The PHYSICS MAJOR

SONOMA STATE UNIVERSITY DEPARTMENT OF PHYSICS AND ASTRONOMY
1997

New Emphasis in Applied Physics

The Sonoma State University Department of Physics and Astronomy has embarked on a major revision of its Bachelor of Science degree with a Concentration in Applied Physics. The changes include the introduction of new courses in opto-electronics and X-ray analysis, a restructuring of the electronics courses, and reduced units in theoretical physics. The new and revised courses are described on page 3.

The Department has long been a source of technically-educated college graduates for local high-tech industries. For many years it has offered high-quality upper division laboratory courses in electronics, lasers, semiconductors, nuclear physics, and microprocessor applications.

The proposed curriculum changes will further strengthen and focus offerings in applied optics. A growing number of optical, electro-optical, and optical communications companies near SSU are eager to see the Department produce more graduates suitable for employment in these fields. In response to these challenges, the faculty are developing new Fiber Optics and Detectors courses.

The current degrees offered by the Department are the Bachelor of Arts in Physics and the Bachelor of Science in Physics. The latter may be chosen with or without a Concentration in Applied Physics. Once the changes in the B.S with the concentration are approved, the Department intends to ask that the name of this program be changed to a B.S. in Applied Physics.

Donations Fund Students' Futures

In the past year a number of our graduates and others have provided the private support upon which the Department of Physics and Astronomy increasingly depends. There have been some substantial gifts.

Chuck and Peggy Dexter became involved with the Department through the "What Physicists Do" lecture series after their post-retirement move to Santa Rosa. They recently chose to name the Department and SSU's Ruben Salazar Library as the ultimate beneficiaries of an estate remainder trust. Although it will be years before the income from the trust will come to the University, the quality of education of future students will be significantly enhanced. The Physics and Astronomy faculty are grateful and feel inspired to maintain a department and curriculum worthy of this generous endowment.

AT THE LAST "WHAT PHYSICISTS DO" LECTURE: Department Chair Duncan Poland, School of Natural Sciences Dean Anne Swanson, Donors Nadenia Newkirk, Margaret Dexter, Charles Dexter, Norma McKinney, Charles McKinney.

Horace Newkirk moved to Santa Rosa and became a regular attendee of the "What Physicists Do" series after retiring from China Lake Naval Weapons Center. He usually came on his motorcycle—when he wasn't flying his single engine plane across the country. In 1979 he spoke in the series, on how he damped out the wobbles on the early Explorer spacecraft. After his death his daughter and other relatives chose to commemorate him by endowing a student assistantship in the Department.

This spring Susan Webster became the first recipient of the Horace L. Newkirk Assistantship. She assisted Dr. Saeid Rahimi in his Physics of Toys lab, a popular innovation with nonscience students, and she helped Dr. John Dunning in his Introductory Physics lab for science majors. The professors greatly appreciated the help in coping with students' questions and equipment problems, and the experience Susan gained will aid her as she begins study in the teaching credential program in the fall. She will also be teaching physics and astronomy at a local private school. This combination of service to the Department and a learning experience for the recipient is the goal of the Newkirk Assistantship.

One of our many graduates who work at Hewlett-Packard Co. has chosen to utilize the company's generous 3 for 1 matching program for H-P equipment donated to an educational institution. Consequently, the department will soon receive a $20,000 Optical Time Domain Reflectometer system. This will be a key instru-

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Internship Leads to Next Level

Amy Weber

In January I began an internship at Next Level Communications in Rohnert Park. Next Level is developing products to provide TV and telephone service digitally using a single fiber optic cable. I have been working with electrical engineers on the development of the optics portion of the product. I mainly perform tests on the product and document the results. The tests are done for many reasons: to ensure performance within set specifications, to investigate tolerance outside those specifications, and to evaluate the quality of new components. By performing these tests, I have been increasing my knowledge and understanding of analog and digital circuitry.

Although I work in the Engineering group, the company includes many other groups. I have been able to work with other groups to learn how each contributes to the success of the product.

I have worked with Manufacturing, where the product is built or modified. It is here that I have become an expert at soldering. I have also worked as a liaison between Engineering and Quality Assurance, where the product is tested before shipment to the customer. Here I test my understanding of the product as I attempt to explain it to the test operators.

