The PHYSICS MAJOR

SONOMA STATE UNIVERSITY **DEPARTMENT OF PHYSICS AND ASTRONOMY**
1999

Dr. Rahimi is Excellent

Dr. Saeid Rahimi has been chosen by Sonoma State University to receive one of two 1999 Excellence in Teaching awards.

The $5000 award "recognizes and rewards excellence in teaching and outstanding contribution to the education of Sonoma State University students through classroom instruction and other activities that promote student learning." Funded by local donors, the award was started in 1998 as a replacement for the Outstanding Professor award, which the California State University system discontinued after many years.

Congratulated on the prize, the modest professor replied, "I try to teach and deal with my students the way my best professors treated me."

Dr. Rahimi was recognized for his outstanding work with students in courses ranging from the first course in the calculus-based sequence to advanced laboratory courses in electronics, photonics, and semiconductors. The founder of the semiconductor and photonics laboratories, he has developed several courses and has also taught a special studies course in the graphical programming language LabVIEW. In the fall this versatile experimentalist will teach the theoretical course in quantum physics for senior physics majors. He has even developed and taught a general education laboratory course in the physics of toys.

He currently has five students working on individual research projects in photonics, some of them paid from two grants he has received from Lockheed Martin Co.

Dr. Rahimi received his B.S. from Shiraz University in Iran and his Ph.D. at Pennsylvania State University. He did research in semiconductors at the Oregon Graduate Institute before coming to SSU in 1982.

The Outstanding Professor award was conferred on three members of the Department of Physics and Astronomy: Dr. Lynn Cominsky in 1993, Dr. Richard Karas in 1978, and Dr. Garrison Sposito in 1970.

Ben Owen Wins Caltech Award

Benjamin J. Owen ('93) received the Clauser prize for Caltech's best doctoral dissertation in 1998. He helped find a compelling solution to the problem of why even young neutron stars have relatively slow spins. When the core of a massive star implodes in a supernova explosion, it sometimes becomes a pulsar. Conservation of angular momentum should make it spin in milliseconds, but the youngest pulsars observed take much longer.

Just five years after receiving his B.S. in physics at SSU, the 24-year-old Owen showed that the angular momentum is most likely lost to gravitational waves, due to fluid circulation in the neutron stars.

The work, done in the research group of famed professor Kip Thorne, was part of an effort to predict what might be detected once the Laser Interferometer Gravitational Wave Observatory (LIGO) goes on the air.

Asked about his success at Caltech, Ben replied,

"SSU was a great experience for me because it gave me a solid grounding in the basics while showing me pointers to more involved things (like relativity). I could always go at my own pace—which varied a lot. One of the more subtle benefits of having professors who spent a lot of time deriving the main results is that I got in the habit of deriving them too rather than taking them for granted. That meant that I knew what assumptions made them work and I got an idea how to redo things when the assumptions no longer worked. That's how you make discoveries in science, on the theory side, anyway."

While at SSU, Ben published research with Drs. Gordon Spear and Lynn Cominsky. He added,

"I gained a lot by getting an early taste of what research is like. I was also helped tremendously by having a high teacher-student ratio, and above all by having teachers who put a lot of effort into helping me in and out of class."

Dr. Owen is now a researcher at the Albert Einstein Institute for Gravitational Physics in Germany.

Why Study Physics?

Kevin Thomas

Recently I served on a panel designed to help undeclared majors decide what major might interest them. The event brought together representatives from most of the academic departments here at SSU. I covered the various topics suggested, citing the favorable job outlook for people with technical degrees, the advantages of small class sizes and the quality of the faculty in our department. But one of the questions really caught my attention: Why did I choose physics?

After some serious thought, I think I figured it out. I love the magic in life, and physics helps me understand that magic. It is the most fundamental science, covering everything from smaller than we can see to the entirety of the Universe, and every scale in between. It helps me make sense of the world, making understandable things that seem at first vastly too complicated to ever consider.

I have heard many people express disapproval of physics for this very reason. They say that physics tries to take the magic away by explaining away the beauty we see in nature as the trivial outcome of a few simple laws. For example, I have heard the argument that physics tries to dismiss rainbows by showing that rainbows are just the refraction of light through water crystals in the air. I would argue that an opposite approach is in order: these simple little water crystals bending the light passing through them form these magnificent displays of color in the sky that have inspired poets for generations.

