visit with the advisor periodically for advice on course selection, career opportunities, applications to graduate schools, or any other issues that may be of concern to the student. Dr. Johnston also has the responsibility of conducting site visits for teaching majors and minors who are engaged in the required student-teaching component of their teacher certification program. (Of course informal advising also takes place through other faculty within the Department as well.)

At the beginning of every school year, a "Welcome Back" letter is sent to all physics majors encouraging them to meet with their advisor, and informing those in their final year of the process involved in preparing for their senior seminar. An email list of physics majors has been compiled to notify students of important events and deadline, such as those for scholarship applications and Graduate Record Exams. The list is updated regularly.

As part of the formal advising process, standard forms have been developed within the Department for degree declaration, graduation sign-off, course scheduling (via semester-by-semester grids that detail suggested course sequences and scheduling options), and an anonymous graduating senior exit survey. A separate file is created for each major/minor/BIS student at the time he/she declares his/her program of study. Each file is maintained throughout the student's undergraduate career. These files are also retained on an ongoing basis after graduation as a mechanism for maintaining information on our graduates.

Along with formal advisement efforts within the Physics Department, the College of Science also has two individuals available for general advisement. Ali Miller is responsible for advisement regarding general education. In addition, she makes recommendations to the Dean of the College of Science regarding general education waiver requests in life and physical science. The advisors in the Physics Department will often refer program majors and minors to Ali when specific questions arise regarding general education degree requirements. Ali refers questions regarding course articulation for transfer students to the Chair.

Gregory Nielson is assigned part-time to the College of Science for the purposes of career and graduate school advising. He develops and maintains a database of career employment opportunities and contacts for most major programs within the College of Science, including in physics and related areas. Greg periodically visits with the Department Chair, and at times with the entire department regarding resource opportunities available through his office, to obtain specific information from the Department, and to insure coordination of efforts. Along with individual advising sessions, Greg has periodically offered seminars concerning job search strategies and selecting and applying to graduate programs. Greg also emails science position announcements directly to interested students and faculty.

## *Data on the Quality of Advising:*

The advising process within the Physics Department is evaluated through data collected via the anonymous exit surveys required of all graduating seniors. One of the questions asked in that survey directly addresses the advising process: "What comments do you have about advisement you received regarding: (a) Course selection and scheduling?, (b) Career goals?, (c) Help in obtaining employment and/or graduate school placement?" The results for (a) indicate that many students have obtained little or no schedule advising simply because they have not sought it. (One student answered, "I didn't receive much advisement, nor did I look for much, but when I did it was there.") As noted above, students are provided with a sound introduction to the department when they sign up as physics majors, and many students feel they do not need additional help with their scheduling, despite the yearly invitation in the "Welcome Back" letter to visit their advisor. The results for (b) indicate that as students near graduation, they rely on the faculty with whom they have worked for help and advice on their post-graduation plans. The results for (c) demonstrate the need for additional resources for career employment and graduate school advisement, both within the Department and through Greg Nielson's office in Career Services. This year the Department presented two seminars, one on how to pursue a career in industry, and the other on how to succeed in graduate school. Both seminars were well received by students, and the PowerPoint slides of the seminars have been posted on the Department's website. These seminars will be repeated regularly.

## *Evaluation:*

A systematic advisement process has been established in the Department of Physics. This mechanism assists students with programs of study and course selection, evaluation of progress toward the degree, career advice, and graduate school application and selection. The effectiveness of this advisement process is continually evaluated through exit survey data and anecdotal information.

# E. Faculty

## *Data Summary:*

At the end of the 2006 – 2007 academic year, the Physics Department had 12 faculty in tenured or tenure-track positions. One of the tenured faculty (Dr. Ron Galli) is on a ¾ time appointment, and another (Dr. Walther Spjeldvik) is on a ½ time appointment. As a result the Department had 10.75 FTE faculty in tenured or tenure-track positions as of the end of 2006 – 2007. Special reappointments within the Department include the Department Chair (Dr. Brad Carroll) with a 0.5 FTE reassignment for administrative duties, the Planetarium Director (Dr. Stacy Palen) with a 0.25 FTE reassignment, and an additional 0.25 FTE commitment to the Honors program to teach two courses of HNRS 1500 per year.

The Department also employed two adjunct faculty members (Dr. Richard Hills, WSU Physics emeritus, and Dr. Lee Davis) on a regular basis to teach evening courses throughout the period of this review (2002 – 2007). Dr. Michael Webb has been employed as an adjunct faculty member since the Spring 2005 semester. Other adjunct faculty are occasionally used to teach lower-division labs: Cristine Lewis, Charles Lear, and Matt Nelson.

Contract faculty perform the vast majority of all instruction within the Physics Department. When adjunct faculty are employed, great care is given to hire faculty who are fully qualified to teach physics at the university level as evidenced by their educational backgrounds. In addition, these faculty are also screened through an interview process to insure that they are good classroom teachers. Specifically, potential adjunct faculty are required to present a lecture to the contract faculty at the level of the course(s) they will be teaching. The Department does not employ applicants who do not meet these rigorous standards. Students evaluate the performance of adjunct faculty in every class they teach, and the Chair periodically reviews their teaching materials. If it is determined that currently employed adjunct faculty are not meeting the rigorous standards of the Department, they are not assigned to additional courses in the future.

In addition to contract/adjunct faculty and classified/professional staff, students are often employed on an hourly-wage basis as laboratory aides or paper graders.

Details regarding FTE information as provided by Institutional Research for contract and adjunct faculty employed between 2002 and 2007 are given in Appendix C. However, it is important to note that the Adjunct FTE data includes contract FTE overload teaching, contract FTE for WSU Online, and contract FTE WSU Davis teaching. Thus the data inflate the number of people (FTE) brought in from outside the Department to teach small numbers of TCHs, the traditional meaning of "adjunct." The Adjunct FTE data below are taken from the Department's Annual Reports, and are calculated by adding the TCHs for traditional adjuncts (brought in from outside) and dividing by 24 TCH per normal FTE load. The other data are as received from Institutional Research.

| | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|
| Adjunct FTE | 0.79 | 1.29 | 2.83 | 3.17 | 1.92 |
| Contract FTE* | 9.42 | 9.41 | 8.74 | 10.74 | 10.15 |
| Total FTE | 10.21 | 10.70 | 11.57 | 13.81 | 12.07 |

* All contract faculty in the Physics Department have tenure-track position.

As of the end of the 2006-07 academic year, the summary of academic ranks within the Department were: Professors (6), Associate Professors (2), Assistant Professors (4). Of the 12 contract faculty, eight (8) are tenured and four (4) are on tenure-track appointments. Ten of the 12 contract faculty and 4 of the 5 currently active adjunct faculty members are male. One faculty member is Asian and the remaining 11 contract and 5 adjunct faculty are White.

At the present time there is no formal orientation program within the Department of Physics for either new contract/adjunct faculty or new classified/professional staff, although they are encouraged to take advantage of University-wide opportunities. Given that turnover within the Department is relatively infrequent, the Department has been able to work with faculty and staff on a case-by-case basis. This informal process involves ongoing conversations with the Department Chair and with other faculty within the Department.

## *Orientation and Development of New Faculty:*

A formal process of orientation has been instituted at the University-wide level for new faculty. Annually a New Faculty Retreat has been held to provide valuable information about the institution, as well as teaching strategies that more seasoned faculty have found useful.

Ongoing training and development opportunities exist at several levels. There are many in-house opportunities for faculty, such as the Teaching and Learning Forum and the Hemingway New Faculty grants. Workshops on various aspects of WSU faculty life may be scheduled on eWeber's Training Tracker. All faculty are encouraged to participate in regional and national meetings in their various areas of expertise. The faculty are also encouraged to actively engage in research and scholarship activities as a means of remaining current in the rapidly progressing and evolving disciplines of physics and astronomy.

The Department Chair reviews all contract faculty and classified/professional staff on an annual basis. The annual review of contract faculty is conducted in a systematic fashion within each department in the College of Science. During the Spring Semester, each faculty member is required to complete an Annual Faculty Review of his/her activities in the areas of teaching, research and scholarship, and service. Each faculty member is also required to attach at least two summaries of student evaluations conducted during the past year. The Annual Review is then discussed during a meeting with the Chair. The Chair also evaluates progress made toward goals set the previous year, and works with the faculty member to establish goals for the coming year. The Chair summarizes his/her evaluation of the faculty member on the Annual Review document, provides a copy to the

faculty member, keeps a copy for departmental files, and shares a copy with the Dean of the College of Science.

In addition to annual reviews, tenure-track faculty and tenured faculty below the rank of full professor are also extensively evaluated through a university-wide procedure for progress toward tenure and/or advancement in rank. The candidate is evaluated by the Chair near the end of his/her second year of service to the institution. In the third and sixth years, and at the time of application to the rank of full Professor, the candidate is also evaluated by a peer review committee (which examines the candidates teaching materials), a departmental rank and tenure committee, a College of Science rank and tenure committee, and the Dean of the College. All candidates are evaluated in the areas of teaching, scholarship, and service, using the evidence developed by the peer review committee and contained in the candidates professional file. In cases of dispute over evaluations at various levels of the process, the Provost will also participate in the review process. An additional University-wide committee may also evaluate certain petitioned cases. Full details of the University's tenure and promotion process are available in the Policy and Procedures Manual, Section 8.

Due to the existence of a fairly uniform curriculum, physics programs across the nation tend to establish similar expectations and standards for undergraduate education, particularly as they apply to core major and minor coursework. A small number of standard textbooks exist in each of these core topic areas, and within these texts, problems have been developed that are challenging but appropriate to the level of the course.

Along with the standardization that naturally occurs due to the common curriculum and textbooks, other factors also help to insure that appropriate teaching standards are established throughout the Department. For example, within the Department of Physics, no faculty member "owns" an individual course. Faculty are often rotated through courses on a periodic basis, allowing them to remain fresh and excited about the material being presented. In addition, faculty within the Department routinely share ideas and pedagogies in an informal way, so that individual faculty members are aware of the expectations of other faculty teaching the same or similar courses.

In multiple-section general education and service courses, faculty are encouraged to discuss textbook selection with the other faculty teaching the same course. Although academic freedom demands that textbook selection is ultimately up to individual instructors, the Department attempts as much as possible to reach a common consensus of the text(s) to be used for a specific course. This commonality of textbook selection also encourages high academic standards among the faculty of the Department.

Following a process that has been in place for a number of years, teaching schedules and service workloads are established in the Physics Department by first requesting that faculty indicate their preferences for courses and service activities. Based on the requests, the Chair then constructs teaching schedules that reflect faculty interests, expertise, and abilities to interact with specific student populations (general education, service, majors/minors). With an average load of 12 TCHs per semester, care is taken to insure an even balance across faculty assignments. The entire department is then given an opportunity to review and comment on the assignments established by the Chair. In most cases minor adjustments can be, and have been made to satisfy specific concerns that arise. Typical concerns have included courses scheduled too close together or multiple sections of courses assigned on alternate day sequences (MWF or TTh). Over the period of time considered

in this program review, this process of establishing faculty workloads appears to satisfy all concerned.

The formal process of annual faculty reviews also seems to be quite successful. These important checkpoints help to identify potential areas of concern for faculty in tenure-track positions and also provide opportunities to discuss current and anticipated future activities with tenured faculty. These annual conversations also provide the Chair with important feedback on the health of the Department by providing faculty with a systematic way to address concerns that they might have about such issues as how the Department is managed.

## *Typical Pedagogies:*

Faculty with the Department of Physics generally use a traditional lecture format in most of the courses taught through the Department. Of course, laboratory courses are the exception to this general statement. Some members of the faculty have experimented with supplemental forms of pedagogy, such as inquiry-based instruction. In addition, increasingly extensive use of online resources, such as the posting of solutions to homework assignments and examinations on course web sites, the use of computer simulations and videos produced by Weber State University faculty, and access to external informational sites on the internet are being employed.

Many faculty with the Department of Physics at Weber State University are actively involved in research and innovation in instructional pedagogy. For example, many faculty in the Department are members of, and actively involved in the American Association of Physics Teachers (AAPT) and the American Physical Society (APS). As such they routinely participate in regional meetings of, for example, the Idaho/Utah section of the AAPT and the Four Corners section of the APS. They also participate in national meetings of those organizations, where they and their students have presented numerous papers. In addition, members of the Weber State Physics faculty have also been actively involved in the leadership of the regional division of the AAPT (Dr. Daniel Schroeder and Dr. John Sohl). One member of the Department (Dr. Daniel Schroeder) serves as the Book Review Editor of the *American Journal of Physics*, a publication of the AAPT.

Along with active involvement in the AAPT, one member of the faculty (Dr. Adam Johnston) has specific research interests in physics education and is well recognized for his contributions in that area. His work has resulted in several publications in journals such as *The Journal of Research in Scientific Teaching* and *The American Education Research Journal*.

## *Measures Used to Determine the Quality of Teaching:*

In general, faculty in the Physics Department at Weber State University have been on the cutting edge of developing and using effective pedagogical strategies in their courses. This is evidenced by the number of faculty in the Department who have been awarded or nominated for various teaching awards while at Weber State, including the Best of State University Professor (one award), College of Science Seager Award (two awards), Lowe Innovative Teaching Award (four awards), Honors Cortez Professor (three awards), Honors Program New Professor Award (two awards), Honors Eccles Fellowship (two awards), and Crystal Crest Teacher of the Year (one award and numerous nominations). One member of the faculty was chosen as the College of Science Endowed Scholar, in part as recognition of his mentoring of undergraduate researchers.

On a more systematic level, faculty within the Physics Department, and faculty across Weber State University are required to have student evaluations performed in at least two courses each year. The selection of the two courses is to be determined through consultation with the Department Chair (PPM 8-11.II.B). Copies of the student evaluations are submitted to the Chair for his/her review and evaluation, and those copies are kept in confidence in faculty files in the Chair's office. In addition, faculty within the College of Science meet with the Department Chair on an annual basis (beyond the requirement of PPM 8-11.II.A) to discuss performance issues in general, and teaching effectiveness in particular. Copies of those Annual Faculty Reviews are also kept on file in the office of the Chair. Additionally the Annual Reviews, together with student evaluations of at least two courses per year are shared with the Dean of the College of Science.

Although adjunct faculty do not meet with the Department Chair on a systematic basis, they are also required to have their teaching effectiveness evaluated through the same student evaluation process as the contract faculty. Every course taught by adjunct faculty is evaluated, and the Chair periodically reviews the teaching materials used by adjuncts.

## *Evaluation:*

The Department of Physics has a strong group of faculty with a broad range of backgrounds in physics and astronomy. These diverse academic backgrounds complement one another and provide excellent opportunities for our undergraduate majors and minors to explore a variety of specialty areas. Areas of expertise represented by the faculty include astrophysics, high energy and particle physics, condensed matter physics, optics, nuclear medical physics, space physics, electronics, physics education, nuclear physics, general relativity, and computational physics. Along with the various specialty areas, the Department has endeavored to provide an appropriate mixture of theoretical, computational, and experimental opportunities for our students. The curriculum vitae of the current departmental faculty are available in Appendix G.

Along with providing a wide range of educational and research opportunities for our majors and minors, the faculty are also carefully selected to be excellent teachers. As documented above, many of our faculty have already received formal recognition for their strengths in teaching and physics education.

All of the contract faculty, and the adjunct faculty who teach courses (not labs) within the Department currently have Ph.D.s in physics or physics education and are highly qualified to provide a first-rate education for our undergraduate students. Faculty in the Department of Physics are also able to serve as examples of faculty who are engaged and excited about their chosen field of study.

When opportunities arise to hire new faculty in the Department, great attention is given to selecting candidates who can enhance the Department's ability to provide the highest possible level of undergraduate education. Serving as a strong guide in this process are the formal objectives and goals that have been established by the Physics Department, and are reviewed on a regular basis. The current list of objectives and goals are presented in Appendix F.

Physics and astronomy have struggled to attract underrepresented populations into the discipline. Unfortunately this problem has been and continues to be more severe in physics and astronomy than

in any other field of science. According to recent statistics from the American Institute of Physics (AIP Publication Number R-430.02, February 2005), in 2002 only 14% of faculty positions in undergraduate-only institutions were held by women, and only 7% of faculty positions at Ph.D. granting institutions were held by women. These data are consistent with the current rate of production of female Ph.D. physicists at 14% of all degrees earned in 2001-2002, which has risen slightly in recent years.

Similar rates of under-representation exist by race and ethnicity. According to AIP Publication Number R-392.6 (December 2005), only 2.0% of physics faculty in the United States are African-American, 10.6% are Asian, 2.7% are Hispanic, 82.2% are White, and 2.2% are Other.

Only one member of the current faculty is classified as minority (Asian), and only two members are female. The Department's diversity has increased in recent years, but Weber State University faces the same difficulties in attracting minority and female faculty as other departments across the nation. In previous faculty searches relatively few highly qualified female or minority candidates have applied. As the diversity of the Department increases, we anticipate that prospective minority applicants will view the Department as a congenial place to apply.

Details regarding contract and adjunct faculty expertise, tenure dates, demographic profiles, and years of service are provided in Appendices B and C.

## F. Support Staff, Administration, Facilities, Equipment, and Library

In support of its academic programs, the Physics Department employs a female secretary (Nereyda Hesterberg, classified staff). The Department also employs a white male laboratory manager (Rick Schroeder, professional staff). Additional details are available in Appendix D.

The secretary continually develops and enhances the necessary skills for her position by continually learning about new office software tools (word processing, spread sheets, scanners, and web authoring tools). The secretary also strives to maintain her proficiency by receiving training for updates in administrative software systems, specifically Banner. On-campus and on-line workshops are available to aid in this process.

The laboratory manager must remain up-to-date in new laboratory technologies, and be prepared to help set up and repair lab and research equipment as needed.

Classified and professional staff are also reviewed on an annual basis. In the Performance Review and Enrichment Program (PREP) the staff are asked to perform a self-evaluation, identifying strengths and weaknesses. This self-evaluation is then shared with the Department Chair who discusses his/her evaluation of performance over the past year. As with the departmental and college Annual Faculty Reviews, the staff are asked to establish goals for the coming year in consultation with the Chair.

The Department's support staff is currently adequate in both quantity and background to support the needs of the physics program. However, as computer and instructional technologies continue to develop and become an increasingly large component of our program, it is becoming apparent that the College of Science badly needs the expertise of a technical support person housed within the College and devoted to serving its various needs.

The Administration is appropriately supportive of the physics program. The Department's budget is adequate to maintain the physics program at its present level of operation.

Principle funding for the programs and activities of the Physics Department is provided through State of Utah legislative appropriations. For the 2006 – 2007 academic year, allocations to the Physics Department totaled $1,114,183.59, including all salaries and benefits for faculty and staff. Of that total, the levels of funding for instructional wage salaries (adjuncts and overload), hourly wage salaries (student assistants), travel, and current expense were:

| | | |
|---|---|---|
| Instructional Wages: | $10,000 | + 15.0% benefits ($1500) |
| Hourly Wages: | $ 5,000 | + 8.5% benefits ($425) |
| Travel: | $ 3,500 | |
| Current Expense: | $17,500 | |
| Total Allocation (w/ benefits) | $37,925 | |

In 2000-01, the Department's total allocation was $50,480, so our working budget has been cut by 24.9%. This reflects the tightening economic circumstances at WSU and the Dean's strategy for resource allocation. (The College of Science changed Deans in 2003; both came from the Physics Department.) We note that the Dean has been willing to allocate substantial one-time funding when the Department has a demonstrated need (for example, for our remodeling project in 2006-07). Additional allocations are also provided for the College of Science Shops, which the Physics Department also operates ($500).

In addition to the baseline funding provided to the Department through annual allocations, departmental faculty have applied for, and received, significant funding for educational and professional development projects.

Various external funding sources are identified through the Office of Sponsored Projects, such as the National Science Foundation and NASA. In past years, faculty in the Department have been successful in obtaining funding through these competitive sources. Donations have also been obtained through private sources that have been cultivated with assistance of the University Development Office. These sources have provided funding for small projects within the Department as well as significant scholarship funding for our majors. Additionally, internal grant sources are available for special projects through the Academic Resources and Computing Committee, the Research, Scholarship, and Professional Growth Committee, the Office of Undergraduate Research, and the Hemmingway Trust.

Between 2002-03 and 2006 – 2007 funding requests have been submitted to, and funded by:

Academic Resources and Computing Committee (WSU Faculty Senate)
American Chemical Society
College of Science special funding
Dee Family Technology Grant (WSU)
The Hemingway Trust
NASA
National Science Foundation
Office of Undergraduate Research (WSU)

Research, Scholarship, and Professional Growth Committee (WSU Faculty Senate)
State of Utah Office of Museum Services
Weber State University grant match

The funding coming into the Department from all grants, internal and external, is shown below:

| 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|
| $45,005 | $23,200 | $105,000 | $1,231,251 | $171,376 |

The Office of Sponsored Projects has the responsibility of assisting faculty across the institution with obtaining and managing external grant programs. Currently there appears to be serious problems with how OSP functions. Communication and coordination among OSP, the PIs on grant, and other campus offices (such as Purchasing) is problematic and at times dysfunctional. Four of the Department's most productive grant writers have voiced their extreme dissatisfaction with the Office of Sponsored Projects, to the point of either choosing not to apply for funding or applying for funding with colleagues at other institutions. If WSU and the Department are to continue to increase its external funding, the Office of Sponsored Projects must be restored to functioning in a fully competent manner.

Along with funding for software and equipment to support educational and research projects, the Physics Department has been fortunate to receive generous donations from private sources and through University tuition waivers to provide financial support for many of our majors as they progress through their undergraduate careers. To date, the Department is able to provide support through the following scholarship, fellowship, and tuition waiver programs:

Jim Bateman Scholarship
College of Science Beishline Computer Application Fellowship
The Pope M. & Grace C. Burkhart Undergraduate Research Fellowship
Mary Margaret Clarke Scholarship
J. Ronald and Cheryl M. Galli Scholarship
H. Paul Huish Scholarship
Questar Corporation Scholarships
Physics Department Activity Fellowship
Planetarium Activity Fellowships
Paul and Carolyn Thompson Research Fellowship
WSU Undergraduate Research Fellowship

Additional scholarships and fellowships are also available through the College of Science and the University.

The Physics Department supplements its lower-division laboratory budgets (a portion of the current expense budget) through laboratory fees of $20 per semester. This source of income is vital to maintaining current laboratory programs, and has provided the opportunity for future upgrades.

Through the process of obtaining other financial resources from the University and through external granting agencies, it has been possible to develop and maintain basic programs within the Department. However, as undergraduate research activities continue to expand, additional funding will become increasingly important. At the present time we are able to provide our students with

access to important experimental and computational resources, including a well-equipped laser laboratory, an electronics laboratory, a nuclear physics laboratory, a nuclear medicine laboratory, an atomic force microscope, an instructional scanning tunneling microscope, and a computing cluster. A large amount of additional, more standard equipment is also available for undergraduate use. Significant resources are required simply to maintain existing equipment; additional resources will be needed in the future to replace aging equipment and provide additional opportunities for undergraduate research experiences.

In 2006-07, the last of our storage space was used to create a new state-of-the-art computational physics lab and an office for adjunct faculty. This extensive remodeling was funded primarily by a $1,000,000 grant from NASA for planetarium activities. The grant funded projects in three areas: the improvement of the department's scientific analysis and visualization capabilities, the development of K – 8 planetarium curriculum modules, and local and regional outreach. This funding allowed the department to acquire a new computing cluster consisting of 33 new computers (or nodes) with four processors each, for a total of total of 132 processor cores. In addition, the new computational physics lab was furnished with 16 new computers (4 processors each) in the distributed grid.

Most critical at the present time is the need for additional space to support our various programs. The initiation of a joint electrical engineering degree with Utah State University, and the anticipated creation of an engineering major at WSU, will have a profound impact on the growth of the Department. The expected increase in our service course Phys 2210/2220 with an influx of engineering students will place a severe strain on the Department's present resources unless the level of support is raised significantly. Offering these courses at the WSU Davis campus, as is eventually anticipated, will place an even greater burden on the Department because it will be necessary to have at least one faculty member stationed full-time on that remote campus. It is anticipated that the assignment will be rotated among the regular faculty on a semester basis. A direct result is that without another faculty member, this additional instructional burden will likely come at the expense of being able to offer sections of general education and service courses on the main campus.

As the student population of the institution continues to grow at a rapid rate, it is becoming increasingly difficult to handle the demands for general education and service courses. As previously stated, the Department has only four classrooms and three student laboratories, and these facilities are already fully scheduled. Our largest lecture room, LL121, seats approximate 100 students. Over the past several years, registration in the Fall semester sections of Phys 2010 and Phys 2210 have been very near, or exceeding capacity. At the same time, enrollments in the Spring semester sections of those courses (the so-called "trailer" sections) have increased significantly, sometimes reaching totals in excess of 60 students per section.

The Department has already been offering highly accelerated summer sections of Phys 2010 and 2020 to provide an important educational option for students. The Department also offers evening sections of Phys 2010, 2210, and 2220, together with the labs Phys 2019, 2219, and 2229, in an attempt to alleviate some of the overcrowding, and to support evening programs in the College of Applied Sciences and Technology. Unfortunately, there are severe limitations in offering additional sections during the prime daytime hours simply because of lack of availability of lecture room and associated laboratory space. The earliest available hour for offering an additional section of either lecture course in LL121 is at 1:00 pm. However, this is a time that has been historically

unattractive to students that have jobs during the day (which is typical of many students at Weber State University). In addition, the lateness of the hour provides challenges in scheduling associated laboratory sections. The Department is already offering laboratory sections for certain courses in the two sequences beginning at 8:30 am, with many other laboratory sections offered throughout the day (current starting times are 11:00 am and 2:00 pm on MWF, and 8:30 am, 11:30 am, and 2:30 pm on TTh). Nevertheless, the Department has started offering an afternoon section (2:30 on TTh) of Phys 1010, with some success.

Along with lecture and laboratory space, faculty office space is becoming critical. For several years the Department has been forced to provide office space for one faculty member in an area that was originally meant to be a small office for a laboratory manager. As the university and the Department continue to grow, it is becoming increasingly important that this critical need be addressed.

In the area of library resources, the Physics Department appears to be adequately supported. The library resources are sufficient for student and faculty needs. The Department is allotted an adequate budget for buying new books, and the library's interlibrary loan program works very well, providing any book or journal article needed within a matter of days. JaNae Kinikin, the Science Librarian, works effectively to keep the faculty up to date on new library technologies and opportunities.

### *Evaluation:*

As discussed above, when consideration is given to the availability of internal and external grants, and the future availability of laboratory fees to supplement existing legislative allocations, current funding levels for departmental equipment, travel, and general operating expenses are adequate to support the mission, objectives, and goals of the Physics Department. However, as departmental programs continue to grow and develop, additional resources will become severely strained. This is particularly true in the various areas of experimental physics.

General space issues are becoming increasingly critical. The existing lecture and laboratory spaces are beginning to inhibit the Department's ability to offer the necessary number of sections of courses required to meet the current and anticipated needs. Additional office space is needed to provide our existing faculty with the necessary environment to be maximally productive. At the same time there is no additional office space available to support future expansion within the Department. Space is also important for faculty and student research programs. Although sufficient space is currently available to meet the existing needs, future program expansion will be severely limited by available space resources.

## G. Relationships with External Communities

### *Professional Relationships with External Communities*

The faculty of the Physics Department have numerous professional relationships with a wide variety of external communities, ranging from local businesses and organizations to national and international agencies and organizations. These relationships are summarized in Appendix E.

- Utah Grid: Dr. John Armstrong serves on the Utah Grid Committee, an initiative with the University of Utah, Utah State, Southern Utah University, Utah Valley State College, and industry partners to integrate Utah's high performance computing infrastructure.

- NASA's Astrobiology Institute: Dr. John Armstrong heads the code integration team for the institute's Virtual Planetary Laboratory, and interdisciplinary planetary modeling team.

- United States Geological Survey: Dr. John Armstrong has a grant with the USGS Astrogeology Group to study polar craters on Mars.

- McMaster University (Hamilton ON, Canada): Dr. Michelle Arnold has worked with a colleague at McMaster on a project, "Sustainable use of lead in Ontario and other developed economies: assessing knowledge gaps and determining evidence based strategies to minimize health impact." WSU belongs to an international consortium to research the health impact of lead.

- Mount Sinai School of Medicine (New York, NY): Dr. Michelle Arnold participated in a Mount Sinai project to standardize the technique of x-ray fluorescence to study the lead content of bone.

- Iguana, Inc. (Carnelian Bay, CA): Dr. Carroll serves on the Board of Directors of Iguana, Inc., the maker of Iguanaware software for project management.

- Thiokol Propulsion: Dr. Colin Inglefield worked with Thiokol Propulsion on the atomic force microscope characterization of HTPB rocket propellants.

- National Renewable Energy Laboratory and the Colorado School of Mines: Dr. Colin Inglefield has worked with collaborators at these institutions on the microstructure on amorphous/microcrystalline silicon and the phase change alloy system GeSbTe.

- DaVinci Academy of Science and the Arts: Dr. Adam Johnston is a member of the Board of Directors of DaVinci Academy, a public charter high school.

- Clark Planetarium: Dr. Stacy Palen is a member of the Board of Directors of the Clark Planetarium in Salt Lake City. Both Dr. Palen and Dr. John Sohl continue to be actively involved in the development of the Clark Planetarium's science exhibits.

- Audio-Visual Imagineering (Orlando, FL): Dr. Stacy Palen works with Audio-Visual Imagineering to distribute planetarium content around the country.

- St. Charles Parish Library Planetarium (Luling, LA): Dr. Stacy Palen is creating how-to manuals for planetarium content designers.

- Garland Planetarium (Garland, TX): Dr. Stacy Palen is converting a show, "The Great Space Race," to Spanish for the Garland Planetarium.

- Shiras Planetarium (Marquette, MI): Dr. Stacy Palen is converting shows to old-fashioned slide and DVD content for Shiras Planetarium.

- Challenger Learning Center (Hammond, IN): Dr. Stacy Palen is collaborating with the learning center on an assessment of K-8 educational module content.

- Williamsville Space Lab (Williamsville, NY): Dr. Stacy Palen is collaborating on converting shows to the format used by the space lab.

- University of Western Australia (Crawley, WA): Dr. Stacy Palen is working on converting shows to the university's Mirrordome format.

- National Optical Astronomy Observatory, United States Naval Observatory, and the National Radio Astronomy Observatory: Dr. Stacy Palen works with colleagues at these institutions on surveys of planetary nebulae.

- Konica-Minolta (Japan): Dr. Stacy Palen collaborates with Konica-Minolta to distribute planetarium content developed at WSU with their planetarium projectors.

- *American Journal of Physics*: Dr. Dan Schroeder serves at the AJP's book editor.

- RSGA International: Dr. John Sohl worked with RSGA International to create and patent (pending) the Firefly Tent Light. (The patent rights will be owned by RSGA International.)

- Leonardo (Utah Science Center): Dr. John Sohl has worked on several of the center's exhibits.

- Children's Gateway Discovery Museum: Dr. John Sohl contributed to an exhibit at the museum.

- National Mountain Rescue Association: Dr. John Sohl has been involved in studies on the physics of hypothermia and snow science with the NMRA.

- Odyssey Elementary (Ogden City School District magnet school): Dr. John Sohl served on the advisory board for development of the school's mission and building.

- Los Alamos National Laboratory: Dr. Walther Spjeldvik has worked with the Space Research Section of Los Alamos.

- Boston University: Dr. Walther Spjeldvik has collaborated with colleagues at Boston University.

- Caltech: Dr. Walther Spjeldvik has collaborated with Caltech's Downs Laboratory on the project SAMPEX spacecraft to detect positrons in space.

- NASA's Jet Propulsion Laboratory: Dr. Walther Spjeldvik has collaborated with the JPL's Division of Planetary Sciences.

- RIKEN (Yokyo, JP): Dr. Walther Spjeldvik has worked with RIKEN's Cosmic High-Energy Physics Laboratory.

- Lawrence Livermore National Laboratory: Dr. Walther Spjeldvik has collaborated with the Space-Radiation Monitoring Section of LANL.

- ONERA-DESP-CERT (Toulouse, FR): Dr. Walther Spjeldvik has collaborated with the Space Research Laboratory, part of the Department of Defense of France.

- University of Compinas (Campinas, BR): Dr. Walther Spjeldvik has worked with colleagues in the Physics Department at UniCamp.

- Space Research Institute of the Russian Academy of Sciences (Moscow, RU): Dr. Walther Spjeldvik has collaborated with the Institute for Cosmic Investigations.

- NASA: Dr. Walther Spjeldvik has worked with the Division of Magnetospheric Physics.

- Instituto Nacional de Pesquisas Espasiais (Sao Jose Dos Campos, BR): Dr. Walther Spjeldvik has worked with the Brazilian Space Research Institute.

- Belgian Institute of Space Aeronomy (Brussels-Uccles, BE): Dr. Walther Spjeldvik has worked on electromagnetic wave investigations with BISA.

- Charles Stark Draper Laboratory (Cambridge, MA): Dr. Walther Spjeldvik has collaborated with the Antimatter Research Division of the laboratory.

- NASA Institute of Advanced Concepts: Dr. Walther Spjeldvik has worked with NIAC.

- Science Journals International: Dr. Walther Spjeldvik is a member of the editorial board of *Physical Sciences,* an electronic journal.

## *Outreach*

The Department's outreach effort includes many audiences, and involves departmental personal going out to these communities, as well as bringing the communities to Weber State. For example, the Department created its first Physics Department Open House in April, 2007. It was a resounding success. The demonstration shows, lectures, physics activities and planetarium shows brought approximately 500 people to the campus.

The Physics Department's Ott Planetarium is responsible for most of the Department's outreach activity. The Ott Planetarium performs outreach of five basic types:

1. Faculty members routinely visit high schools and grade schools, work with teachers and school boards in northern Utah, and host visits from interested students to the

Department. The planetarium also serves as a general information resource for public questions related to astronomy.

2. Students from regional schools (as far away as Salt Lake, Southern Idaho and Western Wyoming) come to the Ott Planetarium for field trips. The planetarium has tailored its shows to the Utah K-12 Core Curriculum, so that teachers use this experience to complement their classroom instruction. In 2007 more than 12,000 K-12 students have visited the planetarium on field trips or for astronomy merit badge programs. Planetarium shows were created in Spanish to reach out to local disadvantaged and Hispanic groups.

   The Ott Planetarium and Physics Department Observatory have weekly public observing sessions, and collaborate with the Ogden Astronomical Society to host star parties from April through October. Over the course of the last year, approximately 1300 members of the general public have been reached through this outreach effort.

3. The Ott Planetarium produces full-dome content for small planetariums. There are more than 1,000 small planetariums in the United States, many of them located in junior high or high schools. To meet the demand for quality shows at affordable prices, the Ott Planetarium has created five full-length planetarium shows, and is currently at work on a set of curriculum modules. The Planetarium has compiled a list of the core curricula of each state, so the curriculum modules can be customized to meet the specific needs of teachers in different states. Shows have been sold throughout the country, extending the outreach efforts of the Physics Department nationwide.

4. In 2007, 15 students worked in the Ott Planetarium. The opportunity to work in the planetarium is one that appeals to students in many different fields of study, from music majors to graphics arts to sound technology to chemistry. All of these students gain experience speaking in public, and our inclusive policy of finding out what useful skills students already have, and designing the program around the students currently involved improves the prestige of the Department and the sciences as a whole. Students from outside the sciences learn an appreciation for science that may be missing from their public school education, and students in the sciences learn an appreciation for the artistic and technical expertise required in other professions.

5. In the summer of 2007, Dr. Adam Johnston collaborated with the Ott Planetarium and the Ogden City School District to create the "Ottreach: Science in the Parks," a summer program in conjunction with Ogden's free lunch program for children in the city's parks. As a pilot project over a three week period at a few selected parks, students and faculty traveled to the parks with science demos, activities, and toys. More than 1300 children explored the world of science, all of whom come from disadvantaged communities. This is the most effective outreach program for this at-risk group on the WSU campus.

## *Other Relationships*

In addition to the numerous cooperative agreements between individual faculty and external communities, and the Ott Planetarium's extensive outreach program, there are a variety of informal processes that provide valuable information and interaction with the community at large.

1. Professional Societies: The faculty within the Physics Department are members of and actively involved in a large number of professional societies. Membership in these societies enables faculty in the Department to stay current in national and international dialogs in a wide variety of areas. Societies that faculty in the Department belong to include:

   - American Association of Higher Education
   - American Association of Physics Teachers
   - American Astronomical Society
   - American Geophysical Union
   - American Physical Society
   - Astronomical Society of the Pacific
   - Committee on Space Research (international)
   - International Association for Geomagnetics and Aeronomy (international)
   - International Planetarium Society
   - Materials Research Society
   - National Association of Research in Science Teaching
   - National Science Teachers Association
   - Ogden Astronomical Society
   - Optical Society of America
   - Pacific Planetarium Association
   - Phi Kappa Phi
   - Rocky Mountain Planetarium Society
   - Sigma Pi Sigma (National Honorary Society)
   - Sigma Xi (Research Society)
   - Society of Physics Students
   - Utah Museum's Association

2. Our faculty also routinely attend and present papers at national and international meetings that are hosted by the various societies.

3. The American Institute of Physics is also an important source of information on employment trends and opportunities, curricular developments, enrollments and graduation rates in undergraduate and graduate programs, graduate schools, women and minorities in physics and astronomy, and various other demographic studies.

4. Center for Science and Mathematics Education: The Center serves as a resource for pre-service and in-service training for grade school and secondary school teaching. Along with its formal training programs, the Center maintains NASA resource information that is available to area teachers. Additionally, the Center offers a variety of programs for middle and high school age students, including Science Olympiad, Science Fair, and S4 ("Science Seminars for Superior Students").

5. Career Services: Resources are available through the Office of Career Services to assist in providing information to students and departments regarding career opportunities and post-graduate education. Greg Nielson, an employee of Career Services, has specific responsibility to work with the students and departments in the College of Science.

6. University Development: The Office of University Development has primary institutional responsibility for fund raising efforts within the university. One member of the staff in the Development office, Lisa Largent, has primary responsibility for programs within the College of Science. As a part of that program Lisa interacts on a regular basis with each of the departments in the College, and meets periodically with the Chairs and the Dean of the College.

7. Office of Sponsored Projects: The Office of Sponsored Projects assists faculty across the institution in obtaining and managing external grant programs.

### *Evaluation:*

A variety of effective procedures are in place to provide important professional interactions between the Physics Department and local, regional, national, and international communities. These include interactions with educational organizations, businesses, and government and higher educational institutions. These relationships are summarized in Appendix E.

Activities involving the Ott Planetarium and WSU Observatory, as well as the Center for Science and Mathematics Education provide important interactions with various school districts throughout northern Utah, along with other communities in the general population. In addition, participation in national and international societies, together with databases maintained by national organizations provides important information about the status of undergraduate education, employment, post-graduate education, and demographics.

## H. Results of Previous Program Review and Future Directions

The last full Program Review for the Department of Physics was conducted in 2002. The Department does not participate in additional accreditation reviews. Listed below are major strengths and challenges of the Department of Physics that were identified by the review team for the previous Program Review. After each item, the Department has provided a response.

### *Strengths:*

The Review Team identified a number of strengths in the Physics Department's programs. Among those areas identified include:

1. "… the physics department is doing a very good job of preparing graduates for graduate degrees, providing significant support courses for other disciplines, and introducing concepts to general education students."

2. "The department defined the faculty and student expectations, which were rigorous and achievable. Observation: Alumni interviews confirmed the rigor of the program. Graduates competed favorably with graduates of other major educational institutions."

3. "The department should be complimented for their effort to closely follow national norms and standards."

4. "Undergraduate research efforts are to be commended. Student and alumni feedback revealed great satisfaction with the opportunity to participate in faculty research. Observation: The department undergraduate research effort is a sleeper and could separate WSU from all other undergraduate physics programs."

5. "The department has an extremely effective process of advising students."