Being involved with different aspects of the product has given me a broad understanding of the company as well as the product. Every day I learn something new and continue to sharpen the skills I have. My internship will end when I graduate May 24th, but I have accepted a junior engineering position to begin in June. I feel very fortunate that I can transition into an exciting career opportunity so smoothly.

This internship would not have been open to Sonoma State students had it not been for Dr. Saeid Rahimi. It is through his efforts and the existence of classes such as LIght and Optics, Lasers and Holography, and Analog and Digital Electronics that I was able to compete for the internship. Thank you to Dr. Rahimi, Dr. John Dunning, and Steve Anderson for working so hard to provide applied courses which lead directly to experience and jobs in the industry.

What Physicists Do

Chad Eichele

SSU's "What Physicists Do" public lecture series had two characteristically strong semesters this year, with Dr. Lynn Cominsky directing the Fall 1996 semester, and Dr. Joe Tenn directing in the spring. These were semesters number fifty-two and fifty-three for the series. The topics ranged from a dialogue between Wolfgang Pauli and Carl Gustav Jung to a demonstration of the not-yet-understood sonoluminescence. Dr. Tenn and Dr. Cominsky did a fine job of making the lectures accessible to everyone (not just physicists or admirers of the natural sciences); there were even some regular attendees who were majoring in the humanities. It was good to see some diversity in majors of those attending, since WPD is meant for everyone.

Fall 1996 was a semester to remember, as the series was graced by its tenth Nobel Laureate, Dr. Richard Taylor (Stanford) who spoke on his trials in "Finding the Quarks." Among others who came to speak, Dr. Bernhard Haisch (Lockheed Martin) lectured on a new unified theory of electromagnetism and gravity, and Dr. Saul Perlmutter (Lawrence Berkeley National Lab) enlightened us on modern techniques using supernovae to measure the expansion rate of the universe.

Greg Sprehn ('93), now vice president and chief scientist of Massie Research Laboratories in Pleasanton, came back to his *alma mater* to speak on "An Adaptive Optic" and how it could be used on the Hubble Space Telescope upgrade mission scheduled for 2002. Susan Owen (Stanford) took us to the bottom of a volcano. Dr. Marla Feller (UC Berkeley) gave a physicist's view of the "wiring" of the human visual system, and Dr. Richard Muller (UC Berkeley) presented an exciting and controversial new theory on the causes of ice ages.

The spring semester also brought some grads back, as Jason Alexander ('93) of Lightwave Electronics spoke on made-to-order solid state lasers, and Geoffrey Syphers ('93) of Eley Associates told us about resource dynamics in a sustainable solar economy. Sonoluminescence was demonstrated by Dr. Michael J. Moran (Lawrence Livermore National Lab). We heard about the discovery of liquid metallic hydrogen from Dr. William Nellis, whose Livermore team discovered it last year. Comet expert Dr. Donald Yeomans came from JPL to talk about Comet Hale-Bopp, and we got to see some of the newest pictures of the Galilean satellites of Jupiter when Dr. Jeffrey M. Moore (NASA Ames Research Center) came to visit.

Dr. Christine Platt of the U.S. Department of Energy presented an exciting account of applications of high temperature superconductivity, and Dr. David Attwood of the Lawrence Berkeley National Lab spoke on X-ray Microscopy and Extreme Ultraviolet Lithography.

We also heard Dr. Nicole P. Vogt from UC Santa Cruz describe observations made with both the Hubble Space Telescope and the Keck Telescopes.

"What Physicists Do" continues to gain popularity with inquisitive SSU students and with a substantial number of people from the community. We can all look forward to more great talks in the years to come.

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Department of Physics and Astronomy
Sonoma State University
Rohnert Park, CA 94928-3609
(707) 664-2119
gayle.walker@sonoma.edu
http://yorty.sonoma.edu

Edited by Joe Tenn

Written by Lynn Cominsky, John Dunning, Chad Eichele, Duncan Poland, Saeid Rahimi, Willie Rodriguez, Joe Tenn, Amy Weber, and Susan Webster

X-ray Physics Thrives

John R. Dunning

With the introduction of Physics 384 X-ray Analysis, our students are offered a new area of expertise for their résumés. The course, first taught in Spring 1997, is an introduction to using X-ray powder diffraction and X-ray fluorescence as analytic techniques.

X-ray diffraction measures the crystal structure of compounds on an atomic scale. We are fortunate to have a superior X-ray instrument made by Rigaku, the Jade+ Software from Materials Data in Livermore, and the 1995 powder diffraction file of more than sixty thousand compounds from the International Centre for Diffraction Data (ICDD). **X-ray fluorescence** reveals the elemental composition. This powerful combination of hardware and software is actually easy to use on a variety of analytic problems.