But this isn't even really the case. All of physics is just a set of simplifying models we apply to the world around us so that we can understand our environment. A rainbow is something that transcends our model of light refraction. There's something more there. And since physics is all models, there will always be something more there, no matter how good the models get. The truth will always elude us, but it will forever inspire us. So, you see, physics doesn't take away the magic, it guarantees that it will always be there.

You ask why I study physics? It lets me take the analytical approach to life, bringing understanding where there was little or none before, while at the same time letting me look on the incredible world around me with the wide-eyed amazement of a child.

Vacuum Evaporation

John Collins

In the study of physics as well as in industry the use of thermal deposition to lay down thin films of metal is pervasive. At SSU our system consists of a bell jar, mechanical and diffusion pumps, a high current low voltage circuit and a plasma generator.

The substrate (the material to coat) is held in place in the bell jar by tooling of our own design. Then the chamber is pumped down to less than 5E-5 torr. With the two pumps in tandem we routinely reach pressures as low as 1E-5 torr. A plasma is then generated by introducing a small amount of inert gas such as argon or nitrogen and applying 5000 volts. This ionized gas does a good job of releasing contaminants that cling to surfaces inside the bell jar. The coating material must be heated to evaporative temperatures by passing 120 amps through the material. The evaporating metal then coats the substrate.

We use our vacuum evaporation equipment to produce mirrors of very specific reflectance for use in fiber optics sensor experiments. Currently we are tooling up our machine to coat optic fibers. Operating, designing and optimizing the system for a given application are very useful skills in research and industry.

Witten Scores in Essay Contest

SSU physics major Alan Witten has won a prize in the annual essay contest sponsored by the *Griffith Observer*, a popular astronomy magazine published by the Griffith Observatory in Los Angeles. Witten will receive a cash prize, and his article on the International Space Station, originally written for Professor Sam Greene's Extraterrestrial Intelligence and Interstellar Travel course, will appear in the magazine.

Al earned his first B.S. in electrical engineering at CSU, Los Angeles. After working in the defense industry for a few years, he and his wife founded a coffee distribution business, which they sold 22 years later. Al will receive a B.A. in physics in May 1999, after which he plans to seek both a management position in industry and an MBA at SSU.

The prize is the eighth in the annual contest to be won by a paper written in the Department of Physics and Astronomy. Students Reiko Hibbett Crane, Donald W. Martin ('83), and Annabel Ayres scored with papers originally written for Dr. Joe Tenn's astronomy classes, and Dr. Tenn has won four prizes. In addition, Katherine Rhode ('89), now a graduate student in astronomy at Yale University, won a prize shortly after graduation, while Miriam Carolin ('82) won one with a brief version of her master's thesis in history.

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Sonoma State University
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gayle.walker@sonoma.edu
http://www.phys-astro.sonoma.edu

Edited by Joe Tenn

Written by Allan Baker, John Collins, Lynn Cominsky, John Dunning, Angela Duprez, Tim Graves, Michael Grzesik, Dan Hogan, Ed Ott, Joe Tenn, and Kevin Thomas.

GARY ZUPAN ('69) is a software engineer for Lockheed Martin. He has been an independent programmer and a technical manager at Applied Computer Techniques in Indiana. He earned an M.Ed. at Anderson College in 1983.

FRED ARIOLI, JR. ('75) is a software engineer working on the Space Infrared Telescope Facility (SIRTF) and the Space Interferometry Mission (SIM) programs at Lockheed Martin in Sunnyvale. *Sonoma State provided a solid theoretical background, where I cultivated a liking for the subject.*

An Australian Touch: An Environmental SEM

John Dunning

I thoroughly enjoyed my sabbatical visiting eastern Australia. My adventures took me to universities near the capital cities of the states of New South Wales and Queensland. They strive for excellence while emphasizing to their students those careers thought to be of most benefit to Australia.

I learned of their successes in teaching lower division physics laboratories. I sought out teaching strategies that they felt enhanced the retention rate of new physics majors. I also visited working Scanning Electron Microscope (SEM) laboratories, places where X-ray diffraction was in use, and nuclear facilities.

I discovered cohesive microanalysis centers functioning well as semiautonomous units within two universities. At the University of Technology, Sydney it is the Microstructural Analysis Unit. At the University of Queensland it goes by the name Centre for Microscopy and Microanalysis. Both centers have several transmission and scanning electron microscopes (SEMs) and X-ray diffraction. The staff initiate their own projects, furnish technical support, and collaborate on the imaging portion of other projects. Their main source of funding is from the University.