6. "Outstanding faculty with great qualifications. The number of Ph.D. faculty exceeded all expectations."

7. "The department demonstrated efforts to achieve demographic diversity by recently hiring two women faculty (the first in the department)."

*Challenges and Recommendations:*

1. "The mission statement should focus more on student outcomes."

   Comment: The Department's mission statement was reviewed in 2007. Although the mission statement itself does not explicitly discuss assessment, assessment activities are an important component of our ongoing program evaluation processes, as discussed in detail above in Section C. Student learning Outcomes and Assessment.

2. "Student learning outcomes for general education students were limited to mastery of physics concepts. Observation: Student learning outcomes should be broadened to include an appreciation for or an understanding of the career field."

   Comment: In Spring 2007, the Faculty Senate approved new general education standards for the physical sciences. They include two sets of outcomes: one for all natural science general education courses, and the other for physical science general education courses. The process of assessment in general education is currently under review at Weber State University. They are:

   **Foundations of the Natural Sciences Learning Outcomes**
   After completing the natural sciences general education requirements, students will demonstrate their understanding of general principles of science:

   **Nature of science**. Scientific knowledge is based on evidence that is repeatedly examined, and can change with new information. Scientific explanations differ fundamentally from those that are not scientific.

   **Integration of science**. All natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.

   **Science and society**. The study of science provides explanations that have significant impact on society, including technological advancements,

improvement of human life, and better understanding of human and other influences on the earth's environment.

**Problem solving and data analysis.** Science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.

**The Physical Sciences Learning Outcomes**
Students will demonstrate their understanding of the following feature of the physical world:

**Organization of systems**: The universe is scientifically understandable in terms of interconnected systems. The systems evolve over time according to basic physical laws.

**Matter**: Matter comprises an important component of the universe, and has physical properties that can be described over a range of scales.

**Energy**: Interactions within the universe can be described in terms of energy exchange and conservation.

**Forces**: Equilibrium and change are determined by forces acting at all organizational levels.

The inclusion of "Science and society" ensures that the impact of physics and/or astronomy on society will be thoroughly covered in all of its many aspects.

3. "…the department ought to consider offering another degree option. For example, an 'engineering physics' or 'instrumentation physics' option would attract a different kind of student who would be interested in going into industry after graduation, rather than attending graduate school."

Comment: Although the majority of declared majors are in the Physics major program rather than Applied Physics or Physics Teaching, upon graduation, only half of our graduates continue on to graduate schools in physics or related fields; the rest of our graduates enter into employment in industry. These percentages are characteristic of national trends in physics.

Prior to 1995 the Physics Department did offer an Engineering Physics degree. However, at that time very few students elected that major option during its entire existence. As a result, the Department chose to eliminate that major in favor of an augmented and more flexible Applied Physics major. Given the important role of experimental physics in undergraduate research, it is anticipated that an increasingly greater number of students may elect the Applied Physics major option.

4. "Liaison with industry seemed to be lacking."

   Comment: The Department's faculty have developed a large number of professional relationships with external communities. These include cooperative agreements with industries such as RSGA International, Thiokol Propulsion, Iguana Inc., Konica-Minolta, Audio-Visual Imagineering, Clark Planetarium, Leonardo (Utah Science Center), and the Children's Gateway Discovery Museum. The Department recognizes that many students consider physics as an educational path to a career in industry, and will pursue more ties with industries, local and otherwise, as appropriate opportunities occur.

5. "More attention needs to be put on recruiting and retaining physics majors."

   Comment: The Department has made the recruitment and retention of physics majors a high priority. The first item on the Goals of the Department of Physics (Appendix F) reads "Improve recruitment and retention of physics majors." As described in Section A, the members of the Department's Recruitment and Retention Committee visit our introductory classes near the end of every semester and give presentations on the opportunities and advantages of a career in physics. They have created three flyers, each directed to the type of course they are visiting. The flyers are "Moving on in Physics" for Phys 1010; "Moving on in Astronomy" for Phys 1040; and "Beyond Phys 2010/2210" for Phys 2010 and 2210. The Department also has a major presence at WSU's Majors Fest. The observed growth of the number of physics majors is attributed to the efforts of the Recruitment and Retention Committee, and to the Department's many outreach efforts as described in Section E.

6. "The faculty are very committed to scholarly activities and research. Observation: More emphasis needs to be put on experimental versus theoretical research."

   Comment: Most of the research carried out in the Department is experimental research, although computational and theoretical research is also pursued. This reflects the backgrounds of the individuals hired in recent years. In the hiring process, the first and foremost criterion is that the applicant be a fine teacher, capable of teaching most of the courses offered by the Department. The successful applicant must have a plan for involving students in undergraduate research. In our most recent faculty search, the three top finalist's backgrounds included a theoretical quantum physics, computational general relativity, and computational condensed matter. (The general relativity finalist was hired.) The three hires before that have been in areas of computational astrobiology, experimental physics, and observational astronomy. All of these hires have involved students in undergraduate research projects. The availability of these research opportunities has directly resulted in significant numbers of student research papers being presented at regional and national meetings, with Weber State University students receiving numerous awards for those presentations. There is also an established track record of our students having a competitive edge when getting hired into industrial positions and for acceptance into graduate schools and summer research programs as a direct result of their research experiences in the laboratory.

## *Comments on Strengths and Challenges:*

Since the last review the Department has continued to build on the strengths identified above. Departmental faculty continue to actively engage in research and scholarship activities, and successfully involve students in that process. The Physics Department has been a campus and regional leader in undergraduate research, and that area of departmental emphasis continues to be very fruitful. Physics students present their results at local, regional, and national meetings, and physics majors routinely publicly report on their research activities in the required capstone course, Phys 4990, "Seminar in Physics."

Evidence of faculty research and scholarship activities is apparent in the attached curriculum vitae, found in Appendix F. As can be seen in perusing the vitae, faculty actively participate in national and international conferences, write papers in refereed journals, and author nationally and internationally recognized textbooks in physics and astronomy.

As was identified in the last review, faculty continue to actively mentor and advise our physics majors. Formal advising occurs through the Department Chair for Physics and Applied Physics majors and minors and BIS degree students, and through the Department's science education specialist (Dr. Adam Johnston) for Physics Teaching majors and minors, and for Physical Science Composite Teaching majors. In addition, departmental faculty work closely with our majors and minors, often one-on-one, to provide a valuable educational experience and important conversation and information regarding career and/or graduate school opportunities. The Department's website contains extensive information on courses, faculty, degree requirements, research programs, career opportunities, and links to external resources.

Over the next five years the Department is committed to the continuing improvement of its educational, research, and scholarship activities. As discussed above and documented in Appendix G, the Department routinely reviews goals previously established and sets new goals for the future. This process of goal-setting is crucial to the continued growth and strengthening of the Department. With the potential addition of a tenure-track faculty in 2009, the Department plans again to revisit its goals in the context of its overall mission, and the mission of the University. It is certainly the case that a major effort of the Department will continue to be its focus on undergraduate research opportunities in collaboration with a committed and vital faculty. The Department will also certainly continue to set high academic standards for all of its courses, including general education, service courses, and upper-division theoretical, experimental, and computational coursework. It is anticipated that the faculty will also continue to contribute in important ways to campus faculty governance, share ideas, and engage in important dialog across the institution.

## *Evaluation:*

Numerous significant changes have occurred since the last program review, reflecting each of the major areas of concern discussed in that report, including a revised mission statement and list of goals, a vigorous effort to recruit more physics majors, and a much-expanded effort in outreach, and a increasing participation in undergraduate research that involves all areas of physics: experimental, theoretical, and computational. The Department is committed to ongoing program assessment, self-evaluation, and change as needed to provide the highest-possible level of education to our students, and service to the "community at large", including the Weber State University

campus, the greater Ogden Community, Utah, and the national and international professional organizations that the departmental faculty represent.

# *Appendices*

Appendix A

**Student Statistical Summary**
(NOTE: data provided by Institutional Research)

| | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|
| Student Credit Hours* | 7,370 | 7,120 | 7,007 | 6,602 | 6,076 |
| Student FTE | 245.67 | 237.33 | 233.57 | 220.07 | 202.53 |
| Student Majors | 53 | 63 | 74 | 63 | 61 |
| Program Graduates | 7 | 3 | 7 | 10 | 7 |
| Student Demographic Profile | 53 | 63 | 74 | 63 | 61 |
| Majors | 3 | 10 | 12 | 10 | 11 |
| Minors | 50 | 53 | 62 | 53 | 50 |

* Student Credit Hours do not include Honors courses (Physics has a 0.25 FTE position devoted to Honors).

Appendix B

**Faculty Statistical Summary**
(NOTE: data provided by Institutional Research)

| | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|
| Adjunct FTE* | 2.30 | 2.98 | 4.50 | 3.04 | 2.97 |
| Contract FTE | 9.42 | 9.41 | 8.74 | 10.74 | 10.15 |
| Total FTE | 11.72 | 12.39 | 13.24 | 13.78 | 13.12 |

* Adjunct FTE includes contract FTE overload teaching, contract FTE for WSU Online, and contract FTE WSU Davis teaching.

Appendix C

## Contract Faculty Profile

(NOTE: data provided by Institutional Research)

| Name | Gender | Ethnicity | Rank | Tenure Status | Highest Degree | Years of Teaching | | | Areas of Expertise |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | WSU | Other | Total | |
| Amiri, Farhang | M | Asian | Prof | 07/01/89 | Ph.D. | 24 | 4 | 28 | Elementary Particles |
| Armstrong, John | M | White | Assist | | Ph.D. | 3 | | 3 | Astro-Biology |
| Arnold, Michelle | F | White | Assist | | Ph.D. | 6 | | 6 | Nuclear Medicine |
| Carroll, Bradley | M | White | Prof | 07/01/90 | Ph.D. | 23 | 3 | 26 | Astrophysics |
| Inglefield, Colin | M | White | Assoc | 07/01/07 | Ph.D. | 7 | | 7 | Condensed Matter |
| Galli, Ron | M | White | Prof | 07/01/67 | Ph.D. | 45 | 2 | 47 | General Physics |
| Johnston, Adam | M | White | Assoc | 07/01/07 | Ph.D. | 7 | 1 | 8 | Physics Education |
| Larson, Shane | M | White | Assist | | Ph.D. | 2 | | 2 | General Relativity |
| Palen, Stacy | F | White | Assist | | Ph.D. | 6 | | 6 | Astrophysics |
| Schroeder, Daniel | M | White | Prof | 07/01/98 | Ph.D. | 15 | 3 | 18 | Theoretical Physics |
| Sohl, John | M | White | Prof | 07/01/97 | Ph.D. | 18 | | 18 | Optics/ Electronics |
| Spjeldvik, Walther | M | White | Prof | 07/01/90 | Ph.D. | 23 | 1 | 24 | Atmospheric/ Space Physics |
| Ostlie, Dale | M | White | Dean | 07/01/89 | Ph.D. | 24 | 2 | 26 | Astrophysics |

## Adjunct Faculty Profile

(NOTE: data provided by Institutional Research)

| Name | Gender | Ethnicity | Rank | Tenure Status | Highest Degree | Years of Teaching | | | Areas of Expertise |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | WSU | Other | Total | |
| Davis, Lee | M | White | Adj | | Ph.D. | | | | Industrial Physics |
| Hills, Richard | M | White | Adj | 07/01/ 68 | Ph.D. | 44 | | 44 | Solid State |
| Webb, Michael | M | White | Adj | | Ph.D. | | | | Industrial Physics |
| Lewis, Cristine | F | White | Adj | | M.A. | | | | Earth and Planetary Sci |
| Lear, Charles | M | White | Adj | | B.S. | | | | Engineering |
| Nelson, Matt | M | White | Adj | | B.S. | | | | Physics |

Note: Dr. Richard Hills is emeritus Professor of Physics

Appendix D

## Contract Staff Profile

(NOTE: data provided by Institutional Research)

| Name | Gender | Ethnicity | Job Title | Years of Employment | | | Areas of Expertise |
|---|---|---|---|---|---|---|---|
| | | | | WSU | Other | Total | |
| Hesterberg, Nereyda | F | Other | Secretary | 3 | | 3 | Secretary |
| Schroeder, Rick | M | White | Lab Manager | 4 | | 4 | Lab Technician |

Appendix E

**Relationships with External Communities**

| Name | Organizations |
|---|---|
| John Armstrong | Utah Grid, NASA's Astrobiology Institute, United States Geological Survey |
| Michelle Arnold | McMaster University, Mount Sinai School of Medicine |
| Brad Carroll | Iguana, Inc. |
| Colin Inglefield | Thiokol Propulsion, National Renewable Energy Laboratory, Colorado School of Mines |
| Adam Johnston | DaVinci Academy |
| Stacy Palen | Clark Planetarium, Audio-Visual Imagineering, St. Charles Parish Library Planetarium, Garland Planetarium, Shiras Planetarium, Challenger Learning Center, Williamsville Space Lab, University of Western Australia, National Optical Astronomy Observatory, United States Naval Observatory, National Radio Astronomy Observatory, Konica-Minolta |
| Dan Schroeder | *American Journal of Physics* |
| John Sohl | Clark Planetarium, RSGA International, Leonardo (Utah Science Center), Children's Gateway Discovery Museum, National Mountain Rescue Association, Odyssey Elementary |
| Walther Spjeldvik | Los Alamos National Laboratory, Boston University, Caltech, NASA's Jet Propulsion Laboratory, RIKEN, Lawrence Livermore National Laboratory, ONERA-DESP-CERT, University of Compinas, Space Research Institute of the Russian Academy of Sciences, Instituto Nacional de Pesquisas Espasiais, Belgian Institute of Space Aeronomy, Charles Stark Draper Laboratory, NASA Institute of Advanced Concepts, Science Journals International |

Appendix F (following pages)

1. Physics Department Goals (revised and approved February 25, 2004)

2. Department Major Accomplishments 2002-03 to 2006-07 (abstracted from Physics Department Annual Reports)

# Department of Physics
# Statement of Purpose and General Objectives

(Revised and Approved February 25, 2004)

**Statement of Purpose:**

- To provide excellent instruction and counseling for all students whom we serve.
- To promote the professional growth of the faculty by pursuing opportunities for research and other scholarly activities.
- To increase global scientific knowledge through research and scholarship.
- To promote the intellectual growth of our students through involvement in undergraduate research.
- To serve the campus, the greater Ogden community, and beyond as a resource and as a source of expertise in physics and astronomy.

**General Objectives:**

- To promote learning and enhance the learning environment.
- To optimize opportunities for the success of each student.
- To enhance the expertise of the faculty and staff.
- To efficiently capitalize on existing strengths and resources, and continue to build and develop our programs as future opportunities arise.
- To maintain a high level of morale among students, staff, and faculty.
- To promote good public relations with the schools and the community, and to seek public and private support for our programs.
- To monitor, evaluate, and recognize the progress and success of departmental programs and activities.
- To plan for future success by building a solid base of personnel, programs, and facilities to be ready to serve Weber State University and northern Utah.

**Guidelines for Establishing Departmental Goals:**

- Established goals should have a broad base of support.
- Established goals should have lasting impact and importance.
- Established goals should be realistically achievable in a reasonable time.
- Established goals should be consistent with the mission of the institution and the purpose of the Department.

## Goals of the Department of Physics

The goals listed here identify needs within the Department. Of course, it is recognized that certain of these goals are attainable in the relative short-term, while others will require an ongoing effort over many years, and will be contingent upon available financial, staffing, and space resources.

**Advisement**
- Improve recruitment and retention of physics majors.
- Give better guidance to majors through effective advising.
- Maintain closer contact with graduates.
- Work with Career Services to help students identify job placement opportunities.

**Assessment**
- Improve assessment of our programs through the use of employment data.
- Develop a plan to better assess strengths and weaknesses.
- Employ standardized national assessment tools.

**Curriculum**
- Improve curriculum for Physics Teaching majors.
- Raise standards across the physics curriculum.
- Raise standards University-wide.
- Add a laboratory component for Phys 1010 and 1030.
- Improve communications skills of our students, both verbal and written.

**Faculty Positions**
- Replace any faculty retirements within the department with tenure-track positions
- Add two more tenure-track faculty.

**Laboratory Program**
- Continue to review and enhance the lower-division laboratory program.
- Review the upper-division laboratory program.
- Expand upper-division laboratory facilities.
- Institute training program for lab aides.
- Establish and maintain a computational physics lab in the department.

**Lecture Demonstrations**
- Purchase and/or develop new lecture equipment.
- Develop a comprehensive database describing available lecture demonstrations and procedures.

**Research and Scholarship (Faculty)**
- Improve opportunities for faculty research and scholarship activities.
- Maintain high-performance computer workstations in faculty offices and computerized areas.
- Improve efficiency in the use of faculty time. (Eliminate inappropriate time-wasting activities.)
- Improve professional interactions with secondary school teachers.

**Research (Students)**
- Establish an ongoing research fund within the Department to support undergraduate research.
- Continue to develop, expand, and acquire equipment and facilities to support undergraduate research.
- Encourage more physics, applied physics, and physics teaching majors to take advantage of research opportunities within the department, including senior thesis projects.
- Encourage more majors to give talks outside of the University.

**Space/Facilities**
- Plan for additional space to support teaching, learning, research, and scholarship.
- Establish an observatory on Powder Mountain.

*Department Major Accomplishments for 2002-03:*

- The Physics Department renewed its efforts to increase the number of physics majors. A team of four faculty members visited every Phys 2020 and 2220 class to make a presentation to students and inform them of the opportunities available to physics graduates. The department will assess the effectiveness of this strategy over the next few years.

- The Physics Department continued to participate in the campus-wide self-assessment of major programs that began in 1998 – 99. Over the past year we have continued to gather and analyze more relevant data.

- Physics faculty played key roles in organizing a meeting of the Four Corners Section of the American Physical Society, held at the University of Utah on October 4 – 5, 2003. Dr. Colin Inglefield was a member of the Local Organizing Committee and the Chair of the Scientific Advisory Committee. Dr. Dan Schroeder was also a member of the Scientific Advisory Committee.

- The Physics Department hosted the annual meeting of the Idaho-Utah Section of the American Association of Physics Teachers during March 28 – 29. Dr. Dan Schroeder, as President of the Idaho-Utah Section of the AAPT, organized this very successful meeting. The meeting began Friday evening with an invited lecture on "The Search for Earth -- The New Science of Astrobiology" by Physics adjunct Dr. John Armstrong. This was followed by a physics demonstration show and a star party hosted by the staff of Ott Planetarium. Drs. Galli, Hills, Johnston, and Sohl were among those who presented demonstrations. These public events were attended by more than 100 members of the local community in addition to the 50 physics teachers and students who attended the entire meeting.

- Our undergraduate research program continues to develop, with an increasing number of students participating in that opportunity. This is consistent with national trends. As of Fall 2002, 35 percent of physics undergraduates are working with a professor on a project, according to a flyer from the American Institute of Physics (available at http://www.aip.org/statistics/trends/reports/fall2002b.pdf).

- Five Physics majors presented their work several meetings: the national meeting of the American Association of Physics Teachers (Boise, ID August 3 – 7, 2002), the Four Corners Section the American Physical (Salt Lake City, UT October 4 – 5, 2002), and the Idaho-Utah Section of the American Association of Physics Teachers (WSU March 28 – 29, 2003) [a star (*) denotes a WSU undergraduate]:

    - *Jeremy Conlin presented "Calculations of Internal Electric Fields in GaInP Quantum Wells" at the national AAPT meeting in Boise and "Modeling the Topography of Hot-Wire Chemical Vapor Deposition

Grown Microcrystalline Silicon Using a Voronoi Diagram" at the Four Corners Section of the APS in Salt Lake City.

- *Brooks Mattison presented "Saturated Absorption in Rb with an Actively-Stabilized Diode Laser" at all three meetings.

- *Christy McDonald presented "Raman Scattering and Electron Spin Resonance Measurements of Liquid Sulfur Near the Polymerization Transition" at the Four Corners Section of the APS in Salt Lake City.

- *Matt Smith presented "Atomic Force Microscope Model" at the national AAPT meeting in Boise.

- *Steve Wheeler presented "Thermal Monitoring in Studying Biological Effects of Electromagnetic Fields" the Four Corners Section of the APS in Salt Lake City.

- Two Weber State University physics majors were awarded special recognition for their papers at the meeting of the Four Corners section of the APS in Salt Lake City: Brooks Mattison and Christy McDonald both received awards for an "Outstanding Presentation by an Undergraduate." This marks the fourth consecutive year that WSU physics majors have received awards at this conference.

- Jeremy Conlin, a WSU student, in collaboration with his research advisor (Colin Inglefield) and their colleagues had a referred publication:

  - M. Manecki, M. Matyjaski, C. Inglefield, and J. Conlin, "In-situ Pb Remobilization in Soils," *Hydrological Science and Technology*, **18**, 123 (2002).

## *Department Major Accomplishments for 2003-04:*

- The number of physics majors has increased by 35 percent from last year, from 45 to 61. This reflects the success of the department's Recruitment/Retention Committee in recruiting new majors by visiting classes and making short presentations on careers in physics.

- The Physics Department successfully offered sections of Phys 1010 (Introduction to Physics), Phys 1040 (Introduction to Astronomy), and Phys 2210/2220 (Physics for Scientists and Engineers) at WSU's new Davis Campus.

- In support of teaching labs for Phys 2210/2220 at WSU Davis, the Physics Department reviewed and extensively revised all of its lower-division labs, and wrote a new laboratory manual for them. Approximately two-thirds of the Davis

labs are completely new. New laboratory and demonstration equipment (totaling $87,500) was purchased in support of teaching physics at WSU Davis.

- A generous donation by Betty Ott and her children of $110,000 was made to the Physics Department's Layton P. Ott Planetarium. Combining this with $30,000 from the College of Science and a matching allocation of one-time funds by the President's Council will allow the planetarium this summer to retire its ailing, out-of-date star projector, and replace it with a new state-of-the-art digital projector.

- The Physics Department completely revised its list of objectives and goals. The new list is attached to this report.

- Associate Professor Jay Phippen retired after 38 years at WSU, and Lenord Neilson retired from his position as the Physics Department's Lab Manager.

- Dr. John Armstrong joined the department as a Research Professor of Physics.

- The department's telescope storage room was converted into a mini-computer-lab for students, with four computer workstations.

- Our undergraduate research program continues to grow, with an increasing number of students participating. This is consistent with national trends. As of Fall 2002, 73 percent of Physics undergraduates have some type of undergraduate research experience, according to the American Institute of Physics.

- Twelve Physics students presented their work at local, regional, or national meetings. These presentations were [a star (*) denotes a WSU undergraduate]:

    - *Jones, P., *Peterson, J., and *Thornley, M., "Measuring Bone Lead Levels Using X-Ray Fluorescence," presented at the WSU Symposium on Undergraduate Research.

    - *Edinger, Ben, *Johnson, AmyJo, *Bailey, Brandon, *Malmrose, Michael, *Whelan, David, *Smith, Kevin and Palen, Stacy, "Extragalactic Planets: Searching for Tertiary Companions to Binary Stars in the Large Magellanic Cloud," presented at the WSU Symposium on Undergraduate Research.

    - *Edinger, Ben, *Johnson, AmyJo, *Bailey, Brandon, *Malmrose, Michael, *Whelan, David, *Smith, Kevin and Palen, Stacy, "Probing Properties of Eclipsing Binaries in the MaCHO Database," presented at the WSU Symposium on Undergraduate Research.

    - *Smith, Ryan and Palen, Stacy, "Solar Observations at the Physics Department Observatory," presented at the WSU Symposium on Undergraduate Research.

- *Trammell, Caleb, "Diode Laser Improvements for Stable Frequency Control," presented at the WSU Symposium on Undergraduate Research.

- *Trammell, Caleb, "Diode laser Improvements for Stable Frequency Control," presented at the Joint AAPT Idaho/Utah Section and Idaho Academy of Science Meeting. (Caleb received an award for his presentation at this meeting.)

- John E. Sohl, *Caleb Trammell. "Optimizing a Highly Stable Diode Laser for Spectroscopy and Atom Trapping," Joint AAPT Idaho-Utah Section and Idaho Academy of Science Meeting, March 27, 2004.

- *Reynolds, Adam and Palen, Stacy, "Astronomical Image Processing in IDL," presented at a meeting of the Four Corners section of the APS, Tempe, AZ.

*Department Major Accomplishments for 2004-05:*

- The number of physics majors has decreased from 61 to 48. With the conversion to the new Banner/Lynx system, these figures are probably not reliable. Major codes were revised during the conversion, and comparing numbers across systems would therefore be of little value. The department's Recruitment and Retention Committee continues to recruit new majors by visiting classes and making short presentations on careers in physics.

- The department continued offering sections of Phys 1010 (Introduction to Physics), Phys 1040 (Introduction to Astronomy), and Phys 2210/2220 (Physics for Scientists and Engineers) at WSU campus. Although the enrollments in Phys 1010 and 1040 were comparable to those at WSU Ogden, the enrollments in Phys 2210/2220 were very low (11 and 4, respectively). As a result , the department decided to withdraw from teaching Phys 2210/2220 at WSU Davis, while continuing to offer sections of Phys 1010 and Phys 1040 there.

- A new evening section of Phys 2010 (General Physics), lecture and labs, was offered to accommodate students in the Parsons Construction Technology program. Two new adjunct professors, Dr. Michael Webb and Dr. Camille Lodwick, were hired to teach this course.

- The Physics Department hired a new faculty member (Dr. John Armstrong) and a new lab manager (Rick Schroeder).

- The department's application for a new full-time tenure-track faculty position was approved. A visiting faculty member will be hired for 2005-2006, and the new tenure-track position will be filled following a national search during the 2005-2006 academic year (to start August 2006).

- The Layton P. Ott Planetarium acquired a new digital state-of-the-art star projector, made possible by a generous donation of $110,000 by Betty Ott and her children. New seats for the planetarium will be installed during the summer of 2005.

- Dr. Colin Inglefield obtained a scanning probe microscope for undergraduate research, funded by a $71,700 grant from the National Science Foundation's MRI/RUI program. See Section 4 below for a summary of the internal grants obtained by WSU faculty.

- The department's HELOISE committee initiated a complete review of departmental space (office, storage, and classroom space). A major reassignment of space has been planned, and will be carried out during the 2005-2006 year to accommodate new faculty office and computer classroom space.

- The Physics Department presented a successful (approximately 300 people attended) public "The Physics of Magic" show as part its celebration of the World Year of Physics 2005.

- Our undergraduate research program continues to be a cornerstone of our physics program. Eleven students presented their work at local, regional, or national meetings of professional organizations. These presentations were [a star (*) denotes a WSU undergraduate]:

    - *R. Smith and M. Arnold, "Lead Concentrations in Human Bone Measured via X-Ray Fluorescence," Four-Corners section of the American Physical Society (Albuquerque, NM, October 2004).

    - Johnston and *L. Durrant, "Lies, damn lies, and statistics: A continual evaluation of a first year physics course," Idaho/Utah section of AAPT, Salt Lake City, UT (2005, March).

    - *M. J. Nelson, C. E. Inglefield, J. K. Olson, H. Li, and P. C. Taylor, "Microstructural Characteristics of GeSbTe Thin Films Grown by RF Sputtering," Four-Corners section meeting of the American Physical Society (Albuquerque, NM, October 2004).

    - *T. Christofferson, C. E. Inglefield, L. Tiliaferro, Joel S. Miller, P. C. Taylor, "Electron Spin Resonance Studies of $[Et_4N]_2[TCNE]_2$ Single Crystals," Four-Corners section meeting of the American Physical Society (Albuquerque, NM, October 2004).

    - *B. Bailey, *K. Smith, *B. Edinger, *D. Whelan, *M. Malmrose, *A. Johnson, and S. E. Palen, "Properties of Eclipsing Binary Stars in the MaCHO Database" *BAAS*, **204** (2004). Poster presenting work searching

the MaCHO database for interesting results on binary stars. Summer meeting of the American Astronomical Society (Denver, CO 2004).

- *A. Johnson, *D. Whelan, *B. Edinger, *B. Bailey, *K. Smith, *M. Malmrose, and S. E. Palen, "Tertiary Companions to MaCHO Eclipsing Binaries" *BAAS*, **204** (2004**)**. Poster presenting preliminary results on a search for planets around binary stars. Summer meeting of the American Astronomical Society (Denver, CO 2004).

- *C. Trammel and J. Sohl, "Undergraduate Atom Trapping and Cooling Experiment," Four-Corners section of the American Physical Society (Albuquerque, NM, October 2004).

- One student was a co-author on a publication [a star (*) denotes a WSU undergraduate]:

  - V. F. Kozhevnikov, W.P. Payne, J.K. Olson, *C. McDonald, and C.E. Inglefield, "Physical properties of sulfur near the polymerization transition," *Journal of Chemical Physics*, **121**, 7379 (2004).

## *Department Major Accomplishments for 2005-06:*

- The number of physics majors has risen from 48 to 78. Last year's figure was low because of the conversion to the new Banner/Lynx system. Two years ago the number of physics majors was 61. The increase from this figure is probably real, and reflects the success of the department's Recruitment and Retention Committee in recruiting new majors by visiting classes and making short presentations on careers in physics.

- The department continued offering sections of Phys 1010 (Elementary Physics) and Phys 1040 (Elementary Astronomy) at the WSU Davis campus.

- The Physics Department hired a new faculty member (Dr. Shane Larson) and a new secretary (Nereyda Hesterberg). Dr. Michelle Larson will also join the department as a Research Professor of Physics.

- Stacy Palen, Director of the Layton P. Ott Planetarium, was awarded a $1,000,000 NASA grant for planetarium activities. The grant will be used to acquire a new computing cluster of 32 computers that will greatly expand the planetarium's visualization capabilities. The cluster will also be available to faculty in the College of Science for computational projects.

- Our undergraduate research program continues to thrive. Nine students presented their work at local, regional, or national meetings of professional organizations. These presentations were [a star (*) denotes a WSU undergraduate]:

- *Ron Proctor and Stacy Palen, " Teaching the Lunar Cycle: Effectiveness of 3-D Visualization," American Astronomical Society Meeting, Washington, 2005 and the WSU Undergraduate Research Symposium, March 2006.

- *JasonVan Shaar and John Armstrong, "The 'Window of Opportunity' for Life Sustaining Water on Mars," Astrobiology General Meeting, Boulder CO, 2005.

- *Trealyn Christensen, John E. Sohl, "Unequal-Arm Interferometer for Laser Characterization and Atom Trapping," American Association of Physics Teachers, Idaho-Utah Section meeting, Rexburg, ID, March 25, 2006.

- John E. Sohl, *Caleb Trammell, *Pete G. Buzianis, "Actively-stabilized diode lasers for spectroscopy and trapping with undergraduates," American Association of Physics Teachers, national meeting, Salt Lake City, UT, August 10, 2005.

- *Pete G. Buzianis, John E. Sohl, "A Visual Display of Sun intensity and Apparent Size," American Association of Physics Teachers, national meeting, Salt Lake City, UT, August 9, 2005.

- *Sarah Henry, Michelle Arnold, "Measuring Bone Lead Levels of Individuals in the Salt Lake Area," WSU Undergraduate Research Symposium, March 2006.

- *Wes Snow, Marek Matyjasik, Colin Inglefield, *Steven Toller, "Precipitation by Wetting-Drying Mechanisms observed on Calcite and Gypsum Surfaces with Atomic Force Microscopy, Scanning Electron Microscopy, and X-ray Microscopy," Weber State Undergraduate Research Symposium, March, 2006.

## *Department Major Accomplishments for 2006-07:*

- The number of physics majors has risen slightly from 78 last year to 83. This and reflects the success of the department's Recruitment and Retention Committee in recruiting new majors by visiting classes and making short presentations on careers in physics.

- Stacy Palen, Director of the Ott Planetarium, was provided with reassigned time to work on Project PLANET. This effort was supported by her $1,000,000 NASA grant for planetarium activities. The grant funded projects in three areas: the improvement of the department's scientific analysis and visualization capabilities, the development of K – 8 planetarium curriculum modules, and local and regional outreach.

- The department extensively remodeled its storage space on the second floor of the Science Lab Building to create a new computational physics lab and an office for adjunct faculty. This was funded by indirect dollars from the NASA Project PLANET grant.

- The department acquired a new computing cluster, which is housed on the first floor of the Science Lab Building in a room generously donated by the Geosciences Department. The cluster has 33 new computers (or nodes) with four processors each, for a total of total of 132 processor cores. That is in addition to the 16 new computers (4 processors each) in the distributed grid in the new computational physics lab.

- The department reviewed its curriculum in the areas of computational physics and physics teaching. Two courses in computational physics, Phys 2300 and Phys 3300, were revised as a result. A new course, Phys 3570, Foundations of Science Education, was created as part of a college-wide effort to improve the training of secondary teaching majors.

- The department held its first Open House. This event included a demonstration show by Colin Inglefield and Adam Johnston; talks, "Black Holes" by Stacy Palen and "Lasers: The Light Fantastic" by John Sohl; and activities by Farhang Amiri, Michelle Arnold, Brad Carroll, Ron Galli, Colin Inglefield, Adam Johnston, and John Sohl. The event was orchestrated by John Armstrong with the help of many physics majors.

- Eight students presented their work at Weber State's Undergraduate Research Symposium or at WSU's Faculty Research Forum. These presentations were [a star (*) denotes a WSU undergraduate]:

    - *Jacob Cain and John Armstrong, Parallel Processing to Solve Scientific Problems, presented at the Fourth Annual Undergraduate Research Symposium, WSU, March 26, 2007.

    - *Giles Manning and John E. Sohl, "Laser Detection of Rubidium Hyperfine Atomic Transitions," presented at the Fourth Annual Undergraduate Research Symposium, WSU, March 26, 2007.

    - *Kevin Smith and John E. Sohl, "Modifying a Wavementer for Rapid Measurement of Laser Wavelength," presented at the Fourth Annual Undergraduate Research Symposium, WSU, March 26, 2007.

    - *Pete Buzianis and John E. Sohl, "Controlling Magnetic Field Intrusion in Rubidium Trapping," presented at the Fourth Annual Undergraduate Research Symposium, WSU, March 26, 2007.

- *Trealyn Christensen, “Unequal-Arm Michelson Interferometer for Laser Characterization and Atom Trapping,” Ergo (WSU Undergraduate Research Journal), 1, 49, 2007.

- *Trealyn Christensen and John E. Sohl, “Embedded PIC Microcontroller Programming for Large-Scale Electronic Circuit Evaluation,” presented at the Fourth Annual Undergraduate Research Symposium, WSU, March 26, 2007.

- John E. Sohl, *Trealyn Christensen, Pete Buzianis, "Photonics products for the consumer market – the FIREFLY" Third Annual Faculty Research Forum, WSU, Ogden, UT, March 27, 2007

- *Michael Malmrose and Stacy Palen, “Detection of Tertiary Companions for Eclipsing Binary Stars,” presented at the Fourth Annual Undergraduate Research Symposium, WSU, March 26, 2007.

- *Stanton Nielson and John Armstrong, “A Survey of Craters in Martian High Latitudes,” presented at the Fourth Annual Undergraduate Research Symposium, WSU, March 26, 2007.

- *Michael Simpson and Stacy Palen, “Observations with a New Radio Telescope at Weber State University,” presented at the Fourth Annual Undergraduate Research Symposium, WSU, March 26, 2007.

- Michael Malmrose, a WSU student, in collaboration with his research advisor (Dr. Stacy Palen) , submitted an article to a referred journal:

  - Malmrose, M. and Palen, S., “A New Method for Finding Tertiary Companions to Eclipsing Binary Stars in the MaCHO Database,” submitted to the *Astrophysical Journal*.

Appendix G (following pages)

Curriculum Vitae of the Physics Faculty and Program Reviewer Evaluation Team Members:

1. Farhang Amiri
2. John Armstrong
3. Michelle Arnold
4. Brad Carroll
5. J. Ronald Galli
6. Colin Inglefield
7. Adam Johnston
8. Shane Larson
9. Stacy Palen
10. Dan Schroeder
11. John Sohl
12. Walther Spjeldvik
13. Paula Szkody
14. D. Mark Riffe
15. Dan Bedford
16. Laine Berghout

**Biographical Sketch**

# Farhang Amiri


**Office Address:**

Physics Department
Weber State University
Ogden, UT 84408-2508
Phone: (801) 626-6199
Fax: (801)626-7445

**Home Address:**

5782 S. 1100 E.
Ogden, UT 84403
Phone: (801) 479-0315
E-mail: famiri@weber.edu


## Professional Preparation

| | |
|---|---|
| Florida State University: | 1976-1981 Ph.D. Elementary Particle Physics |
| Pars College (Iran): | 1971-1973 M.Sc. Theoretical Physics |
| Tehran University (Iran): | 1967-1971 B.Sc. Physics |

## Appointments

Weber State University
Physics Department

| | |
|---|---|
| Full Professor | 1991-present |
| Associate Professor | 1986-1991 |
| Assistant Professor | 1984-1986 |
| Physics Department | |

Dept. of Physics
Jackson State University
Jackson, MS 39217

| | |
|---|---|
| Assistant professor | 1981-1984 |

## Research Laboratory Appointments

Lawrence Berkeley Lab, Berkeley, California; **Visiting Scientist**, Summer 1984
Stanford Linear Accelerator Center, Stanford; **Visiting Scientist**, Summer 85, 86, 87, 89
CERN, Geneva, Switzerland; **Visiting Scientist**, Summer 1992, and Fall 1995

## Research Interests

- QCD phenomenology: Inclusive and exclusive production of heavy mesons in electron-positron annihilations; fragmentation functions of quarks
- Neutrinos: Neutrino oscillations, neutrino mass
- High energy reactions; Low transverse momentum reactions

## Teaching Developments

I am interested in applications of computers and multimedia systems in teaching. Here is a list of my most recent work in the development of physics teaching material.

- **Computer animations:** This is the work that I have done in collaboration with Brad Carroll. We have created more than 100 computer animations of different physics phenomena.
- **Demonstration videos:** In collaboration with Ron Galli, we have created around 200 short movies of physics demonstrations that encompass most of the topics in lower division physics courses.

## Publications

Publications in Elementary Particle Physics and Nuclear Physics

1. Comments on QCD fragmentation functions for $B_c$ and $B_c$* production, Phys. Rev. D57, 7048, 1998; (with C.R. Ji).
2. Heavy meson pair production in production in polarized $e^+e^-$ annihilation, Phys. Lett. B, 384, 1996.
3. Perturbative QCD analysis of pion and kaon form factors, Phys. Rev. D42, 3764, 1990; (with C.R. Ji).
4. Correlated Nuclear and Thermal Measurements in D/Pd and H/Pd Systems, Proceedings of BYU Conference on Anomalous Nuclear Effects, October 1990, (with Jeffery, Montgomery and Adams).
5. Quantum Chromodynamics predictions for the fragmentation function of heavy quarks, Phys. Lett. B, 593, 1987: (with C. R. Ji).
6. Perturbative QCD predictions for Inclusive production of heavy mesons in $e^+e^-$ annihilation, Phys. Rev. D23, 3318, 1987.
7. Exclusive heavy meson production in $Z^0$-decay, Phys. Rev. D23, 2982, 1985; (with B. Harms and C.R. Ji).
8. Valons in mesons, Phys. Rev. D31, 1561, 1985.
9. Low-PT hadron production and a valon-parton recombination model, Phys. Rev. D24, 2409, 1981; (with P.K. Williams).

Publications in Teaching Physics

1. The Phase Shift in the Jumping Ring, submitted to The Physics Teacher, March 2007, (with Rondo Jeffery).
2. Simple Experiments to Study the Earth's Magnetic Field, The Physics Teacher, Vol 42, 458, 2004, (with Rondo Jeffery).
3. Applications of Mathematica in undergraduate quantum mechanics, Proceedings of the Workshop on Computational Physics, Cal State Fullerton, 17, 1990.
4. Trip to the Moon, Proceedings of the Workshop on Computational Physics, Cal State Fullerton, 135, 1990.