Initially the course centers on learning X-ray diffraction. Good tutorial experiments exist, thanks to the ICDD. Sugars were chosen as the initial project. They were sweet.

Separating the $K\alpha_1$ and $K\alpha_2$ lines of copper using a large angle line of NaCl was next. The numbers indicated very high magnetic fields inside copper atoms. Students compared dark green olivine sand from Hawaii with black sand from another Hawaiian beach. Several phases of quartz were used as evidence of the internal heat of the earth at work. The next project involved X-ray analysis of intact stamps. These stamps are still intact. However, the composition of the ink and of the cellulose paper has yielded somewhat to our efforts. A final project involves measuring respirable silica (SiO_2) collected on filter papers. These projects are intended to foster understanding, inspire independence, and be useful examples of what X-rays can do to help students in their careers.

The class also made a field trip to the Advanced Light Source at Lawrence Berkeley National Lab.

New Courses in Optics

Saeid Rahimi

The Department has been offering Physics 447 Lasers and Holography, consisting of one hour of lecture and three hours of lab per week. Next year we will retain the lab portion as a one-unit course, add an additional laboratory course in Fiber Optics and Detectors, and expand the lectures on lasers into a new, 3-hour lecture course, Physics 445 Lasers, Fiber Optics and Detectors. The new lab course, Physics 449 Fiber Optics and Detectors, will provide students an opportunity to gain more expertise with lasers and to deal with related applications.

The major goals of our curriculum renovation are (1) to better prepare our graduates for careers in the growing high tech industry in our region, and (2) to encourage more qualified students seeking a technical degree to join our department. The new program will also be beneficial to those who would like to pursue an advanced degree in physics, applied physics, engineering physics, materials science, and electronics. We expect that the number of physics majors in our department will increase as a result of our new focus on applied optics.

These three courses are designed to provide our students with an overall knowledge of the principles of three major components in applied optics—lasers, fiber optics, and detectors—and to familiarize them with basic measurement techniques and applications in optical communications.

The focus of the present course has been primarily on gas lasers. The new courses will cover all types of lasers, and diode lasers in particular will be treated in detail. For optical communications experiments we have chosen the standard 1310 nm and 1550 nm wavelengths.

Prior to taking the applied optics courses most students will cover the basic theory of optics in the required course Physics 340 Light and Optics. Semiconductor materials and devices are covered in the existing Physics of Semiconductors course. Integration of the new courses and the existing optics and electronics courses will produce an effective electro-optics program in our department.

One of the major components of a fiber optics experiment is to measure losses due to various discontinuities in the length of the fiber. The discontinuity may be introduced by connectors, test or amplification instruments, or breaks and faults in the fiber. The major instrument used for the evaluation of optical fibers based on backscattered light is an Optical Time Domain Reflectometer (OTDR).

The OTDR will be used to measure fiber attenuation, evaluate splice and connector joints, and detect faults and breaks. The ordinary visual tests used for visible laser light may not be applicable to the infrared wavelengths used in optical fiber communications.

A timely and generous donation (see p. 1) has provided the Department with a Hewlett-Packard OTDR which will arrive shortly.

The other important instrument necessary for optical beam characterization is an Optical Spectrum Analyzer which can be used for the spectrum analysis of laser sources, light-emitting diodes, and the beams emerging from optical fibers. We hope to be able to obtain this instrument with another donation or possibly a collaborative donation. It would also play a major role in the upgrading of our existing laser experiments.

In addition to the OTDR, our existing gas lasers, and visible and infrared diode laser equipment, the department has recently purchased a 1310-nm diode laser source with about 2 GHz modulation capability with an appropriate detector, a diode laser driver and thermoelectric cooler system, a solid state laser, optical power meters, fiber optics launchers and components.

Electronics Courses Revised

Saeid Rahimi

In the interest of efficiency, the Department has decided to condense the three electronics courses into two, each, of course, with an accompanying lab. The new required electronics course, Physics 313 and Physics 313L, will include both analog and digital topics. The advanced electronics course, Physics 413 and Physics 413L, will now include signal processing and microprocessor-controlled circuits in addition to the usual digital electronics topics.