The most recent purchases by both centers are Philips XL-30 SEMs. This is the very make and model that we are proposing for SSU. Both Australian centers concluded that these SEMs are easy to operate, versatile machines with superior repair records.

The Environmental option on the Philips XL-30 ESEM was purchased by the Microstructural Analysis Unit. This option allows the sample to be bathed in up to 20 mm water vapor pressure while still being viewed at a full resolution of three nanometers. The vapor pressure of water at 4 °C is only 6 mm. In a water vapor environment, a biological sample cooled to this temperature will not dry out, and it is above freezing. Environmental samples with water content will retain their structure. The 6 mm water vapor pressure is also high enough to leak off charge so that no sample coating is needed, so there is no sample preparation. The elemental analysis addition called Energy Dispersive X-ray (EDX) works just fine with the short working distance possible in a Philips instrument.

SSU needs in-house research capability to keep our faculty sharp, attract new faculty, and interest today's students. An Environmental SEM with EDX will be of use here over a broad range of disciplines. Biology, Geology, Physics, and Chemistry all stand to benefit. This unit nicely complements our existing X-ray powder diffraction instrument, which measures dimensions on the order of 0.1 nm. With this addition we too will have modern microanalysis capability.

I solicited bids for the XL-30-ESEM and for the EDX system. You say the price of $284,989 is the catch. Actually this price is lower than we were quoted three years ago for an instrument without water vapor capability. The computing power today is six to ten times greater. Help us find the funds. You will be proud of your alma mater.

Students Celebrate Rahimi Award

R. Allan Baker

The students of the 1999 Excellence in Teaching Award winner, Professor Saeid Rahimi, held an impromptu celebration in his honor and in appreciation for all he has done for them, by breaking into his Physics 114 lecture and disrupting it with a cake and a card. His students have long recognized Dr. Rahimi as one of the best teachers SSU has to offer and the award came as no surprise to them. Gathering in the Physics Study Room (Darwin 343) and going en masse to his lecture hall they surprised him amidst cheers and applause. To the delight of his Physics 114 students he had no choice but to postpone the day's lecture and take part in the festivities. This prestigious award was Dr. Rahimi's peers' way of acknowledging all he has done for the Department of Physics and Astronomy, and his students, not to be outdone, expressed their appreciation for the professor many of them consider their mentor, in a manner they felt would be remembered and appreciated. A fun and memorable time was had by all. Thank you Dr. Rahimi from those who value your efforts most, your students.

New Observatory Activities

Kevin Thomas

This semester has seen the SSU optical observatory move out of obscurity and back into use. Although bad weather caused two of the public viewing nights to be cancelled, there were several successful ones. Interest by new students is giving Dr. Gordon Spear, the observatory director, something he hasn't had in a while: a potential research staff.

Recently while at a late night study session for modern physics, the attending students all went out to the observatory to relax and learn about the stars. Despite a computer glitch with the automated telescope, the CCD imager captured a breathtaking image of the galaxy Messier 51 and its interacting companion. This was the first time many of the physics majors there had seen an astronomical CCD camera in action.

With clear skies and a new CCD camera, which totally eclipses the old one, about to be installed, this summer promises to be a productive one for the observatory. Research and public viewing are both scheduled for the summer months.

Stellar Year for Prof. Cominsky

In August 1998 Dr. Lynn Cominsky gave two invited lectures at the Stanford Linear Accelerator Center's Summer Institute on Particle Physics. Her lectures, which were reprised in October during the fall semester's "What Physicists Do" lecture series, were entitled "X-ray Emission from Compact Sources."

She also finished work on the paper "X-ray/Gamma-ray Observations of the PSR B1259-63/SS2883 System near Apastron," (Hirayama et al. 1999), which has been accepted by the *Astrophysical Journal*, and worked on another paper, "A Search for Aperiodic Millisecond Variability in Cygnus X-1," (Chaput et al. 1999) which was submitted to the *Astrophysical Journal* in December 1998.

In the fall Cominsky also gave lectures entitled "Weapons of Mass Destruction" in the War and Peace series at SSU and a public lecture to over 300 people in the Mountain Theater on Mt. Tamalpais, entitled "The New Gamma-ray Astronomy."