## Synergic Activities

Submitted (co-PI with Bradley Carroll) proposal, “Integrating Computer and Multimedia Technologies into the Physics Curriculum” to Utah System of Higher Education’s Technology and Distance Education Initiative. This proposal was funded for $127,285 in June 1997.

Submitted proposal to the Weber State University Research, Scholarship and Professional Growth Committee “Implementing Computational and Simulation Techniques in Upper Division Physics Courses”. This proposal was funded in May 1999.

**Collaborators:** Bradley Carroll (Weber State University); Phill Dukes (University of Wyoming); Dorian Hatch (Brigham Young University); Sid Rudolph (University of Utah); Chueng Ji (North Carolina State University); Ron Galli (Weber State University)

**Graduate Advisors:** P.K. Williams and J.F. Owens (Florida State University).

# John C. Armstrong

*Assistant Professor*
*Weber State University Department of Physics*

**Education**

PhD Astronomy, University of Washington, June 2003;
Certificate, University of Washington Astrobiology Program, June 2003;
MS Astronomy, University of Washington, June 2001;
BS Physics, University of Iowa, May, 1998

## Accomplishments

- Mentored undergraduate researchers, including a team analyzing data from the Mars Global Surveyor Spacecraft and a team building software tools for the Virtual Planetary Laboratory
- Taught a wide range of courses, including introductory classes in astronomy and planetary science, physics, astrophysics, modern physics, advanced lab for astrophysics, a graduate course in fundamentals of astrobiology, and an introductory course in scientific computing.
- Conducted original research including orbital dynamics and the climate physics of Mars
- Published popular articles in *Astronomy Magazine*, *Northwest Science and Technology Magazine*, and *Science in Dispute*

## Employment History

- ***Weber State University***, Assistant Professor – 2005-Present
- ***Weber State University***, Research Professor – 2003-2005
- ***Weber State University***, Adjunct Instructor – 2003-2004
- ***United States Geological Survey***, Astrogeology Research Group, Contractor – 2003-2004
- ***University of Washington***, Graduate Teaching and Research Assistant – 1998-2003
- ***Torus Technologies***, Iowa City, IA, Curriculum Developer – 2001-2002
- ***University of Iowa***, Undergraduate Research and Teaching Assistant – 1995-1998

## Teaching Experience

- ***Elementary Astronomy,*** Assistant Professor, Weber State University, two terms per year, 2003-present
- ***Astrophysics,*** Assistant Professor, Weber State University, each Fall, 2004-present
- ***Modern Physics***, Assistant Professor, Weber State University, each Spring, 2004-present
- ***Scientific Computing with Fortran/C++***. Adjunct instructor, Weber State University. Fall 2003, Assistant Professor, Fall 2004 and Fall 2005
- ***Introduction to Astronomy, Teacher Training Workshop.*** Instructor, Emery County, 2003/2004
- ***Introduction to Astronomy***. Adjunct instructor, Weber State University. Fall 2003
- ***Conceptual Physics***. Adjunct instructor, Weber State University. Spring 2003
- ***The Planets***. Instructor, University of Washington. Autumn 2000
- ***Astrobiology Disciplines***. Team Instructor, University of Washington. Autumn, 2000
- ***The Planets.*** Teaching Assistant, University of Washington. Spring 1999; Winter 2000
- ***Introduction to Astronomy***. TA, University of Washington. Autumn 1998; Winter 1999
- ***Observational Astrophysics***. TA and Observatory Instructor, University of Washington. Summer 1999

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## Current and Past Research Collaborations

- ***The Virtual Planetary Laboratory 4D*** – Collaborators: Victoria Meadows, David Crisp, Giovanna Tinetti and others, *Jet Propulsion Lab*. Funded: $30K/yr, five years. Part of a $5 million cooperative agreement with NASA. (Co-I)
- ***The Virtual Planetary Laboratory Community Tools*** – Collaborators: Victoria Meadows, David Crisp, Giovanna Tinetti and others, *Jet Propulsion Lab*. Funded $50K over 18 months (Co-I0
- ***The Virtual Planetary Laboratory*** – Collaborators: Victoria Meadows, David Crisp, Giovanna Tinetti and others, *Jet Propulsion Lab*. Funded: $160K, two years. Funded: $25K/yr, two years. (Co-I)
- ***Observations of the Martian Polar Regions with TES and THEMIS*** – Collaborators: Tim N. Titus and Hugh H. Kieffer, *United States Geological Survey*. Funded: $10.8K, one year. Funded: $60K/yr, two years. (PI)
- ***Development of a Micro-imaging Spectrometer for In-situ Analysis of Materials on Mars*** – Collaborators: R. Glenn Sellar, *University of Central Florida*; Laurel Kirkland, *Lunar and Planetary Science Institute, Houston, TX*; Jack Farmer, *Arizona State University*. Funded: $10K/yr, two years;

## Professional Service

- ***Science Organizing Committee,*** Lunar and Planetary Science Meeting, 2006
- ***Science Organizing Committee***, NASA Astrobiology Meeting, 2004
- ***Working Group***, Astrobiology Primer, 2004 – present
- ***Working Group***, Lunar Astrobiology, 2004
- ***Referee***, Introductory Astronomy Textbook, 2004
- ***Referee***, Geophysical Research Letters, 2004, 2006
- ***Science Organizing Committee***, Astrobiology Graduate Conference, 2003
- ***Steering Committee***, Astrobiology Program, UW (Graduate Rep.), 2001-2002
- ***Science outreach activities***, 1998 – present

## Awards and Fellowships

- ***Planetary Science Summer School Fellowship*** – Jet Propulsion Laboratory, August 2002
- ***Excellence in Teaching Award*** – University of Washington, 2001
- ***NSF-IGERT Astrobiology Fellowship*** – University of Washington, 1999
- ***Jacobsen Fellow*** – University of Washington, 1998
- ***Mary Althaus Smith Award for excellence in Astronomy and Geology*** – University of Iowa, 1998
- ***Barry M. Goldwater Fellow*** – University of Iowa, 1995-1998
- ***Iowa Space Grant Award*** – University of Iowa, Summer 1997
- ***NRAO REU student*** – National Radio Astronomy Observatory, Virginia, Summer 1996
- ***Iowa Space Grant Award*** – University of Iowa, Summer 1995
- ***Antarctic Service Medal of the United States*** – Winter-over, 1992-1993

## Publications

### Student Papers

Van Shaar, Jason, Persistence of Liquid Water Environments on the Surface of Mars: Results from the NASA Ames Mars General Circulation Model, *Weber State University Undergraduate Research Symposium*, Ogden, UT, 2004

Plesko, C.S., S.P. Brumby, J.C. Armstrong, E. Ginder, and C. Leovy, Applications of Machine Learning Techniques in Digital Processing of Images of the Martian Surface, in *SPIE Conference*, Seattle, WA, 2002.

Plesko, Catherine, Applications of Machine Learning Techniques in Digital Processing of Images of the Martian Surface, *University of Washington Undergraduate Research Symposium*, Seattle, WA, 2002

Phillips, David, Water Gullies on Mars, *University of Washington Undergraduate Research Symposium*, Seattle, WA, 2001

Plesko, Catherine, Automatic Feature Extraction for Panchromatic Mars Global Surveyor Mars Orbiter Camera Imagery, *University of Washington Undergraduate Research Symposium,* Seattle, WA, 2001

**Refereed Publications**

Armstrong, J. C., S. K. Nielson, and T. N. Titus, Survey of TES high albedo events in Mars' northern polar craters, Geophys. Res. Lett., 34, L01202, 2007

Mix, L. J., J. C. Armstrong, and 20 colleagues, The Astrobiology Primer: An Outline of General Knowledge - Version 1, 2006, Astrobiology, Volume 6, Number 5, p. 735-813, 2006

Armstrong, J. C. and C. B. Leovy, Long term wind erosion on Mars. Icarus 176: 57-74, 2005

Armstrong, J.C., C.B. Leovy, and T.R. Quinn, A 1 Gyr Climate Model for Mars: New Orbital Statistics and the Importance of Seasonally Resolved Polar Processes, Icarus, 171, 255-271, 2004.

Armstrong, J.C., T.N. Titus, and H.H. Kieffer, Evidence of Subsurface Water Ice Within Korolev Crater, Mars, Icarus, Submitted, 2004.

Wells, Llyd, Julie Huber, and John Armstrong, Astrobiology: Disciplinary Aspirations and Emerging Educational Opportunities, Planets and Life: The Emerging Science of Astrobiology, eds. J. Baross and W. Sullivan, Cambridge U. Pr., 2007

Wells, L.E., J.C. Armstrong, and G. Gonzalez, Reseeding of Early Earth by Impacts of Returning Ejecta During the Late Heavy Bombardment, *Icarus*, *162*, 38-46, 2003.

Armstrong, J.C., Wind Erosion and Long Period Climate Change on Mars, *Ph.D. Thesis*, 2003.

Armstrong, J.C., L.E. Wells, and G. Gonzalez, Rummaging through Earth's Attic for Remains of Ancient Life, *Icarus*, *160*, 183-196, 2002.

Ivezic, Z., S. Tabachnik, R. Rafikov, R.H. Lupton, T. Quinn, M. Hammergren, L. Eyer, J. Chu, J.C. Armstrong, X. Fan, K. Finlator, T.R. Geballe, J.E. Gunn, G.S. Hennessy, G.R. Knapp, S.K. Leggett, J.A. Munn, J.R. Pier, C.M. Rockosi, D.P. Schneider, M.A. Strauss, B. Yanny, J. Brinkmann, I. Csabai, n, R.B. Hindsley, S. Kent, D.Q. Lamb, B. Margon, T.A. McKay, J.A. Smith, P. Waddel, D.G. York, and the Sloan Collaboration, Solar System Objects Observed in the Sloan Digital Sky Survey Commissioning Data, *Astronomical Journal*, *122*, 2749-2784, 2001.

Szkody, P., J. Armstrong, and R. Fried, Extreme Ultraviolet Explorer and Optical Observations of the Magnetic Cataclysmic Variables RX J1015.5+0904 and V405 Auriga (RX J0558+5353), *Publications of the Astronomical Society of the Pacific*, *112*, 228-236, 2000.

Armstrong, J.C., B. Nellermoe, and L. Reitzler, Measuring Rotation Periods of Asteroids Using Differential CCD Photometry, *International Amateur-Professional Photoelectric Photometry Communications*, *63*, 59, 1996.

**Selected Popular Articles**

Armstrong, J.C., Extrasolar Planets: Closing in on Earth, in *Astronomy Magazine Exploring the Universe, 9th edition*, pp. 20-27, 2003.

Armstrong, J.C., Mercury: Heading Back to the Forgotten Planet, in *Astronomy*, pp. 40-46, 2002.

Armstrong, J.C., Mapping Northwest Geology, in *Northwest Science and Technology*, pp. 42-45, 2002.

Armstrong, J.C., Northwest Collaboration to Explore Structure of the Universe, *Northwest Science and Technology*, *Autumn*, 9, 2001.

**Posters and Proceedings**

Complete list of recent conference proceedings available upon request

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# Michelle L. Arnold

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Weber State University
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marnold@weber.edu

## Education

09/1996 – 11/2000 **Ph.D. Physics**
McMaster University, Hamilton ON, Canada
*Dissertation: Development of an Accelerator Based System for In Vivo Neutron Activation Analysis Measurements of Manganese in Humans*

09/1992 – 04/1996 **B.S. Physics and Mathematics** *(double major)*
University of Winnipeg, Winnipeg MB, Canada
*GPA: 3.95/4.00*

### Honors

07/2001 – 06/2002 National Science and Engineering Research Council of Canada (NSERC) Postdoctoral Fellowship
*$32 000 per year*

09/1998 – 08/2000 NSERC Postgraduate Scholarship B
*$19 000 per year*

09/1996 – 08/1998 NSERC Postgraduate Scholarship A
*$16 000 per year*

04/1996 Gold Medal in Physics *(highest GPA)*, University of Winnipeg
Gold Medal in Math, University of Winnipeg
Silver Medal in Sciences 4-year program, University of Winnipeg

## Employment

07/2002 – present **Assistant Professor of Physics**
Weber State University, Ogden UT
- teach three or four courses per semester
- teach physics courses and labs at introductory and upper division level
- developed and maintain an x-ray fluorescence research laboratory
- have supervised approximately a dozen student research projects
- involved in all levels of service for the university (department, college and university level committees)

07/2001 – 06/2002 **Postdoctoral Research Fellow**
Lawrence Livermore National Laboratory, Livermore CA
- research using Monte Carlo simulations to calculate the dose that accelerator machines deliver to patients undergoing radiotherapy

| | |
|---|---|
| 12/2000 – 06/2001 | **Postdoctoral Research Fellow**<br>McMaster University, Hamilton ON, Canada<br>• research on *in vivo* bone lead measurements using x-ray fluorescence |
| 09/2000 – 12/2000 | **Teaching Assistant**<br>Ryerson University, Toronto ON, Canada |
| 09/1996 – 04/2000 | **Teaching Assistant**<br>McMaster University, Hamilton ON, Canada |
| 09/1995 – 04/1996 | **Laboratory Assistant and Teaching Assistant**<br>University of Winnipeg, Winnipeg MB, Canada |

## University Courses Taught

PHYS 1010, Elementary Physics
PHYS 1040, Elementary Astronomy
PHYS 2010, College Physics I
PHYS 2020, College Physics II
PHYS 2019/2219, Introductory Physics Labs I
PHYS 2029/2229, Introductory Physics Labs II
PHYS 2600, Laboratory Safety
PHYS 2710, Introductory Modern Physics
PHYS 2800, Introductory Individual Research Projects
PHYS 3500, Analytical Mechanics
PHYS 3640, Advanced Physics Laboratory
PHYS 4800, Individual Research Projects
PHYS 4990, Seminars in Physics

## Refereed Publications

"Dosimetry for Quantitative Analysis of the Effects of Low-Dose Ionizing Radiation in Radiation Therapy Patients". Lehmann J, Stern RL, Daly TP, Rocke DM, Schwietert CW, Jones GE, Arnold ML, Hartmann-Siantar CL, and Goldberg Z. *Radiation Research*, **165**, 240-247 (2006)

"A Study of MDL Improvement for the *In Vivo* Measurement of Lead in Bone". Mie H, Chettle D, Stronach I, Arnold M, Huang S, McNeill F, and O'Meara J. *Nuclear Instruments and Methods in Physics Research Section B*, **213,** 579-583 (2004)

"An Agreed Statement on Calculating Lead Concentration and Uncertainty in XRF *In Vivo* bone lead Analysis". Chettle DR, Arnold ML, Aro AC, Fleming DE, Kondrashov VS, McNeill FE, Moshier EL, Nie H, Rothenberg SJ, Stronach IM, and Todd AC. *Applied Radiation and Isotopes.* **58**(5), 603-605 (2003)

Letter to the editor: "Corrections to 'How to calculate lead concentrations and concentration uncertainty in XRF *in vivo* bone lead analysis' by Kondrashov and Rothenberg". Todd AC, Moshier EL, Arnold M, Aro A, Chettle DR, McNeill FE, Nie H, Flemming DE, Stronach IM. *Applied Radiation and Isotopes*. **58**(1), 41-50; author reply 51-54 (2003)

"An Accelerator Based System for *In Vivo* Neutron Activation Analysis Measurements of Manganese in Human Hand Bones". Arnold ML, McNeill FE, Stronach IM, Waker A, Pejovic-Milic A, and Chettle DR. *Medical Physics*, **29**(11), 2718-2724 (2002)

"The Feasibility of *In Vivo* Measurements of Manganese in the Human Brain Using Neutron Activation Analysis, Based on Monte Carlo Simulations". Arnold ML, McNeill FE, Prestwich WV, and Chettle DR. *Applied Radiation and Isotopes*, **53**(4-5), 651-656 (2000)

"Monte Carlo Design Study for *In Vivo* Aluminum Bone Measurement Using a Low Energy Accelerator Beam". Pejovic-Milic A., Arnold ML, McNeill FE, and Chettle DR. *Applied Radiation and Isotopes*, **53**(4-5), 657-664 (2000)

"The Feasibility of Measuring Manganese Concentrations in Human Liver Using Neutron Activation Analysis". Arnold ML, McNeill FE and Chettle DR. *Neurotoxicology*, **20**(2-3), 407-412 (1999)

## Research Projects and Grants

09/2007 **"Sustainable use of lead in Ontario and other developed economies: assessing knowledge gaps and determining evidence based strategies to minimize health impact"**
Ontario Ministry of Research and Innovation, International Strategic Opportunities Program
- a grant funded to establish and support an international consortium of researchers to discuss and evaluate lead research
- final dollar value not yet confirmed

04/2007 **"When experiments are too expensive, scientists turn to computer simulations"**
Dee Family Research Grant, Weber State University
- a grant funded to purchase a Monte Carlo simulation software package to simulate the x-ray fluorescence system at Weber State University
- $1200

09/2005 One of approximately two dozen research labs that participated in an international bone lead standardization study using the technique of x-ray fluorescence.

04/2004 **"Updating the Forty-year-old Computer Hardware and Software in the Nuclear Lab of the Physics Department"**
Academic Resources and Computer Grant, Weber State University
- a grant funded to purchase digital electronics and accompanying software to replace the analog nuclear instrumentation in the Weber State Department of Physics
- $12 500

06/2004 **"Measuring Bone Lead Levels in Healthy, Human Adult Volunteers"**
Research, Scholarship and Professional Growth Grant, WSU ($4600)
WSU Undergraduate Research Fellowship (Ryan Smith, $3000)
- this grant, funded by two sources, provided funds for a student researcher and equipment resources to setup the WSU bone lead x-ray fluorescence system for ongoing measurements of adult volunteers in the Utah area

Summer 2003, 2004 **"The Biology of the Greater Sale Lake Ecosystem"**
National Science Foundation, Research Experience for Undergraduates
- lead levels measured in the wing bones of various birds, including eagles

11/2002 **"Development of an X-Ray Fluorescence Research Laboratory"**
College of Science, Weber State University ($12 600)
Research, Scholarship and Professional Growth Grant,
WSU ($5,000)
- a grant, funded by two sources, for the original x-ray fluorescence equipment (radioactive source, detector, etc.) at Weber State University

## University Service

**Weber State University**

12/2002 – present Radiation Safety Officer
- renew and amend current radioactive materials license as necessary
- inventory campus radioactive materials, including any new materials delivered to campus
- train new users of radioactive materials
- distribute personal dosimeters quarterly

09/2005 – 08/2007 Curriculum Committee
- this committee reviews and approves all substantive curriculum changes to any academic course or program

09/2004 – 08/2005 Academic Resources and Computing Committee
- this committee reviews and awards grants submitted by faculty for information technology improvements across campus, including classroom and research needs

**College of Science**

09/2003 – present Safety Committee
09/2002 – present Curriculum Committee
09/2005 – 08/2007 Math Department Hiring Committee

**Department of Physics**

09/2007 – present Lower Division Lab Coordinator
09/2007 – present Lower Division Lab Committee
09/2006 – present Upper Division Lab Committee
09/2002 – present Curriculum Committee
09/2002 – present Recruitment Committee
09/2006 – 08/2007 Undergraduate Physics Club Advisor
09/2005 – 08/2007 Assessment Committee
09/2004 – 08/2006 Hiring Committee
09/2003 – 08/2006 Undergraduate Research Committee

## Community Outreach Activities

| | |
|---|---|
| 06/2007 | **Make-Your-Own Constellation**<br>**A**ctivity for children between the ages of two and ten. |
| 05/2007 | **Hands-On Physics Activities**<br>**O**rganized for middle school girls interested in science (one day campus event). |
| 04/2007 | **Physics Department Open House**<br>X-ray fluorescence system used by the public to detect metal composition of keys, coffee mugs, jewelry, etc. |
| 11/2003 | **Expanding Your Horizons**<br>Introduction to radiation activity for middle school girls interested in science (one day event at the middle school). |
| 1999 | **Let's Talk Science**<br>Partnership between McMaster University and the local public schools: tour of the McMaster nuclear reactor, demonstrations brought to the schools, lectures given, etc. |

## Affiliations

American Physics Society (APS)
American Association of Physics Teachers (AAPT)
Canadian Physics Society (CAP)
Canadian Organization of Medical Physicists (COMP)

**Curriculum Vitae**

# BRADLEY W. CARROLL


**Office Address:**

Department of Physics
Weber State University
2508 University Circle
Ogden, UT 84408-2508
Phone: (801) 626-7921
E-mail: bcarroll@weber.edu
Web page: http://physcs.weber.edu/carroll/

**Home Address:**

1563 Swan Street
Ogden, UT 84401
Phone: (801) 392-8216


**Education:**

University of Colorado, Boulder (1974 — 1981)
- Ph.D. Astrophysics (1981)
- M.S. Physics (1978)

University of California, Irvine (1967 — 1972)
- Standard Secondary Teaching Credential (1972)
- B.A. Mathematics, *cum laude* (1971)

**Appointments:**

2003 — present
- Chair, Department of Physics

1992 — present
- Professor of Physics, Weber State University

1995 — 1996
- Interim Chair, Department of Physics

1987 — 1992
- Associate Professor of Physics, Weber State University

1985 — 1987
- Assistant Professor of Physics, Weber State University

1985
- Instructor (part-time) at University of Rochester, Department of Physics and Astronomy

**Appointments (cont'd)**

1981 — 1985
Research Associate at University of Rochester Department of Physics and Astronomy (working with Hugh M. Van Horn)
1979 — 1981
Research Assistant at Joint Institute for Laboratory Astrophysics (working with Carl J. Hansen and John P. Cox)
1974 — 1979
Teaching Assistant at University of Colorado Department of Physics
1972 — 1974
Teacher of physics and mathematics at Highland High School in Bakersfield, California

**Scientific Interests:**

Stellar interiors, stellar pulsation, white dwarf and neutron stars, cataclysmic variables, accretion disks

**Thesis Title:**

"Nonadiabatic Stellar Pulsation in the Presence of Slow, Uniform Rotation"

**Professional Associations:**

American Astronomical Society (Full Member)
Astronomical Society of the Pacific
American Physical Society
American Association of Physics Teachers
National Science Teachers Association
Phi Kappa Phi Honor Society

**Courses Taught:**

University of Rochester
Thermal Physics

Weber State University:
Preparation for College Physics (Phys 100*)
Elementary Physics (Phys 1010)
Elementary Astronomy (Phys 1040)
Principles of Physical Science (Phys 1360) — for elementary ed majors
College Physics (Phys 2010 / 2020)
Laboratory Physics (Phys 2219 / 2229)

**Courses Taught (cont'd):**

Physics for Scientists and Engineers (Phys 2210 / 2220)
Introductory Modern Physics (Phys 2740)
Astrophysics (Phys 3160)
Thermal Physics (Phys 3180)
Analytical Mechanics (Phys 3500)
Electromagnetic Theory (Phys 3510)
Mechanical and Electromagnetic Waves (Phys 3540)
Quantum Mechanics (Phys 4610)
Cosmology (Phys 4830)
Astronomy for Secondary Teachers (Phys 5030)
Understanding Science (Natural Science Education 650*)
Physics in the Plays of Tom Stoppard; It's About Time (Honors 1500)
* numbering under quarter system

**Awards:**

WSU Honors Program Eccles Fellowship 2007

WSU Honors Program Distinguished Cortez Professor 1999

Dr. Spencer L. Seager Distinguished Teaching Award 1997 (College of Science)

WSU's George and Beth Lowe Teaching Award 1996

**Grants:**

1997: Utah System of Higher Education Technology and Distance Education Initiative grant, "An Interactive Conceptual Physics Course Designed for On-Demand, Remote Access" (PI Sid Rudolph, University of Utah; Co-Principal Investigators Farhang Amiri and Bradley W. Carroll (WSU), Dorian Hatch and Phillip Dukes (BYU). WSU portion funded for **$127,285.00**.

1986 — 2008: **$8820.85** for various grants from WSU's Research, Scholarship, and Professional Growth Committee.

1986: **$860.00** from the American Astronomical Society's Small Research Grant Program.

**Publications:**

*An Introduction to Modern Astrophysics*, 2nd Ed (text, 1278 pp) - B. W. Carroll and D. A. Ostlie, Addison Wesley, San Francisco, CA, 2007.

*An Introduction to Modern Stellar Astrophysics*, 2nd Ed (text, 712 pp) - D. A. Ostlie and B. W. Carroll, Addison Wesley, San Francisco, CA, 2007.

*An Introduction to Modern Galactic Astronomy and Cosmology*, 2nd Ed (text, 770 pp) - B. W. Carroll and D. A. Ostlie, Addison Wesley, San Francisco, CA, 2007.

*Instructor Solutions Manual for An Introduction to Modern Astrophysics*, 2nd Ed (226 pp) - B. W. Carroll and D. A. Ostlie, Addison Wesley, San Francisco, CA, 2007.

*An Introduction to Modern Stellar Astrophysics* (text, 832 pp) - D. A. Ostlie and B. W. Carroll, Addison-Wesley, Reading, MA, 1996.

*An Introduction to Modern Astrophysics* (text, 1424 pp) - B. W. Carroll and D. A. Ostlie, Addison-Wesley, Reading, MA, 1996.

*Instructor's Solution Manual for An Introduction to Modern Astrophysics* (274 pp) - B. W. Carroll and D. A. Ostlie, Addison-Wesley, Reading, MA, 1997.

"A Survey of the Introductory Physics Course" - B. W. Carroll, *Conference on the Introductory Physics Course*, J. Wilson (ed.), John Wiley & Sons, New York, NY, 1997.

"Modeling Vertebrate Dispersal Distances: Alternatives to the Geometric Distribution" - G. L. Miller and B. W. Carroll, *Ecology*, 70(4), 977, 1989.

"Oscillations Spectra of Neutron Stars with Strong Magnetic Fields" - B. W. Carroll, E. G. Zweibel, C. J. Hansen, P. N. McDermott, M. P. Savedoff, J. H. Thomas, and H. M. Van Horn, *Ap. J.*, **305**, 767, 1986.

"Accretion Disk Oscillations: A Local Analysis in a Disk of Finite Thickness" - B. W. Carroll, W. Cabot, P. N. McDermott, M. P. Savedoff, and H. M. Van Horn, *Ap. J.*, **296**, 529, 1985.

"The scientist fights an elusive duel:" (limerick) - B. W. Carroll, *The Journal of Irreproducible Results*, **30**, 4, 1985.

**Publications (cont'd)**

"White Dwarf/Accretion Disk Interactions: Instabilities of Infinite, Differentially Rotating Cylinders" - B. W. Carroll and H. M. Van Horn, *Cataclysmic Variables and Low-Mass X-Ray Binaries*, D. Q. Lamb and J. Patterson (eds.), Reidel, Boston, MA, 1985.

"The Sun as a Detector of Gravitational Waves" - B. W. Carroll, P. N. McDermott, S. N. Shore, and C. E. Wendell, *Nature*, **308**, 165, 1984.

"The Nonadiabatic Analysis of Nonradial Modes of Stellar Oscillations in the Presence of Slow Rotation" - B. W. Carroll and C. J. Hansen, *Ap. J.*, **263**, 352, 1982.

"Are Neutron Star Oscillations Detectable in Neutron Star Binaries?" - H. M. Van Horn, P. N. McDermott, and B. W. Carroll, *Pulsations in Classical and Cataclysmic Variable Stars*, J. P. Cox and C. J. Hansen (eds.), Joint Institute for Laboratory Astrophysics, Boulder, CO, 1982.

"Hydrogen-Driving and the Blue Edge of Compositionally Stratified ZZ Ceti Star Models" - D. E. Winget, H. M. Van Horn, M. Tassoul, C. J. Hansen, G. Fontaine, and B. W. Carroll, *Ap. J. Lettr.*, **252**, L65, 1982.

"Linear, Nonadiabatic Pulsation Calculations for Models of Upper Main Sequence and Beta Cephei Stars" - H. Saio, J. P. Cox, C. J. Hansen, and B. W. Carroll, *Proceedings of the Workshop in Nonradial and Nonlinear Stellar Instabilities*, H. Hill and W. Dziembowski (eds.), Springer-Verlag, NY, 1980.

"The Quasi-Adiabatic Analysis of Nonradial Modes of Stellar Oscillation in the Presence of Slow Rotation" - C. J. Hansen, J. P. Cox, and B. W. Carroll, *Ap. J.*, **226**, 210, 1978.

**Software:**

"Exploration of Physical Science: Simulation Library Vol II," Version 2.0 (101 interactive physics computer animations), Farhang Amiri and Bradley W. Carroll, published by Physics Curriculum & Instruction, Lakewood, MN, 2002.

**Book and Film Reviews:**

Book review of "Death Stars, Weird Galaxies, and a Quasar-Spangled Universe: The Discoveries of the Very Large Array Telescope" by Karen Taschek, *Science Books and Films*, **42**, 213, 2006.

Book review of "Conflict in the Cosmos: Fred Hoyle's Life in Science" by Simon Mitton, *Science Books and Films*, **41**, 202, 2005.

Book review of "New Moon Rising: The Making of America's New Space Vision and the Remaking of NASA" by Frank Sietzen and Keith L. Cowing, *Science Books and Films*, **41**, 65, 2005.

Book review of "Frontiers of Space Exploration" by Roger D. Launius, *Science Books and Films*, **41**, 19, 2005.

Book review of "Leaving Earth: Space Stations, Rival Superpowers, and the Quest for Interplanetary Travel" by Robert Zimmerman, to appear in *Science Books and Films*.

Book review of "Space Trivia" by William Pogue, to appear in *Science Books and Films*.

Book review of "The Cosmos: Astronomy in the New Millennium" by Jay M. Pasachoff and Alex Filippenko, in *Science Books and Films*, **40**, 18, 2004.

Book review of "Photographic Atlas of the Moon" by S. M. Chong, Albert C. H. Lim, and P. S. Ang, in *Science Books and Films*, **39**, 109, 2003.

Book review of "Astronomy: The Evolving Universe" by Michael Zeilik, *Science Books and Films*, **39**, 60, 2003.

Book review of "The Solar System and the Stars" and "Exploring the Universe" by Nathalie Fredette and Claude Lafleur, *Science Books and Films*, **38**, 507, 2002.

Book review of "Nearest Star: The Surprising Science of Our Sun" by Leon Golub and Jay M. Pasachoff, *Science Books and Films*, **38**, 309, 2001.

Book review of "Living in Space: From Science Fiction to the International Space Station" by Giovanni Caprara, *Science Books and Films*, **37**, 215, 2001.

Book review of "The Galaxies of the Local Group" by Sidney van den Bergh, *Science Books and Films*, **37**, 60, 2001.

**Book and Film Reviews (cont'd):**

Book review of “Astronomer’s Computer Companion” by Jeff Foust and Ron Lafon, *Science Books and Films*, **36**, 158, 2000.

Book review of "Merlin’s Tour of the Universe" by Neil de Grasse Tyson, for *Science Books and Films Online* (http://www.sbfonline.com/), April 1999. (Summary of review published in *Science Books and Films*, **35**, 272, 1999.)

Book review of "NASA and the Exploration of Space" by Roger L. Launius and Bertram Ulrich, *Science Books and Films*, **35**, 114, 1999.

Book review of "The Inflationary Universe: The Quest for a New Theory of Cosmic Origins" by Alan H. Guth, *Science Books and Films*, **33**, 230, 1997.

Book review of "Numerical Recipes in Fortran 90: The Art of Parallel Scientific Computing" by William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery, *Science Books and Films*, **33**, 100, 1997.

Book review of "Spiral Structure in Galaxies: A Density Wave Theory" by G. Bertin and C. C. Lin, *Science Books and Films*, **32**, 230, 1996.

Book review of "Gravity's Fatal Attraction: Black Holes in the Universe" by Mitchell Begelman and Martin Rees, *Science Books and Films*, **32**, 103, 1996.

Book review of "Image Lab:  Colorize, Transform, Animate, Zoom, and Morph Images on Your PC, 2nd ed." by Tim Wegner, *Science Books and Films*, **32**, 9, 1996.

Book review of "The Observer's Guide to Astronomy: Volume 1" by Patrick

Martinez, *Science Books and Films*, **31**, 71, 1995.

Book review of "The Guide to the Galaxy" by Nigel Henbest and Heather Couper, *Science Books and Films*, **30**, 262, 1994.

Book review of "Probing Deep Space" by Terrance Dolan, *Science Books and Films*, **29**, 201, 1993.

Book review of "Our Expanding Universe" by Evry Schatzman, *Science Books and Films*, **28**, 198, 1992.

Film review of "The Birth of the Stars and the Great Cosmic Cycle," *Science Books and Films*, **28**, 184, 1992.

**Book and Film Reviews (cont'd):**

Film review of "The Grand Design," *Science Books and Films*, **28**, 184, 1992.

Book review of "The Future of the Sun" by Jean-Claude Pecker, *Science Books and Films*, **28**, 71, 1992.

Book review of "Warped Disks and Inclined Rings around Galaxies" by Stefano Casertano, Penny D. Sackett, and Franklin H. Briggs (eds.), *Science Books and Films*, **27**, 265, 1991.

Book review of "A Young Astronomer's Guide to the Night Sky" by Michael R. Porcellino, *Science Books and Films*, **27**, 176, 1991.

Book review of "The Planet Neptune" by Patrick Moore, *Science Books and Films*, **25**, 63, 1989.

Book review of "Uranus and Neptune: The Distant Giants" by Eric Burgess, *Science Books and Films*, **24**, 155, 1989.

Book review of "Astronomy: A Self-Teaching Guide, 3rd ed." by Dinah L. Moche, *Science Books and Films*, **23**, 159, 1988.

Film review of "The Rutherford Scattering of Alpha-Particles" (Films for the Humanities, Inc.), *Science Books and Films*, **23**, 117, 1987.

Film review of "Millikan's Oil-Drop Experiment" (Films for the Humanities, Inc.), *Science Books and Films*, **23**, 53, 1987.

Book review of "The Mind-Boggling Universe: A Dazzling Scientific Journey through Space and Time" by Neil McAleer, Science Books and Films, **23**, 13, 1987.

Book review of "Computer Languages: A Guide for the Perplexed" by Naomi S. Baron, *Science Books and Films*, **22**, 283, 1987.

**Presentations:**

"The Scientific Method in a Cup" - B. W. Carroll and Michelle More - Winter Joint Meeting of the American Astronomical Society and the American Association of Physics Teachers, Seattle - January, 2007.

"The Hot Chocolate Effect" - B. W. Carroll and Michelle More - Education Press Conference at the Winter Joint Meeting of the American Astronomical Society and the American Association of Physics Teachers, Seattle - January, 2007.

"Einstein's Meanders" - B. W. Carroll - Four Corners Section of the American Physical Society, Utah State University - October, 2006.

"Playing with Science Concepts" - B. W. Carroll - Science Education at the Crossroads conference, Ogden, UT - September, 2006.

"Good Vibrations and Stellar Pulsations" - B. W. Carroll - colloquium at BYU - April, 2007.

"Terra Firma: A Solid Foundation for Pre-Service Elementary Teachers" - Michelle More and B. W. Carroll - 19th Biennial Conference on Chemical Education, Purdue University - August, 2006.

"Terra Firma: 'Physics First' for Teaching Chemistry to Pre-Service Elementary School Teachers" - Michelle More and B. W. Carroll - Annual Conference of the Utah Academy of Sciences, Arts & Letters, Snow College - April, 2006.

"The Scientific Method in a Cup" - B. W. Carroll and Michelle More - Annual Conference of the Utah Academy of Sciences, Arts & Letters, Snow College - April, 2006.

"The Pitfalls of Teaching Ptolemy: Two Confusing Figures" - B. W. Carroll - Spring meeting of the Idaho/Utah section of the American Association of Physics Teachers, Pocatello, ID - March, 2004.

"Pulsating Stars" - B. W. Carroll - colloquium at Utah Valley State College - April, 2003.

"Building Bridges: Physic and the Arts" - B. W. Carroll - Spring meeting of the Idaho-Utah section of the American Association of Physics Teachers, WSU - March 29, 2003.

**Presentations (cont'd):**

"Using Macromedia's Director to Support Web-Based Physics Instruction" - B. W. Carroll and Farhang Amiri - Winter Meeting of the American Association of Physics Teachers, Austin, TX - January, 2003.

"The 'Out' in Public Outreach at Weber State University" (invited talk) - B. W. Carroll - Winter Meeting of the American Association of Physics Teachers, Austin, TX - January, 2003.

"Five Remarkable Women at the Crossroads of Astronomy" (invited talk) - B. W. Carroll - ALCON 2002, the national convention of the Astronomical League - Salt Lake City - July, 2002.

"T + 25: The Challenges Ahead for Physics Education" (invited talk) - B. W. Carroll - Four Corners section of the American Physical Society, in Salt Lake City - October, 2002.

"Scientist Teachers and Science Educators: Seeking Common Ground on Teaching and Learning Issues," panel member at NSTA Western Regional Convention, Salt Lake City - October, 2001.

"$E^3$: Exploring Europa's Environment" - B. W. Carroll - Utah Science Teachers Association, BYU - February, 2001.

"Bringing Pulsating Stars into the Physics Classroom" - B. W. Carroll and D. A. Ostlie - 197$^{th}$ meeting of the American Astronomical Society, San Diego - January, 2001.

"Using Macromedia's *Director* to Support Learning Modern Physics Concepts" - B. W. Carroll and Farhang Amiri - 122$^{nd}$ AAPT National Meeting, San Diego - January, 2001.

"Exploring Europa," - B. W. Carroll and Adam Johnston - NASA Teachers Workshop - November, 2000.

"Physics Animations and Simulations Using Macromedia's *Director 7*" - B. W. Carroll and Farhang Amiri - Four Corners Sectional Meeting of the American Physical Society, Tucson, AZ - October, 1999.

"Self-Organized Criticality: Applications to Astrophysics," - B. W. Carroll - Four Corners Sectional Meeting of the American Physical Society, Provo, UT - October, 1998.

**Presentations (cont'd):**

"Multimedia Animations for Introductory Physics using Macromedia's *Director*" - Farhang Amiri and B. W. Carroll - American Physical Society / American Association of Physics Teachers Joint Meeting - Columbus, OH - April, 1998.

"Web-Based Instruction in an Intro Conceptual Physics Course" - Farhang Amiri and B. W. Carroll - Spring Meeting of the Idaho-Utah Section of the American Association of Physics Teachers, Pocatello, ID - March, 1998.

"Physics Simulations Using Macromedia's *Director*" - B. W. Carroll and Farhang Amiri - Winter Meeting of the American Association of Physics Teachers, New Orleans, LA - January, 1998.

"Bringing Pulsating Stars into the Physics Classroom" - B. W. Carroll - Idaho-Utah section of the American Association of Physics Teachers, Weber State University, Ogden, UT - March, 1995.

"The Effect of a Vertical Magnetic Field on the Periods of Trapped g-modes in White Dwarfs" - B. W. Carroll - IAU Colloquium 139, New Perspectives on Stellar Pulsation and Pulsating Variable Stars, Victoria, B.C. - July, 1992.

"Chaos in the Classroom" - B. W. Carroll - Idaho-Utah section of the American Association of Physics Teachers, Brigham City, UT - March, 1991.

"An Analytical Model of the Influence of Habitat Size and Settling Rate on Emigrant Sex Ratio" - G. L. Miller and B. W. Carroll - 75th Annual Meeting of the Ecological Society of America, Snowbird, UT - July, 1990.

"Changes in the Continuous Spectrum of Eclipsed Accretion Disks in Dwarf Novae: A Simple Model" - B. W. Carroll and D. W. Keith - 174th Meeting of the American Astronomical Society, University of Michigan, Ann Arbor, MI - June, 1989.

"Oscillations of Beta Cephei Stars" - B. W. Carroll - colloquium at the University of Wyoming - May, 1989.

"Eclipses of Accretion Disks" - D. Keith and B. W. Carroll - Idaho/Utah section of the American Association of Physics Teachers, University of Utah, Salt Lake City, UT - March, 1989.

"Undergraduate Research in Physics at Weber State College" - B. W. Carroll - Idaho-Utah section of the American Association of Physics Teachers, University of Utah, Salt Lake City, UT - March, 1989.