Reflections on SPS

Willie Rodriguez

Since my arrival in 1994, I have had the pleasure of being a member of the Society of Physics Students here at Sonoma State University. It has been one of the most rewarding experiences of my college career, giving me a chance to see and do many things related to physics, politics and life in general that I might have missed otherwise. In the past year, Amanda Tunison and I, as Co-Presidents, have attempted to offer these experiences to all of our members.

In the Fall, politics took the forefront as the campus was asked to vote for a fee increase to offset the lack of funding from our state government. Since our members shared the concerns raised by both the pro and con factions, I feel we were probably the most effective group to promote the fee increase. We held an equipment fund bake sale during the referendum to provide factual information about the issue and to show some of the outdated equipment that could be replaced if the referendum passed. Although the fee was voted down, we were successful in raising the awareness of students to the issues facing our campus.

In response to the need for a dedicated lounge area and workspace for physics students, Dr. Saeid Rahimi proposed a redesign of Darwin 343. Furniture for the room was found by Dr. Lynn Cominsky during the summer, and work was completed on the partition during Fall '96. During the well-attended room dedication party, Steve Anderson was awarded the SSU Champion Award in recognition of his hard work and dedication. Part of this award was a $300 donation to the organization of his choosing, and SPS was the fortunate recipient. We cannot thank you enough, Steve. With Dr. Duncan Poland's help, a work/computer table was custom-built for the room. On this table now sits the new Sun Sparc station that was acquired by Dr. Cominsky. SPS has allocated $300 towards a new hard drive.

The Beginning-of-Semester party for Spring '97 was held at Amy Weber's abode. Vast quantities of food, drink and good company made for a great time. Thanks, Amy!

SPS members can always be found staffing Public Viewing Nights, and this year was no exception. SPS members showed up in force for the March 14 Public Viewing Night at the SSU Observatory. We were operating the telescopes, staffing a refreshment table, and acting as a combination parking attendant/campus information booth/guide for the masses of humanity that braved the elements to get an early look at Comet Hale-Bopp. This was one of the largest turnouts to Public Viewing Night in quite a while, according to Amanda Tunison, and the extra help was greatly appreciated.

"What goes on at NASA Ames Research Center?" was the question that we attempted to answer by taking a field trip to Moffett Field on April 18. Dr. Jeff Scargle of the Space Sciences Division gave us a tour of the facilities and had the poor fortune of fielding questions from our group while attempting to eat lunch. We also had a chance to talk to Dr. Max Bernstein, who is studying the photochemistry of interstellar ices, and Dr. Dale Cruikshank, who is planning on observing the spectra of large Kuiper Belt objects at Keck Observatory in Hawaii. Dr. Cruikshank published in the Perspectives section of the March 28, 1997, issue of *Science*.

For the third consecutive year, SPS members joined in at Physics Day at Paramount's Great America. This year, our group of eight members staffed two help/information tables, both of which, I believe, were records: the largest number of people belonging to an individual group given free admission to staff tables, and the most tables staffed by an individual group! Future generations of SPS members will also have to try to top the record set by John Hayes and me, as we rode the Demon five times in a row!

Thanks in advance to Dr. Rahimi as he has offered to host the End-of-Semester party at his *casa grande* on May 17. Unfortunately, you will have to wait until next year to read about the stories from this party!

As this is my last year as a student member of SPS, I would like to take a few lines to thank those students who founded our local chapter and those students who have kept it alive through tough times. I would like to thank the faculty members who have advised our group, and everyone who has offered their support over the years. With our support and a little luck, future students will also be able to share in the challenges and rewards that come with membership in the Society of Physics Students.

Steve Anderson receiving the Champion Award from SSU President Ruben Armiñana.

Steve Is a Champion

Steve Anderson, the SSU Physics & Astronomy Department's software, hardware, and mechanical expert, lasers and holography wizard, generous helper to all, and the person who makes everything work, received a Champion Award as one of SSU's finest this year. He was cited for enormous contributions to instruction and laboratories both in the Department and outside, and to computing at all levels.

A High Energy Astronomer

This past year has been busy as usual for Professor Lynn Cominsky. In June 1996 she attended a meeting in Cambridge, MA of the *Advanced X-ray Astronomy Facility* (*AXAF*) Users Group. This group gives advice to NASA about the policies that should be developed regarding the use of the huge X-ray observatory, which is due for launch in late 1998. She also gave a talk about the *Gamma-ray Large Area Space Telescope* (*GLAST*) to the Users Organization at the Stanford Linear Accelerator Center (SLAC). The talk reported on the status of the research and development of this future mission, which is being planned by an international consortium of scientists from both the particle physics and astrophysics communities. The talk was so well received that very shortly thereafter, Dr. Cominsky was elected to the SLAC Users Organization executive committee for a three year term.