Throughout the year, Cominsky continued work on the Gamma-ray Large Area Space Telescope (GLAST) with collaborators at Stanford and Goddard Space Flight Center. In her role as Chair of the GLAST Public Affairs Working Group, she received $45,000 in grant funding to perform "GLAST Mission Concept Studies and Public Outreach." Work on this project has resulted in the release of the GLAST public outreach web site, which can be seen at: http://www-glast.sonoma.edu. The web site was designed and implemented by SSU physics student Tim Graves. GLAST may be launched in 2005.

Cominsky also helped write the Education and Public Outreach portion of the proposal to NASA MIDEX (medium-sized Explorer satellite) program entitled "Swift—Catching Gamma-ray Bursts on the Fly." This proposal describes plans for a satellite to chase gamma-ray bursts and observe their afterglows at other wavelengths. It has been awarded Phase A funding from NASA. Cominsky and her collaborators are eagerly awaiting NASA's decision for further funding. Swift is one of five missions competing for two flight opportunities, and if selected, could be launched in 2004. Cominsky will serve as Swift's press officer, if it is selected.

The most exciting satellite event of the past year for Cominsky, however, was the long-awaited successful launch on February 23, 1999, of the Unconventional Stellar Aspect experiment on board the ARGOS satellite. On May 4, 1999, the X-ray proportional counters in USA saw "first light" and will soon begin the scientific program, which consists primarily of studying time-variable X-ray emission from selected black hole and neutron star binaries. Cominsky has been a co-investigator on USA since 1991, working with Stanford's Particle Astrophysics Group and scientists from the Naval Research Laboratory.

In the spring Cominsky served as deputy press officer at the 193rd meeting of the American Astronomical Society, in Austin, Texas, and press officer at the AAS High Energy Astrophysics Division meeting in Charleston, SC. Cominsky organized all the press activities for the latter meeting, including briefings on the discovery of hypernova remnants, new results on black holes, and the discovery of exotic photon bubble phenomena in an X-ray pulsar. These briefings featured web sites designed and implemented by SSU student Tim Graves.

During the school year, Cominsky once again taught the popular Physics by Inquiry version of the Physics 210/209 sequence. Ably assisted by SSU physics student Allan Baker, this twice-weekly course features hands-on learning in small groups, and encourages students to think about physics as they investigate the properties of matter, magnets, electric circuits and kinematics. She also taught a special studies course to four students, who learned advanced techniques of astronomical and physical data analysis, along with some probability and statistics. And she served on the Board of Directors for the SSU Enterprises, Inc., the Executive Committee of the Stanford Linear Accelerator Center's User Organization and the Engineering Sciences Curriculum Committee.

Donations Help Out

Private donations have become essential to the programs of the SSU Department of Physics & Astronomy.

Donations are the sole support of the Department's two public programs, the "What Physicists Do" public lecture series and the Public Viewing Nights at the SSU Observatory; they fund the Horace Newkirk Student Assistantship; and they allow equipment purchases.

This year Flex Products, Santa Rosa, donated a monochromator, a spectrometer with a CCD detector, and an optical bench, valuable instruments which will be used in the photonics program. We thank Howard Day and Michael Noffe for facilitating these donations.

We are very grateful as well to the following cash donors since last year's newsletter:

David & Paula ('86) Bennett, Ronald R. Bleau ('79), Bert Brians, Charles & Judith Buff, Stephen & Elizabeth Bursch, Charles Carpenter ('88), Harold D. Chaney ('75), Marvin & Elfi Chester, Clover-Stornetta Farms [Gary Imm], Lynn Cominsky & Garrett Jernigan, Charles Daymond, Joanne del Corral ('83), Donald J. Farmer, Steven A. Grossberg ('92), Trudy Tuttle Hart ('91), Laurel ('83) & Steven Highland, James L. Hill ('71), Dale Houston, Kerry Ann King ('87), Valerie Leppert ('87), Janet D. Maisen, Francis V. Marshall, MAX Machinery Inc. [John Max], Charles & Norma McKinney, Bernard & Barbara Meyers, Jim & Melinda Moir, Monsoon Construction [Alex & Martha ('88) Hunt], Nadenia Newkirk, Evelyn Norton, Bill ('96) & Pam Oakes, Claude ('81) & Teresa ('84) Plymate, Duncan & Marion Poland, Robert & Bertha Rains, Linda Rarey ('88), Greg ('93) & Susan Sprehn, Joe & Eileen Tenn, Miriam Tobin ('90).