**Presentations (cont'd):**

"Discontinuity Modes in Polytropes" - B. W. Carroll - IAU Colloquium 111, The Use of Pulsating Stars in Fundamental Problems of Astronomy, University of Nebraska, Lincoln, NE - August, 1988.

"Good Vibrations on the Upper Main Sequence: The Beta Cephei Variables - B. W. Carroll - colloquium at Utah State University - Nov, 1987.

"Oscillations of Upper Main Sequence Stars: The Beta Cephei Variables" - B. W. Carroll - Spring Meeting of the Utah Academy of Sciences, Arts, and Letters, Weber State College, Ogden, UT - May, 1987.

"Report on the Los Alamos Conference on Stellar Pulsation" - B. W. Carroll - colloquium at the University of Rochester - Aug, 1986.

"A Model of Electromagnetic Damping Mechanisms for Neutron Star Oscillations" - B. W. Carroll, E. G. Zweibel, C. J. Hansen, P. N. McDermott, M. P. Savedoff, J. H. Thomas, and H. M. Van Horn - 167th Meeting of the American Astronomical Society, Rice University, Houston, TX - Jan, 1986.

"The Effect of a Vertical Magnetic Field on Neutron Star Oscillations" - B. W. Carroll, P. N. McDermott, M. P. Savedoff, J. H. Thomas, H. M. Van Horn, E. G. Zweibel, C. A. Morrow, and C. J. Hansen - Spring Meeting of the Astronomical Society of New York, State University of New York, Alfred, NY - May, 1985.

"White Dwarfs: A Stroll Through the Stellar Cemetery" -B. W. Carroll - colloquium at the Rochester Institute of Technology - April, 1985.

"Neutron Star Oscillations in the Presence of a Vertical Magnetic Field" - B. W. Carroll, P. N. McDermott, M. P. Savedoff, J. H. Thomas, H. M. Van Horn, E. G. Zweibel, C. A. Morrow, and C. J. Hansen - 165th Meeting of the American Astronomical Society, University of Arizona, Tucson, AZ - Jan, 1985.

"Nonradial Oscillations of White Dwarfs and Neutron Stars" (invited talk) - B. W. Carroll and H. M. Van Horn - Fall Meeting of the Astronomical Society of New York, Rensselaer Polytechnic Institute, Troy, NY - Nov, 1984.

Accretion Disk Oscillations: Local Analysis in a Disk of Finite Thickness" - B. W. Carroll, W. Cabot, P. N. McDermott, M. P. Savedoff, and H. M. Van Horn - 164th Meeting of the American Astronomical Society, The Johns Hopkins University, Baltimore, MD - June, 1984.

**Abstracts:**

“Bringing Pulsating Stars into the Physics Classroom” - B. W. Carroll and D. A. Ostlie, *Bulletin of the American Astronomical Society*, **32**, #4, 1559.

“Using Macromedia’s Director to Support Learning Modern Physics Concepts” - B. W. Carroll and F. A. Amiri, *American Association of Physics Teachers Announcer*, **30**, #4, 2000.

“Physics Animations and Simulations Using Macromedia’s *Director* 7" - B. W. Carroll and Farhang Amiri, *The Bulletin on the American Physical Society*, **44**, #9, 6, 2000.

“Self-Organized Criticality: Applications to Astrophysics,” - B. W. Carroll, *The Bulletin of the American Physical Society,* **43**, #10, 2150, 1998.

"The Effect of a Vertical Magnetic Field on the Periods of Trapped g-Modes in White Dwarfs" - B. W. Carroll, *New Perspectives on Stellar Pulsation and Pulsating Variable Stars*, J. Nemec and J. Matthews (eds), Cambridge University Press, Cambridge, 1993.

"An Analytical Model of the Influence of Habitat Size and Settling Rate on Emigrant Sex Ratio" - G. L. Miller and B. W. Carroll, *Bulletin of the Ecological Society of America (Supplement)*, **71**, #2, 255, 1990.

“Multimedia Animations for Introductory Physics using Macromedia’s *Director*” - Farhang Amiri and B. W. Carroll, *American Association of Physics Teachers Announcer*, **28**, #1, 55, 1998.

"Changes in the Continuous Spectrum of Eclipsed Accretion Disks in Dwarf Novae: A Simple Model" - B. W. Carroll and D. W. Keith, *Bull. A. A. S.*, **21**, 788, 1989.

"Discontinuity Modes in Polytropes" - B. W. Carroll, *The Use of Pulsating Stars in Fundamental Problems of Astronomy*, E. G. Schmidt (ed.), Cambridge University Press, Cambridge, 1989.

"Oscillations of Upper Main Sequence Stars: The Beta Cephei Variables" - B. W. Carroll, *Encyclia*, **64**, 145, 1987.

"A Model of Electromagnetic Damping Mechanisms for Neutron Star Oscillations" - B. W. Carroll, E. G. Zweibel, C. J. Hansen, P. N. McDermott, M. P. Savedoff, J. H. Thomas, and H. M. Van Horn, *Bull. A. A. S.*, **17**, 855, 1985.

**Abstracts (cont'd):**

"The Effect of a Vertical Magnetic Field on Neutron Star Oscillations" - B. W. Carroll, P. N. McDermott, M. P. Savedoff, J. H. Thomas, H. M. Van Horn, E. G. Zweibel, C. A. Morrow, and C. J. Hansen, *News Letter Astron. Soc. N. Y.*, **2**, #8, 27, 1985.

"Nonradial Oscillations of White Dwarfs and Neutron Stars" - B. W. Carroll and H. M. Van Horn, *News Letter Astron. Soc. N. Y.*, **2**, #7, 5, 1985.

"Neutron Star Oscillations in the Presence of a Vertical Magnetic Field" - B. W. Carroll, P. N. McDermott, M. P. Savedoff, J. H. Thomas, H. M. Van Horn, E. G. Zweibel, C. A. Morrow, and C. J. Hansen, *Bull. A. A. S.*, **16**, 943, 1984.

"Accretion Disk Oscillations: Local Analysis in a Disk of Finite Thickness" - B. W. Carroll, W. Cabot, P. N. McDermott, M. P. Savedoff, and H. M. Van Horn, *Bull. A. A. S.*, **16**, 516, 1984.

"A Preliminary Look at Accretion Disk Oscillations" - B. W. Carroll, W. Cabot, P. N. McDermott, M. P. Savedoff, and H. M. Van Horn, *News Letter Astron. Soc. N. Y.*, **2**, #6, 9, 1984.

"Star/Disk Interactions. I. Incompressible Cylinder Models" - B. W. Carroll and H. M. Van Horn, *Bull. A. A. S.*, **14**, 901, 1982.

"Nonradial Pulsations of Neutron Stars" - P. N. McDermott, H. M. Van Horn, and B. W. Carroll, *News Letter Astron. Soc. N. Y.*, **2**, #2, 26, 1982.

"Nonradial g-mode Oscillations of Warm Neutron Stars" - P. N. McDermott, H. M. Van Horn, B. W. Carroll, and J. F. Scholl, *Bull. A. A. S.*, **14**, 665, 1982.

"Nonadiabatic Stellar Pulsation with Slow, Uniform Rotation" - B. W. Carroll and C. J. Hansen, *Bull. A. A. S.*, **14**, 557, 1982.

**RESUME — NOVEMBER 2007**

JOHN RONALD GALLI

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EDUCATION: Ph.D. Physics/Metallurgy, University of Utah, 1963
M. S. Physics/Mathematics, University of Utah, 1960
B.S. Physics/Mathematics, University of Utah, 1958

CHAUTAUQUA SHORT COURSES IN SCIENCE AND MATHEMATICS:

"Henri Poincaré and the Origins of Chaos Theory"
Harvard University, Cambridge, Massachusetts, June 1994.

"Computer Experiments in Mathematics"
Boston University, Boston, Massachusetts, June 1993.

"Chaotic Dynamics in Physics, Mathematics, and Engineering"
Temple University, Philadelphia, Pennsylvania, March 1992.

"An Introduction to Fractals and Chaos"
SUNY at Stony Brook, Long Island, New York, April 1991.

"The Theory of Relativity"
Parkland College, Champaign, Illinois, October 1980 and March 1981.

"Fundamental Particles"
University of Missouri, Kansas City, Missouri, October 1978 and February 1979.

"Cosmology"
University of Missouri, Kansas City, Missouri, November 1972 and March 1973.

SPECIAL FOUR-WEEK TOUR COURSE:

"History of Physics in Great Britain"
Sponsored by Indiana State University, Summer 1977.
Visited the major universities, research facilities, and science museums in England and Scotland, including Oxford and Cambridge Universities and the Royal Institution in London. Gained a better appreciation for scientists such as Newton, Maxwell, Faraday, Rutherford, and others; for the places and conditions where they worked, and for the contributions that they made to our present understanding.

PROFESSIONAL EMPLOYMENT HISTORY:

| | |
|---|---|
| Sept. 1963 to Present: | Physics Professor at Weber State University, Full Professor since 1972. |
| | Dean, College of Science, 1994-2003. |
| | Department Chair, Physics Department, 1983-1995 and 1964-1970. |
| | Associate Dean, Continuing Education, 1973-74 |
| March-Sept. 1963: | Senior Physicist at Aerojet General Corporation, Downey, California (Fracture Dynamics). |
| Summers 1958, 1959: | Physicist at Naval Weapons Center, China Lake, California (Radar and Missiles). |

IMPORTANT PROJECTS THAT I HELPED FACILITATE AS DEAN:

(Please see the attached list of activities and accomplishments involving the dean's office.)

COMMITTEES THAT I HAVE CHAIRED AS A FACULTY MEMBER AT WSU:

University Promotion/Tenure Committee, 2004-05.

Committee to review Athletics at WSU, 1989-90.

Screening Committee for Dean of Natural Sciences, 1982-83.

Faculty Advisory Committee to Continuing Education, 1974-75.

College Curriculum Committee, 1973-74 (now the "University" Committee).

Student Affairs Committee, 197 1-72, 1972-73.

Committee to Reorganize the School of Arts, Letters and Science, 1971-72.

PROJECTS IN WHICH I PLAYED A MAJOR PLANNING ROLE AS A FACULTY MEMBER OR AS A DEPARTMENT CHAIR:

Carried out and compiled the initial comprehensive study that examined and made recommendations on athletics at WSU, 1989.

Drafted the policy that defines the faculty role in program reductions, 1987.

Acquired the Powder Mountain site for a future observatory, 1987.

Proposed the 50% tuition waiver for dependents, 1975.

Wrote the first Student Handbook of Rights and Responsibilities, 1973.

Helped plan the Reorganization of the School of Arts, Letters, and Science, 1972.

Originated the WSU Planetarium, 1963-66.

Helped plan the Science Building, 1963-66.

Helped plan and build many of the existing programs within the Physics Department and the College of Science.

PUBLICATIONS:

"Angular Momentum Conservation and the Cat Twist", John Ronald Galli, *The Physics Teacher,* **33**, 404 (1995).

"Blackboard Mechanics, An Apparatus Review", J. R. Galli, *The Physics Teacher,* **19,** 130 (1981).

"The Organization and Operation of Academic Physics Departments—A Survey", J. R. Galli, WSC in-house publication, February 1968.

"The Effect of Hydrostatic Pressure on the Ductile—Brittle Transition in Molybdenum," J. R. Galli and P. Gibbs, *Acta Metallurgica*, **12**, No. 7, 775, July 1964.

"On the Problem of Fracturing Solids into Very Small Fragments Using Explosive Techniques," J. R. Galli, Special Report, No. 039-04(09) SP. Aerojet-General Corp., August 1963.

"High Pressure Physics," J. R. Galli, et al, ARL Technical Report 60-330, December 1960.

RECENT SCHOLARLY STUDIES AND RESEARCH:

Demonstrations developed, presentations given, and paper published on the dynamics of the falling, twisting cat. Invented and constructed mechanical models of a typical cat that are capable of turning over and landing on their "feet" when dropped from an inverted position. Invented the concept and developed a consistent theory of how my models and real-life cats perform this maneuver using the basic principles of physics and the anatomical construction of the cat.

Paper written (unpublished) and presentations given on a simpler way to explain the basis and significance of the special theory of relativity.

The mathematical analysis of reflection of electromagnetic waves from a relativistically moving mirror.

Produced about 200 computer videos of physics lecture demonstrations, together with Farhang Amiri.

SPECIAL PROFESSIONAL RECOGNITION:

Honorary member of Golden Key.

National newspaper, radio, and TV publicity on the Cat Twist project. For example, *The Chronicle of Higher Education* published an article with a photograph.

Outstanding Service to Students Award—College of Science Students, 1996.

Hemmingway Faculty Vitality Award, 1997

Member of the Honor Society of Phi Kappa Phi

Movies and inventions are now being marketed commercially. Samples are available at http://physics.weber.edu/galli (please see attached advertisements).

MISCELLANEOUS INFORMATION:

Elected member, Faculty Senate Executive Committee, 1994, 1985-87, 1972-74.

Numerous professional presentations to local, regional, and national organizations in addition to those indicated above (list available on request).

Numerous consulting activities (list available on request).

Numerous lecture demonstrations invented, developed, and shared to help make physics lectures more understandable and relevant (list available on request).

Member National Ski Patrol 1966-1981. Awarded "Outstanding Patroller of the Year—Intermountain Division", 1977.

President of fraternity—β Chapter of ΛΔΣ, 1958.

Licensed aircraft pilot (solo license), 1957.

Commercial driver's license (Class A, M), 2007.

Married, 5 children. Wife, Cheryl Maur Corley.

Web page: http://physics.weber.edu/galli

LISTED IN:

*American Men and Women of Science*

*International Biographical Dictionary*

*Lexington Who's Who*

*Who's Who among America's Teachers*

*Who's Who in America*

*Who's Who in American Education*

*Who's Who in Science and Engineering*

*Who's Who in the West*

*Who's Who in the World*

**ACTIVITIES AND ACCOMPLISHMENTS INVOLVING THE DEAN'S OFFICE**
**COLLEGE OF SCIENCE**

**1994-2003**

- Establishing the position of Senior Fellow of Science.

- Bringing the bioremediation program together with □ $750,000 worth of prime research equipment from the U.S. Bureau of Mines to WSU, including the establishment of funding and laboratory space. Currently developing strong community partnerships centered on this program. At present, three students are gaining undergraduate research experience in microbiology.

- Acquiring supplementary funding from private and public sources. This includes the first year of funding for the bioremediation program ($200,000) and the science/technology initiative money for laboratory equipment ($75,000/year for three years). Planning for additional resources is currently underway.

- Establishing the Ritchey Charitable Foundation, which will eventually fund several programs in the College of Science, including stipends for undergraduate research.

- Planning and carrying out the successful Ritchey Lecture Series for the greater Ogden community. The comet collision with the planet Jupiter, the Ebola virus crisis, and the discovery of an extrasolar planetary system were each presented by the world's respective leading scientists.

- Recruiting, screening, and hiring of 17 new tenure-track faculty, 2 new research faculty, and 10 new staff.

- Revising the process of annual faculty evaluations to increase accountability and improve the reward system.

- Working to achieve equitable salaries and an equitable internal distribution of salaries for the faculty and staff in the College.

- Administering the budget for the College of Science, and reducing the operating budget by □ $300,000 while maintaining and enhancing the academic programs.

- Establishing and supporting a funding base for sabbaticals and otherwise supporting and encouraging scholarship and professional growth of the faculty.

- Purchasing up-to-date lab equipment for each department.

- Encouraging and supporting the acquisition of an on-campus observatory, water well, and weather station.

- Remodeling of the Lind Lecture rooms. New lighting, lowered ceilings.

- Coordinating and funding twelve major renovation projects to better utilize existing space, including a new anatomy lab built below the tiered seats of a lecture room in LLH.

- Encouraging and taking steps to have department chairs work in concert to support relative operating budget allocations.

- Restructuring of the Geology/Geography Departments.

- Establishing (with the faculty) goals for the College of Science and funding priorities for the Capital Campaign.

- Encouraging and supporting course assessment and curriculum improvement in each department.

- Encouraging and supporting the strengthening of General Education.

- Initiating and setting the example for "conceptual" teaching strategies using demonstrations, and student-friendly methods, especially in general education courses.

- Initiating and supporting the policy of hiring at least one new faculty in each major discipline with the expertise, interest and professional development expectations to coordinate and improve the public school science and math teacher education programs.

- Preparing the case and working toward the goal of acquiring the much-needed second phase of the Science Building and the much-needed remodeling of the Math Building heating and air conditioning system.

- Enhancing the recruitment, advisement and placement of students through funding and office remodeling to accommodate a College Advisor and a Career Counselor.

- Giving special support to the Pre-Med and Pre-Dent recruiting, advising, and placement of students.

- Accepting and supporting the Math Department during a period of conflict and controversy within the Department.

- Acquiring new computers with strategic savings, including 20 new computers for the Math lab.

- Encouraging and supporting the education of thousands of successful students, taught by highly qualified competent faculty.

- Encouraging and supporting numerous faculty accomplishments—publications, textbooks, presentations, significant service.

- Restructuring the College committees. For example, Public Relations Committee created and fully functioning.

- Planning and coordinating several successful retreats, graduation and awards programs, etc.

- Attending and participating in several national and regional conferences, such as AAHE, CCAS, CASE, and Rocky Mountain Deans Association.

- Encouraging and supporting many successful programs—Science Fair, planetarium programs, etc.

- Coordinating and administering miscellaneous activities such as annual reports, evaluation of faculty, department chair selection, conflict resolution, hiring new faculty, etc.

- Working to establish better systems for safety and security.

- Participating at various levels in activities such as Faculty Senate, committee service, special presentations, etc.

- Teaching one course each term, except summers, to a normally full class of one hundred Physics 1010 students.

- Publishing a paper on my research while functioning as dean, and continuing to participate actively in an ongoing research program.

**Curriculum Vitae**
**Dr. Colin Inglefield**

**Address:**

Physics Department
Weber State University
2508 University Circle
Ogden, UT 84408-2508
http://physics.weber.edu/inglefield

Phone:(801) 626-6127
Fax: (801) 626-7445
cinglefield@weber.edu

**Home Address:**

2147 N 3850 E
P.O. Box 1107
Eden, UT 84310

Phone: (801) 745-3043

**Education:**

| | |
|---|---|
| 1998 | Ph.D. Physics, University of Utah, Salt Lake City UT<br>Thesis title: "Luminescence and Modulated Luminescence Investigations of Semiconductors" |
| 1992 | B.S. Physics, Rensselaer Polytechnic Institute, Troy NY |

**Appointments:**

My current primary affiliation is with Weber State University, a primarily undergraduate institution with no graduate programs in the sciences.

| | |
|---|---|
| 2006 Fall | Research Assistant Professor, Colorado School of Mines, Golden, CO |
| 2004 - present | Adjunct Associate Professor, U. of Utah, Salt Lake City UT |
| 2003 - present | Associate Professor, Physics Department, Weber State U., Ogden UT |
| 2001 - 2004 | Research Assistant Professor, U. of Utah, Salt Lake City UT |
| 1999 - 2003 | Assistant Professor, Physics Department, Weber State U., Ogden UT |
| 1998-1999 | Visiting Assistant Professor, Physics Department, Weber State U. |
| 1996 | Instructor, Salt Lake Community College, Salt Lake City UT |
| 1994-1998 | Research Assistant, Physics Department, U. of Utah, Salt Lake City UT |
| 1992-1994 | Teaching Assistant, Physics Department, U. Of Utah, Salt Lake City UT |

**Honors/Awards**:

| | |
|---|---|
| 2007-2010 | WSU College of Science Endowed Scholar |
| 2006 | WSU Hemingway Faculty Collaboration Award |
| 2005 | WSU Hemingway Faculty Excellence Award |
| 2002 | Summer Research Fellowship,<br>American Chemical Society, Petroleum Research Fund |
| 1998 and 1996 | "Outstanding Graduate Student in Physics" , U. of Utah |
| 1994 | "Outstanding Teaching Assistant in Physics", U. of Utah |

**Current Research Interests:**

Atomic Force Microscopy
Optical Characterization of Semiconductors
Disorder in Semiconductors
Semiconductor and Semiconductor Device Physics
Materials Science
Nanotechnology

**Research Grants/Contracts:**

| | |
|---|---|
| 2004 | "Acquisition of an Atomic Force Microscope for Undergraduate Research"<br>National Science Foundation, Major Research Instrumentation |
| 2002-2003 | PI for the Beishline Undergraduate Research Fellowship<br>"Modeling the Growth of Microcrystalline Silicon"<br>College of Science, Weber State University |
| 2001 | "AFM characterization of HTPB Rocket Propellants"<br>Thiokol Propulsion |
| 2000 | "Measurement of the Recombination Velocity of<br>Microcrystalline/Amorphous Silicon Interfaces"<br>Materials Research Society, Undergraduate Materials Research Initiative |
| 2000-2001 | "Mobilization of Lead By Lactic Acid"<br>Weber State U., Research Scholarship and Professional Growth |

| | |
|---|---|
| 1999-2001 | "Photoreflectance Investigations of Semiconductors"<br>Weber State U., Research Scholarship and Professional Growth |

**Affiliations/Memberships/Professional Service:**

| | |
|---|---|
| 2003 | National Science Foundation panel review "Major Research Instrumentation/Instrumentation for Materials Research" |
| 2001-2002 | American Physical Society 2002 4-Corners Section Meeting<br>Local Organizing Committee and Scientific Organizing Committee |
| 2000-2006 | Society of Physics Students Zone 15 (UT, ID, MT) Zone Councilor |
| 2003-present | Member, Council on Undergraduate Research |
| 2001-present | Member, Materials Research Society |
| 1995-present | Member, American Physical Society |

**Courses Taught at Weber State University:**

Phsx 1010 "Introduction to Physics"
Phsx 1030 "Introduction to Astronomy"
Phsx 2010L, 2020L "General Physics Laboratory"
Phsx 2210L, 2220L "Laboratory Physics"
Phsx 2210 "Physics for Scientists and Engineers I"
Phsx 2220 "Physics for Scientists and Engineers II"
Phsx 2800 "Introductory Individual Research Problems"
Phsx 3200 "Solid State Physics"
Phsx 3510 "Electromagnetic Theory"
Phsx 3540 "Mechanical and Electromagnetic Waves"
Phsx 3640 "Advanced Physics Laboratory"
Phsx 4800 "Individual Research Problems"
Phsx 4830 "Readings in Physics"
Phsx 4970 "Senior Thesis" (Advisor)
Phsx 4990 "Seminar in Physics"

**Selected Administrative Service at Weber State:**

| | |
|---|---|
| 2005 | Interim Chair, Physics Department |
| 2003-present | University Undergraduate Research Task Force |

2003-present Chair/Co-Chair, College of Science Undergraduate Research Committee

2003-2004 University Academic Resources and Computing Committee

1999-2001 Chair, Department of Physics Curriculum Committee

1998-present Advisor, Department of Physics Society of Physics Students chapter

**Publications (Archival Journals):**
(An * indicates an undergraduate author/coauthor)

"What constitutes successful undergraduate research?" Colin Inglefield and Adam Johnston, Journal of Materials Education **26**, 261 (2004).

"Acoustical impedence of sulfur near the polymerization transition" J. K. Olson, W. B. Payne, C. E. Inglefield, V. F. Kozhevnikov, and P. C. Taylor. International Journal of Thermophysics, **25**, 1429 (2004).

*"Physical properties of sulfur near the polymerization transition" V. F. Kozhevnikov, W.P. Payne, J.K. Olson, C. McDonald, and C.E. Inglefield. Journal of Chemical Physics, **121**, 7379 (2004).

"An Instructional Two-Dimensional Diffraction Laboratory Using Patterns Created with Electron-Beam Lithography" Colin Inglefield, Royce Anthon. Journal of Materials Education, **24**, 53 (2003).

*"In-situ Pb Remobilization in Soils" M. Manecki, M. Matyjasik, C. Inglefield, J. Conlin, Hydrological Science and Technology, **18**, 123 (2002).

"Excitation mechanisms and structure-related Er3+ emission in amorphous and nanocrystalline GaN films" S. B. Aldabergenova, M. Albrecht, A. A. Andreev, C. E. Inglefield, J. Viner, V. Yu Davydov, P. C. Taylor, H. P. Strunk, J. Non-Cryst. Solids, **283**, 173 (2001).

"Quantum wells due to ordering in GaInP" Y. Hsu, G. B. Stringfellow, C. E. Inglefield, M. C. DeLong, P. C. Taylor, J. H. Cho, and T.-Y. Seong, Appl. Phys. Lett., **73**, 3905 (1998).

"Microwave modulated photoluminescence used to measure surface recombination velocities" C. E. Inglefield, M. C. DeLong, P. C. Taylor, and W. A. Harrison, J. Vac. Sci. Technol. B, **16**, 2328 (1998).

"Microwave modulated photoluminescence as a contactless probe of interface states" C. E. Inglefield, M. C. DeLong, P. C. Taylor, J. F. Geisz, and J. M. Olson, J. Vac. Sci. Technol. B, **15**, 1201 (1997).

"Characterization of unicompositional GaInP2 ordering heterostructures grown by variation of V/III ratio" C. E. Inglefield, M. C. DeLong, P. C. Taylor, Y. S. Chun, I. H. Ho, G. B. Stringfellow, J. H. Kim, and T.-Y. Seong, J. Appl. Phys., **82**, 5107 (1997).

"Heterostructures in GaInP grown using a change in V/III ratio" Y. S. Chun, H. Murata, S. H. Lee, I. H. Ho, T. C. Hsu, G. B. Stringfellow, C. E. Inglefield, M. C. DeLong, P. C. Taylor, J. H. Kim, and T.-Y. Seong, J. Appl. Phys., **81**, 7778 (1997).

"Effects of microwave electric fields on the luminescence of n- and p-type GaAs" C. E. Ingledfield, M. C. DeLong, P. C. Taylor, and W. A. Harrison, Phys. Rev. B, **56**, 12434 (1997).

"Microwave modulated photoluminescence in doped GaAs" C. E. Inglefield, M. C. DeLong, P. C. Taylor, and W. A. Harrison), J. Electronic Materials, **26**, 878 (1997).

"A dual-mode interpretation of nuclear spin relaxation for 13CO2 sorbed in polystyrene" A. Bandis, B. J. Cauley, C. E. Inglefield, W.-Y. Wen, P. T. Inglefield, A. A. Jones, and A. Melc'uk, J. Polymer Science B, **31**, 447 (1993).

"Nuclear spin relaxation dynamics of 13CO2 sorbed in polyisobutene rubber" Z. P. Dong, B. J. Cauley, A. Bandis, C. W. Mou, C. E. Inglefield,A. A. Jones, P. T. Inglefield, and W.-Y. Wen, J. Polymer Science B, **31**, 1213 (1993).

**Publications (Peer-Reviewed Conference Proceedings):**

*"Structural and Optical Properties of Amorphous $Ge_2Sb_2Te_5$" Heng Li, T. Ju, T. Herring, P. C. Taylor, D. L. Williamson, M. J. Nelson, and C. E. Inglefield, Mater. Res. Soc. Symp. Proc. **918**, H02-05 (2006).

*"Structural characterization of SiF4, SiH4, and H2 hot-wire-grown microcrsystalline silicon with large grains" J. J. Gutierrez, C. E. Inglefield, C. P. An,M. C. DeLong, P. C. Taylor, Scott Morrison, Arun Madan, Mat. Res. Soc. Symp. Proc., **664** (2001).

"Microwave modulated photoluminescence of excitons in III-V semiconductor heterostructures" C. E. Inglefield, M. C. DeLong, P. C. Taylor, and W. A. Harrison, in Proceedings of the Third International Conference on Excitonic Processes in Condensed Matter, edited by R. T. Williams and W. M. Yen, Proceedings Volume 98-25 (The Electrochemical Society, Pennington, NJ, 1999) pp 531-536.

"Local Structure and Er3+ Emission From Pseudo-Amorphous GaN:Er Thin Films" S.B. Aldabergenova, M. Albrecht, A.A. Andreev, C. Inglefield, J. Viner, P.C. Taylor, and H.P. Strunk, Mat. Res. Soc. Symp. Proc., **536**, 81 (1999).

"Advances in correlating the unusual optical properties of Ga0.52In0.48P to the microstructure" M. C. DeLong, C. E. Inglefield, P. C. Taylor, L. C. Su, I. H. Ho, T. C. Hsu, G. B. Stringfellow, K. A. Bertness, and J. M. Olson, Int. Phys. Conf. Ser., **141**, 207 (1994)

**Selected Presentations to Professional Groups:**

"Instructional Laboratory Exercises for Undergraduate Students in Solid-State Physics or Materials Science" Colin Inglefield, Royce Anthon, Fall 2002 meeting of the Materials Research Society, symposium on "The Undergraduate Curriculum in Materials Science and Technology" Boston, MA 12/02

"Microwave Modulated Photoluminescence used to measure Surface Recombination Velocities"(talk and poster) C. E. Inglefield, M. C. DeLong, P. C. Taylor, and W. A. Harrison, 1998 conference on the Physics and Chemistry of Semiconductor Interfaces, Salt Lake City, UT, 1/98

"Characterization of Unicompositional GaInP2 Ordering Heterostructures Grown by Variation of V/III Ratio" C. E. Inglefield, M. C. DeLong, P. C. Taylor, Y. S. Chun, I. H. Ho, G. B. Stringfellow, J. H. Kim, and T.-Y. Seong. 1997 Electronic Materials Conference, Fort Collins, CO, 6/97

"Microwave Modulated Photoluminescence as a Contactless Probe of Interface States"(talk and poster) C. E. Inglefield, M. C. DeLong, P. C. Taylor, J. F. Geisz, and J. M. Olson, 1997 Conference on the Physics and Chemistry of Semiconductor Interfaces, Raleigh, NC, 1/97

"Microwave Modulated Photoluminescence in Doped GaAs" C. E. Inglefield, M. C. DeLong, P. C. Taylor, and W. A. Harrison. 1996 Electronic Materials Conference, Santa Barbara, CA, 6/96

**Presentations By Undergraduate Students in Dr. Inglefield's Research Group:**

"Characterization of GeSbTe Thin Films for Phase-Change Applications" C. D. Grijalva, C. E. Inglefield, T. Herring, Heng Li, P. C. Taylor, 4-Corners section meeting of the American Physical Society 10/06.

"Microstructural Characteristics of GeSbTe Thin Films Grown by RF Sputtering" M. J. Nelson, C. E. Inglefield, J. K. Olson, H. Li, P. C. Taylor, 4-Corners section meeting of the American Physical Society 10/04.

"Electron Spin Resonance Studies of $[Et_4N]_2[TCNE]_2$ Single Crystals" T. Christofferson, C. E. Inglefield, L. Tiliaferro, Joel S. Miller, P. C. Taylor, 4-Corners section meeting of the American Physical Society 10/04.

"Raman Scattering and Electron Spin Resonance Measurements of Liquid Sulfur Near the Polymerization Transition" C. McDonald, C. E. Inglefield, J. Olson, V. Kozhevnikov, P. C.

Taylor, 4-Corners section meeting of the American Physical Society, 10/02. This presentation received an award as an “Outstanding presentation by an Undergraduate”.

“Modeling the Topography of Hot-Wire Chemical Vapor Deposition Grown Microcrystalline Silicon Using a Voronoi Diagram” J. L. Conlin, C. E. Inglefield, 4-Corners section meeting of the American Physical Society, 10/02

“Atomic Force Microscope Model” (Poster) M. T. Smith, C. E. Inglefield, A. T. Johnston, Presented at the American Association of Physics Teachers annual national meeting in Boise, ID, 8/02. Abstract also published in the AAPT Announcer, Summer 2002

“Calculations of Internal Electric Fields in GaInP Quantum Wells” J. L. Conlin. Presented in a Society of Physics Students undergraduate research session at the American Association of Physics Teachers annual national meeting in Boise, ID, 8/02. Abstract also published in the AAPT Announcer, Summer 2002

“Mobilization of Lead Studied by Atomic Force Microscopy” J. L. Conlin (Poster), 4-Corners section meeting of the American Physical Society 11/01. This presentation won an award as an "Outstanding Poster".

“Photoluminescence of Amorphous Silicon” J. L. Conlin, 4-Corners section meeting of the American Physical Society 11/01

“Measurement of the recombination velocity of microcrystalline silicon/amorphous silicon interfaces” C. Pedersen (Poster), Spring meeting of the Materials Research Society 4/01. A copy of this poster has also been on display at the University of Utah physics department.

“AFM characterization of hot-wire grown microcrystalline silicon with large grains” J. J. Gutierrez, Spring meeting of the Materials Research Society 4/01

“Waveguides based on photodarkening in As2Se3” D. Housely, Society of Physics Students zone 15 meeting 3/01.

“An atomic force microscopy study of the topology of microcrystalline silicon surfaces” J. J. Gutierrez , 4-Corners section meeting of the APS 9/00. This presentation received an award as an “Outstanding presentation by an Undergraduate”.

**Adam T. Johnston**
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## Education

Ph.D., Science Education (2000). University of Utah, Salt Lake City, UT
M.S., Physics; emphasis in education (1997). University of Utah, Salt Lake City, UT
B.S., Physics; departmental honors (1994). Lewis & Clark College, Portland, OR

## Honors

Lowe Innovative Teaching Award, Weber State University (2006)
Hemingway Faculty Excellence Award, Weber State University (2006)
Eccles Fellowship, Weber State University Honors Program (2005-06)
Gwen S. Williams Award of Excellence, Weber State University (2005)
Hemingway Faculty Vitality Award, Weber State University (2005)
Hemingway Faculty Collaboration Award, Weber State University (2005)
Honorary inductee into Phi Kappa Phi Honor Society (2005)
Honorary inductee of Golden Key International Honor Society (2004)
Hemingway Faculty Vitality Award, Weber State University (2003)
Nye/Cortez Distinguished Professor, Weber State University Honors Program (2002)

## Experience

| | | |
|---|---|---|
| Weber State University | Associate Professor | July 2003 - present |
| | Assistant Professor | July 2000 - June 2003 |
| | Visiting Instructor | July 1997 - June 2000 |
| | Adjunct Instructor | August 1996 - June 1997 |
| University of Utah | Adjunct Instructor | Various; 1999 - 2007 |
| | Research assistant | June - Sept. 1998 |
| | Laboratory manager | June - Sept. 1997 |
| | Laboratory manager | June 1995 - Sept. 1996 |
| | Teaching Assistant | August 1994 - June 1997 |
| Lewis & Clark College | Research assistant | June 1992-August 1994 |

## Courses taught

Weber State University
*Introduction to Physics* (PHYS 1010)
*Elementary Astronomy* (PHYS 1040)
*Physics of the Mundane* (HNRS 1500)
*Contemporary Issues in Physics* (HNRS 1500)
*General Physics I & II* (PHYS 2010/2020)
*Physics laboratories* (PHYS 2019, 2029, 2219, 2229)
*The Construction of Truth: A User's Guide to Knowledge* (HNRS 3900)
Foundations of Science Education (PHYS/BTNY/CHEM/GEO/MICR/PHYS/ZOOL 3570)

*Secondary Science Teaching Methods* (PHYS/BTNY/CHEM/GEO/MICR/PHYS/ZOOL 4570)

*Independent research/readings* (PHYS 4800/4830; HNRS 4990; additional thesis committees)
*Honors seminar, ''Foundations of Research''* (HNRS 4920)
*First Course in Algebra* (MATH 0960)
*Advanced Physics for Teachers* (MEduc 6670)

University of Utah
*The Nature of Science & Science Education* (TL 6733) [Summer, 2001; Summer 2004; Summer 2007]
*Physical Science Teaching Methods* (Phys 5070) [Summer, 1999]
*Introduction to Physics* (Phys 1010) [Summer, 1998]

## Research and other Scholarly Activity

### Current work

- Development, organization, and documentation of *Science Education at the Crossroads* (http://www.sciedxroads.org), an interactive, reform minded conference in science education.
- Research in physics misconceptions and conceptual change in undergraduate learners.
- Cross-curricular (physics, psychology, mathematics, English) research on student reasoning and conceptual change.

### In preparation

- Johnston, A., Roehrig, G., & Austin, B. (in review). Researching the Researchers: Learning Science in the undergraduate research setting. *Journal of College Science Teaching.*
- Johnston, A. (in preparation). A conversation with Billy Collins. *Weber: The Contemporary West.*
- Amsel, E., Johnston, A., & Goodwin, R. (in preparation). Student concepts of fiction.

### Proceedings edited

- Settlage, J. & Johnston, A. (Eds.) (2007). Proceedings of the 2007 meeting of *Science Education at the Crossroads*. Amherst, MA.
- Johnston, A. & Settlage, J. (Eds.) (2006). Proceedings of the 2006 meeting of *Science Education at the Crossroads*. Ogden, UT.
- Settlage, J. & Johnston, A. (Eds.) (2005). Proceedings of the 2005 meeting of *Science Education at the Crossroads*. Storrs, CT.

### Articles (refereed)

- Johnston, A. (in press). Demythologizing or dehumanizing? A response to Settlage and the ideals of open inquiry. *Journal of Science Teacher Education.*
- Johnston, A. (2007). Emphasizing the Tentative Nature of Science in the Classroom. In Settlage, J & Southerland, S.A. (2007). *Teaching science to every child: Using culture as a starting point*. New York: Routledge. [ISBN 9780415956369]
- Settlage, J. & Johnston, A. (2007). Editorial: In the present. *Journal of Science Teacher Education*, *18*(1), 129-132.
- Sowell, S., Johnston, A., & Southerland, S. A. (2007). Calling for a focus on where learning happens: A response to Abd-El-Khalick and Akerson. *Science Education, 91*(1), *195-199.*
- Johnston, A., Southerland, S. A., Sowell, S. (2006). Dissatisfied with the fruitfulness of 'learning ecologies'. *Science Education, 90*(5), 907-911.
- Southerland, S. A., Johnston, A., Sowell, S. (2006). Describing teachers' conceptual ecologies for the nature of science. *Science Education, 90*(5), 874-906.
- Inglefield, C., & Johnston, A. T. (2004). What Constitutes Successful Undergraduate Research? *Journal of Materials Education, 26*(3&4), 261-266.
- Gess-Newsome, J., Southerland, S. A., Johnston, A., & Woodbury, S. (2003). Educational Reform, Personal Practical Theories, and Dissatisfaction: The Anatomy of Change in College Science Teaching. *American Educational Research Journal*, *40*(3), 731-767.

- Sherry A. Southerland, S.A., Gess-Newsome, J., Johnston, A. (2003). Portraying science in the classroom: The manifestation of scientists' beliefs in classroom practice. *Journal of Research in Science Teaching*, *40*(7), 669-691.
- Johnston, A. T. (2001). *A conceptual change analysis of nature of science conceptions: The deep roots and entangled vines of a conceptual ecology.* Unpublished doctoral dissertation, The University of Utah, Salt Lake City. (Defended Sept. 15, 2000; Abstracted 2001.)
- Johnston, A. T. (2000). Deliberating over science curricula: A 'mundane' solution. *National Honors Report*, *20*(4), 23-27.

**Articles (not refereed)**

- Johnston, A. (2007). Book reviews: Walking Zero, by Chet Raymo. *American Journal of Physics*, *75*, 478. Johnston, A. & Settlage, J. (March/April 2004). Last call [Originally titled: A Call to Homebrewers: The Future of Science Education]. *Brew Your Own*, 64.
- Web-based and interactive CD quizzes (600 questions) for Hester et al. (2002), *21st Century Astronomy*, W. W. Norton. See < http://www.wwnorton.com/astro21>.
- Rudolph, S. & Johnston, A. (1997). *Elementary Physics Lab Manuals*. Department of Physics, University of Utah.