Dr. Cominsky's popular alternative Physics 209/210 course, which uses the *Physics by Inquiry* text developed at the University of Washington, entered its second year. She was ably assisted by Amy Weber ('97) during the fall and by Mark Robinson ('93) in the spring. This course, which features hands-on learning in small groups, will return in the fall of 1998, after Dr. Cominsky's upcoming sabbatical leave. During the next year, she will again be working with scientists at SLAC on matters pertaining to the *GLAST* mission. She is hoping to receive NSF funding to study several different outstanding problems in high energy physics, which may be solved by observations using GLAST. One example is the origin of cosmic rays. Although it has long been believed that cosmic rays are accelerated by supernova remnants, this has never been shown directly by observation. *GLAST* offers the opportunity to do these important observations for the first time.

During the fall semester, Dr. Cominsky organized the What Physicists Do series, which featured the series' tenth Nobel laureate, Dr. Richard Taylor, from SLAC. Dr. Taylor described his prize winning work in doing the crucial experiments which demonstrated the existence of quarks. Dr. Cominsky also gave her annual lecture in the War and Peace seminar series about the relationships between nuclear weapons, nuclear power and the environment, and participated as a judge in Project Censored, reviewing articles on similar subjects. At the Toronto meeting of the High Energy Astrophysics Division (HEAD) of the American Astronomical Society, she was appointed the HEAD press officer, based on the success of her efforts at last April's HEAD meeting in San Diego.

Her press activities continued this spring when Dr. Cominsky was asked to be the press officer for the Fourth Compton Gamma-ray Observatory Symposium in Williamsburg, VA in April. The big story from this conference was the discovery of a fountain of anti-matter emanating from a region about 10 degrees north of the center of our galaxy. Anti-matter cannot be directly observed, but is found by studying the 511-keV emission line which results from the annihilation of electrons with their anti-particles, positrons.

Although such annihilation radiation has long been seen from the center of our galaxy and along the galactic plane, it is very difficult to understand how this radiation can occur in such profuse quantities so far away from the galaxy. This has led to speculation that there is a fountain of material gushing out of the galaxy which then collides with pre-existing positrons to make the observed emission. The media coverage was excellent, with the story making the front page of the *New York Times* and many other newspapers, and also appearing on many television news broadcasts, including the CBS Evening News.

Applied Nuclear Is Computer-Coupled

John R. Dunning

The output of our gamma ray detector is now coupled to a master database which includes over 75,000 gamma ray energies. The software, Nuclide Navigator II, developed for EG&G ORTEC, facilitates easy access to the data subset appropriate to an experiment. Check Thermal Neutron Activation and you home in on the gammas from nuclides formed by adding a single neutron. Check Naturally Occurring and you are led to a different group of radioactive nuclides.

We will introduce this system in the Modern Physics Laboratory using naturally occurring gamma rays. Here the straightforward analysis routines will enable students to rapidly grasp the details of natural gamma radiation, glimpse the power of the database, and want more.

Later, those choosing the Applied Nuclear Chemistry and Physics laboratory will be rewarded with interesting experiments involving both alphas and gammas. Many graduates will remember the experiment when we use neutron activation analysis to test our own hair for heavy elements.

We now have the Washington State University reactor or the new reactor at McClellan Air Force Base activate the hair samples for us. Students use gamma counting in the basement of Darwin Hall to measure the longer-lived trace elements present. In addition, many radioisotopes purchased for SSU tracer experiments are gamma emitters, and medical doctors have treated our faculty and staff using radioisotopes.

The lecture portion of applied nuclear has shifted emphasis toward biochemistry and health physics. There is a new text, *Atoms, Radiation and Radiation Protection*, by James Turner. As always the curriculum is beneficial to biology, chemistry, and geology majors interested in broadening their expertise. The next offering will be Fall 1998.

DONALD HERRIOTT ('72) is the president and general manager of Roche Carolina, Inc., a South Carolina company which develops new pharmaceuticals and the technology for making them.

Physics is about natural structure and processes. The science used to discover, describe and predict has applications to most technical and many business activities. I've used my training and learnings in banking, computer, and manufacturing professions. Add people skills and an action/results orientation and you have what you need for leadership positions in any field.