Donations may be sent to Dr. Duncan Poland, Chair, at the Dept. of Physics & Astronomy. (707) 664-2376. See http://www.phys-astro.sonoma.edu/PublicSupport. html for more information.

ARTHUR B. FLYNN II ('76) is a scientist and security team leader with the Dept. of Energy in Albuquerque. He earned his M.A. in security management at Webster University in 1992.

DAVID K. HAWK ('77) is a software engineer at Lockheed Martin in San Jose.

Angela Duprez Wins Newkirk

Angela Duprez has been awarded the third Horace L. Newkirk Student Assistantship. Angela manages to be an outstanding student while raising three children.

The holder of Associate in Science degrees in electronics technology and biomedical electronics technology, both from Napa Valley College, Angela decided to become a physics major after taking the first course from Prof. Saeid Rahimi.

The Newkirk Assistantship was endowed by his relatives and friends in memory of the retired physicist who attended "What Physicists Do" for many years.

Exploring Technology with Photonics Projects

Angela Duprez

The photonics group this year has been developing exciting new experiments and research projects in fiber optics, detectors, and lasers. Under the guidance of Professor Saeid Rahimi, the group has been working with new technology to enhance students' technical expertise. Two Lockheed Martin grants obtained by Dr. Rahimi provide student stipends.

Angela Duprez has been working on the development of fiber optic sensors through methods of light intensity measurements. By exposing the tip of a stripped fiber to different environmental conditions, such as variations in temperature and index of refraction, Angela has measured the changes in intensity of back-scattered laser light using an HP optical time domain reflectometer. She is studying the effects on the sensitivity of the sensor of modifying the fiber tip by means of etching and thin film coating.

Allan Baker is exploring the possibilities of designing various detectors utilizing the wave nature of light as a laser beam is split and propagated through fiber optics and recombined in an interference pattern. The present setup uses a Mach/Zehnder type of interferometer arrangement, which has increased stability and sensitivity over the Michelson interferometer. When one of the beam paths is stressed (by heat, pressure, mass, etc.) the interference patterns change. Allan has interfaced the Mach/Zehnder interferometer with LabVIEW, and has designed a virtual instrument that can detect the number of fringes as they pass a specific location on the detector. Allan and Dr. Rahimi will report their progress soon at a conference held by Lockheed Martin.

John Collins is the mechanical support for the photonics group and assists in the machining of parts, as well as producing mirrors of specific reflectance through thermal thin film deposition.

Henry Schafer is writing a user-friendly program using LabVIEW to control the HP Low Frequency Impedance Analyzer, increasing the speed and flexibility of the measurement process and increasing research productivity. According to Henry, an electrical contractor,

"The LabVIEW program can control and record more data from the instrument in seconds than an operator could record in hours. But there's also much more functionality. The data can be saved and recalled, graphed automatically on the computer screen or printed out. Many types of analysis can be programmed in, such as deviation measurements, averaging, statistics, etc. Use of the instrument also becomes clearer and easier by dividing the instrument into different screens that open only when they are relevant, color coding graphs and buttons, and making buttons and indicators only visible when they are necessary.

These exciting experiments are only samples of what can be accomplished by future students. Much work needs to be done, and more students are welcome to participate. With the ever-growing optics and telecommunications industry, there is an increasing demand for highly qualified and technically educated graduates. Some of the participants in these research efforts have been approached by some major local high tech industries for internships that could potentially lead to more permanent employment as engineers. The experience with SSU's photonics group not only helps students prepare for work in industry, but also gives them solid foundations in research technique for graduate school, and most importantly provides them with a great sense of scientific accomplishment.

From SSU to Nuclear Subs

Daniel Hogan, who will receive his B.A. in physics from Sonoma State University in May 1999, was recently accepted into the U.S. Navy's nuclear submarine officer program.

Dan will attend officer candidate school in Florida this summer and then enter the nuclear propulsion program, which is restricted to college graduates with degrees in math and science. He will study nuclear physics, chemistry, thermodynamics, electrical engineering, and reactor and core dynamics in Charleston, South Carolina and then work with nuclear reactors and submarines at two more schools. Finally he will be ready to operate the nuclear reactors on submarines.