**Papers presented at professional meetings (refereed)**

- Johnston, A. (2007, September). Orchestrations of Science Education Adventurism. Keynote address given at Science Education at the Crossroads, Amherst, MA.
- Johnston, A. (2007, September). 'Correspondence to:' Paper presented at Science Education at the Crossroads, Amherst, MA.
- Settlage, J., Johnston, A., Meadows, L., Harkins, H., Kittleson, J. (2007, January). *Professional Development at a Crossroads. Using Vexations as the Focal Point.* Workshop presented at the Annual Meeting of the Association for Science Teacher Education, Clearwater, FL.
- Johnston, A. (2006, September). *The Good Book for Our Science Education Neighborhood.* Paper presented at Science Education at the Crossroads, Ogden, UT.
- Johnston, A. (2006, April). Learning the nature of research: Models for undergraduate research experiences? Pre-conference presentation at the Annual Meeting of the Rocky Mountain Psychological Association, Park City, UT.
- Johnston, A. & Amsel, E. (2006, April). *Student questioning and reflection in introductory astronomy.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, San Francisco, CA.
- Johnston, A. & Settlage, J. (2006, January). *Science education at the crossroads*. Paper presented at the Annual Meeting of the Association for Science Teacher Education, Portland, OR.
- Proctor, R., Johnston, A., Palen, S. & Armstrong, J. (2006, January). *The effectiveness of scientific visualization techniques: Teaching the lunar cycle*. Poster presented at the Annual Meeting of the American Astronomical Society, Washington, D.C.
- Johnston, A. (2005). *What Learning Leaves*. Paper presented at *Science Education at the Crossroads*, University of Connecticut, Storrs.
- Johnston, A. (2005). *The Physics of Brewing Beer*. Presentation at the Summer Meeting of the American Association of Physics Teachers, Salt Lake City, UT.
- Southerland, S., Sowell, S., Johnston, A., & Settlage, J. (2005, April). *Perhaps triangulation isn't enough: A call for crystallization as a methodological referent in NOS research*. Paper presented at the Annual Meeting of the American Educational Research Association, Montreal, Canada.

- Southerland, S., Johnston, A., & Sowell, S. (2005, April). *Reinvoking conceptual ecologies: Inservice teachers' conceptual change in nature of science*. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, Dallas, TX.
- Johnston, A. (2004, April). *Learning the process of science: The case of undergraduate research and the nature of science*. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, Vancouver, BC, Canada.
- Inglefield, C. & Johnston, A. (2004, April). *What Constitutes Successful Undergraduate Research?* Paper presented at the Annual Meeting of the Materials Research Society, San Francisco, CA.
- Shipman, H., Jordan, J., Southerland, S., Johnston, A., Jackson, D., & Meadows, L. (2003, March). *Science and religion in the context of science education*. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching; Philadelphia, PA.
- Southerland, S., Settlage, J., Johnston, A., Scuderi, A., & Meadows, L. (2003, March). *Development and application of a web-based NOS instrument*. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching; Philadelphia, PA.
- Settlage, J., Southerland, S. A., Johnston, A. T., & Meadows, L. (2003, January). *Electronically informing teacher decision making: Utilizing computers to provide instantaneous assessments of students' understanding of the nature of science*. Paper presented at the Annual meeting of the Association for Educators of Teachers of Science, St. Louis, MO.
- Smith, M. T., Inglefield, C. E., & Johnston, A. T. (2002, August). *Atomic force microscope model*. Poster presented at the Summer Meeting of the American Association of Physics Teachers, Boise, ID.
- Johnston, A. T., & Southerland, S. A. (2002, April). *Conceptual ecologies and their influence on nature of science conceptions: More dazed and confused than ever*. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching April, 2002; New Orleans, LA.
- Johnston, A. T., & Southerland, S. A. (2001, November). *The multiple meanings of tentative science*. Paper presented at the 6th International History, Philosophy, and Science Teaching conference, Denver, CO.
- Johnston, A. T. & Southerland, S. A. (2001, March). *Conceptualizing the nature of science: Extra-rational evaluations of tiny atoms, round planets, and big bangs*. Paper presented at the Annual Meeting of the National Association of Research in Science Teaching, St. Louis, MO.
- Gess-Newsome, J., Southerland, S. A., Johnston, A. T., & Woodbury, S. (2001, March). *Offering a model of reform: The interaction of factors and their impact on scientists' practice of reform-based teaching*. Paper presented at the Annual Meeting of the National Association of Research in Science Teaching, St. Louis, MO.
- Gess-Newsome, J., Southerland, S. A., Johnston, A. T., & Woodbury, S. (2001, January). *Reforming the reformers: Conceptual change of scientists' conceptions of teaching and learning*. Paper presented at the annual meeting of the Association for the Education of Teachers in Science, Costa Mesa, CA.
- Gess-Newsome, J., Southerland, S. A., & Johnston, A. T. (2000, January). *Translation of Teachers' Views to Students' Understandings of the Nature of Science: Examining a Reform Based College Science Course*. Paper presented at the Annual meeting of the Association for the Education of Teachers in Science, Akron, OH.
- Southerland, S. A., Gess-Newsome, J., & Johnston, A. T. (2000, April). *Defining Science In the Classroom: How Scientists' Views Shape Classroom Practice*. Paper presented at the Annual meeting of the National Association of Research in Science Teaching, New Orleans, LA.

- Johnston, A. T., & Southerland, S. A. (2000, April) *A Reconsideration of Science Misconceptions Using Ontological Categories*. Paper presented at the Annual meeting of the National Association of Research in Science Teaching, New Orleans, LA.
- Johnston, A. (1997). *A computer interactive student laboratory investigating the properties of heat and temperature*. Unpublished master's thesis, Department of Physics, University of Utah, Salt Lake City.
- Johnston, A. T. (1994). *Unraveling convective roll patterns within a Rayleigh-Benard cell*. Unpublished undergraduate thesis completed for departmental honors in physics, Lewis & Clark College, Portland, OR.

**Other scholarly presentations**

- Johnston, A. (August 1, 2007). Inquiries in the physical sciences: Hot chocolate, light bulbs, and simple machines. A workshop for Science Olympiad training, Center for Science and Mathematics Education, Weber State University.
- Johnston, A. (January 24, 2007). Student Thinking in Science and Math. Workshop presented at the Weber State University Adjunct Faculty Retreat, Layton, UT.
- Amsel, E. & Johnston, A. (August 15, 2006). What you don't know your students don't know. Presentation for WSU New Faculty Retreat, Weber State University.
- Amsel, E. & Johnston, A. (September 12 & 20, 2005). What you don't know your students don't know (and what you can do about it). Presentation for TEAM workshop series, sponsored by the Teaching and Learning Forum, Weber State University.
- ''Success in failure,'' (May 6, 2005). General studies commencement address, Weber State University.
- Johnston, A. & Durrant, L. (2005, March). Lies, damn lies, and statistics: A continual evaluation of a first year physics course. Presentation at the annual meeting of the Utah/Idaho section of AAPT, Salt Lake City, UT.
- Johnston, A. (2005, February). Undergraduate researchers' conceptions of science. Paper presented at Faculty Forum, Weber State University, Ogden, UT.
- Johnston, A. (2004, March). The shortcoming of physics education research. Presentation for the annual meeting of the Utah/Idaho section of AAPT, Pocatello, ID.
- ''Measuring a molecule'' and ''Science myths'' (February 18, 2005). Presentations for Utah Science Teachers Association annual meeting, Layton, UT.
- "The Joy of Teaching," (April 17, 2003). A keynote address for the 2003 Nye/Cortez Honors Banquet, Weber State University.
- Johnston, A. T. (2003, March). Conceptual physics in a problem-solving physics course. Presentation for the Annual Meeting of the Utah/Idaho section of AAPT, Ogden, UT.
- Johnston, A. T. (2003, March). Glowing vegetables and levitating soap. Demonstrations for the Annual Demo Show of the Utah/Idaho section of AAPT, Ogden, UT.
- Invited panel participant: ''Scientist teachers and science educators: Seeking common ground on teaching and learning issues.'' (Oct. 26, 2001). Presented at the National Science Teachers Association Western Regional Meeting, Salt Lake City, UT.
- Invited lecture: ''The Cutting Edge of Physics Education Research.'' (April 21, 2000). Lewis & Clark College, Department of Physics; Portland, Oregon.
- ''Physics of the Mundane: A curriculum alternative?'' (April 16-18, 1999). Presented at the Western Regional Honors Conference, San Francisco, CA. (with Adam Taintor, student).

- ''Physics of the Mundane: An alternative for general education?'' (March 6, 1999). Presented to Utah-Idaho Section of American Association of Physics Teachers, Utah State University.
- ''Non-science Students as Scientists." (March 7, 1998). Presented to the Utah-Idaho Section of American Association of Physics Teachers, Idaho State University.

**Grants**

- ''Project OttReach: Science Education Outreach in Ogden City Parks.'' Hall Endowment for Community Outreach. Decision pending ($7800) for fall 2007.
- ''Disseminating *Science Education at the Crossroads* to an International Audience.'' Hemingway Faculty Vitality grant, Weber State University. Funded ($1250) fall 2007.
- ''Capacity Building Conference Series: Supporting an Emerging Community of Science Education Researchers.'' National Science Foundation, Award number 0711264 (co-PI with John Settlage, University of Connecticut). Funded ($99,858) summer 2007.
- ''Teacher-Researcher Community Interaction via an Experimental Web Server.'' ARCC grant, Weber State University. Funded ($2676) spring 2007.
- ''Science Education at the Crossroads 2006.'' Hemingway Faculty Excellence grant, Weber State University. Funded ($1800) spring 2006.
- ''Science Education at the Crossroads.'' Hemingway Vitality grant, Weber State University. Funded ($1026) spring 2005.
- ''Reflective Learning in the General Education Curriculum.'' Hemingway Collaborative grant proposal; Co-PI with Eric Amsel, Weber State University. Funded ($5000) spring 2005.
- Proposed (not funded - no appropriations): ''Enhancing the nature of inquiry in undergraduate research experiences.'' FIPSE grant proposal; Co-PI with Eric Amsel, Weber State University.
- Proposed (not funded): ''Astrobiology Research Experience for Undergraduates (REU) Site.'' NSF Grant Proposal 0453289. Co-investigator and program assessor with Palen, S. (PI) et al., Weber State University.
- Hemingway Faculty Vitality Grant, Weber State University. ''The Davis Dilemma: A Student-Faculty Partnership for Physics Laboratory Development'' ($2713). Spring, 2003.
- Consultant for an educational grant from the U.S. National Institutes of Health (NIH) grant: Scientific Thinking and Internet Learning Technologies. See <http://stilt.genetics.utah.edu/>.
- Research, Scholarship, and Professional Growth Grant (RS&PG), Weber State University. ''New Faculty'' award ($250), Fall 2000.
- Research, Scholarship, and Professional Growth Grant (RS&PG), Weber State University. Curriculum development grant ($1585), Spring 1997.

## Service and outreach

**Major projects and appointments**

- Developer/director of *OttReach* summer science outreach in Ogden City Parks; http://dewey.weber.edu/ottreach/ (2007 - present)
- Co-director of *Science Education at the Crossroads*; http://www.sciedxroads.org/ (2005 - present)
- Consultant to Ott Planetarium education programming and outreach (2006 - present)
- DaVinci Academy of Science and Arts, Board of Directors (2006 - present)
- American Physical Society reviewer for *Physical Review: Physics Education Research* (2005 - present)

**Student research**

- Dina Drits, Department of Teaching and Learning, University of Utah (Doctoral work, independent research), Fall 2007 - present.

- William DeLeeuw, Department of Physics, Weber State University (Undergraduate research, physics education), Fall 2006.
- Ron Proctor, Department of Physics, Weber State University (Undergraduate research, astronomy education), co advisor. Summer - Fall 2005.
- Brock Frost, Department of Psychology, Weber State University (thesis committee member). Spring 2005 - Fall 2005.
- Lori Durrant, Department of Physics, Weber State University (Undergraduate research, physics education). Summer 2004 - Fall 2005.
- Heather London, College of Education, Weber State University (Master's Committee). Spring 2004 - Spring 2005.
- Susan Labasky, Department of Teaching and Learning, University of Utah (Doctoral Committee). ''A Study of the Relationships Among Student Nurse Epistemology, Critical Thinking, and Clinical Decision Making.'' Defended May 13, 2004.
- Rene Meyers, Department of Zoology, Weber State University. ''Taking the Plunge: Pouch Morphology and Function in Brown Pelicans.'' Defended May 11, 2004.
- Troy Lund, Department of Physics, Weber State University (Undergraduate research, physics education and laboratory curriculum development). Summer 2003.
- Matthew Smith, Department of Physics, Weber State University (Undergraduate research, physics education). Spring 2002.
- Adam Taintor, Honors Thesis (Chair), Weber State University. ''Dioxin and Wasatch Energy Systems: Is It Better To Be Safe Than Sorry?'' Defended May, 2001.

**Other professional reviews and contributions**

- Referee of proposals for the 2008 annual meeting of the American Educational Research Association (Division C, Section 4 (Science)).
- Referee of proposals for the 2008 annual meeting of the National Association for Research in Science Teaching (Strands 1 and 5).
- External reviewer of Dr. Mark James, Department of Physics, Northern Arizona University (Fall, 2007)
- Delphi reviewer of ''The Nature of Science'' chapter in physics teaching methods text in preparation, Carl Wenning (Fall 2007)
- External reviewer of Dr. Leigh Smith, Department of Teacher Education, Brigham Young University (Fall, 2007)
- Review of prospectus of introductory physics text, Springer (April, 2007)
- Referee of proposals for the 2007 annual meeting of the National Association for Research in Science Teaching.
- Review of Zimmerman's *Core Concepts in Physics*, Prentice Hall (July, 2006).
- Review of Williams' *Visualizing Physics*, John Wiley & Sons, Inc. (July, 2006).
- Review of Snow & Stern's *Asking About the Universe*, W. W. Norton & Co. (June, 2006).
- Science Fair Judge, Weber School District (February 6, 2006).
- Referee of proposals for the 2006 annual meeting of the National Association for Research in Science Teaching (Strands 1, 3 and 5).
- Review of Zimmerman's *Core Concepts in Physics*, Prentice Hall (July, 2006).
- Review of Williams' *Visualizing Physics*, John Wiley & Sons, Inc. (July, 2006).
- Review of Snow & Stern's *Asking About the Universe*, W. W. Norton & Co. (June, 2006).
- Consultant for ''Space Mysteries,'' a supplement to the *Standard Examiner* (December 5, 2005).
- Referee of proposals for the 2006 annual meeting of the National Association for Research in Science Teaching (Strands 1,3 and 5).

- Review of prospectus of introductory physics text, John Willey & Sons (September, 2005).
- Review of three chapters of Walker's College Physics text (3e), Prentice Hall, Inc. (July, 2005).
- Review of pilot tests for secondary science assessment, Utah State Office of Education (July 12, 2005).
- Review of three chapters of Walker's College Physics text (3e), Prentice Hall, Inc. (March, 2005).
- Review of one chapter of Touger's College Physics text, John Wiley & Sons, Inc. (February, 2005).
- Review of one chapter of Touger's College Physics text, John Wiley & Sons, Inc. (November, 2004).
- Review of workbook to accompany Touger's College Physics text, John Wiley & Sons, Inc. (October, 2004).
- Referee of proposals for the 2005 annual meeting of the National Association for Research in Science Teaching (Strands 1 and 3).
- Review of pilot tests for secondary science assessment, Utah State Office of Education; August 20, 2004.
- ''Standards Setting'' for secondary science assessment, Utah State Office of Education; July 27-29, 2004
- Reviewer of Wiley's ''Visual Imprints Series'', May 2004.
- Presider for paper presentation session 9R at the Annual Meeting of the National Association for Research in Science Teaching, April 2004, Vancouver, BC, Canada.
- Presider and judge for the First Annual Undergraduate Research Symposium, March 29, 2004, Weber State University.
- Invited facilitator at the ''Red Rock Great Teaching Retreat'' (February 26-28, 2004). Workshop for university faculty, providing interactive discussion and development of teaching strategies. Hosted by *Highroad Professional Development*; Springdale, UT.
- Prospectus and chapter reviews for college physics text by VanHuevlen & Etikina, Adison-Wesley (December 2003).
- Invited panelist on General Education discussion at the ''What is an Educated Person?'' conference, (November 17, 2003). Hosted by Utah Board of Regents, Salt Lake City.
- External tenure reviewer for Dr. David Moss, Neag College of Education, University of Connecticut (November 2003).
- Two chapter review of introductory physics text by Trefil & Hazen, John Wiley and Sons (November 2003).
- Review of multimedia for Bennet et al. astronomy text, Addison-Wesley (November 2003).
- Reviewer of proposal for new College Physics text for Addison-Wesley Longman Publishers (September 2003).
- Teaching mentor for colleague, as arranged by the Dean of the College and a department chair (Fall 2003).
- Referee of proposals for the 2004 annual meeting of the National Association for Research in Science Teaching (Strands 1 and 3).
- Reviewer of chapter of College Physics text for John Wiley & Sons Publishers (August 2003).
- Reviewer of proposal for new College Physics text for Addison-Wesley Longman Publishers (May 2003).
- Prospectus reviewer for general college physics text of John Wiley Publishers (December, 2002).
- NASA Science Teacher Workshop/Inservice facilitator, Weber State University. (December, 2002).
- Referee of proposals for the 2003 annual meeting of the National Association for Research in Science Teaching

- Prospectus reviewer for introductory physics text of John Wiley Publishers (July, 2002).
- Reviewer of McGraw-Hill web-based interactive media for introductory astronomy (January, 2002).
- Prospectus reviewer for conceptual physics text of McGraw-Hill (December, 2001).
- Referee of proposals for the 2002 annual meeting of the National Association for Research in Science Teaching
- Co-writer for Utah State Core science instruction vignettes, Utah State Office of Education (August, 2001).
- Visited and assisted with model rocket building for USU's Extension Youth and Families with Promise program; accompanied by WSU physics majors (August 2001).
- Co-writer for *Physics* Core Curriculum revision, Utah State Office of Education (June, 2001).
- Reviewer for *Astronomy: Journey to the Cosmic Frontier (2nd Ed., updated)*, McGraw Hill (June, 2001).
- Advisor to *Standard Examiner's* Astronomy supplement, (December 2000).
- Reviewer for *In Quest of the Universe (3rd Ed.)*, Jones & Bartlett (May 2000).
- Advisor to *Standard Examiner's* ''Physics Phun'' (February 7, 2000).
- Reviewer for *21st Century Astronomy*, W. W. Norton & Company. (August, 1999).

**Presentations given to campus and community groups**

- ''Multiple meanings of learning'' (October 12, 2007). Presentation for Weber State tutors.
- ''Science Museum Roadshow'' (October 4-5). Six physical science demonstration shows (grades K-5) for Polk Elementary School, Ogden, UT.
- ''Bubbleology'' (August 17, 2007). Workshop for Girl Scouts of N. Davis County, Layton, UT.
- ''Wonders of Physics'' (June 28, 2007). Demo show and lecture for Upward Bound, Weber State University.
- ''First Grade Physics'' (May 11, 2007). Demo show and lecture for 1st graders from Polk Elementary School.
- ''Circus of Physics'' (April 13, 2007). Two demo shows with Colin Inglefield for 1st Annual Physics Open House.
- ''Wonders of physics'' (November 14, 2006). Two demonstration and interactive lecture sessions for Central Middle School students.
- ''Using our senses and imaginations (November 7, 2006). Demonstrations and discussions with preschoolers from Weber State University's Children's School.
- ''Mechanics and motion'' (October 20, 2006). Two demonstration and interactive lecture sessions for Mt. Ogden Middle School students (in coordination with Dr. John Sohl's demo/lecture on thermodynamics).
- ''Physics and the senses'' (May 26, 2006). Interactive demonstrations for first grade classes at Sand Springs Elementary School (Layton, UT).
- ''The light-up pickle and other wonders'' (March 15, 2006). Two demonstrations and interactive lecture for St. Paul's schools (Ogden, UT) pre-school classes.
- ''Physics around us'' (March 14, 2006). Demonstration and interactive lecture for Horizon School (Ogden, UT).
- ''Imagination and the sky'' (March 14, 2006). Planetarium presentation for St. Paul's school's (Ogden, UT) Kindergarten class.
- ''The physics of flying, falling, and landing,'' (November 3, 2005). A presentation for the first annual *Jump Start* Science Fair, Weber State University.

- ''How and why to think like a scientist'' (November 2, 2005). A presentation for First Year Experience, Weber State University.
- ''Teambuilding'' workshop for Honors Student Advisory Council, Weber State University (June 28, 2005).
- ''The wonder of motion and sound'' (June 14, 2005). A presentation for Ogden MOMS club.
- ''The shape and size of space'' (June 4, 2005). A slide show for the OAS/Ott Planetarium Star Party, Antelope Island.
- ''The glowing pickle and other physics of change'' (March 14, 2005). Presentations for two preschool classes from St. Paul's School.
- ''Engaging Students in the Classroom'' (December 16, 2004). A presentation for FYE instructors and mentors.
- ''Images of Science'' (October 26, 2004). A 'Pizza with a prof' presentation for the WSU Honors program.
- ''A brief tour of 'out there''' (August 21, 2004). A slide show for the OAS/Ott Planetarium Star Party, Ogden Bay Bird Refuge.
- ''The physics of change'' (May 13, 2004). A presentation and demonstration show for MOMS club of Ogden.
- ''How things change'' (December 12, 2003). A presentation and demonstration show for local Head Start classes.
- ''A primer on assessment: Philosophy and practice.'' (November 24, 2003). A presentation for WSU English Literature/Writing Methods teaching methods courses.
- ''Learning across the curriculum: Conceptual resistance and change in student understanding'' (November 21, 2003). A presentation for NOUS (Weber State University Philosophy Club) with Eric Amsel, Psychology.
- Presented ''Alternative assessment: What is it? How do I do it?'' Sponsored by the University Teaching and Learning Forum (November 12 & 20, 2003).
- ''A tour of observational astronomy'' (August 30, 2003). A slide show for the OAS/Ott Planetarium Star Party, Antelope Island.
- ''The Universe: A Crash Course'' (April 28, 2003). A presentation for Wahlquist JHS MESA program.
- ''The Physics of the Mundane Roadshow'' (March 10, 2003). An outdoor demo presentation for Honors Emphasis Week, Weber State University.
- ''The Nature of Natural Law'' (February 13, 2003). A presentation for Science Seminars for Superior Students, WSU.
- ''Astronomy across the curriculum'' (January 31, 2003). A workshop for New Science Teacher Induction and Retention Program, Center for Science and Math Education, WSU.
- ''Living on a spinning ball'' and ''Heat and light in space'' (December 3, 2002). Two NASA Science Teachers Workshops, Center for Science and Math Education, WSU.
- ''A physics demonstration tour'' (November 1, 2002). A presentation for the WSU Student Chapter of the National Science Teachers Association.
- ''Problem solving across the disciplines'' (August 12, 2002). A presentation for the Honors Student Advisory Committee, WSU.
- ''The Music of Physics'' (April 19, 2002). Two presentations for the 6$^{th}$ grade class of Green Acres Elementary.
- ''The nature of science education'' (Nov. 1, 2001). A guest lecture/discussion for Science Teaching Methods (PHYS 4570).
- ''Mother Nature's rules of conservation'' (Nov. 1, 2001). A presentation for MESA.
- ''A crash course in science learning, constructivism, and conceptual change'' (Oct. 11, 2001). A guest lecture for Science Teaching Methods (PHYS 4570).
- ''The Mars files: Evaluating the evidence for life on the red planet'' (Oct. 10, 2001). Workshop presented for WSU/NASA Teachers Workshop.

- ''Playful science'' (June 14, 2001). A presentation for MOMS Club of Layton, UT.
- Physics and astronomy presentation for career day (April 4, 2001), Sunset Jr. High School.
- ''Exploring Europa'' (Nov. 15, 2000). NASA Teacher Workshop Presentation with Dr. Brad Carroll.
- ''What is astronomy?'' (Nov. 10, 2000) Central Middle School, Ogden, UT.
- ''Bridging Heaven and Earth: The nature of natural laws'' (Oct. 24, 2000). WSU Honors/AP Night.
- ''Probing for understandings of science: The deep roots and entangled vines of a conceptual ecology'' (Oct. 11, 2000). WSU Physics Department Seminar.
- ''The nature of science'' (Oct. 2, 2000). A guest lecture for Science Teaching Methods.
- ''Constructivism & science learning'' (Sept. 29, 2000). A guest lecture for Science Teaching Methods.
- Doctoral defense: "A conceptual change analysis of nature of science conceptions: The deep roots and entangled vines of a conceptual ecology'' (Sept. 15, 2000). The University of Utah, Graduate School of Education, Department of Teaching & Learning.
- "A Field Trip Through the Solar System" (Feb. 4, 2000). Utah Science Teachers Association's annual conference, Ogden, UT.
- "Scale & Structure of the Universe" (Jan. 7, 2000) to First Year Science Teachers Workshop, Center for Science and Math Education, Weber State University.
- MESA presentations for the physics department, Weber State University. (Several throughout Spring 2000.)
- "Science literacy: What, Why, and How?" (Nov. 17, 1999). WSU Honors' 'Pizza with a prof'.
- Two lectures on the nature of science and science learning for science teaching methods course, Fall 1999.
- "The Nature of Natural Laws" (Oct. 20, 1999). Honors-AP night, Weber State University.
- "The Universe in a Soap Bubble" (Oct. 21, 1998). Honors-AP night, Weber State University.
- "Misconceptions in Astronomy" (May 14, 1998). Presented to Ogden (UT) Astronomical Society.
- "Grocery Store Physics" (Feb. 18, 1998). Presented to Jordan (UT) School District.
- "Physics is Hard" (Nov. 25, 1997). Presentation at Weber State University, sponsored by W.S.U. Physics Club.
- "Unraveling convective rolls within a Rayleigh-Bénard cell" (June 6, 1994). Senior honors presentation for the Department of Physics, Lewis & Clark College, Portland, OR.

**University service**

**Departmental**

- Physics Teaching and Physical Science Teaching advisor
- Assessment committee (chair)
- Curriculum committee
- Lower division lab committee (chair).

**College**

- Developmental Math Director Search Committee, chair (2006 - 2007)
- Center for Science and Math Education advisory committee (2000 - present)
- Science Museum Committee (2005 - present)
- College of Science General Education Assessment committee (2001 - present)

- Science Fair committee and judge
- Science Olympiad judge

**University**

- First Year Experience Director search committee (August 2007 - present).
- University Council on Teacher Education (2006 - present)
- Developmental mathematics search committee (chair) (April 2006 - present).
- University General Education Assessment and Improvement Committee (2005 - 2007)
- Developmental mathematics task force (co-chair) (August 2004 - August 2005).
- Curling club, faculty advisor (January 2004 - present).
- Selection committee for director of WSU Teaching and Learning Forum (December 2003).
- Advisory committee for Weber State University partnership with NUAMES charter school (June 2003 - March 2004).
- Faculty advisor WSU National Science Teachers Association student chapter (August 2002 - present).
- University Teaching, Learning, and Assessment Committee (August 2002 - May 2005).
- Physical/life Science General Education Assessment committee (August 2002 - present).
- Honors Faculty Advisory Committee (August 2002 - June 2006).

**Other skills and interests**

- Outdoor excursions (backpacking, hiking, x-country skiing, snowshoeing, etc.)
- Piano playing and composition
- Beer brewing and the science thereof
- Playing the game and studying the science of curling

# CURRICULUM VITA
## Shane L. Larson


NAME Shane L. Larson
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Weber State University
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SCIENTIFIC BACKGROUND
Assistant Professor of Physics
Director, WSU Observatory
Weber State University (2006-present)

Postdoctoral Scholar, Center for Gravitational Wave Physics & Institute for Gravitational Physics
The Pennsylvania State University (2004-2006)

Postdoctoral Scholar, Space Radiation Laboratory & TAPIR
California Institute of Technology (2001-2004)

NASA EPSCoR Postdoctoral Research Associate
Jet Propulsion Laboratory & Montana State University (1999-2001)

Ph. D. *Theoretical Physics*, Montana State University (1999)
M. S. *Physics*, Montana State University (1994)
B. S. *Physics (with High Scholarship)*, Oregon State University (1991)

INTERESTS Gravitational wave astronomy, relativistic astrophysics, general relativity, cosmology.

EXPERIENCE

2006 - present: *Assistant Professor of Physics, Weber State University.*
Assistant professor in 18,000 student regional undergraduate institution. Full teaching load (12 semester credit hours; courses + laboratories), maintain an active research program in gravitational physics.

2004 - 2006: *Postdoctoral Scholar, Center for Gravitational Wave Physics.* [Center Postdoc]
Research in low frequency gravitational wave astrophysics and phenomenology: galactic binaries, extreme mass ratio inspirals, and supermassive black holes.

2001 - 2004: *Postdoctoral Scholar in Physics, California Institute of Technology.* [Tom Prince]
Research in gravitational wave physics pertaining to the proposed LISA space interferometer: binary data analysis, time delay interferometry, and observatory sensitivity.

1999 - 2001: *NASA EPSCoR Postdoctoral Associate, Jet Propulsion Laboratory.* [Ron Hellings]
Research in gravitational wave astrophysics, studying possible astrophysical sources of gravitational radiation and design aspects of the proposed LISA space interferometer.

1991 - 1999: *Graduate Research Student, Montana State University.* [Bill Hiscock]
Ph. D. student in theoretical physics: gravitational wave physics, classical relativity and semi-classical gravity.

1990: *Summer Intern, National Radio Astronomy Observatory, Charlottesville, VA.* [Glen Langston]
Work on characterization of core-jet radio sources based on luminosity, internal structure of fields (from polarization), and external morphology from VLA survey data.

1989 - 1991: *Research Assistant, Biophysics, Oregon State University.* [Jeanne Rudzki Small]
Experimental work on protein (predominantly carboxymyoglobin) dynamics using time-resolved pulsed laser photoacoustic calorimetry.

1987-1988: *Research Technician, Oregon State University (Union County Station).*
Worked on projects relating to land management practices in rangeland ecosystems (and built a lot of barbed wire fence!).

## Honors & Awards

Member of APS Topical Group in Gravitation *Speakers Bureau*
World Year of Physics (2004-2005)

Classical and Quantum Gravity, Research Highlight (2002)
for N. J. Cornish and S. L. Larson, CQG **18**, 3473 (2001)

NASA Space Grant Graduate Student Internship
Montana Space Grant Consortium, Montana State University (1994-1999)

Graduate Teaching Assistant of the Year
Department of Physics, Montana State University (1993)

Graduate Teaching Assistant of the Year (Honorable Mention)
Department of Physics, Montana State University (1992)

Presidential Scholar
Oregon State University (1987 - 1991)

DeWuhs-Keckritz Scholar
Oregon State University (1987)

## Refereed Publications

[1] *A report on the second Mock LISA Data Challenge*
K. A. Arnaud, S. Babak, J. G. Baker, M. J. Benacquista, N. J. Cornish, C. Cutler, S. L. Larson, B. S. Sathyaprakash, M. Vallisneri, A. Vecchio, J-Y. Vinet (The Mock LISA Data Challenge Task Force)
submitted to *Class. Quant. Grav.*, (2007)

[2] *Specific angular momentum of extrasolar planetary systems*
John C. Armstrong, Shane L. Larson and Rhett R. Zollinger
submitted to *Astrophysical Journal* (2007); astro-ph/arxiv:0708.1771

[3] *The LISA gravitational wave foreground: a study of double white dwarfs*
Ashley J. Ruiter, Krzysztof Belczynski, Matthew Benacquista, and Shane L. Larson
submitted to *Astrophysical Journal* (2007); astro-ph/arXiv:0705.3272

[4] *Spurious acceleration noise in spaceborne gravitational wave interferometers*
Patricia Purdue and Shane L. Larson
accepted in *Classical & Quantum Gravity* (2007)

[5] *Selection effects in resolving Galactic binaries with LISA*
Matthew J. Benacquista, Shane L. Larson and Brett E. Taylor
*Class. Quant. Grav.* **24**, S513 (2007)

[6] *An overview of the second round of the Mock LISA Data Challenges*
K. A. Arnaud, S. Babak, J. G. Baker, M. J. Benacquista, N. J. Cornish, C. Cutler, S. L. Larson, B. S. Sathyaprakash, M. Vallisneri, A. Vecchio, J-Y. Vinet (The Mock LISA Data Challenge Task Force)
*Class. Quant. Grav.* **24**, S551 (2007)

[7] *Report on the first round of the Mock LISA Data Challenges*
K. A. Arnaud, S. Babak, J. G. Baker, M. J. Benacquista, N. J. Cornish, C. Cutler, S. L. Larson, B. S. Sathyaprakash, M. Vallisneri, A. Vecchio, J-Y. Vinet (The Mock LISA Data Challenge Team)
*Class. Quant. Grav.* **24**, S529 (2007)

[8] *Gravitational wave bursts from the Galactic massive black hole*
Clovis Hopman, Marc Freitag and Shane L. Larson
*Monthly Notices of the Royal Astronomical Society* **378**, 129 (2007)

[9] *Hands-on Gravitational Wave Astronomy: Extracting astrophysical information from simulated signals*
Louis J. Rubbo, Shane L. Larson, Michelle B. Larson and Dale R. Ingram
*The American Journal of Physics* **75**, 597 (2007)

[10] *Observing IMBH-IMBH binary coalescences via gravitational radiation*
John M. Fregeau, Shane L. Larson, M. Coleman Miller, Richard O'Shaughnessy, and Frederic A. Rasio
*Astrophysical Journal* **646**, L135 (2006)

[11] *Gravitational radiation timescales for extreme mass ratio inspirals*
Jonathan R. Gair, Daniel J. Kennefick and Shane L. Larson
*Astrophysical Journal* **639**, 999 (2006)

[12] *Gravitational Waves: new observatories for new astronomy*
Louis J. Rubbo, Shane L. Larson and Michelle B. Larson
*The Physics Teacher* **44**, 420 (2006)

[13] *Science icebreaker activities: an example from gravitational wave astronomy*
Michelle B. Larson, Louis J. Rubbo, Kristina D. Zaleski and Shane L. Larson
*The Physics Teacher* **44**, 416 (2006)

[14] *LISA: A modern astrophysical observatory*
Shane L. Larson
review paper in the proceedings of the 33rd SLAC Summer Institute, *Gravity in the Quantum World and the Cosmos*, SLAC-R-819, T023 (2005)

[15] *Semi-relativistic approximation to gravitational radiation from encounters with non-spinning black holes*
Jonathan R. Gair, Daniel J. Kennefick and Shane L. Larson
*Physical Review D* **72**, 084009 (2005)

[16] *The LISA zero-signal solution*
Massimo Tinto and Shane L. Larson
*Classical and Quantum Gravity* **22**, 531 (2005)

[17] *The LISA time-delay interferometry zero-signal solution I: geometrical properties*
Massimo Tinto and Shane L. Larson
*Phys. Rev. D* **70**, 062002 (2004)

[18] *Event rate estimates for LISA extreme mass ratio capture sources*
J. Gair, L. Barack, T. Creighton, C. Cutler, Shane L. Larson, E. S. Phinney and M. Vallisneri
*Classical and Quantum Gravity* **21**, 1595 (2004)

[19] *Constraining the properties of the proposed supermassive black hole system in 3C66B: Limits from pulsar timing*
Frederick A. Jenet, Andrea Lommen, Shane L. Larson and Linqing Wen
*Astrophysical Journal* **606**, 799 (2004)

[20] *LISA data analysis: doppler demodulation*
Neil J. Cornish and Shane L. Larson
*Classical and Quantum Gravity* **20**, 163 (2003)

[21] *LISA data analysis: source identification and subtraction*
Neil J. Cornish and Shane L. Larson
*Phys. Rev. D* **67**, 103001 (2003)

[22] *LISA, binary stars and the graviton mass*
Curt Cutler, William A. Hiscock and Shane L. Larson
*Phys. Rev. D* **67**, 024015 (2003)

[23] *The LISA Optimal Sensitivity*
Thomas A. Prince, Massimo Tinto, Shane L. Larson and J. W. Armstrong
*Phys. Rev. D* **66**, 122002 (2002)

[24] *Unequal arm space-borne gravitational wave interferometers*
Shane L. Larson, Ronald W. Hellings and William A. Hiscock
*Phys. Rev. D* **66**, 062001 (2002)

[25] *Perspectives on water flow and FLIR imagery*
Shane L. Larson, Larry L. Larson and P. A. Larson
*Journal of Rangeland Management* **55**, 106 (2002)

[26] *Space missions to detect the cosmic gravitational-wave background*
Neil J. Cornish and Shane L. Larson
*Classical and Quantum Gravity* **18**, 3473 (2001)

[27] *Determination of meteor showers on other planets using comet ephemerides*
Shane L. Larson
*Astronomical Journal* **121**, 1722 (2001)

[28] *Ripples on a cosmic sea: Gravitational waves and the new astronomy*
Shane L. Larson
*Quantum* **11**, 4 (2001)

[29] *Low frequency gravitational waves from binary white dwarf MACHOs*
William A. Hiscock, Shane L. Larson, Joshua Routzahn, and Ben Kulick
*Astrophysical Journal Letters* **540**, L5 (2000)

[30] *Sensitivity curves for spaceborne gravitational wave interferometers*
Shane L. Larson, William A. Hiscock and Ronald W. Hellings
*Phys. Rev. D* **62**, 062001 (2000)

[31] *Using binary star observations to bound the mass of the graviton*
Shane L. Larson and William A. Hiscock
*Phys. Rev. D* **61**, 104008 (2000)

[32] *Null geodesics in the Alcubierre warp drive spacetime: the view from the bridge*
Chad Clark, William A. Hiscock and Shane L. Larson
*Classical and Quantum Gravity* **16**, 3965 (1999)

[33] *Astrophysical bounds on global strings*
Shane L. Larson and William A. Hiscock
*Phys. Rev. D* **56**, 3242 (1997)

[34] *Semiclassical effects in black hole interiors*
William A. Hiscock, Shane L. Larson and Paul R. Anderson
*Phys. Rev. D* **56**, 3571 (1997)

[35] *Riparian shade and stream temperature: a perspective*
Larry L. Larson and Shane L. Larson
*Rangelands* **18**, 149 (1996)

[36] *Effects of solvent viscosity on the microsecond protein motions of myoglobin determined by pulsed-laser photoacoustics*
M. L. Pearson, K. L. Mrakovcich, S. L. Larson and J. Rudzki Small
*Biophysical J.* **59**, 289a (1991)

[37] *Photoacoustic studies of carboxymyoglobin*
S. L. Larson and J. Rudzki Small
*Biophysical J.* **57**, 229a (1990)

[38] *Photoacoustic determination of fluorescent quantum yields of protein probes*
J. Rudzki Small and S. L. Larson
in *Time-Resolved Laser Spectroscopy in Biochemistry II*, J. R. Lakowicz, ed.,
SPIE Proceedings **1204**, 126 (1990)

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In Preparation

[1] *Space weather and spaceborne gravitational wave observatories*
Kristina D. Zaleski and Shane L. Larson
to be submitted to *Classical and Quantum Gravity*

[2] *Disruption of compact binary systems in extreme mass ratio systems*
Shane L. Larson, Pablo Laguna and Deirdre Shoemaker
to be submitted to *Astrophysical Journal Letters*

[3] *Extracting the galactic shape from low-frequency gravitational wave observations*
Shane L. Larson, Brett E. Taylor and Matthew Benacquista
to be submitted to *Astrophysical Journal*

[4] *Probing the neutron star-black hole binary population with LISA*
Vassiliki Kalogera, Shane L. Larson and Lee Samuel Finn
in preparation, to be submitted to *Astrophysical Journal*

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Proceedings

[1] *The Impact of Finite-Differencing Errors on Binary Black Hole Merger Templates*
Birjoo Vaishnav, Deirdre Shoemaker and Shane L. Larson
*Proceedings of the Sixth International LISA Symposium*, AIP Conf. Proc. **873**, 125 (2006)

[2] *The resolving power of LISA: comparing techniques for binary analysis*
Shane L. Larson and Lee Samuel Finn

*Proceedings of the Sixth International LISA Symposium*, AIP Conf. Proc. **873**, 415 (2006)