A Day in the Life of a Physics Major

Susan Webster

6:55 a.m. The alarm rings and I hit the off button. I roll over to try to enjoy a few more minutes of sleep before the day begins. Five minutes later I drag my body out of bed to begin the morning routine. First I wake my son, Aaron, who is 9, because he is the fastest to get ready. Next I tell the girls it's time to get out of bed. I turn to the kitchen to start breakfast while my son gets finished dressing. "Do you have your backpack packed and a lunch ticket in it," I ask. "Girls get out of bed now or you won't get any breakfast."

8:00 a.m. I drop the older two kids at school and proceed to SSU. My youngest is 4 and goes to the Children's School on campus.

8:20 a.m. I finally manage to make it to my 8:00 class which is x-ray diffraction with Dr. Dunning, who graciously starts class at 8:30.

12:10 p.m. X-ray class is over, and I begin the afternoon. I pick up Hannah from the Children's School, and we drive to Monte Vista Elementary School to pick up Aaron and Maegan, who is 6. Today is their minimum day (every week) because the teachers have staff development.

12:30 p.m. Home again. Now it's time for homework. Not mine but the kids. We spend the next two hours doing homework while the youngest plays outside.

3:30 p.m. Start dinner because tonight Aaron has a little league game at 5:00, and I am the scorekeeper which means I have to be there every game too.

5:00 p.m. The girls go to the park while Aaron and I watch the game.

7:30 p.m. The game ends and we head home. (No, they lost for those of you wondering).

7:45 p.m. Time for showers and bedtime routines. This lasts until about 8:30, which is the official time for bed, but the children don't settle down for another half hour.

9:00 p.m. Ahhh! time to sit for a few moments and relax. Well, now I have to start MY homework.

11:00 p.m. Time for bed and NEWS.

11:30 p.m. Lights out!

The joys of motherhood and going to school at the same time are very trying on occasion but the rewards greatly outweigh the difficulties.

Some of the joys come from the fact that I know I am being a good role model for my children. I know it has happened, because one time when I wanted to not do a homework assignment my son said, "Mom, I'll tell everyone you are a quitter, now get to work." Or the time when he said, "You are going to be a good teacher, Mom."

The hugs and kisses I get from my daughters when they can tell I've had a rough day are priceless. I need to mention that I have a very supportive husband who manages to take the kids and give me time on the weekends for homework when he is in town.

Some of the difficulties are when I am just too tired to manage that homework assignment all the way. Also when the kids have holidays and I don't. Or if they get sick and can't go to school. But through it all God has blessed me with actually allowing me to make it through school and graduate with a Bachelor of Science Degree in Physics with a concentration in Applied Physics and a minor in Astronomy.

I believe I am not any different than any other student in the sense that there is no longer a typical student. The friends I have made during this time have just as many time constraints and responsibilities as I have. The age-old image of a student who just goes to school is a luxury these days, because most of the students that I know have to work or find ways to support themselves while in school.

I know I have benefited from these friendships, and my children have benefited from these friendships. Thank you for being good role models to my children and supporting me along the way.

LYNN M. HUBBARD ('75) is coordinator for environmental monitoring at the Swedish Radiation Protection Institute. The winner of a national fellowship in atmospheric science upon graduation from SSU, she earned a Ph.D. in physical chemistry at the University of California, Riverside, in 1980. She has also worked at UC Berkeley and the Center for Energy and Environmental Studies at Princeton University.

SHARON GILKISON MORGANELLI ('76) is a project coordinator with Jones Hall Hill & White, a municipal finance law firm in San Francisco. She earned an M.B.A. in finance from California State University, Northridge.

ROSS GOODWIN ('78, physics and applied mathematics) works in customer value management at Hewlett-Packard in Santa Rosa and currently serves on the Bennett Valley School Board. He earned an M.B.A. at the University of California at Berkeley in 1980.

A physics degree from SSU is a general-purpose technical degree that teaches you how to think logically, creatively, and mathematically, allowing on-th- job migration almost in any direction imaginable. This background gives me the tools to quickly learn new techniques and approaches to keep me ahead of the learning curve to add value to the company as hi-tech industry continuously evolves.

RICK KAMEN ('80) is a trail guide and docent at two parks, a volunteer at the Birch Aquarium at Scripps Institution of Oceanography, and a nature columnist for two newspapers in San Diego. He has taught electronics, mathematics, and physics at several community colleges.

Donors

(continued from p. 1)

ment in the fiber optics and photonics curriculum which Dr. Rahimi will introduce next year. If any other graduates employed by H-P would like to have their donation multiplied by four, rather than by the two provided by H-P's matching for cash donations, they are encouraged to contact the department.

Student research projects in astronomy received a significant, vital boost from a donation made this spring by Charles and Norma McKinney of Windsor. Their gift allowed the department to purchase a Compaq Pentium Pro computer for use in image and data processing with the new CCD camera obtained earlier. Susan Webster is assembling a spectrometer for use with the CCD as her senior design project, and the computer will process the spectral data.

In addition to these major gifts the Department has been fortunate to receive a number of other donations The "What Physicists Do" public lecture series and Public Viewing Nights at the Observatory are supported entirely by donations. Privately-funded scholarships support a small number of physics majors.

Contributions to any of the Department's accounts may be sent to the Department Chair, Dr. Duncan Poland, with a note designating the account(s) for which the donation is intended. Checks should be made out to the SSU Academic Foundation. Contributions are tax deductible to those who itemize. The following donors have contributed since last year's newsletter. We thank them all.

#63851 **PUBLIC PROGRAMS**. Charles & Judith Buff, Santa Rosa; Ben & Zoe Burmester, Petaluma; Marvin Chester, Occidental; Ruth Clary, Petaluma; Clover-Stornetta Farms, Petaluma; Charles Daymond, Cotati; Donald J. Farmer, Sebastopol; Will Gipple, Novato; James ('71) & Judith Hill, Sonoma; Dale Houston, Petaluma; Paul & M'lu Ishmael, Rohnert Park; David Jackson, Novato; William & Lucy Kortum, Petaluma; Francis V. Marshall, Petaluma; Charles R. & Norma McKinney, Windsor; Evelyn Norton, Kelseyville; Richard W. Porter, Santa Rosa; Robert & Bertha Rains, Santa Rosa; Donald B. Rathjen, Pleasanton; Greg & Linda Rose, Sonoma; Joseph & Jo-Ann Smith, SSU; Stella's Apartments, Sonoma; Geof Syphers ('93), San Francisco; Rex & Sally Thompson, San Anselmo; Michael Thuesen, Cotati.

#63852 **PHYSICS & ASTRONOMY EQUIPMENT AND SUPPLIES.** Stephan Crandall ('82), San Jose; James L. Hill ('71), Sonoma; Edwin Lenhart, Petaluma; Valerie Leppert ('87), Sonoma; Charles & Norma McKinney, Windsor; Duncan & Marion Poland, SSU; Marie-Christine Raude ('91), Sebastopol; Christopher Ray ('87), Davis; David Shoaf ('75), American Fork, UT; Society of Physics Students, Washington, DC; Amanda Tunison, SSU.

#63853 **SSU OBSERVATORY**. Claude ('81) & Teresa ('84) Plymate, Tucson, AZ.

#63855 **STUDENT DEVELOPMENT PROGRAM**. David & Paula ('86) Bennett, Novato; Anthony Blume ('92), Santa Rosa; Hewlett-Packard Co., Santa Rosa; Chuck Bullen ('74), Port Townsend, WA; Milton Hagler ('85), San Francisco; Martha ('88) & Alex Hunt, Healdsburg.

#75380 **HORACE L. NEWKIRK MEMORIAL STUDENT ASSISTANTSHIP FUND**. Nancy & James Kroening, Seattle, WA; Nadenia Newkirk, Santa Rosa; Virginia Newkirk Cain, Schenectady, NY; Geneva Post, Shorewood, MN.

#75960 **PHYSICS & ASTRONOMY SCHOLARSHIP** (endowment). Lynn Cominsky & Garrett Jernigan, SSU.

#77020 **SCIENCE AT WORK** (endowment). Max Machinery Inc., Healdsburg.

#78380 **JOSEPH S. TENN SCHOLARSHIP** (endowment). Mark Robinson ('93), Cotati.

#85960 **PHYSICS & ASTRONOMY SCHOLARSHIP** (current). Joe & Eileen Tenn, SSU.

THE CHARLES J. AND MARGARET C. DEXTER ENDOWMENT FUND. Charles & Margaret Dexter, Santa Rosa.