[3] *An Overview of the Mock LISA Data Challenges*
K. A. Arnaud, S. Babak, J. G. Baker, M. J. Benacquista, N. J. Cornish, C. Cutler, S. L. Larson, B. S. Sathyaprakash, M. Vallisneri, A. Vecchio, J-Y. Vinet (The Mock LISA Data Challenge Task Force), *Proceedings of the Sixth International LISA Symposium*, AIP Conf. Proc. **873**, 619 (2006)

[4] *A How-To for the Mock LISA Data Challenges*
K. A. Arnaud, S. Babak, J. G. Baker, M. J. Benacquista, N. J. Cornish, C. Cutler, S. L. Larson, B. S. Sathyaprakash, M. Vallisneri, A. Vecchio, J-Y. Vinet (The Mock LISA Data Challenge Task Force), *Proceedings of the Sixth International LISA Symposium*, AIP Conf. Proc. **873**, 625 (2006)

[5] *Preparing for LISA Data: The Testbed for LISA Analysis Project*
L. S. Finn, M. J. Benacquista, Shane L. Larson & L. J. Rubbo,*Proceedings of the Sixth International LISA Symposium*, AIP Conf. Proc. **873**, 640 (2006)

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Other Contributions

[1] *Instructor: International Summer School on Gravitational Wave Astronomy*
China West Normal University & Center for Gravitational Wave Astronomy - University of Texas at Brownsville
Nanchong, Sichuan, China (June, 2007)

[2] *White Paper: Addressing LISA Science Analysis Challenges*
M. J. Benacquista, L. S. Finn, Shane L. Larson & L. J. Rubbo (2006)
arxiv.org: gr-qc/0606089

[3] *White Paper: The Testbed for LISA Analysis Project*
L. S. Finn, M. J. Benacquista, Shane L. Larson & L. J. Rubbo (2006)
arxiv.org: gr-qc/0602019

[4] *Testbed for LISA Analysis*
February 2006
http://tla.gravity.psu.edu

[5] *Contribution of Compact Mass Transferring Systems to the Galactic Gravitational Wave Background*
Krzysztof Belczynski, Matthew Benacquista, Shane L. Larson, and Ashley J. Ruiter
astro-ph/0510718 (2005)

[6] *Gravitational Wave Astronomy*
Special Session of the American Astronomical Society Meeting, January 2005
Shane L. Larson, Michelle B. Larson, Lee Samuel Finn (Organizers)

[7] *Workshop Summary: Imagining the Future*
in *Matters of Gravity*, APS Topical Group in Gravitation, January 2005
Shane L. Larson

[8] *White Paper: Estimates of detection rates for LISA capture sources*
report to the LISA International Science Team (2004)
L. Barak, T. Creighton, C. Cutler, J. Gair, S. Larson, E. S. Phinney, K. S. Thorne, & M. Vallisneri (LISA Working Group 1)

[9] *New eyes on the sky: Gravitational waves and multi-messenger astronomy*
Karen Willacy & Shane L. Larson
LISA Newsletter, Vol. 1 No. 2 (2004)
http://lisa.nasa.gov/newsletter/newsletter_200408.pdf

[10] *Online Sensitivity Curve Generator*
Shane L. Larson, April 2002
http://www.srl.caltech.edu/∼shane/sensitivity/MakeCurve.html

[11] *White Paper: LISA Draft Science Requirements*
report to the LISA International Science Team (2002)
E. S. Phinney & LISA Working Group 1

[12] *White Paper: Science impact of the low frequency performance of LISA*
report to the LISA International Science Team (2001)
E. S. Phinney & LISA Working Group 1

[13] *Museum of the Rockies Observatory (MoRO): An idea document*
Loren W. Acton, Alisdair Davey, Michelle B. Larson and Shane L. Larson
submitted to Museum of the Rockies, Bozeman, MT (2001)

[14] *Can gravitational waves be detected in quasar microlensing?*
Shane L. Larson and Rudolph Schild
arxiv.org: astro-ph/0007142

[15] *Is dark matter theory or fact?*, Rhett Herman & Shane L. Larson
for Scientific American "Ask the Experts" (June, 1998); available online

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Invited Talks

[1] *Oases in the Dark: Galaxies as Probes of the Cosmos*
*Monsters in the Cosmic Sea: Black Holes & Einstein's Astronomical Legacy*
Yellowstone National Park — 10 & 11 August 2007

[2] *Oases in the Dark: Galaxies as Probes of the Cosmos*
Winter Lecture Series, Museum of the Rockies
Bozeman, MT — 26 January 2007

[3] *Listening to the Cosmic Fugue: LISA and the gravitational wave Universe*
at "Albert Einstein and his Legacy" Symposium
Topical Meeting of the New York Section of the American Physical Society
Hamilton, NY — 15 October 2005

[4] *LISA: a modern astrophysical observatory*
SLAC Summer Institute Lecture, Stanford University
Stanford, CA — 26 July 2005

[5] *Using LISA as an astrophysical observatory*
LISA: Science, Sources and Analysis Workshop
Aspen Center for Physics
Aspen, CO — 30 May 2005

[6] *Close encounters of a different kind: Extreme mass ratio capture orbits*
Institute for Gravitational Physics and Geometry
The Pennsylvania State University
University Park, PA — 11 October 2004

[7] *Galactic binary foregrounds: resolving, identifying and subtracting binary stars*
Globular Cluster Dynamics and Gravitational Radiation Workshop
The Pennsylvania State University
University Park, PA — 17 October 2003

[8] *Low frequency gravitational waves from the galactic halo*
Source Simulation and Gravitational Wave Data Analysis Workshop
The Pennsylvania State University
University Park, PA — 29 October 2002

[9] Departmental Colloquia: 21 invited colloqiua — 2000-2007

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## Outreach Activities

[1] Planetarium Narration: *Gravitational Attraction*
Ott Planetarium, Weber State University — 2007

[2] Public Lectures: 30 Public Lectures — 1997-2007
*States:* California, Colorado, Montana, Oregon, Pennsylvania, Utah, Virginia, Washington
*Topics:* Black Holes, Gravitational Waves, Einstein, Astronomy, Galaxies, Mars Exploration

[3] *World Year of Physics Speakers Bureau*
*Gravitational Physics Speakers Bureau*
APS Topical Group in Gravitation – 2005 to present

[4] Science Advisor: STARDATE Radio, *Astrophysics and gravitational waves*
4 Radio Scripts – April, 2006
2 Radio Scripts – December, 2005
5 Radio Scripts – June, 2005

[5] Science Advisor:*Black Holes*, Planetarium Script
Clark Planetarium, Salt Lake City, UT – April, 2005

[6] Science Advisor: *Science is all around us*
30 sec commercial spot, Discovery Science Channel
Concrete Pictures, Philadelphia, PA — 2002

[7] Professional mentor: *Senior Project: Video Rocketry*
Senior project, Gabriel Rudy and Daniel Patterson
Loomis Chaffee School, Windsor, CT — 2002

[8] Science Advisor: BOREALIS High Altitude Balloon Program
Montana State University — 2001-2003

[9] Vice-President/Program Coordinator: Southwest Montana Astronomical Society
Bozeman, Montana — 1997-2000

[10] Coordinator: Montana Mars Exploration Outreach Program
Montana Space Grant Consortium — 1996-1999

[11] *Montana Space Odyssey* (Summer Science Experience), Montana State University
Director — Summer 1996
Science Advisor — Summer 2001

[12] Director: Peaks and Potentials I & II (Summer Youth Camps)
Montana State University — Summers 1992-1995

[13] Science Advisor: Young Scholars Program
Montana State University — 1992;1994
Oregon State University — 1991

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## Grant Awards

*"RUI: Problems in Multi-Spectrum Gravitational Wave Astrophysics"*
Shane L. Larson (P.I.)
NSF Gravity, (2008-20010, pending)

*"Gravitational Radiation from Intermediate Mass and Massive Black Holes"*
Sachiko Tsuruta (P.I.), Shane L. Larson (Co-I.)
NASA ATFP, (2008-2009, pending)

*"HARBOR - A high altitude balloon program for student access to near space"*
Shane L. Larson (P.I.), John C. Armstrong (Co-I.)
Weber State University (internal); $3500.00 (2007-2008, pending)

*"PASCAL: An Experiment in High Altitude Ballooning"*
Samantha Balaich (P.I.), Shane L. Larson (Faculty Advisor)
Weber State University Undergraduate Research Program; $1650.00 (2007-2008)

*"Observatory Renovation and Improvement Project"*
Shane L. Larson (P.I.) Hemmingway Instructional Improvement
Weber State University (internal); $2500.00 (2007-2008)

*"Million Star Galactic Computer Modeling"*
Shane L. Larson (P.I.), Hemmingway New Faculty Grant
Weber State University (internal); $2000.00 (2007)

*"Compact binary sources and science with LISA"*
Lee Samuel Finn (P.I.), Shane L. Larson (Science P.I.)
NASA ROSS - Beyond Einstein Foundation Science, $426,566.00 (2005-2007)

*"Montana Space Odyssey"*, Kimberly K. Obbink, Shane L. Larson & C. Vogeli
Education Enhancement Grant, Montana Space Grant Consortium, $53,538.00 (1996)

## Refereeing Duties

*American Journal of Physics*
*Astronomy and Astrophysics*
*Classical and Quantum Gravity*
*Europhysics Letters*
*International Journal of Modern Physics D*
*Monthly Notices of the Royal Astronomical Society*
*Physical Review D*

## Teaching Experience

Instructor: PHYS 1040: Elementary Astronomy – Weber State, Spring 2007
Instructor: PHYS 2010: College Physics I – Weber State, Fall 2006, Fall 2007

Instructor: PHYS 2020: College Physics II – Weber State, Spring 2007
Instructor: PHYS 3500: Analytical Mechanics – Weber State, Fall 2006, Fall 2007
Instructor: PHYS 2830: Introductory Readings in Physics – Weber State
▷ Fall 2007: *Fundamental Physics* (Matt Spiva)
Instructor: PHYS 4800: Individual Research Problems – Weber State
▷ Fall 2007: *Atmospheric Physics and High-altitude Ballooning* (Samantha Balaich)

Instructor: PH 213: Modern Physics (with Calculus) – Fall 1996
Lead Tutorial Instructor: PH 205: General Physics – Fall 1997
Lead Tutorial Instructor: PH 206: General Physics – Spring 1994
Laboratory Teaching Assistant:

- PH 311: Observational Astronomy – Fall 1993, Summer 1998
- PH 103: Conceptual Physics – Fall 1997
- PH 101: Mysteries of the Sky – Fall 1991 to Spring 1993

Teaching evaluations, as well as feedback from public events can be provided upon request.

## Affiliations

American Association of Physics Teachers
American Astronomical Society
Astronomical League
American Physical Society
LISA Working Group 1 (Astrophysical Sources & Data Analysis)
Mock LISA Data Challenge Task Force (LISA Working Group 1b)
National Association of Rocketry (NAR #73310)
Sigma Pi Sigma

## Recent Colleagues

John C. Armstrong (Physics, Weber State University)
Krzysztof Belczynski (Astronomy, New Mexico State University)
Matthew Benacquista (Physics, University of Texas-Brownsville)
Lee Samuel Finn (Physics, Pennsylvania State University)
Marc Freitag (Institute of Astronomy, Cambridge University)
Jonathan Gair (Institute of Astronomy, Cambridge University)
Dawn Gelino (Michelson Science Center, Caltech)
Ron Hellings (NASA HQ & Physics, Montana State University)
Clovis Hopman (Leiden University)
Danny Jacobs (Physics, Montana State University)
Rick Jenet (Physics, University of Texas-Brownsville)
Vicky Kalogera (Physics & Astronomy, Northwestern University)
Dan Kennefick (Einstein Papers/Caltech & University of Arkansas)
Pablo Laguna (Astronomy & Astrophysics, Pennsylvania State University)
Andrea Lommen (Physics & Astronomy, Franklin & Marshall College)
Joseph Plowman (Physics, Montana State University)
Tom Prince (Space Radiation Laboratory, Caltech & JPL)
Patricia Purdue (Physics, Colorado College)
Pete Roming (SWIFT/Astronomy & Astrophysics, Pennsylvania State University)
Louis Rubbo (CGWP, Pennsylvania State University)
Ashley Ruiter (Astronomy, New Mexico State University)
Deirdre Shoemaker (Physics, Pennsylvania State University)
Brett Taylor (Physics, Radford University)
Seth Timpano (Physics, Pennsylvania State University)

Massimo Tinto (Jet Propulsion Laboratory)
Sachiko Tsuruta (Physics, Montana State University)
Michele Vallisneri (Jet Propulsion Laboratory)
Kristina Zaleski (Engineering, North Carolina State University)
Rhett Zollinger (Physics, Weber State University)

OTHER INTERESTS

Recreational Astronomy: Telescope making, Deep sky observing
Lego modeling: http://www.brickshelf.com/gallery/graviton/
Model and High Power Rocketry
Mountain biking

RESEARCH REFS

*Dr. Lee Samuel Finn*
Director, Center for Gravitational Wave Physics & Professor of Physics
Member LISA International Science Team
104 Davey Lab, The Pennsylvania State University, University Park, PA 16802
PHONE: 814/863-9598 eMAIL: lsfinn@psu.edu

*Dr. Pablo Laguna*
Associate Director, Center for Gravitational Wave Physics &
Professor of Astronomy and Astrophysics
104 Davey Lab, The Pennsylvania State University, University Park, PA 16802
PHONE: 814/863-8470 eMAIL: pablo@astro.psu.edu

*Dr. Thomas A. Prince*
Chief Scientist, Jet Propulsion Laboratory & Professor of Physics
LISA Mission Scientist & Head LISA International Science Team
M/C 220-47, California Institute of Technology, Pasadena, CA 91109
PHONE: 626/395-6605 eMAIL: prince@srl.caltech.edu

*Dr. Bonny L. Schumaker*
LISA Deputy Mission Scientist & Research Scientist
Jet Propulsion Laboratory
Mail Stop 198-235, Pasadena, CA 91109
PHONE: 818/354-4169 eMAIL: Bonny.L.Schumaker@jpl.nasa.gov

*Dr. Massimo Tinto*
Research Scientist
Jet Propulsion Laboratory
Mail Stop 161-260, Pasadena, CA 91109
PHONE: 818/354-0798 eMAIL: massimo.tinto@jpl.nasa.gov

*Dr. Ronald W. Hellings*
Discipline Scientist, Gravitational Physics, Universe Division (NASA Headquarters) &
Research Professor, Montana State University
PHONE: 202/358-0995 eMAIL: rhelling@nasa.gov

*Dr. William A. Hiscock*
Director, Montana Space Grant Consortium & Professor of Physics
Montana State University, EPS 264 Bozeman, MT 59717
PHONE: 406/994-6170 eMAIL: hiscock@montana.edu

*Dr. Neil J. Cornish*
Assistant Professor of Physics; Member LISA International Science Team
Montana State University, EPS 264 Bozeman, MT 59717
PHONE: 406/994-7986 eMAIL: cornish@physics.montana.edu

Teaching Refs

*Dr. Kimberly K. Obbink*
Director, Burns Technology Center
Montana State University, EPS 128 Bozeman, MT 59717
PHONE: 406/994-6550 eMAIL: kobbink@montana.edu

*Dr. Gerry Wheeler*
Executive Director, National Science Teachers Association
NSTA, 1840 Wilson Blvd., Arlington VA 22201
PHONE: 703/312-9255 eMAIL: gwheeler@nsta.org

*Dr. Larry D. Kirkpatrick*
Professor of Physics
Montana State University, EPS 264 Bozeman, MT 59717
PHONE: 406/994-6182 eMAIL: kirkpatrick@physics.montana.edu

*Dr. Gregory Francis*
Associate Professor of Physics
Montana State University, EPS 264 Bozeman, MT 59717
PHONE: 406/994-6625 eMAIL: francis@physics.montana.edu

**Stacy E. Palen**

Weber State University * 2508 University Circle * Ogden, UT * 84408-2508
(801)626-7030
spalen@weber.edu
(last updated, October, 2007)

## Education

PhD Physics: University of Iowa, July, 1998
MS Astronomy: University of Iowa, May 1996
BA Physics: Rutgers University, May, 1993

## Accomplishments

- Crystal Crest Master Teacher, Weber State University, 2006
- Best of State University Professor, Utah, 2005
- Obtained $1,000,000 grant in NASA federal appropriations to a) produce K-12 planetarium content specific to the states' core curricula, b) add a large (208-node) computing cluster to extend the Ott Planetarium's rendering capability, and c) improve SMET outreach to the public in Utah.
- Obtained ~$200,000 to upgrade the Ott Planetarium, installing a new, digital projector system, and upgrading facilities.
- Wrote a $200,000 proposal to establish the Undergraduate Astronomy Institute at the University of Washington. The Undergraduate Astronomy Institute is on-line at *tamiel98.astro.washington.edu/uaiweb*
- Wrote a basic text in introductory astronomy: Schaum's Outlines of Astronomy, McGraw-Hill.
- Involved undergraduates in research using national facilities such as Hubble Space Telescope and the Very Long Baseline Array.
- Created an innovative set of computer aided teaching materials used by TAs and instructors all over the world. These materials may be viewed on-line at *www.astro.washington.edu/labs/clearinghouse/*
- Conducted and published original research on planetary nebulae and late-type stars, at many different wavelengths (optical, infrared and radio), using single-slit, echelle, imaging, and interferometric techniques.
- Wrote a lab manual and associated CD-ROM for Astronomy 101 using the Automated Telescope Facility at the University of Iowa.

## Grants

- Planetarium Learning and New Education Technology, $1,000,000 (granted, 2005)
  - (see description above)
- Planetarium Digital Upgrade, $110,000 (granted, 2004)
  - (see description above) Total cost of the project, $200,000.
- Undergraduate Research Award $2712.50 (Spring, 2006)
  - To write new programming for the tertiary body search. Undergraduate collaborator: Michael Malmrose
- Undergraduate Research Award $3492 (Spring, 2006)
  - To acquire a receiver for the scavenged radio telescope that Michael Simpson is building. Undergraduate collaborator: Michael Simpson
- Undergraduate Research Award $750 (Spring, 2006)
  - A group project to investigate parameters of tuning forks. Undergraduate collaborators: James Aston, Milt Poll, Ron Proctor
- RS&PG $960 (Spring, 2006)

    - Travel award for AAS meeting
- Hemingway Faculty Excellence $8,979 (Fall, 2005)
    - To translate, record and distribute Spanish-language editions of planetarium shows, including the perennial favorite 'Secret of the Cardboard Rocket' (i.e. 'El Secreto del Cohete de Carton'). Collaborators include the Clark Planetarium. Total cost of the project $25,500.
- Undergraduate Research Award $ (Spring, 2005)
    - Ron's ed project
- Beishline Fellowship $12,000 (Spring, 2004)
    - undergraduate collaborator: Adam Reynolds, Spring, 2004. Purpose: to develop a parallel-processing protocol which allows users to submit jobs to an Xgrid system, run them on a number of machines simultaneously, insert the results into a database, and reference that database as necessary. The goal is to make this as general as possible, so that it may be used by a large number of researchers. Work finished 5/2005.
- Undergraduate Research Award $3,000 (Spring, 2004)
    - To search for tertiary companions to binary stars. Undergraduate collaborator: Ben Edinger
- Burkhardt Award $4,000 (Spring, 2003)
    - undergraduate collaborator Adam Reynolds
- Dee Family Technology Grant $3,600 (Summer, 2003)
    - undergraduate collaborator: Adam Reynolds Summer, 2003. Purpose: to produce a suite of astronomical tools for use by undergraduates for the calibration and reduction of astronomical data. Work finished 9/2003.
- Tools for Transformation, $64,000 (granted, 1999)
    - Created Astronomy 101 Clearinghouse: astronomy activities, homeworks and labs.
    - Collaborator: Craig Hogan
- Student Technology Fee, $193,000 (granted, 2000)
    - Start-up equipment grant to build optical and radio telescopes for undergraduate research.
    - Also included are spectacular computer facilities for theoretical work and data analysis.
    - Collaborators: Sean Doyle, Dawn Erb, Jeremiah Murphy (undergrads), Chris Stubbs, Paula Szkody (professors)

## Awards

- 2006: Crystal Crest Master Teacher, Weber State University
- 2005: Hemingway Faculty Excellence, Weber State University
- 2005: Best of State University Professor, Utah
- 1993: Department of Energy Fellow
- 1989: Charles C. Smith Educational Foundation Scholar

## Employment History

- Aug 2002-present: Weber State University: Assistant Professor, Physics Department
- 1998-2002: University of Washington: Post-doc/Lecturer, Astronomy Department
- 1994-1998: University of Iowa: Teaching/Research Assistant
- 1995-1998: University of Iowa: Curriculum Development/Technical Writer

## Significant Service Contributions

- 2006-present: Member, Environmental Initiatives Committee, Weber State University
- 2005-present: Treasurer, Sigma Xi, Weber State University Chapter
- 2004-2007: Member, Astronomy Education Board, American Astronomical Society
- 2004-2005: Member, Planning Initiative II Task Force, Weber State University
- 2003-present: Director, Ott Planetarium and Physics Observatory
- 2003-2008: Member, Clark Planetarium Board of Directors
- 1998-present: Various Outreach Activities: Visits to schools, career days, interviews, talks to amateur groups, etc. Of order 20 activities per year.

- 2001: "A Responsive PhD": invited to serve on an interdisciplinary committee to create pilot projects in doctoral education under the Woodrow Wilson Initiative.
- 2001: "The Graduate Program Committee": served on a sub-committee to evaluate and improve the graduate curriculum in the Astronomy Department at the University of Washington.
- 2001: "Issues in Introductory Astronomy": served on committee of national Astronomy Department chairs (as a proxy for Craig Hogan) in discussing issues concerning introductory astronomy courses. Sponsored by AAS, NSF.
- 2000: "Earth-Space Standards Study" committee: together with professors from other departments, devised a series of curricular pathways through new Earth-Space standards for elementary school teachers.
-

**Refereed Journal Publications**

- Hajian, A. et al. 2007, 'An Atlas of [NII] and [OIII] Images and Spectra of Planetary Nebulae', ApJS, 169, 289
- Palen, S. 2006, 'Preparing High Quality Professionals for Science Outreach', Science Education at the Crossroads Conference Proceedings
- Palen, S. and Proctor, A. 2006, 'Astronomy in the K-8 Core Curriculum: A Survey of State Requirements Nationwide.' AEdRv, 5, 23
- Palen, S., Balick, B., Hajian, A. R., Terzian, Y., Bond, H. E., & Panagia, N. 2002, 'Hubble Space Telescope Expansion Parallaxes of the Planetary Nebulae NGC 6578, NGC 6884, NGC 6891, and IC 2448' AJ, 123, 2666
- Stanghellini, L., Shaw, R. A., Mutchler, M., Palen, S., Balick, B., & Blades, J. C. 2002, 'Optical Slitless Spectroscopy of Large Magellanic Cloud Planetary Nebulae: A Study of the Emission Lines and Morphology' ApJ, 575, 178
- Palen, S. 2001, 'Polarization and Extent of Maser Emission from Late-Type Stars: Support for a Plasma Turbulence Model of Maser Production' ApJL, 547, L57
- Palen, S. & Fix, J. D. 2000, 'Models of OH Maser Variations in U Herculis' ApJ, 531, 391
- Palen, S. E. 'Effecting Global Change', The Universe in the Classroom. 48, 1, 1999.
- Palen, S. 1999, 'Investigation of the Causes of the Variations of the OH Masers of U Herculis' PASP, 111, 378

**Books, Manuals and Electronic Media**

- Palen, S. Schaum's Outline of Astronomy, McGraw-Hill, 2001
- Palen, S. E. The Astronomy 101 Clearinghouse, 1999
- Mutel, R. L. and Palen, S. E. Imaging the Universe: A Laboratory Manual for Introductory Astronomy Students Hayden-McNeil, 1997
- Mutel, R. L., Palen, S. E. and Downey, E. C. Imaging the Universe: Software and Images (CD-ROM), University of Iowa, 1997

**Planetarium Show Production (Technical Shows)**

The Great Space Race; Boy Scout Merit Badge Program; Cardboard Rocket en espanol; Science Olympiad; 3rd Grade Moon Core; Atoms, Molecules and Chemstry, Oh My!; National K-8 Curriculum Modules

Daniel V. Schroeder
Department of Physics
Weber State University
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Degrees: B.A. magna cum laude with departmental honors (physics), Carleton College, 1984
Ph.D. (physics), Stanford University, 1990

Employment: Stanford University. Teaching assistant, 1984-87. Programmer for physics educational software project, 1985.
Stanford Linear Accelerator Center. Research assistant, 1986-90.
Pomona College. Pew Teaching Fellow, 1990-91.
Grinnell College. Assistant Professor, 1991-93.
Weber State University. Assistant Professor, 1993-95; Associate Professor, 1995-2000; Professor, 2000-present.

Professional service:
Book Review Editor, *American Journal of Physics*, 2003-present.
Editorial Board member, *American Journal of Physics*, 1998-2000.
President, Idaho-Utah Section, American Association of Physics Teachers, 2003.
Referee for *Nuclear Physics B* and *American Journal of Physics*.

Honors: Paul Harmon Kirkpatrick Award (departmental award for excellence in teaching), 1987.
WSU Honors Program New Professor Award, 1995.

Scholarly interests:

Quantum Electrodynamics, especially as applied to beam-beam interactions and other background processes at linear colliders. Other problems in theoretical physics, especially quantum field theory, elementary particle physics, accelerator physics, and statistical mechanics. Physics pedagogy at all levels.

Publications:

*Beamstrahlung and QED Backgrounds at Future Linear Colliders*. Ph.D. thesis, Stanford University, 1990. Available as SLAC-Report-371.

Pair Creation at Large Inherent Angles, with P. Chen and T. Tauchi. In *Research Directions for the Decade (Snowmass 1990)*, ed. E.L. Berger, World Scientific, 1992, pp. 751-756.

Physics educational software: *Spins*, *Schrödinger*, *Q-wave*, *Fourier*, *E-field*, *B-field* (some written with Michael Martin). Self-published, 1988-93; available at http://physics.weber.edu/schroeder/software/.

A Computer-Simulated Stern-Gerlach Laboratory, with Thomas A. Moore. *American Journal of Physics* 61, pp. 798-805, 1993.

Fractional Luminosity Near Maximum Energy in the Presence of Beamstrahlung, with Zu Xin Yu. In *Physics and Experiments with Linear $e^+e^-$ Colliders*, ed. F. A. Harris, et al., World Scientific, 1993, pp. 754-757.

*An Introduction to Quantum Field Theory*, with Michael E. Peskin. Perseus Books (formerly Addison-Wesley Advanced Book Program), 1995.

Renormalizaton. In the *Macmillan Encyclopedia of Physics*, ed. J. S. Rigden, Macmillan, 1996, pp. 1370-1372.

A Different Approach to Introducing Statistical Mechanics, with Thomas A. Moore. *American Journal of Physics* 65, pp. 26-36, 1997.

*An Introduction to Thermal Physics*. Addison-Wesley, 2000.

Review of *Atmospheric Thermodynamics*, by Craig Bohren and Bruce Albrecht. *American Journal of Physics* 68, pp. 1159-1160, 2000.

*Instructor's Solutions Manual to An Introduction to Thermal Physics*. Addison-Wesley, 2001.

Physics educational software: *Ising*, *Molecules*, *E-Field Applet*, *Zoomer Applet*. Self-published, 2002-06. Available at http://physics.weber.edu/schroeder/software/.

*Physics Simulations in Java: A Lab Manual*. Self-published, 2005-07. Available at http://physics.weber.edu/schroeder/javacourse/.

# Curriculum Vitae
# John Edward Sohl, Ph.D.

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## EMPLOYMENT

**Professor** **1999 - Present**
**Associate Professor** **1993 - 1999**
**Assistant Professor** **1990 - 1993**
DEPARTMENT OF PHYSICS, WEBER STATE UNIVERSITY OGDEN, UT

**Director** **1990 - 2003**
LAYTON P. OTT PLANETARIUM, WEBER STATE UNIVERSITY OGDEN, UT

**Atomic Physics Laboratory Manager** **1989 - 1990**
**Research Associate** **1986 - 1990**
**Teaching Associate** **1982 - 1986**
DEPARTMENT OF PHYSICS, OHIO STATE UNIVERSITY COLUMBUS, OH

**Laser Weapon Systems Design Engineer** **1981 - 1982**
MARIN MARIETTA ORLANDO AEROSPACE ORLANDO, FL

**Physicist, Non-Destructive Test Engineering and Analysis** **1979 - 1981**
PROCESS QUALITY ENGINEERING LAB, HONEYWELL, INC, AVIONICS DIVISION CLEARWATER, FL

**Astronomy Laboratory Teaching Assistant** **1977 - 1979**
DEPARTMENT OF PHYSICS, UNIVERSITY OF WEST FLORIDA PENSACOLA, FL

**Science Tutor, Lab Assistant** **1976 - 1977**
DEPARTMENT OF SCIENCE, ST. PETERSBURG JUNIOR COLLEGE ST. PETERSBURG, FL

**Electronics Technician** **1973 - 1977**
**Electronics Apprentice** **1971 - 1972**
SOUND BY SEAGERS (ORIGINALLY PAUL SEAGERS TV) SAINT PETERSBURG, FL

## EDUCATION

**Ph.D.** **June, 1990**
**M.S.** **December, 1986**
THE OHIO STATE UNIVERSITY COLUMBUS, OH

*Major Fields:* Experimental Physics in Atomic Laser Spectroscopy, Laser Theory and Design

*Thesis Title:* Rydberg Series Analysis of Even-Parity Levels in Titanium and Yttrium Using Multi-Photon Laser Spectroscopy.

**B.S.** **March, 1979**
THE UNIVERSITY OF WEST FLORIDA PENSACOLA, FL

*Major:* Physics, emphasis on lasers and optics

**A.A.** **June, 1977**
SAINT PETERSBURG JUNIOR COLLEGE SAINT PETERSBURG, FL

*Major:* Natural Science/Physics

## AWARDS & HONORS

- George and Beth Lowe Innovative Teaching Award, Weber State University, 2004
- Spencer L. Seager Distinguished Teaching Award, College of Science, Weber State U. 2003
- Who's Who Among America's Teachers (Must be nominated by a past student), 1998, 2002
- Distinguished Individual Service Award, from the international Mountain Rescue Association for leading the rescue of two men in a downed aircraft in the Monte Cristo mountains, 1999
- Homers Cortez Professor ("Honours Professor of the Year"), Honours Programme, Weber State University, 1994
- "Most Innovative Class," Honours Programme, Weber State University, 1994
- Heningway Faculty Vitality Award, Weber State University, 1993
- New Professor of the Year, Honours Programme, Weber State University, 1993
- Graduate Student Alumni Research Award, Ohio State University, 1988
- Graduate Student Teaching Award, ("Teacher of the Year") Ohio State University, 1985
- Sigma Pi Sigma (National Physics Honorary), University of West Florida, 1979
- Eighteen awards in Junior Achievement, Boy Scouts of America, and Toastmasters International.
- Numerous awards by the Weber County Sheriff's Office for leadership and dedication to Mountain Rescue and Search and Rescue.

## AFFILIATIONS

- Optical Society of America
- American Association of Physics Teachers
- Ogden Astronomical Society
- ΣΠΣ, National Physics Honorary
- Mountain Rescue Association
- National Association of Rocketry (Level I Certified)

## PATENTS

- Firefly Tent Light, 2007, patent pending (patent rights owned by RSGA International), The Firefly received Underwriters Laboratory (UL) certification in Spring 2007.

## PUBLICATIONS

- Trealyn Christensen, John E. Sohl, Unequal-Arm Michelson Interferometer for Laser Characterization and Atom Trapping, Ergo, Weber State University Undergraduate Research Journal, 49, **1**, 2007
- Brittany D. Benko, W. Sue Fairbanks, John E. Sohl and James D. Fawcett "Ultraviolet Reflectance Properties of the Dewlap of the Puerto Rican Crested Anole (*Anolis cristatellus*)," *Journal of Herpetology*, to be submitted
- John E. Sohl, Steven G. Payton "A Modular Reconfigurable-cavity, Pulsed Dye Laser for the Advanced Undergraduate Laboratory." *American Journal of Physics*, **65**, 640 (1997)
- J. E. Sohl, "Protective circuit for the Leybold electron spin resonance apparatus," *American Journal of Physics*, **65**, 451 (1997)
- John Sohl, "CCD Astronomy for Public Star Parties and Educational Outreach Programs, Part I: Public Star Parties." Summer 1996, *The High Altitude Observer: the Newsletter of the Rocky Mountain Planetarium Association*.
- John Sohl, "Using the Stars to Navigate at Night," *Scent Articles, Search and Rescue Dogs of Colorado*, May 1996
- John E. Sohl, "A Semi-quantitative Analysis of the Impact of E-mail on Learning", Accepted March, 6, 1996 to *Forum for Honors*. (Never published, the *Forum* folded prior to pub. date.)
- John Sohl, "SARs...Looking to the Stars," *The Scentinal, Rocky Mtn. Rescue Dogs*, Dec. 1995
- John Sohl, "CCD Astronomy for Public Star Parties and Educational Outreach Programs, Part I: Public Star Parties." *The High Altitude Observer: the Newsletter of the Rocky Mountain Planetarium Association*, **XV**, (1995)
- John Sohl, "Internet: A Resource for Planetarians," Translated into Japanese for *Goto* the Journal of the Japanese Planetarium Association, 1995
- John Sohl, "Internet: A Resource for Planetarians, Pt. II,"*The High Altitude Observer: the Newsletter of the Rocky Mountain Planetarium Association*, **XIV**, 4 (1994)

- John Sohl, “Internet: A Resource for Planetarians, Pt. I,”*The High Altitude Observer: the Newsletter of the Rocky Mountain Planetarium Association*, **XIV**, 3 (1994)
- John Sohl, “Internet: A resource for Planetarians, Obtaining Images, Improving Communications.” The Proceedings of the 1994 International Planetarium Society Conference, Cocoa Beach, FL, July, 1994
- John Sohl, “Obtaining NASA Spacecraft Images on a Personal Computer,”*The High Altitude Observer: the Newsletter of the Rocky Mountain Planetarium Association*, **XI**, 2 (1992)
- Richard H. Keates, Robert T. Bloom, Richard T. Schneider, Quishi Ren, John Sohl, Jeffrey J. Viscardi “Absorption of 308-nm Excimer Laser Radiation by Balanced Salt Solution, Sodium Hyaluronate, and Human Cadaver Eyes,” Arch. Ophthalmol. **108**, 1611 (1990)
- J.E. Sohl, Yang Zhu, and R.D. Knight, “Two-Color Laser Photoionization Spectroscopy of Ti I: MQDT Analysis and a New Ionization Potential” JOSA B **7**, 9 (1990)
- R.D. Knight, J.E. Sohl, Y. Zhu, and L. Wang, “Rydberg States of $H_2$” in *Laser Spectroscopy VIII*, eds. S. Svanberg and W. Perrson, Springer-Verlag (1987).