CLAUDE PLYMATE ('81) is an associate engineering physicist for the Fourier transform spectrometer on the McMath Solar Telescope of the National Solar Observatory in Arizona.

MARY C. SILBER ('81) is an assistant professor of applied mathematics at Northwestern University. She has conducted research at the University of Minnesota, the Georgia Institute of Technology, and the California Institute of Technology since earning her Ph.D. in physics at the University of California at Berkeley in 1989. She is also a new mother.

PETER SIECK ('82, physics and applied mathematics) is a process engineer at Optical Coating Laboratory, Inc. in Santa Rosa.

MICHAEL W. HELM ('82) works on the Energy Sciences Network at the Lawrence Berkeley National Lab. His beautiful plots appeared on the covers of the *LBL Research Review* and *Scientific American* when he was designing magnets for the Superconducting Supercollider.

R. JEFFERSON PORTER ('83) is a postdoctoral research fellow at the Lawrence Berkeley National Laboratory, where he continues research in the dilepton spectrometer collaboration. He earned his Ph.D. in physics at UC Davis in 1995.

BENJAMIN BURRESS ('85) is an observer at the Naval Prototype Optical Interferometer Observatory in Flagstaff, Arizona.

PETER ROONEY ('86) is a program officer at the National Research Council in Washington, DC. He earned his Ph.D. in physics in 1995 at UC San Diego, where he was a teaching assistant and an IBM fellow.

CHRISTOPHER RAY ('87, physics & applied mathematics) is an assistant professor of physics at St. Mary's College in Moraga. He earned his Ph.D. in physics in 1994 at the University of California, Davis.

PHILIPPE ARGOUARCH ('88) is a senior application programmer/analyst with Wells Fargo Online Financial Services in San Francisco.

DOUGLAS EPPERSON ('88) is a graduate student in physics at UC Santa Cruz, currently doing research at the HERA accelerator in Germany. He received his M.S. in physics at San Francisco State University in 1994.

PHILIP CULLEN ('89) is a manufacturing engineer at Read-Rite in Milpitas.

I believe that the fundamental philosophy of physics, that one should carry six things in one's hat and derive everything from that, has been a very powerful problem solving tool for me....I think that the critical thinking skills that I honed at SSU ...have been quite useful to me and my employers in keeping a lot of half-baked ideas off of the table. Plus, it was a hell of a lot of fun.

JON C. DAVIS ('89) is a software support consultant for Hewlett-Packard, based in Oklahoma.

MIEKO YOSHIDA ('90) is a research assistant with KRI International in Kyoto, Japan. She earned her master's degree in nuclear engineering science at the University of Florida in 1992.

PAUL KOHLMANN ('92) is an engineer/scientist in the Research/Analytical Lab at Optical Coating Laboratory, Inc. in Santa Rosa.

I received quite a bit of hands-on with various types of equipment, i.e., X-ray labs, electronics, nuclear science. This has been extremely important in the types of work I have done since graduation.

ART ONWAN ('93) is a graduate student and teaching assistant in physics at the University of North Dakota.

JEFFREY KAVANAUGH ('94) is a graduate student and research assistant in geophysics at the University of British Columbia. His specialty is glaciers.

Thus far, my degree has gotten me into the graduate program of my choice, and the foundation it has provided me has allowed me to handle whatever my research and studies have thrown at me.

SCOTT FRASER & SEAN FRASER ('95, physics, mathematics and English) have accepted teaching assistantships at the University of California, Santa Barbara, where they will begin work on Ph.D.'s in theoretical physics in Fall 1997. They earned certificates of advanced study in theoretical physics at the University of Cambridge in 1996 after spending a year at the University of Heidelberg on Goldwater Scholarships.

DANIEL HALE ('96) is a graduate student and teaching assistant in astronomy at San Francisco State University.

WILLIAM OAKES ('96) is an engineer at Optical Coating Laboratory, Inc. in Santa Rosa.

W. CHRIS ROSTEL ('96) is a process engineer at Deposition Sciences, Inc. in Santa Rosa.

DAVID E. MILLER ('96, physics and mathematics) is a software technician with Advanced Fibre Communication in Petaluma.

VICTOR L. HIPKISS ('96) is an engineer at Compumotor Corp. in Rohnert Park.

DEPARTMENT OF PHYSICS & ASTRONOMY
SONOMA STATE UNIVERSITY
1801 EAST COTATI AVENUE
ROHNERT PARK, CA 94982-3609