## BOOKS

- Pedrotti, “Introduction to Optics” 3rd Edition, I was one of only two reviewers chosen to review the entire textbook for technical accuracy.
- "Advanced LabVIEW Labs" by John Essick, peer reviewer for the 2nd edition.
- John E. Sohl “Applied Optics Lab Manual,” © 2003, 2006, 120 p, ISBN 9-9740779-5-8, published in house; Revised 3rd Edition in progress, due Autumn 2008.
- John E. Sohl, “Laboratory Manual for Electronics,” © 2003, 2004, 2005, 2007 97 p, WSU SKU 10481028

## PRESENTATIONS

- Not listed below are numerous presentations/lectures/slide programs on astronomy each year to the general public at sites ranging from Brigham City to Antelope Island State Park to the Grand Canyon National Park. I have also presented numerous special star parties for eclipses, comets, meteor showers, etc.
- John E. Sohl, Trealyn Christensen, Pete Buzianis, "Photonics products for the consumer market – the FIREFLY" Third Annual Faculty Research Forum, WSU, Ogden, UT, March 27, 2007
- Trealyn Christensen, John E. Sohl, "Embedded PIC Microcontroller Programming for Large-scale Electronic Circuit Evaluation" Fourth Annual Undergraduate Research Symposium, WSU, March 26, 2007
- Giles Manning, John E. Sohl, "Laser Detection of Rubidium Hyperfine Atomic Transitions" Fourth Annual Undergraduate Research Symposium, WSU, Ogden, UT, March 26, 2007
- Kevin Smith, John E. Sohl, "Modifying a Wavemeter for Rapid Measurement of Laser Wavelength" Fourth Annual Undergraduate Research Symposium, WSU, Ogden, UT, March 26, 2007
- Pete Buzianis, John E. Sohl, "Controlling Magnetic Field Intrusion in Rubidium Trapping" Fourth Annual Undergraduate Research Symposium, WSU, Ogden, UT, March 26, 2007
- John E. Sohl, "The Efficacy of Online Homework: Mastering Astronomy" Idaho-Utah Chapter meeting, AAPT, USU, Logan, UT, March 24, 2007
- Trealyn Christensen, John E. Sohl, “Unequal-Arm Interferometer for Laser Characterization and Atom Trapping.” Am. Assoc. of Physics Teachers, Idaho-Utah Section meeting, Rexburg, ID, March 25, 2006.
- John E. Sohl, “Hands on Astronomy Activites for Outside the Classroom.” Am. Assoc. of Physics Teachers, Idaho-Utah Section meeting, Rexburg, ID, March 25, 2006.
- John E. Sohl, “The Physics of Hypothermia, Hyperthermia and Other Outdoor Problems.” Idaho State University Colloquium, Pocatello, ID, October 24, 2005.
- John E. Sohl, Caleb Trammell, Pete G. Buzianis, “Actively-stabilized diode lasers for spectroscopy and trapping with undergraduates.” Am. Assoc. of Phys. Teachers, national meeting, Salt Lake City, UT, August 10, 2005
- Pete G. Buzianis, John E. Sohl, “A Visual Display of Sun intensity and Apparent Size.” Am. Assoc. of Phys. Teachers, national meeting, Salt Lake City, UT, August 9, 2005
- "Hypothermia/Hyperthermia - The physics of human body temperature regulation." Am. Assoc. of Phys. Teachers, Idaho-Utah Section, Salt Lake City, UT, March 26, 2005
- John E. Sohl, Caleb Trammell. “Optimizing a Highly Stable Diode Laser for Spectroscopy and Atom Trapping,” Joint AAPT Idaho-Utah Section and Idaho Academy of Science Meeting, March 27, 2004

- John E. Sohl, Cliff Peterson “A Demonstration of the Mass distribution of the Solar System,” Joint AAPT Idaho-Utah Section and Idaho Academy of Science Meeting, March 27, 2004
- “Creating an Aurora Borealis in the Classroom,” AAPT Idaho-Utah Section Meeting, Ogden, UT, March 28, 2003
- "Computer Interfacing in the Advanced Electronics Course" Am. Assoc. of Physics Teachers, Idaho-Utah Section meeting, Ogden, UT, 3/29/03.
- "Successfully Managing an Undergraduate Research Program" Am. Assoc. of Physics Teachers, National meeting, Boise, ID, 8/6/02.
- “Redesigning the Electronics Courses for Science Majors” at the Am. Assoc. of Physics Teachers, Idaho-Utah Section meeting, Boise, ID, March 30, 2002
- "Professional Level Optical Modeling in an Upper Division Optics Course" at the Am. Assoc. of Physics Teachers, Idaho-Utah Section meeting, Provo, UT, April 31, 2001
- Presented three papers: "From Spreadsheets to Space--Getting School Kids to Scale the Solar System." "Total Internal Reflection and Evanescent Waves." "Construction of an On-Campus Observatory for Student and Public Use." at the Am. Assoc. of Physics Teachers, Idaho-Utah Section meeting, Twin Falls, ID, April 1, 2000.
- "Assessment of, and with, Technology in Introductory Astronomy," John Sohl, Presented at the Am. Assoc. of Physics Teachers, Idaho-Utah Section meeting, Logan, UT, March 6, 1999
- “Voyage to the Planets” Planetarium show. Produced complete show package including script, visuals, sound track, and all digital editing/programing. Presented to the public in the Ott Planetarium at Weber State University from May 1997 through June 1998. (Most shows where sold out and the program run was extended for an additional half year.) This program is continuing to be presented to school groups.
- “Sensitivity to Ultraviolet Light by Lizards,” Idaho-Utah Section meeting of the Am. Assoc. of Physics Teachers, Salt Lake City, UT, March 15, 1997.
- “The Electrostatic Bottle Motor,” Idaho-Utah Section meeting of the Am. Assoc. of Physics Teachers, Salt Lake City, UT, March 14, 1997.
- “Yet Another Computer Based Astronomy Lab, The Hubble Constant,” Idaho-Utah Section meeting of the Am. Assoc. of Physics Teachers, Boise, ID, March 2, 1996.
- “A Critical Point Demonstration”, Idaho-Utah Section meeting of the Am. Assoc. of Physics Teachers, Boise, ID, March 1, 1996.
- “Do We Really Have a Population Problem? A Scientist’s View,” Cortez Lecture on physics and society, Weber State University, April, 18, 1995
- “Self-running Computerized Astronomy Labs,” Idaho-Utah Section meeting of the Am. Assoc. of Physics Teachers, Ogden, UT, March 11, 1995.
- “An Upper-division Laser Spectroscopy Experiment Using a Scanning Dye Laser,” Idaho-Utah Section meeting of the Am. Assoc. of Physics Teachers, Ogden, UT, March 11, 1995.
- “The Great Comet-Jupiter Collision,” Public Lecture at Weber State University, Ogden, UT, July 21, 1994
- “Laser Spectroscopy of Transition Group Elements, A New Ionization Potential for Yttrium,” Utah Academy of Science, Ogden, UT, May 13, 1994
- “Safely Viewing Today’s Solar Eclipse,” Ogden, UT, May 10, 1994
- “Using Electronic Mail to Enhance Learning” Writing & Critical Thinking Conference at Weber State University, February 18, 1994
- “A Modern Laser/Optics Laboratory for Teaching and Research with Students,” Idaho-Utah Section meeting of the Am. Assoc. of Physics Teachers, Rexburg, ID, March 12, 1994.
- “Fun with Physics,” Science Seminar for Superior Students, WSU, Ogden, UT, January 27, 1994.
- “Laboratory Astrophysics,” three 90 minute invited lectures. Ogden Astronomical Society, April 9, May 13, June 10, 1993
- “An Undergraduate Laser Spectroscopy Experiment,” Utah-Idaho Chapter, Am. Assoc. Physics Teachers Provo, UT, March 27, 1993
- “Laboratory Astrophysics,” Salt Lake Astronomical Society, July 15, 1993
- “The Trial of Galileo, Revolutions in Science and Society.” Great Trials guest lecture, Honors Department, WSU, February 3, 1993
- “Obtaining NASA Images on a Personal Computer,” International Planetarium Society 1992 Conference, Salt Lake City, UT, June 26, 1992
- “Hydroelectric Power and Its Effects on the Environment,” Mount Ogden Rotary Club, April 14, 1992

- "Obtaining NASA Spacecraft Data on a Personal Computer via Internet," Utah-Idaho Chapter, Am. Assoc. Physics Teachers Pocatello, ID, March 28, 1992
- "Beats by two singing rods, lecture demonstration," Utah-Idaho Chapter, Am. Assoc. Physics Teachers Pocatello, ID, March 27, 1992
- "Physics in Action," Science Seminar for Superior Students, WSU, March 19, 1992
- "The Dawn of Astronomy," Science Seminar for Superior Students, WSU, January 23, 1992
- "Lasers and Optics," two presentations, Lynn Elementary's 5th grade, February 5, 1991
- "Lasers - The Light Fantastic," Science Seminar for Superior Students, WSU, January 3, 1991
- "Lasers - The Light Fantastic," Sigma Xi (invited lecture), Ogden, UT, November 19, 1990
- R.D. Knight and J.E. Sohl, "Spectroscopy of Highly Excited States in Ti and Y," American Physical Society / Atomic, Molecular, and Optical Physics Division, Windsor, Canada, May 18, 1989
- J.E. Sohl and R.D. Knight, "Multi-photon Laser Spectroscopy of Ti and Y," Southern Ohio Section / American Physical Society, Miami, OH, April 29, 1989
- "An Evaluation of Wrist Strap Parameters," 2nd National Electrostatic Discharge Control Conference, San Diego, CA, September 11, 1980
- "A Method of Laser Spectrum Analysis," Society of Physics Students, Zone 6, Pensacola, FL, January 27, 1979
- "A Frictional Analysis of a Repelling Harness," Society of Physics Students, Zone 6, Auburn, AL, February 11, 1978

## WORKSHOPS PRESENTED

- Hosted section meeting of the Idaho-Utah Chapter of the Am. Assoc. Physics Teachers, Ogden, UT, March 9-10, 1995.
- "Internet: A resource for Planetarians, Obtaining Images, Improving Communications." An invited workshop presented July 15, 1994 at the 1994 International Planetarium Society Conference, Cocoa Beach, FL.
- "The Planetarium Resource," WSU/NASA Teacher's Workshop, *Ogden, UT,* September 23, 1994
- "The Planetarium - A Teacher's Resource," WSU/NASA Teacher's Workshop, *Ogden, UT,* September 24, 1993.
- "WSU's Ott Planetarium and Primary Education," WSU/NASA Teacher Workshop, Ogden, UT, September 24, 1992
- "Science Education in WSU's Ott Planetarium," Teacher Academy Science Workshop, Ogden, UT, January 28, 1991

## GRANTS AND PROPOSALS

- "Applied Optics Laboratory Upgrade and Expansion." Internal Funds, Requested $11,450, Funded for $8,000. August 2007
- "Modernization of the Electronics for Scientists Lab" Internal Funds, Requested $12,000, funded in full. June 2006
- Grant $5,000, funded in full. "Refurbishment and expansion of public access observatory," State of Utah Office of Museum Services, 8/30/02.
- Grant (internal, ARCC), $8,292, funded in full. "Multimedia System for Physics Lecture Room LL121", 3/14/03. Coauthor with Farhang Amiri.
- "Electronics Design and Computer Interfacing Enhancement." Internal "one-time" funds, Requested $3,390, funded in full, March 15, 2002.
- "Software for Upper Division Laboratories" Internal "one-time" funds, Requested $3,335, funded in full, April 20, 2001.
- "Ultraviolet Sensitive CCD Camera" Internal "one-time" funds, Requested $12,000, funded in full, January 2, 1998.
- "Scanning Tunneling Microscope with Atomic Resolution." Internal "one-time" funds, Requested $12,850, funded in full, January 2, 1998.
- "Laser Cooling and Trapping of Rubidium Atoms using High Resolution Diode Lasers." Internal "one-time" funds, Requested $7,500, funded in full, January 2, 1998.

- "Digital High Speed Oscilloscope." Internal "one-time" funds, Requested $9,750, funded in full, January 2, 1998.
- "Electron Spin Resonance Apparatus." Internal "one-time" funds, Requested $1,975, funded in full, January 2, 1998.
- "Fiber Optics Projects Kit." Internal "one-time" funds, Requested $6,200, funded in full, January 2, 1998.
- "The Effects of Low Level Electromagnetic Fields on Biological Systems." Internal: Research, Scholarship & Professional Growth Committee, Requested $1,800, funded in full, May 1997
- "Ultraviolet Characterization of Lizard Dewlaps and the Affect on Mating." Internal: Research, Scholarship & Professional Growth Committee, Requested $895, funded in full, March 7, 1997
- "Two zip drives for the planetarium for moving/storing large graphics files." Iomega Corporation $548, funded in full, January 2, 1997
- "Improvement of a Student Configurable Dye Laser," Internal: Research, Scholarship & Professional Growth Committee, Requested $1,599, funded at $1,013, May 28, 1996.
- Laser Laboratory Equipment, Utah Science and Technology Initiative, Requested $10,420, funded in full. January 15, 1996.
- "Zeeman Effect Spectroscopy and Laser Beam Analysis," Internal: Research, Scholarship & Professional Growth Committee, Requested $1,521 funded at $1,521, May 24, 1995.
- Video/computer projection facility for planetarium, Educational Technology Initiative, Requested $17,847, funded at $14,712, November 11, 1994.
- "Planetarium Computer for Automated Control System," IBM Corporation, Requested $2,400, funded in full, December 6, 1993.
- "Expansion and Improvement of Planetarium Outreach Programs," Internal funds: Research, Scholarship & Professional Growth Committee, Requested $6,314, funded in full, February 11, 1992.
- "Improvements to an Undergraduate Physics Lab," National Science Foundation, Requested (with match) $65,590, funded at $37,156, November 15, 1992.
- "Laser Laboratory Safety Improvements," Internal "one-time" funds, Requested $3,412, funded in full, October 27, 1992.
- Proposal for Physics Laboratory Equipment, Internal "one-time" funds, Requested $1,540, funded at $545, October 27, 1992.
- Laser Lab Optical and Laser Accessories, Internal "one-time" funds, Requested $13,580, funded in full, April 28, 1992.
- Computers for Data Acquisition in Upper Division Labs, Internal: Academic Resources and Computing Committee, Requested $11,122, funded in full, February 27, 1992.
- "Attend Workshop on Upper-Division Physics Labs," Internal funds: Research, Scholarship & Professional Growth Committee, Requested $411, funded at $198, November 25, 1991.
- Acquire Computer for Data Collection and Analysis, Internal funds: Research, Scholarship & Professional Growth Committee, Requested $7,743, funded at $1,750, November 25, 1991.
- Stipend for writing external grants, Internal funds: Faculty Vitality Grants, Requested $3,000, funded in full, February 28, 1991.
- Optical Components For the Laser Laboratory, Internal "one-time" funds, Requested $5,808, funded at $5,398, December 10, 1990.
- "Micro-channel plate detector for single atom detection," Graduate Student Alumni Research Grant, requested $1450, funded in full. 1986
- Co-authored with Richard N. Buggle the following unsolicited proposals to the United States Air Force: "Interferometric Stress Analysis of Electronic Hardware." "Non-Destructive Testing with Holographic Interferometry." "Defect Detection in Hidden Metallurgical Bonds by Infrared Scanning." "X-Ray Analysis of Plastic Film Densities." "Holographic Inspection Enhancement - Hybrids and Printed Wiring Assemblies." "Elimination of Radiographic Plates using Computer Enhancement." "Analysis of Plated-Thru Holes via Moiré Interference." "Development of Advanced Processes in Hi-Resolution X-Ray Radiography." and "Spectroscopic Detection of Moisture in Plastics." Seven of the nine proposals had received favorable reviews and were pending funding decisions when I left Honeywell in 1981.

## Other Scholarly Activities

- Product Analysis: Analyzed a blue lighting system for health disorders for Apollo Health, an

American Fork, UT company. April 27, 2007

- Advisory Board for Ogden City Schools' new aerospace, math & science magnet school, Odyssey Elementary, 33rd & Washington, 2005-2006. School opened for classes in Fall 2007.
- Court Case: Data analysis and accident reconstruction review for Hasenyager law firm. Case was settled out-of-court in our favor. February 2006.
- Wrote, proofed, designed and/or reviewed all public science exhibits at the Clark Planetarium in Salt Lake City, 2003 - present.
- Designing an amplified multi-wavelength light irradiance and illuminance measurement system. Prototypes built in 2005 and 2007, revisions in progress, publication expected in 2008.
- Currently designing an LED warning beacon system for emergency personnel. I intend to patent the system.
- Designed an LED replacement lamp system for headlamps for camping/hiking.
- Have scientifically reviewed and challenged several groups making paranormal or extraordinary claims. This includes a detailed analysis of "Vibravision" for the James Randy Educational Foundation. A publication is currently in preparation for either Skeptic Magazine or Skeptical Inquirer. The results are available online at the JREF site.
- Completed a detailed chemical analysis of an ice fall from the sky that the FAA declared was a fragment of a comet but was actually water from a commercial aircraft's fresh water holding tanks likely resulting from a faulty mast heater.
- Have designed and built numerous electronic circuits ranging from high-power rocket launch controls to data acquisition to light detection and control.
- Have designed and successfully constructed over a dozen lasers ranging from external cavity diode lasers to excimer pumped dye lasers.
- Computer programming experience with LabVIEW, FORTRAN, BASIC and Visual BASIC. Skilled in major software packages such as FrontPage, Excel, Word, Word Perfect, LaTeX, SigmaPlot, etc.

## Selected Courses Taught

- Introduction to Electronics (with lab), PHYS 3410
- Data Acquisition and Analysis (with lab), PHYS 3420
- Applied Optics (with lab), PHYS 3190
- Advanced Physics Laboratory, PHYS 3640
- General Physics I and II, PHYS 2010, PHYS 2020
- Astronomy, PHYS 1030
- Honors Program courses on Energy, Nuclear Issues and Pseudoscience.
- Student Research in Physics, PHYS 2800 and PHYS 4800
- Avalanche Level I and II through the National Ski Patrol for search and rescue teams.

# Resume of Walther N. Spjeldvik, PhD

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*Internet E-mail:* WSpjeldvik@Weber.edu WEB=*http://physics.Weber.edu/Spjeldvik*

## EDUCATION

- **Ph.D**. in Meteorology and Space Physics, University of California, Los Angeles
- **C.Phil.** in Meteorology, University of California, Los Angeles
- **M.S**. in Physics, University of California, Los Angeles
- Bachelor's degree **(C.Mag**.) in Mathematics and Physics, University of Bergen
- **E.Art.** degree in Sciences and Languages (Norwegian, English, German, French, Swedish, Danish, Old Norse), U. Pihl, Bergen, Norway
- Postgraduate courses in *Institutional Management* (from MIT, NASA), *Accelerator Physics*, *Scientific Computations*, *Radiation Physics*, and *Medical Physics* (from USPAS/FermiLab)

## PROFESSIONAL EXPERIENCE

1985 - present: **Professor of Physics** (tenured)**,** Weber State University, Ogden, Utah.

*Concurrent assignments:*

1992 - 1994: **NASA Headquarters Senior Discipline Scientist,** Washington, DC (Caltech/JPL Member of Technical Staff, operational management detailed to NASA Headquarters' Office of Space Science).

1990 - 1991: **Chief Scientist** at Hughes STX Corporation, at ST Systems Corporation, and at Science Applications Research Inc. (now Raytheon, Inc.).

1980 - present: **Principal Scientist and CEO** at Nordmann Research Ltd. and at Nordmann Research and Development, Inc. of Colorado.

1985 - present: **Consultant/Collaborator/Scholar** at: Los Alamos National Laboratory; Boston University; Johns Hopkins University; California Institute of Technology; Jet Propulsion Laboratory; National Oceanic and Atmospheric Administration, Space Environment Laboratory; University of California at Los Angeles; University of Bergen; University of Moscow, Russia (on U.S. Gov't assignment); RIKEN, Tokyo, Japan; NASA/Goddard Space Flight Center; Lawrence Livermore National Laboratory; ONERA-DESP-CERT Laboratory, Toulouse, France; University of Campinas, Brazil; INPE Brazilian Space Science Institute, Sao Jose Dos Campos, Brazil; Belgian Institute of Space Aeronomy, Brussels-Uccle, Belgium; Draper Laboratory, Massachusetts.

1983 - 1985: **Faculty Senior Research Physicist**, Boston College, Boston, Massachusetts (with research office at the Air Force Geophysics Laboratory, Hanscom AFB).

1978 - 1983: **Research Associate**, University of Colorado, CIRES, Boulder (with research office at: U.S. DoC/ NOAA / Space Environment Laboratory).

1975 - 1977: **NAS Awardee Resident Research Associate**, National Academy of Sciences / National Research Council, Washington, D.C. with tenure at the Space Environment Laboratory, DoC/National Oceanic and Atmospheric Administration.

1975: **Adj. Asst. Professor of Meteorology**, concurrent with appointment as Post-Doctoral Scholar of UCLA and Research Scientist post, University of California, Los Angeles, California: General Meteorology Education, and research on Space Weather Magnetosphere-Ionosphere interactions.

## MEMBERSHIPS, POSTS HELD, AWARDS and HONORS

Member, American Geophysical Union; Associate, European Geophysical Society; Elected member of honor societies Sigma Xi and Phi Kappa Phi; Associate of COSPAR: International Committee for Space Research, and of IAGA: International Association of Geomagnetism and Aeronomy.

Co-editor, USAF / Air Force Geophysics Laboratory Space Research Conference Proceedings. Reviewer of NASA Research Proposals for NASA Headquarters, Space Physics Div., Co-author of USAF Handbook of Geophysics and Space Physics, Contributor to Caltech-JPL Space Environment Engineering Handbook.

Liaison, NASA Panel on Data Restoration and Value-Added Data Processing. NASA H.Q. Panel Chairman, NASA Panel on Grand Challenge Supercomputing, NASA Headquarters representative to the U.S. Government Interagency Consultative Group, CONAE Argentina's Space Agency, ESA European Space Agency.

Program Scientist, NASA Headquarters SR&T Funding in Magnetospheric Physics, 1992-93; NASA H.Q. Panel Member, Inter-Agency Consultative Group (NASA, ESA, IKI, ISAS), 1992-93; NASA H.Q. Senior Discipline Scientist; NASA HQ Panel on Small Explorers (SMEX), 1993. NASA's Solar Connection Program.

United States Delegate to the Russia-USA Joint Working Group in Space Physics (Moscow and Washington, DC); United Nations, International Standards Organization (ISO), WG-4 on space standards; Many administrative program presentations given to government and inter-government bodies.

Recipient (Principal Investigator, co-investigator and sub-contractor) of a number of NASA Research Awards for Space Research in Magnetospheric Physics.

Scientific Referee for national & international foundations and professional journals.

Committee Member or Chair of many University Department committees, College of Science committees and Campus-wide academic committees.

College of Science Hearing Officer and Presiding Judge, Institutional ethics and student disciplinary matter, Weber State University, Utah.

## PUBLICATIONS AND PRESENTATIONS

Numerous publications in the premier refereed scientific literature, monographs and handbooks: see separate listings or extract current tabulations from: **http://physics.Weber.edu/Spjeldvik**

Many lectures and presentations given in the USA, Canada, Europe, Asia and South America.

## PERSONAL INFORMATION

***Multi-lingual:*** English, Norwegian, German, Danish, Swedish, some French.

***Interests:*** Participation sports, music (jazz, classical, folk), theater and performing arts, world travel, world history, advances in scientific discoveries, and the environment.

***Married:*** Two grown daughters.

## UNIVERSITY FACULTY AND ACADEMIC GOVERNANCE

### *Professorial Experience:*

Taught essentially all of the traditional physics disciplines: General Education Physics, Engineering Physics (Mechanics, Electricity & Magnetism, Thermodynamics), General Physics, University Physics (with calculus), Advanced Classical Mechanics, Electromagnetic Theory, Thermal Physics, Modern Physics, Solid State Physics, Computational Physics, Astronomy, Meteorology, General Laboratory Physics, Advanced Fundamental Physical Constants Laboratory, Upper Division Physics Experimentation, Planetarium Operations.

### *Academic Governance Experience:*

University Constitution Committee; WSU Campus Safety and Police Oversight Committee; WSU Disciplinary Hearing Officer (and presiding judge); Advanced Laboratory Committee (chair); Lower Division General Physics Laboratory Committee; College of Science Computer and Information Technology Development Committee; College of Science Graduation Committee; Astronomical Observatory Mountain Site Committee; Planetarium Development and Operations Committee; University Faculty Recruitment Committees (many); Participant in university dean searches; Participant in Utah State Regents Administrator Academies.

## POSTGRADUATE EDUCATION AND TRAINING:

- United States Accelerator School (USPAS/FermiLab), Post-graduate course in **Laser Physics** for High Energy Accelerators, Cornell University, Ithaca, New York (Summer 2005)
- United States Accelerator School (USPAS/FermiLab), Post-graduate course in **Medical Accelerator Physics**, Cornell University, Ithaca, New York (Summer 2005)
- United States Accelerator School (USPAS/FermiLab), Post-graduate course in **Radiation Safety** for High Energy Accelerators, College of Engineering, University of Wisconsin, Madison (Summer 2004)
- United States Accelerator School (USP AS/FermiLab), Course in **Electromagnetics Computations** for High Energy Accelerator Physics, College of Science, Physics Department, Yale University (Summer 2002)
- United States Accelerator School (USPAS/FermiLab), **Executive Management** course for scientific institutions / Laboratories with CERN-Switzerland as a model institution, MIT: Massachusetts Institute of Technology (Summer 1997)
- NASA **Group Management and Institutional Leadership** in Government Administration: TQM (Total Quality Management), NASA Headquarters, Executive Education, Washington, DC. (Spring 1994)
- United States Accelerator School (USPAS/FermiLab), **Beam Intensity Limitations** in High Energy Accelerator Technology, International Hilton Head Island Advanced Technology Symposium, South Carolina (Summer 1990)

- Independent Studies in **Corporate Law and Business Management**, Boulder, Colorado (during 1979-80), followed by the founding of two specialized computational space development research companies (in 1980 and 1996)

# WALTHER N. SPJELDVIK: A Brief Biographical Sketch

Walther N. Spjeldvik was born in Bergen, Norway, and he received his fundamental education in Humanities, Sciences and Languages from U. Pihl in Bergen. Later he was given NATO Norwegian Army Personnel Test Psychology education, and he served in the army. He subsequently received his undergraduate university education in Mathematics and Physics from the University of Bergen. In parallel with his university education he took Stage Management education from the State School of Theater Arts in Oslo, and he taught mathematics, physics and chemistry as adjunct high school teacher in the cities of Bergen and Tromsø, Norway. As a graduate student, he conducted research-award funded studies in Upper Atmosphere Physics, Ion Chemistry and Space Sciences at the Auroral Observatory at Tromsø in the Arctic Northern Norway in 1970.

With academic scholarships he further pursued his graduate education in Physics, Atmospheric Science (including Meteorology) and Space Physics at the University of California, Los Angeles, receiving the M.S., C.Phil. and Ph.D. degrees from UCLA. He also independently studied Corporate Management Principles and Corporate Law. He later received specialized Computer Science education in a summer school in Kapaa, Kauai, Hawaii, scientific institution Management Education from MIT, and he continues to engage in a variety of other specialized courses and scientific study subjects (Cornell University, Brookhaven National Laboratory, Yale University, University of Colorado-Boulder, and University of Wisconsin-Madison, USPAS Accelerators Schools, etc.). He has also participated in a faculty computational physics summer course at Lawrence University. Dr. Spjeldvik has used university computers and a variety of digital systems extensively throughout his career, and he often teaches advanced computational physics at WSU.

After attaining his doctoral degree, Dr. Spjeldvik spent an additional year at UCLA conducting research in upper atmosphere aeronomy and space physics as an adjunct faculty member and research staff scientist teaching atmospheric science in the UCLA Department of Meteorology (now: Department of Atmospheric Sciences). This was followed by two years as a United States National Academy of Sciences (NAS)'s National Research Council Research Associateship awardee (resident Research Associate) at the U.S. Department of Commerce National Oceanic and Atmospheric Administration's (NOAA) Space Environment Laboratory in Boulder, Colorado. He continued his work at the NOAA Space Environment Laboratory via NASA research funding for five years through NOAA / SEL and the Cooperative Institute for Research in Environmental Sciences (CIRES) of the University of Colorado. Several scientific discoveries were made and many research publications followed. At the Space Environment laboratory, Dr. Spjeldvik was an integral part of the national space effort, and he worked on spacecraft instrumentation (solid state proton/ion detectors and magnetic electron/ion spectrometers) that were successfully flown on the NASA ISEE-1 research spacecraft and on the USAF SCATHA space test spacecraft. All instruments were carefully tested and beam-calibrated prior to launch, and the instrumentation functioned perfectly in orbit. Much valuable data were harvested, and many scientific discoveries were made, as evidenced by journal publications by him and by many colleagues.

During this period Dr. Spjeldvik and other scientists (including Dr. J. Feynman, later of Caltech-JPL and Mr. O. J. Stensbo, later of the BKK Electrical Power Company) founded Nordmann Research Ltd. (1980), and he served as its Principal Scientist and Chief Executive Officer. The company has conducted research for U.S. government agencies. From 1983 to 1985 he served as a Senior Research Physicist in a research project for the U.S. Air Force, and he served as a consultant to the USAF CRRES spacecraft instrumentation development project at Hanscom Air Force Base in

Massachusetts, funded through Boston College. During 1986-1990 he served as computational space physics modeling consultant for the Earth's space environment to the Quality Assurance Division of California Institute of Technology's Jet Propulsion Laboratory (JPL), providing predictive and descriptive models on the Earth's proton and heavy ion radiation environment.

Since 1985 Dr. Spjeldvik has served as Professor of Physics at Weber State University in Utah where he advanced up the academic ranks to became a tenured full Professor of Physics at Weber State University (WSU) in 1990. WSU is a large Utah university of almost 20,000 students with strong emphasis on quality education, scholarship and institutional service. He has served on many faculty and deanship candidate evaluations, and on numerous university and departmental committees, including service as University Hearing Officer and Presiding Judge in disciplinary matters within the College of Science.

In parallel with his professorship Dr. Spjeldvik continues to operate Nordmann Research Ltd. and Nordmann Research and Development, Inc., contracting widely with major national research laboratories, such as Caltech/JPL, NOAA Space Environment Laboratory, Los Alamos National Laboratory, the Johns Hopkins University's Applied Physics Laboratory, and other institutions. He was also briefly a consultant to UCLA in a high power radio wave atmospheric modification project. Later he served NASA Goddard Space Flight Center in the development of the Master Directory for Space Physics through a contractual role as Chief Scientist with the Hughes STX Corporation (now: Raytheon STX) in Maryland.

Dr. Spjeldvik was an invited Research Visiting Professor and fellowship holder in the Cosmic Physics Group at the University of Bergen, Norway during the autumn semester of 1991. He was briefly an invited Visiting Senior Scientist at the Skobeltsyn Nuclear Physics Institute of the State University of Moscow, Russia in early summer of 1993. and he lectured at a Space Physics conference in Dubna, Russia. Later he lectured at research institutions in Brazil, France and Norway. He has repeatedly been a consultant to the Belgian Institute of Space Aeronomy in Brussels where he conducted research in plasma wave modeling at the Belgian Institute of Space Aeronomy at the Brussels Observatory. He has been a guest investigator at the RIKEN Cosmic Physics Laboratory in Tokyo, Japan where he studied heavy ion isotopic composition of the inner magnetosphere using the Japanese ADEOS spacecraft detectors. In the USA, Dr. Spjeldvik has repeatedly been a NASA Principal Investigator on space physics modeling projects regarding space radiation, as well as co-investigator on larger space program efforts involving multiple spacecraft. More recently he has been a subcontractor to a project involving the search for natural depositories of antimatter in the solar system. This was under the auspices of the NASA Institute for Advanced Concepts (NIAC),

With leave from Weber State University, Dr. Spjeldvik was appointed to serve as NASA's national Space Physics Discipline Scientist for Magnetospheric Physics at NASA Headquarters in Washington, D.C. during the term June 1992 through September 1994. During his tenure at NASA Headquarters he handled the Magnetospheric Physics Supporting Research and Technology (SR&T) funding program for NASA's Space Physics Division (awarding about $4 to $5 million per year to U.S. space scientists). At NASA he served on and arranged appointments to many NASA Headquarters evaluation panels and scientific planning committees, and he has also served as coordinator of various NASA science and administrative evaluation panel activities. Dr. Spjeldvik has taken an active part in NASA's Solar Connections Flight Program development, promoted Space Weather Research (plasma science and radiation physics) initiatives, and he is an expert on geomagnetically confined energetic particle physics.

Professor Spjeldvik has served as a coordinator of NASA's national and international outreach, such as International Liaison to the Inter-Agency Consultative Group (IACG consisting of NASA, ESA, ISAS, and the Russian Space Agency), and as a United States Science Diplomat-Liaison to the bilateral Russia-USA Joint Working Group in Space Physics, convening in Moscow and in Washington, DC, where he developed and co-wrote (with his Russian counterparts) protocols for space collaboration treaty agreements between the United States of America and the Russian Federation / Commonwealth of Independent States. NASA Headquarters also appointed him Space Physics Liaison in science diplomatic missions to Argentina to explore and foster space research/utilization collaboration between the Space Agencies of the Country of Argentina (CONAE) and the United States (NASA) resulting in the launch of cooperative spacecraft. As NASA representative he also served as liaison to the Danish Ørsted satellite program with high resolution magnetometers in Earth orbit.

In 1993 Dr. Spjeldvik became a member of Working Group 4 (WG4) for Space Environment Radiation Effects under the United Nations' International Standards Organization (ISO). Among the tasks was the joint development of an international standard magnetosphere in analogy with the standard atmosphere and standard ionosphere reference models already in existence. This has strong relevance to the future safe utilization of space activity (manned and unmanned) in Earthspace, particularly relevant to communication satellites. Following his NASA Headquarters tenure, Dr. Spjeldvik was an active contributing member of UN/ISO/TC20/WG4 until 1999.

Professor Spjeldvik has published in many first-line professional refereed journals, he has been co-editor of U.S. Air Force space physics conference proceedings, he has written chapters in space physics handbooks and in various monographs, and has contributed to a U.S. Air Force / Caltech Jet Propulsion Laboratory space environment engineering handbook. Dr. Spjeldvik has served as scientific referee for major professional journals, and he has functioned as editorial support for a U.S. textbook publisher. Currently he is on the editorial board of the electronic journal: Physical Science, a modern experiment in scientific publications. He has substantial experience in data analysis and data management from several NASA spacecraft, including the construction of data reduction algorithms and computer graphics for the Explorer-33 and Explorer-45, SCATHA, ISEE-1, AMPTE-CCE and ISTP-POLAR spacecraft instrumentation.

Dr. Spjeldvik has extensive experience in physical systems simulation, ionospheric physics, magnetospheric physics, space physics model building, solar system science and in applied numerical mathematical methods. He has substantial expertise in electron, proton and heavy ion physics in the Earth's space environment, and he has professional interests in atmospheric physics, the environment, the exploration of the planets, studies of the sun, and probing the boundaries of the solar system. In addition Dr. Spjeldvik has served as Chief Scientist (*pro tem*) for a NASA effort to produce a space physics Master Directory (now publicly available through the National Space Science Data Center), functioning in that contractual capacity at Hughes STX Systems Corporation (now merged into Raytheon Corporation). He has been the NASA Headquarters Liaison to the NASA space physics data restoration and archiving oversight committee. In 1994 he was appointed to the NASA Steering Committee of the Space Environment and Effects Program operated by NASA HQ's Advanced Technology Division (Code C) where his interests have been in the area of novel miniaturized detector technology and physical systems imaging.

In 1996 Dr. Spjeldvik founded Nordmann Research and Development, Inc. to serve as an additional institutional funding vehicle for consultantships and special research project assignments. This company has provided service to the Lawrence Livermore National Laboratory (LLNL), the French Government ONERA-CERT/DESP space science laboratory in Toulouse, France, to the Energetic

Particle Group at the Center for Space Physics (CSP) at Boston University, and to the Catholic Free University of Belgium and the Belgian Institute of Space Aeronomy at Brussels Observatory. A number of specialized technical reports on computational techniques have been issued as well as journal papers on scientific findings.

With sabbatical leave from his Utah university in 1996-97, Dr. Spjeldvik spent a year in residence at the Center for Space Physics at Boston University where he participated in analysis of data from the CAMMICE-instrumentation on the NASA/ISTP-POLAR spacecraft. During the summer of 1997 he took an advanced course at Massachusetts Institute of Technology (MIT) in Management of Scientific Institutions. Here his management team developed a business plan for a hypothetical large scale medical accelerator treatment facility. This executive education was sponsored by the National Science Foundation (NSF) and the United States Particle Accelerator School (USPAS) at FermiLab. In the summer of 2002 Dr. Spjeldvik participated in the NASA / JPL Summer School for Planetary Scientists in Pasadena, California.

Presently Dr. Spjeldvik is engaged in frontier research on the feasibility of extraction of naturally generated anti-particles (positrons and antiprotons) from planetary magnetospheres for use in future interplanetary and interstellar relativistic space propulsion systems. Recently Draper Laboratory of Massachusetts has received a NASA NIAC research contract for a pilot study in this area (Bickford (PI), Spence, Spjeldvik, Kochocki and Batishchev). This is in part based on research Dr. Spjeldvik has done over the past several years in collaboration with Russian scientists (Prof. Pugacheva and Dr. Gusev).

Dr. Spjeldvik is a member of the American Geophysical Union (since 1972) where he has chaired some of its meeting sessions. He is an active associate of the international Committee on Space Research (COSPAR), and he is affiliated with the International Association of Geomagnetism and Aeronomy (IAGA) and with the European Geophysical Society (EGS). He has also been elected to membership in the honor societies of Sigma Xi and Phi Kappa Phi. During the 2002 Winter Olympic Games in Utah, Dr. Spjeldvik served as member of the Salt Lake City Olympic Committee (SLOC) as volunteer to the Ice Sheet arena in Ogden, Utah and as National Olympic Committee (NOC) liaison to the Norwegian Olympic Team.

Through progressively more responsible positions in university education, business and government Dr. Spjeldvik has become recognized as a national and international space science scholar, space exploration technical expert, an experienced university educator, an interim NASA manager of public policy, and a grants/contracts administrator. He has completed service as an associated scientific referee for the International Science Foundation (ISF), and he continues to serve as scientific referee for the American Geophysical Union. Professor Spjeldvik serves from time to time as scientific proposal assessor/referee for NASA and for the U.S. National Science Foundation (NSF). He has participated in the Utah Regents of Higher Education faculty academy on "What Constitutes an Educated Person", at the Regents' Facility in Salt lake City, Utah, and he continues to be engaged in educational philosophy aspects of higher education.

## Publications by Walther N. Spjeldvik and collaborators:


Spjeldvik, W. N., Space Physics Data Derivatives of Power-Law Functional Dependencies Based on Numerical Data Tabulations, Nordmann Research and Development, Technical Note, Denver, Colorado, February 2006.

Bickford, J. (PI and team leader) et al., Extraction of Antiparticles Concentrated in Planetary Magnetic Fields, Draper Laboratory Report to NASA, Cambridge, Massachusetts, April 2006.

Spjeldvik, W. N.: On The Content of Antiprotons in the Magnetosphere of Saturn: A Brief Pre-Project Assessment, Nordmann Research and Development, Inc, Technical Note, June 2006.

Bickford, J., W. N. Spjeldvik, A. A. Gusev, V. Pankov, G. I. Pugacheva, U. Jayanthi, I. Martin, Antiparticle Content in Planetary Magnetospheres and Its Possible Use as Fuel for Remote Heliospheric Space Missions, COSPAR Scientific Symposia, Beijing, China, July 2006.

Gusev, A. A., K. T. Choque, U. B. Jayanthi, V.M. Pankov, G. I. Pugacheva, and W. N. Spjeldvik, Account for Tertiary Antiprotons in the Leaky Box Interstellar Antoproton Flux Model, COSPAR Scientific Symposia, Beijing, China, July 2006.

Spjeldvik, W. N., Magnetically Confined Antiparticle Orbit Tracing Through the Earth's Exosphere: Effective Mean Densities of Atomic Hydrogen, Helium and Atomic Oxygen, Nordmann Research and Development, Computer Algorithm Report, Denver, Colorado, July 2006.

Gusev A. A., K. T. Choque, V. M. Pankov, , U. B. Jayanthi, G. I. Pugacheva, W. N. Spjeldvik, Formation of the Antiproton RadiationBelt Accounting for the Diffusion Process, COSPAR Scientific Symposia, Beijing, China, July 2006.

Bickford, J., W. Schmitt, W. N. Spjeldvik, A. Gusev, G. Pugacheva, I. Martin, Natural Sources of Antiparticles in the Solar System and the Feasibility of Extraction for High Delta-V Space Propulsion, International Conference on New Trends in Astrodynamics and Applications , Princeton University, Princeton, New Jersey, August 16-18, 2006

Spjeldvik, W. N., Steady State Positrons in the Magnetosphere: Distribution Computation vi the Gauss-Siedel Iterative Algorithm, Technical Report 2006-1001, Nordmann Research and Development, Inc., Denver, Colorado, October 2006.

Bickford, J. (PI and team leader) et al., Antiparticles in Planetary Magnetic Fields, Conference Report, NASA Institute for Advanced Concepts, Tuscan, Arizona, October 2006.

***2005***

Spjeldvik, W. N., T. A. Fritz, J. Chen, and Q.-G. Zong: Energetic Ion Observations of the Earth's Magnetic Cusps During an Extended Geomagnetically Quiescent Period in April 2001 Using Detectors on S/C POLAR, Journal of Advances in Space Research, in press, 2005.

Pugacheva, G. I., A. A. Gusev, U. B. Jayanthi, N. J. Schuch and W. N. Spjeldvik, Cusp Region Radiation Belts in the Dayside Magnetosphere, J. Atmospheric and Solar-Terrestrial Physics, 67 , 479-487, 2005.

A. A. Gusev, A. A., U. B. Jayanthi, G. I. Pugacheva, N. J. Schuch, I. M. Martin, and W. N. Spjeldvik, Cusp Confinement Zones on the Quiet and Disturbed Dayside Magnetosphere, Journal of Advances in Space Research, in press, 2005.

***2004***

Gusev, A. A., I. M. Martin, M. G. S. Mello, V. M. Pankov, G. I. Pugacheva, N. J. Schuch, and W. N. Spjeldvik, Bidecadal Cycles in Liquid Precipitations in Brazil, Journal of Advances in Space Research , v.34, issue 2, pp.370-375, 2004.

Pugacheva, G. I., U. B. Jayanthi, N. G. Schuch, A. A. Gusev, and W. N. Spjeldvik, Ring Current Ion Motion in the Disturbed Magnetosphere with Non-equipotential Magnetic Field Lines; Journal of Advances in Space Research, v.33 (5), pp. 723-728, 2004

Almeida, A., A. A. Gusev, M. G. S. Mello, I. M. Martin, G. I. Pugacheva, V. M. Pankov, N.J. Schuch, and W. N. Spjeldvik, Rainfall Cycles with Bidecadal Periods in the Brazilian Region of the South American Continent, Geofisica Internacional, V.43, num.2, pp. 271-279, 2004.

Pugacheva, G. I., A. A. Gusev, U. B. Jayanthi, N. J. Schuch, W. N. Spjeldvik, and K. T. Choque, Trapped Antiprotons Produced by Cosmic Rays in the Earth's Magnetosphere, Journal of Advances in Space Research v.34, issue 6, p.1433-1437, 2004.

***2003***

Gusev, A. A., U.B. Jayanthi, K. T. Choque, G. I. Pugacheva, N. Schuch, and W. N. Spjeldvik, Antiproton Radiation Belt Produced by Cosmic Rays in the Earth's Magnetosphere, Journal of Geophysical Research, 30, 101-104, 2003.

Pugacheva, G. I., A. A. Gusev, U. B. Jayanthi, N. G. Schuch, K. T. Choque , and W.N. Spjeldvik, Antiproton Radiation Belt Produced by Cosmic Rays in the Earth's Magnetosphere, Geophysical Research Letters, 30, N.4, 1161-1164, 2003.

Darrouzet, F., W. N. Spjeldvik, J. F. Lemaire, G. Gustafsson, C. Hann, and C. Dyck: Towards Statistical and Empirical Models of the Distribution of VLF Waves at High Latitude from the Observations of the Viking Spacecraft, Journal of Advances in Space Research , v.32 (3), 323-328, 2003.

Miyasaka, H, A. A. Gusev, G. I. Pugacheva, U. B. Jayanthi, N. J. Schuch, and W. N. Spjeldvik, Cosmic Ray Produced Antiprotons Confined in the Innermost Magnetosphere, Proceedings of the 28th International Cosmic Ray Conference Tsukuba, Japan SH3.6, 2P-210, pp. 4265-4268, 2003.

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Pugacheva, G. I., A. A. Gusev, U. B. Jayanthi, N. J. Schuch, and W. N. Spjeldvik, Seasonal Polar Cap Radiation Zones in the Dayside Magnetosphere, Earth, Planets and Space Journal, 56 (No.6), pp. e17-e20, 2004.

***2002***

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## 1981

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## 1976

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## 1975

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Spjeldvik, W. N.: "Maintenace of the Ionospheric D-Region at Middle Geomagnetic Latitudes During the Night: Radiation Belt Electron Precipitation Ionization due to Quasi-Linear Pitch Angle Scattering in the Magnetosphere", Department of Meteorology, University of California, Los Angeles, California, May, 1975.

Spjeldvik, W. N.: "Ozone Photo-Chemistry in the Earth's Stratosphere: Results from a Numerical Model", Department of Meteorology, University of California, Los Angeles, California, November, 1975.

## 1974

Spjeldvik, W. N.: "Geomagnetic Storm Perturbations on the Lower Ionosphere", Doctoral Committee Dissertation Topic Defense Lecture, University of California, Los Angeles, California, March 16, 1974.

Spjeldvik, W. N. and R. M. Thorne: "Geomagnetic Storm Recovery Phase Electron Precipitation and its Ionospheric Effects below 90 km", Annual Meeting of URSI, The International Union of Radio Science, Boulder, Colorado, October 17, 1974.

Spjeldvik, W. N.: "Radiation Belt Electron Precipitation and its Ionospheric Effects at Middle Latitudes", Dissertation Defense Lecture, University of California, Los Angeles, California, November 23, 1974.

Spjeldvik, W. N. and R. M. Thorne: "Middle Latitude Electron Precipitation During the Recovery Phase of a Magnetic Storm", Fall Annual Meeting of the American Geophysical Union, San Francisco, California, December 9, 1974. In: EOS, Transaction of the American Geophysical Union, 56, 1160, 1974.

## 1973

Spjeldvik, W. N.: "The Mystery of Jupiter's Red Spot: A Viable Meteorological Solution?", Department of Meteorology, University of California, Los Angeles, California, November 23, 1973.

Spjeldvik, W. N. and R. M. Thorne: "Relativistic Electron Precipitation: A D-Region Ionization Source", Fall Annual Meeting of the American Geophysical Union, San Francisco, California, December 12, 1973. In: EOS, Transactions of the American Geophysical Union, 54, 1162, 1973.

## 1972

Spjeldvik, W. N.: "What we Don't Know about the Mesosphere", Seminar, Department of Meteorology, University of California, Los Angeles, California, January 28, 1972.

Spjeldvik, W. N.: "Water Cluster Ions in the D-Region Ionosphere: Ion Reaction Schemes at 50-90 km Altitude", Department of Meteorology, University of California, Los Angeles, California, September 20, 1972.

## 1971

**Spjeldvik, W. N.: "Solar X-ray Observations with the Explorer-33 Spacecraft and Sudden Ionospheric Disturbance Events", Department of Physics, University of California, Los Angeles, California, March 1971.**

**Spjeldvik, W. N.: "Hydrated Photo-Chemistry of the Lower Ionosphere at 50-100 km Height", Department of Physics, University of California, Los Angeles, California, June 1971.**

## 1970

Spjeldvik, W. N.: "Riometer Observations of the Auroral Ionosphere", The Auroral Observatory (now: Department of Mathematical Sciences, University of Tromso), Tromso, Norway, May, 1970.

Spjeldvik, W. N.: "Recent Findings in Solar Flare Associated X-Ray Perturbations of the Ionosphere: SID-Events", The Auroral Observatory (now: Department of Mathematical Sciences, University of Tromso), Tromso, Norway, June 20, 1970.

## 1969

Spjeldvik, W. N.: "Review of the Axiomatic Foundation of Modern Quantum Mechanics", Department of Physics, University of Bergen, Norway, September, 1969.

Spjeldvik, W. N.: "An Alternate Approach to Quantum Mechanical Eigenfunctions: A Literature Study", Department of Physics, University of Bergen, Norway, October 3, 1969.

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**Education:**

Ph.D. University of Washington, 1975, Astronomy,
"The Emission of Dwarf Novae"
M.S. University of Washington, 1972, Astronomy
B.S. Michigan State University, 1970, Astrophysics

**Positions Held:**

Professor, Univ. of Washington, 1999-present
Professor, Research Professor, Univ. of Washington, 1993-1999
Research Professor, Univ. of Washington, 1991-1993
Research Associate Professor, Univ. of Washington, 1983-1991
Senior Research Associate, Univ. of Washington, 1982-1983
Research Associate, Lecturer, Univ. of Washington, 1975-1982
Adjunct Assistant Professor, UCLA, Jan.-June, 1980, March-June, 1981
Visiting Associate, Caltech, Sept. 1978-March, 1979, Jan.-June, 1980
Visiting Assistant Professor, University of Hawaii, Jan.-June, 1978
Visiting Instructor, UCLA, March-June 1977
Visiting Scientist, Kitt Peak National Observatory, June-Sept., 1976
Part-time Faculty, Bellevue College, 1975-1977
Part-time Faculty, Seattle University, 1974-1975, 1982
Research, Teaching Assistant, University of Washington, 1970-1975
Research Assistant, Kitt Peak National Observatory, June-Sept., 1970
Research Assistant, Observatoire de Geneve, June-August, 1969

**Awards:**

Annie J. Cannon Award, 1978
AAAS Fellow, 1994

**Appointments:**

IUE Users Committee, 1983-1985; 1993-1997
KPNO Users Committee, 1983-1985; KPNO TAC 1997-1999
A.J. Cannon Advisory Committee, 1986-1991, Chairman 1988-1990
NASA Management & Operations Working Group (UV/V/R) 1988-1992
ASP Board of Directors, 1988-1992, Pub Board 2001-2003
AAAS Nominating Committee, 1990-1993; Chair 1993
AAAS Member-at-Large 1995-1999
NASA Senior Review 1996
HEAD Executive Committee, 1996-1997
RXTE Users Committee, 1996-2000
MAST Users Com. 2001-2003; HST Archive Users Com 1993-1995
Councilor AAS, 1996-1999; Van B Prize Com. 2001-2004; Chair 2003
IAU Com. 42 President 2000-2003; VP 1997-2000; OC 1991-2006
AURA OC 2004-2010 (Chair 2007-08); SOC 2001-2004; Mem Rep 2000-2009
AAVSO President 2007-2008, VP 2006-2007, Council 2004-2008
ApJ Scientific Editor 2002-2005
PASP Editor 2006-2010

**Professional Societies:**

American Astronomical Society
International Astronomical Union
Astronomical Society of the Pacific
Phi Beta Kappa
American Association for the Advancement of Science
American Association of Variable Star Observers

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7. Szkody, P., "Infrared Photometry of SS Cyg and RX and Near Maximum", 1974, *Ap. J. (Letters)*, **192**, L75.

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9. Szkody, P., "The Minimum State of Dwarf Novae", 1976 *Ap. J.*, **207**, 824.

10. Szkody, P., "A Study of the Rise to Maximum and the Decline in Dwarf Novae", 1976, *Ap. J.*, **210**, 168.

11. Cowley, A., Crampton, D., Szkody, P., Brownlee, D., "AM Her", 1976, IAU Circ. No. 2984.

12. Szkody, P., "The Optical Light Curve of the Eclipsing X-ray Binary AM Her", 1977, *B.A.A.S.*, **8**, 511.

13. Szkody, P., Brownlee, D., "AM Her: A Unique X-ray Binary as Revealed Through the Optical Light Curve", 1977, *Ap. J. (Letters)*, **212**, L113.

14. Szkody, P., "IR Photometry of Dwarf Novae and Possibly Related Objects", 1977, *Ap. J.*, **217**, 140.

15. Szkody, P., "Changes in AM Her During Maximum and Minimum States", 1978, *P.A.S.P.*, **90**, 61.

16. Margon, B., Szkody, P., Bowyer, S., Lampton, M., Paresce, F., "Extreme UV Observations of Dwarf Novae from Apollo-Soyouz", 1978, *Ap. J.*, **224**, 167.

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23. Margon, B., Downes, R. A. and Szkody, P., "Stepanyan's Star", 1980, IAU Circ. # 3465.

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## EXPERIENCE

May 1999 to Present: Associate Professor, Department of Physics, Utah State University, Logan, UT.

September 1993 to May 1999: Assistant Professor, Department of Physics, Utah State University, Logan, UT.

December 1990 to August 1993: Research Associate and Lecturer, Department of Physics, University of Texas, Austin, TX.

November 1988 to November 1990: Postdoctoral Member of Technical Staff, AT&T Bell Laboratories, Murray Hill, NJ.

June 1983 to October 1988: Research Assistant, Laboratory of Atomic and Solid State Physics, Cornell University.
June 1981 to May 1983: Teaching Assistant, Dept. of Physics, Cornell University.

1979 to 1981 (Academic years): Laboratory Instructor, Wake Forest University.

**HONORS AND AFFILIATIONS**

- Hankins Scholarship, Wake Forest University (1977 – 1979).
- Carswell Scholarship, Wake Forest University (1979 – 1981).
- Speas Award for outstanding undergraduate-physics accomplishment, Wake Forest University.
- Member: Phi Beta Kappa, American Physical Society.

**OTHER ACTIVITIES**

Journal Referee

- Applied Optics: 1991.
- Physical Review Letters: 1991 – present.
- Physical Review B: 1992 – present.
- Europhysics Letters: 1994.
- Surface Science: 1996 – present.
- Proceedings of the IME, Part A, Journal of Power and Energy – 2006
- International Journal of Materials and Structural Integrity – 2007

Proposal Review

- Research Corporation: 1997.

Four Corners Section of the American Physical Society

- USU representative -- organizational meeting, Albuquerque, NM, 1997.
- Organizing Committee, Fall 1998 Meeting, Provo, UT.
- Executive Committee, 2001 - 2003.
- Vice Chair 2003 – 2004.
- Chair Elect 2004 – 2005.
- Chair 2005 – 2006.
- Chair of Local Organizing Committee, Fall 2006 Meeting, Logan UT
- Past Chair 2006 – 2007.

**TEACHING EXPERIENCE**

Department of Physics, Utah State University

- Physics Colloquium 581: Fall 1993.
- Statistical Mechanics 651: Fall 1993.
- Statistical Mechanics 652: Winter 1994.
- Statistical Mechanics 653: Spring 1994.
- Electrons in Solids 782: Winter 1995; 783: Spring 1998.
- Solid State Physics 474: Spring 1995.

- Analytical Mechanics 341: Fall 1995, Winter 1997.
- Analytical Mechanics 342: Winter 1996, Spring 1997.
- Topics in Mechanics 343: Spring 1996.
- Introduction to Scientific Computing 374A: Spring 1996.
- Scientific Computing with Mathcad 525W: Summer 1996, 1997 Workshops.
- Independent Study: Topics in Mechanics 343: Spring 1996 – Fall 1997.
- Introduction to Statistical Mechanics 781: Fall 1997.
- Statistical Mechanics of Solids 782: Winter 1998.
- Advanced Laboratory 5870: Fall 1998, 1999, 2000.
- Foundations of Wave Phenomena 3750: Spring 1999 - 2001, 2006, 2007.
- Scientific Computing with Mathcad 5500W: Summer 1999, 2000 Workshops.
- Intermediate Mechanics 3550: Fall 1999.
- Solid State Physics 6530: Fall 2000.
- Physics of Living Systems I 2110: Fall 2001 - 2004, 2006, 2007
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Department of Physics, University of Texas, Austin

- Engineering Physics II Phy 303L: Fall 1991.
- Introductory Physical Science I — Mechanics PS303: Fall 1992, Spring 1993.

**DISSERTATIONS, THESES, AND SENIOR PROJECTS**

- Marley Kunzler, Senior Project, 1996: "Nd:YAG Laser Refurbishment for Ultrafast and Nonlinear Spectroscopies."
- Trevor Willey, Senior Project, 1996: "Computer Interfacing of Components in a New Ultrahigh Vacuum Surface Analysis Chamber."
- Greg Cantwell, Senior Project, 1997: "Computer Interfacing to a Hemispherical Analyzer Controller and Pulse Counter."
- Dominic Spear, Senior Project, 1999: "Construction of a High-Frequency Laser Beam-Path-Length Modulator."
- Ali Sabbah, Ph.D. Dissertation, 2002: "Ultrafast Carrier and Coherent Phonon Dynamics of Silicon."
- Elizabeth Williams, Senior Project, 2003: "A Mathcad Handbook for Physics 2110: Physics for Life Science."
- Heidi Wayment, Senior Project, 2003: "The Color of Tea."

**COMMITTEES**

Utah State University.

- Physics and Chemistry Representative/Coordinator for USU Scholars' Day, 1995.

College of Science, Utah State University.

- Curriculum Committee, Fall 2000 – present.

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- Physics Day Committee: Fall 1993 – Spring 1999.
- Colloquium Committee: Chair, Fall 1993 – Spring 1994; Member, Fall 1994 – Spring 1996.
- Computer Literacy Committee: Winter 1995 – Spring 1995.
- Curriculum Committee: Fall 1996 – Spring 1999; Chair, Fall 1999 – present.
- Library Committee: Fall 1995 – present.
- Industrial Master's Planning Committee: Spring 1997 – Spring 2000.
- Search Committee: Fall 1997 – Spring 1998; Spring 1999 – Fall 1999; Fall 2000 – Spring 2001, Fall 2001 – Spring 2002.
- Graduate Student Tracking Committee: Fall 1997 – present.

Ph.D. Student Committees, Utah State University.

- Teresa Burns, Ph. D. 1994: Fall 1993 – Spring 1994.
- Ed Toplikar, Ph. D. 1995: Summer 1994 – Spring 1995.
- Morton Sorlie, Ph. D. 1998: Fall 1995 – Spring 1998.
- Jinhua Feng, Ph. D. 1998: Winter 1995 – Summer 1998.
- Jishou Xu, Ph.D. 1999: Fall 1995 – Spring 1999.
- Robert Davies, Ph.D. 1999: Summer 1996 – Spring 1999.
- Stanislav Sazykine, Ph.D. 2000: Fall 1995 – Spring 2000.
- Ali Sabbah, Ph.D. 2002: Chair, Spring 1994 – Spring 2002.
- Neal Nickles, Ph.D. 2002: Summer 1996 – Spring 2002.
- Brian Pyper, Ph.D. 2003: Summer 02 – Summer 2003.
- Tim Doyle, Ph.D. 2004: Spring 1999 – Spring 2004.
- Clint Thomson, Ph.D. 2005: Summer 2000 – Spring 2005.
- Zijun Zhang, Ph.D. 2005: Summer 2002 – Fall 2005.
- Jeong-Young Ji, 2006: Spring 2003 – Fall 2006.
- Jason Kite, Ph.D. 2007: Spring 1999 – Spring 2007.
- Julie Brink: Summer 1994 – Fall 1994.
- Guangyuan Li: Fall 1996 – Fall 2001.
- Troy Stark: Fall 1998 – Fall 2001.
- Josh Herron: Fall 2002 – present.
- Jerilyn Brunson: Spring 2004 – present.
- Kripa Nidhan: Chair, Fall 2005 – present.
- Mukta Sharma: Fall 2005 – present.
- Dong Jun Kim: Spring 2006 – present.

M.S. Student Committees, Utah State University.

- Sang-Joon Lee, M. S. 1995: Fall 1993 – Spring 1995.
- Martin Searcy, M. S. 1996: Winter 1996 – Spring 1996.
- Shaoqing Song, M. S. 1997: Winter 1996 – Fall 1997.

- Clint Thomson, M.S. 2001: Spring 1999 – Spring 2001.
- Tee Chang Wong, M.S. 2001: Fall 2001.
- Josh Herron, M.S. 2002. Fall 2000 – Fall 2002.
- John Howell: Summer 1995 – Spring 1996.
- Stephen Collins: Fall 1996 – Fall 1997.
- Carl Howard: Fall 1998 – Fall 2004.
- Robert Franckowiak: Chair, Fall 1999 – Fall 2003.

**ELECTRONIC PUBLICATIONS**

1. *Schaum's Electronic Tutor: College Physics*, J. R. Dennison, D. Mark Riffe, and Frederick J. Bueche (McGraw-Hill, NY; Mathcad, Cambridge, MA; 1996).

2. *Introduction to Scientific Computing, Introductory Physics Handbook*, v. 1.2, Neal Nickles, J. R. Dennison, and D. Mark Riffe (Utah State University, Logan, UT, 1997).

3. *Introduction to Scientific Computing, Modern Physics Handbook*, v. 1.2, D. Mark Riffe, J. R. Dennison, Neal Nickles, and Teresa Burns (Utah State University, Logan, UT, 1997).

4. "Problem-Solving Tutorial," Neal Nickles, J. R. Dennison, D. Mark Riffe, and Beth Porter, part of the *StudyWorks II for Schools* software package (MathSoft, Cambridge, MA, 1998).

5. "Problem-Solving Tutorial," Neal Nickles, J. R. Dennison, D. Mark Riffe, and Beth Porter, part of the *Mathcad 8.0 Professional* software package (MathSoft, Cambridge, MA, 1998).

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9. "Photoemission and Tunneling Microscopy of $CoSi_2$(100) MBE Surfaces," J. E. Rowe, R. S. Becker, D. M. Riffe, G. K. Wertheim, S. M. Yalisove, and R. T. Tung, 36th National Symposium and Topical Conference of the American Vacuum Society, Boston, MA, October 1989.

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17. "Photoemission Studies of Surface Segregation of GeSi(100) 2×1," J. E. Rowe, D. M. Riffe, and G. K. Wertheim, 1991 Conference on Physics and Chemistry of Semiconductor Interfaces, Long Beach, CA, Jan. 19 - Feb. 1, 1991.

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20. "Space-Charge Limited Thermionic Emission from Femtosecond-Excited Metal Surfaces," X. Y. Wang, D. M. Riffe, M. C. Downer, J. L. Erskine, and R. M. More, Quantum Electronics and Laser Science Conference, Anaheim, CA, May 10-15, 1992 [in 1992 OSA Technical Digest Series, Vol. **13** (Optical Society of America, Washington, DC, 1992), pp. 278-279].

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29. "A Foundation for the Integration of Mathcad into the Undergraduate Physics Curriculum," D. M. Riffe, J. R. Dennison, and Neal Nickles, APS Four Corners Section Spring Meeting, Albuquerque, NM, April 1998.

30. "Ultrafast Reflectivity Measurements of Si from 20 Femtoseconds to 140 Picoseconds," A. J. Sabbah and D. M. Riffe, APS Four Corners Section Fall Meeting, Provo, UT, October 1998.

31. "Application of Empirical Potential-Energy Calculations to Surface Core-Level Spectra of the Alkali Metals," D. M. Riffe and Carl Howard, APS Centennial Meeting, Atlanta, GA, March 1999. [Bull. Am. Phys. Soc. **44**, 243 (1999)].

32. "Ultrafast Reflectivity Measurements of Si Probed with 20 Femtosecond Laser Pulses," A. J. Sabbah and D. M. Riffe, APS Centennial Meeting, Atlanta, GA, March 1999. [Bull. Am. Phys. Soc. **44**, 444 (1999)].

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34. "Shifts in the $4f_{7/2}$ Core Levels of W(110) due to Nickel Adsorption," R. T. Franckowiak, B. Kim, B. J. Kim, T.-H. Kang, N. D. Shinn, and D. M. Riffe, APS Four Corners Section Fall Meeting, Fort Collins, CO, September 2000.

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37. "Femtosecond Carrier and Coherent-Phonon Dynamics of Si(100) Measured With Pump-Probe Reflectivity at 800 nm," D. M. Riffe and Ali Sabbah, APS Four Corners Section Fall Meeting, Las Cruces, NM, October 2001.

38. "Modeling of Nonequilibrium Electron Dynamics in Metals at Ultrafast Timescales," D. M. Riffe, APS Four Corners Section Fall Meeting, Salt Lake City, UT, October 2002.

39. "Carrier and Coherent Lattice Dynamics of Si Probed with Ultrafast Spectroscopy," D. M. Riffe and Ali Sabbah, International Conference on the Physics of Semiconductors, Flagstaff, AZ, July, 2004.

40. "Semiconductor Energy Gap Temperature Dependence Based on Spectral Functions," D. M. Riffe, APS Four Corners Section Fall Meeting, Albuquerque, NM, October, 2004.

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42. "Real Time Measurement of Semiconductor Dielectric Functions Using Femtosecond Ellipsometry, K. Nidhan and D. M. Riffe, APS Four Corners Section Fall Meeting, Boulder, CO, October, 2005.

43. "Epitaxial Growth of Au on W(110): Analysis of Core Level Shifts and Lineshapes," M. Sharma and D. M. Riffe, APS Four Corners Section Fall Meeting, Boulder, CO, October, 2005.

44. "Coherent Excitation of the Optic Phonon in Si Measured with Femtosecond Spectroscopy," D. M. Riffe and A. J. Sabbah, APS Four Corners Meeting, Logan, UT, October 2006.

45. "Interfacial Core-Level Shifts at W(110)-Based Bimetallic Interfaces," D. M. Riffe, APS Four Corners Meeting, Flagstaff, AZ, October 2007.

**COLLOQUIA AND SEMINARS**

- Cornell University, Ithaca, NY: Seminar, 1988.
- Sandia National Laboratories, Albuquerque, NM: Seminar, 1988.
- University of Pennsylvania, Philadelphia, PA: Seminar, 1988.
- AT&T Bell Laboratories, Murray Hill, NJ: Seminar, 1988, 1989.
- National Synchrotron Light Source, Brookhaven National Laboratory, Upton, NY: Seminar, 1989.
- Florida Atlantic University, Boca Raton, FL, Colloquium, 1989.
- University of Arkansas, Fayetteville, AK: Colloquium, 1990.
- Georgia State University, Atlanta, GA: Colloquium, 1990.
- Auburn University, Auburn, AL: Colloquium, 1990.
- University of Pittsburgh, Pittsburgh, PA: Seminar, 1990.
- University of Central Florida, Orlando, FL: Colloquium, 1990.
- University of Florida, Gainesville, FL: Seminar, 1990.
- New Jersey Institute of Technology, Newark, NJ: Seminar, 1990.
- National Institute of Standards and Technology, Gaithersburg, MD: Seminar, 1990.
- Naval Research Laboratory, Washington, DC: Seminar, 1990.
- 3M Corporation, Minneapolis, MN: Seminar, 1990.
- University of Texas, Austin, TX: Seminar, 1990, 1992.
- University of North Carolina, Chapel Hill, NC: Colloquium, 1991; Seminar, 1991.
- University of Tennessee, Knoxville, TN: Seminar, 1992.
- Oak Ridge National Laboratory, Oak Ridge, TN: Seminar, 1992.
- Utah State University, Logan, UT: Physics Colloquium, 1993, 1999, 2002; Surface Science Seminar, 1994, 1995, 2000, 2004; National Center for the Design of Molecular Function Seminar, 1994; Analytical and Physical Chemistry Seminar, 1994.
- Brigham Young University, Provo, UT: Colloquium, 1995.
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## Education

Ph.D. (Geography), awarded December 1997, University of Colorado, Boulder, Colorado 80309, U.S.A.

MA (Geography), awarded 1992, University of Colorado, Boulder, Colorado 80309, U.S.A.

BA Honours, First class (Geography), awarded 1990, Jesus College, University of Oxford, Oxford OX1 3DW, England.

## Employment

**April 2007 to present:** Associate Professor (tenured), Geography Department, Weber State University, 1401 University Circle, Ogden, UT 84408.

**July 2002 to April 2007:** Assistant Professor, Geography Department, Weber State University, 1401 University Circle, Ogden, UT 84408.

**January 1997-July 2002:** Assistant Professor, Geography Department, Middlebury College, Middlebury, VT 05753.

**January 1997-December 1997:** Instructor, Geography Department, Middlebury College, Middlebury, VT 05753.

**August 1994-December 1996:** Graduate Research Assistant, National Snow and Ice Data Center, Campus Box 449, University of Colorado, Boulder, CO 80309-0449.

**January 1994-August 1994:** Graduate Instructor, Geography Department, Campus Box 260, University of Colorado, Boulder, CO 80309-0260.

**Courses taught:**
*Weber State University:*
GEOGR 1000 Natural Environments of the Earth
GEOGR 1300 Places and Peoples of the World
GEOGR 3050 Weather and Climate
GEOGR 3090 Arctic and Alpine Environments
GEOGR 3590 Geography of Europe
GEOGR 4990 Senior Seminar

*Middlebury College:*
GG 250 Arctic and Alpine Environments
GG 256 Water Resources Geography
GG/BI 013 The Causes and Consequences of Climate Change
GG 450 Seminar in Physical Geography: Climatology
GG 254 Weather and Climate
GG 150 Physical Earth Processes
FS 018 Natural Hazards

*University of Colorado:*
GEOG 1001 Environmental Systems 1: Climate and Vegetation
GEOG 3201 Atmospheric Science 2: Climatology
GEOG 3412 Conservation Practice and Resource Management

## Publications

**Refereed journals:**
Bedford, D.P., and Douglass, A., Changing properties of snowpack in the Great Salt Lake basin, western United States, from a 26-year SNOTEL record. Manuscript under review at the *Professional Geographer*.

Bedford, D.P., Area-dependent climatic influence of the Great Salt Lake, Utah. Manuscript under review at the *Journal of Applied Meteorology and Climatology*.

Bedford, D.P., 2005, Utah's Great Salt Lake: A complex environmental-societal system. *Geographical Review* vol. 95, no. 1, pp. 73-96.

Bedford, D.P., 1996, International water management in the Aral Sea basin. *Water International*, vol. 21, no. 2, pp. 63-69.

Bedford, D.P., and Barry, R.G., 1995, Glacier trends in the Caucasus, 1960s to 1980s. *Physical Geography* vol. 15 no. 5, pp. 414-424.

**Non-refereed publications:**
Bedford, D.P., Barry, R.G., and Haggerty, C.D., 1996, Analysis of mass balance indicators in the new glacier inventory of the former Soviet Union. In Colbeck, S.C. (ed.), *Glaciers, Ice Sheets and Volcanoes: A Tribute to Mark F. Meier*, pp. 12-16, CRREL Special Report 96-27, US Army Corps of Engineers, Hanover, New Hampshire.

Bedford, D.P., and Haggerty, C.D., 1996, New digitized glacier inventory for the former Soviet Union and China. *NOAA Earth Systems Monitor* vol. 6 no. 3, pp. 8-10.

Bedford, D.P., and Barry, R.G., 1995, New cryospheric data sets from the former Soviet Union. *International GEWEX Workshop on Cold-Season/Region Hydrometeorology: Summary Report and Proceedings,* compiled by Krauss, T.W., and Carroll, T.R., IGBPO Publication Series No. 15, UCAR, pp. 179-182.

**Book Reviews:**
McNeill, J.R., 2000, *Something New Under the Sun: an Environmental History of the Twentieth-century World*, published by W.W. Norton and Company; review published in *Ethics, Place and Environment*, vol. 5 no. 2, pp. 158-161, June 2002.

Merrett, S., 1997, *Introduction to the Economics of Water Resources: An International Perspective*, published by Rowman & Littlefield; review published in *The Professional Geographer*, vol. 51 no. 2, pp. 323-324, May 1999.

## Current Research

Climatic influences of the Great Salt Lake, UT.

## Conference Presentations (last 10 years only)

Bedford, D.P., *Maritime Climatic Influence of the Great Salt Lake, Utah* (paper), Association of American Geographers' (AAG) national meeting in Chicago, IL, 2006.

Bedford, D.P., *Variable Maritime Climatic Influence of the Great Salt Lake, Utah* (paper), Second Annual Faculty Forum, Weber State University, Ogden, UT, 2006.

Bedford, D.P., *Human Ecology And Great Salt Lake-Effect Snowstorms: Prospects For Regional Anthropogenic Climate Change*, Society for Human Ecology national meeting, Salt Lake City, UT, 2005.

Bedford, D.P., *Climate-Society Interactions and Utah's Great Salt Lake* (paper), AAG meeting in Denver, CO, 2005.

Bedford, D.P., *Establishing a heat budget-water clarity relationship for Utah's Great Salt Lake* (paper), First Annual Faculty Forum, Weber State University, Ogden, UT, 2005.

Bedford, D.P., *Establishing a heat budget-water clarity relationship for Utah's Great Salt Lake* (paper), AAG meeting in Philadelphia, PA, 2004.

Bedford, D.P., *Changes in Salinity Levels of Utah's Great Salt Lake and their Environmental and Societal Consequences* (paper), AAG meeting in New Orleans, LA, 2003.

Bedford, D.P., *Snowmelt Runoff Modeling of the New Haven River Basin* (paper), AAG meeting in Los Angeles, CA, 2002.

Bedford, D.P., and O'Hara, S., *Water Policies in Central Asia* (paper), AAG meeting in Pittsburgh, PA, 2000.

Bedford, D.P., *Climate Change in Vermont* (paper), Conference on the Impact of Climate Change on Vermont's Economy, Burlington, VT, 1999.

Bedford, D.P., *Historical Climate Changes in the Aral Sea Basin* (paper), AAG meeting in Honolulu, HI, 1999.

Bedford, D.P., *Climate Sensitivity and Water Management in the Upper Amu Darya Basin* (illustrated paper), AAG meeting in Boston, MA, 1998.

Bedford, D.P., *Climate Change and Water Management in Post-Soviet Central Asia* (illustrated paper), AAG meeting in Dallas-Fort Worth, TX, 1997.

Bedford, D.P., *Water Use and Core-Periphery Relations in Uzbekistan* (invited paper), International Studies Association meeting in Toronto, Canada, 1997.

## Professional Affiliations

Member, Association of American Geographers (AAG), and AAG Climate, Water Resources, Human Dimensions of Global Change, Mountain, and Cryosphere specialty groups.

Member, American Geophysical Union.

# H. Laine Berghout

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## Research and Employment

**Associate Professor of Chemistry** **July 2004-Present**

**Assistant Professor of Chemistry** **July 2000 -June 2004**

*Weber State University, Ogden, Utah*

Teach physical chemistry, chemical principles, and general chemistry courses and laboratories. Research interests include chemical reaction dynamics, energetic materials combustion, development and use of use of computer application as teaching, learning, and research tools for physical chemistry.

**Los Alamos National Laboratory Affiliate** **August 2000 -Present**

*DX-2, Los Alamos National Laboratory, Los Alamos, New Mexico*

Ongoing experimental investigation of combustion in defects of energetic compounds and combustion characteristics of high nitrogen energetic materials. Currently hold DOE Q security clearance.

**Post Doctoral Research Assistant** **November 1998 - August 2000**

*Los Alamos National Laboratory, Los Alamos, New Mexico, Steve Son*

Experimentally investigated combustion in defects of energetic compounds. Employed digital video, high-speed digital video, infrared imaging, laser second harmonic generation surface characterization, pressure and temperature characterization techniques, high pressure techniques. Held DOE L security clearance.

**Research Assistant** **January 1994 - November 1998**

*University of Wisconsin-Madison, Professor F. Fleming Crim*

Experimentally investigated reaction pathway control by exploiting initial vibrational excitation in the photofragmentation processes in small molecules. Developed skills in experimental apparatus design, machining and setup, high energy pulsed laser setup, maintenance and repair, laser spectroscopic technics, computer programming, instrumentation interfacing, and electronics design and repair.

**Teaching Assistant** **August 1992-December 1993**

*University of Wisconsin-Madison, Professors John W. Moore, R. Claude Woods, Brian Laird, Arun Yethiraj*

Developed teaching skills in the areas of general chemistry, physical chemistry laboratory, and quantum chemistry.

**Chemistry Laboratory Technician** **March 1988-March 1991**

*Western Zirconium, Ogden, Utah, Steve Anderson*

Applied various separation and combustion techniques to analyze samples of zirconium and hafnium for alloying components and trace impurities. Developed skills in operation, maintenance and repair of ICP and combustion analysis instrumentation. Position required DOE L security clearance.

## Education

**Ph.D. Physical Chemistry** **December 1998**

University of Wisconsin-Madison
Thesis Advisor: Professor F. Fleming Crim
Thesis Title: Spectroscopy and Dissociation Dynamics of Electronically Excited Isocyanic Acid by Vibrationally Mediated Photodissociation

**B.S. Chemistry, Magna Cum Laude** **June 1992**

Physics/German Minor
Weber State University, Ogden, Utah

**A.A. Integrated Studies, Cum Laude** **June 1991**

Weber State University, Ogden, Utah

## Service and Volunteer Work

**Committee Member, Utah State Science and Engineering Fair** **2002-present**

Assisted in planning and preparation for the state junior and senior science fair

**Elected Member Weber State University Faculty Senate** **2003-present**

**Member Weber State University Curriculum Committee (Chair 2005-2007)** **2003-present**

**Member Weber State University College of Science Curriculum Committee (Chair 2006 – present)** **2000-present**

**Various other university and college committee responsibilities** **2000-present**

**Volunteer Judge for Weber County and Utah State Science and Engineering Fair** **2001-2002**

**Volunteer Event Coordinator for Utah State Science Olympiad** **2001-2006**

Planned and supervised the *Compute This!* event.

## Skills

Photography, video, high-speed video, and infrared imaging
High explosives handling
Use, maintenance, and repair of high power pulsed lasers
Application of photoacoustic, stimulated Raman, and laser-induced fluorescence spectroscopies
Computer systems management: DOS, Windows, OS/2, Linux, Unix, VAX/VMS, and Macintosh, hardware, software, networking, and programming (Fortran, C, BASIC and others)
Design, construction, computer interfacing, and troubleshooting of custom experimental apparatus
Application of high vacuum techniques
Application of high pressure techniques
Basic electrical design, wiring, troubleshooting
Basic design, machining, lathe and mill working
Read and speak fluent German
University level instruction

## Honors and Awards

**Weber State University**

Chemistry Faculty Scholarship, 1991-1992
Outstanding Chemistry Graduate, 1992
Sigma Xi, 1992
Phi Kappa Phi, 1991-

**Boy Scouts of America**

Eagle Scout, 1980

## Presentations

19th Rocky Mountain Regional Meeting of The American Chemical Society, Tucson, AZ, October 14 - 20, 2006
Thirty-First International Symposium on Combustion, University of Heidelberg, Heidelberg, Germany, 6 - 11 August, 2006
13th International Detonation Symposium, Norfolk Virginia, July 23 - 28, 2006
Annual Conference of the Utah Academy of Sciences, Arts, and Letters, Snow College, Ephraim, Utah, 7 April, 2006
3rd Annual Undergraduate Research Symposium and Celebration, Weber State University, March 27th, 2006
Flame Spread in Cracks and Across Surfaces of PBX 9501, Navel Air Warfare Center, China Lake, California, March 13, 2006
14th Conference of the APS Topical Group on Shock Compression of Condensed Matter, Baltimore, Maryland, July 31 - August 5, 2005
2nd Annual Undergraduate Research Symposium and Celebration, Weber State University, March 28th, 2005
1st Annual Undergraduate Research Symposium and Celebration, Weber State University, March 29th, 2004
JANNAF 39th CS Meeting Colorado Springs, Colorado, December 1 - 5, 2003
Los Alamos Energetic Materials Review, Los Alamos National Laboratory, September 29 - October 2, 2003
Weber State University Campus Conversation on Undergraduate Research, September 26th, 2003
High Explosives Work Group, Los Alamos National Laboratory, June 19, 2003
2003 Annual Conference of the Utah Academy of Sciences, Arts, and Letters, Weber State University, Ogden, Utah, 11 April, 2003
Twenty-Eighth International Symposium on Combustion, University of Edinburgh, Scotland, 30 July-4 August, 2000
High Explosives Work Group, Los Alamos National Laboratory, July 20, 2000
Energetic Materials Gordon Research Conference, Tilton School, Tilton, New Hampshire, July 2 - 7, 2000
JANNAF Propulsion System Hazards Subcommittee Meeting, Cocoa Beach, Florida, October 18-21, 1999
APS Topical Conference on Shock Compression of Condensed Matter, Snowbird, Utah, June 27-July 2, 1999
Conference on the Dynamics of Molecular Collisions, Gull Lake, Minnesota, July 20-25, 1997
Conference on the Dynamics of Molecular Collisions, Asilomar, California, July 16-21, 1995

## Publications

Flame spread across surfaces of PBX 9501, S. F. Son, B. W Asay, E. M. Whitney, H. L. Berghout, Proceedings of the Combustion Institute **31**(2), 2063 (2007)
Flame spread through cracks of PBX 9501 (a composite octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine-based explosive), H. L. Berghout, S. F. Son, L. G. Hill, and B. W. Asay, Journal of Applied Physics **99**, 114901 (2006)
Combustion of damaged PBX 9501 explosive, H. L. Berghout, S. F. Son, C. B. Skidmore, D. J. Idar, B. W Asay, Thermochimica Acta **384**, 261 (2002)
Relative product yields in the one-photon and vibrationally mediated photolysis of isocyanic acid (HNCO), H. L.

Berghout, S. Hsieh, F. F. Crim, J. Chem Phys. **114**, 10835 (2001)

Convective burning in the gaps of PBX 9501, H. L. Berghout, S. F. Son, B. W Asay, Proceeding of the Combustion Institute **28**, 911 (2000)

The electronic origin and vibrational levels of the first excited singlet state of isocyanic acid (HNCO), H. L. Berghout, F. F. Crim, M. Zyrianov, H. Reisler, J. Chem Phys. **112**, 6678 (2000)

Controlling the bimolecular reaction and photodissociation of HNCO through selective excitation of perturbed vibrational states, E. Woods, H. L. Berghout, C. M. Cheatum, F. F. Crim, J. Phys. Chem. A **104**, 10356 (2000)

Vibrational Spectroscopy and Intramolecular Energy Transfer in Isocyanic Acid (HNCO), M. J. Coffey, H.L. Berghout, E. Woods III, and F. F. Crim, J. Chem. Phys. 110, 10850 (1999)

Nonadiabatic effects in the photodissociation of vibrationally excited HNCO: The branching between singlet (a $^1\Delta$) and triplet (X $^3\Sigma^-$) NH, H. L. Berghout, S. S. Brown, R. Delgado and F. F. Crim, J. Chem. Phys. **109**, 2257 (1998)

Initial state resolved electronic spectroscopy of HNCO: stimulated Raman preparation of initial states and laser induced fluorescence detection of photofragments, S. S. Brown, H. L. Berghout and F. F. Crim, J. Chem. Phys. **107**, 8985 (1997)

Raman spectroscopy of the N-C-O symmetric ($\nu_3$) and antisymmetric ($\nu_2$) stretch fundamentals in HNCO, S. S. Brown, H. L. Berghout and F. F. Crim, J. Chem. Phys. **107**, 9764 (1997)

Raman spectroscopy of the $\nu_1$ N-H stretch fundamental in isocyanic acid (HNCO): state mixing probed by photoacoustic spectroscopy and by photodissociation of vibrationally excited states, S. S. Brown, H. L. Berghout, and F. F. Crim, J. Chem. Phys. **106**, 5805 (1997)

The HNCO heat of formation and the N-H and C-N bond enthalpies from initial state selected photodissociation, S. S. Brown, H. L. Berghout and F. F. Crim, J. Chem. Phys. **105**, 8103 (1996)

Vibrationally mediated photodissociation of isocyanic acid (HNCO): preferential N-H bond fission by excitation of the reaction coordinate, S. S. Brown, R. B. Metz, H. L. Berghout, and F. F. Crim, J. Chem. Phys. **105**, 6293 (1996)

Internal energy distribution of the NCO fragment from the near-threshold photolysis of isocyanic acid, HNCO, S. S. Brown, H. L. Berghout and F. F. Crim, J. Phys. Chem. **100**, 7948 (1996)

Vibrational state controlled bond cleavage in the photodissociation of isocyanic acid (HNCO), S. S. Brown, H. L. Berghout, and F. F. Crim, J. Chem. Phys. **102,** 8440 (1995)

## Personal Data

Born December 16, 1963; Ogden, UT

U.S. Citizen

Interests: family, photography, travel, automobiles, personal computers, flight, music, history, camping, fire...