The second winner of the Department's Horace Newkirk Assistantship in 1998, Dan came to SSU from UC Irvine, where he was an art major.

ROY W. HARTHORN ('78) is a building safety and code consultant in Santa Barbara. He recently published a book on methods for the temporary shoring and stabilization of earthquake-damaged historic buildings. He earned a master's degree in public administration at CSU, Northridge in 1994.

ALAN DeMARS ('78) is principal software engineer with Ericsson Access Products in Santa Barbara, where he works on remote access products. He received an M.S. in scientific instrumentation at UC Santa Barbara in 1980.

ALBERT PLAMBECK ('78, physics & music) is senior marketing manager with KLA Tencor Corp. in San Jose.

RICK KAMEN ('80) recently edited and published a book of heirloom stories by his father.

Showing that Physics is Fun

Kevin Thomas and Ed Ott

When someone asks us what we are studying, we proudly reply, "Physics." The most common reactions include widened eyes, a whistle of pity/awe, pained looks, and "Wow, you must be geniuses." Contrary to popular belief, the majority of us are of average intelligence. We simply enjoy learning how things work in the natural world. Why does lightning blow up trees but not people? If a laser used in surgery can cut through skin, why doesn't the laser in a CD player? How does the moon affect the tides? How do we measure the distances to stars we cannot even see without high power telescopes? How does cable TV work? These are questions we can answer by studying physics.

Recently we had the opportunity to give a presentation to a group of junior high school students on how physics is fun. Armed with a battery of cool physics toys borrowed from department technician Steve Anderson, we met with what looked like a herd of sleepy cows. But when we brought out our first demo, we had our students' attention for sure.

Mechanics is the best place to start, because it is the basis of motion. From sports to cars, bridges to buildings, mechanics is the study of movement and change on the large scale. The energy and angle required to throw something over a specified distance is one example. How fast will an object free fall when dropped from any height? What is the maximum speed one can travel while rounding a curve? We used common sports situations like baseball and hockey to illustrate these concepts.

We explained the simplicity of waves in terms of sound. Using a long metal wire slinky and a tuning fork, we explained the Doppler effect and produced sounds that someone in another room would have sworn were the sound of shots from a Star Wars Blaster. Our audience's enthusiasm was beginning to show; it looked like the force was with us.

Although their interest waned when we started on light, all it took was a laser to regain their attention. It's amazing what a little chalk dust and some scattered photons can do. They were impressed by our retroreflector, a device similar to one which allowed scientists to measure the distance to the moon with reflected laser light, and our flashlight demonstration of how a laser actually works. But their real enthusiasm was evident during the next part of the presentation.

The audible crack of a stun gun is a great attention-getter when speaking to kids, and it made a wonderful segue into the topic of electricity and magnetism. We showed them the power of a Jacob's Ladder by torching some paper with the spark of electricity, and the effect of a magnet on a beam of electrons. The students could see that despite the fact that the electron beam looked just like the laser, a magnetic field changed its path, whereas the magnet did nothing to the light of the laser beam.

We ended with a question and answer period and (of course) a gratuitous plug for the study of science, telling the students what exciting breakthroughs the future holds, and that any of them could be a part of it. We emphasized that they shouldn't worry about the difficulty of learning the math and other such things right now as these concepts can be learned later. The study of physics unlocks the door to an exciting world waiting for discovery.

What Physicists Do

Michael Grzesik

The 56th and 57th series of SSU's "What Physicists Do" public lectures brought another year of fine speakers. The topics spanned the entire history of the universe, ranging from Dr. Andreas Albrecht's (UC Davis) talk on the initial conditions of the universe to Dr. Stan Williams' (Hewlett Packard Laboratories) lecture on the future of physics and chemistry in building the next generation of computers.

The fall semester of 1998, directed by Dr. Lynn Cominsky, featured several talks on astronomical topics including two related to the search for extraterrestrial intelligence. One of the most compelling lectures, "Quantum Whistles From Superfluid Helium-3", by Dr. Richard Packard (UC Berkeley), discussed how he and his students investigate the mysterious properties of Helium-3 and what has been learned through his experiments.

The spring semester of 1999, directed by Dr. Joe Tenn, brought a very interesting and diverse group of speakers. Dr. Donald Aitken (Union of Concerned Scientists) spoke on the future of renewable energy. Dr. Aitken gave much insight on the political and economic issues which need to be addressed in making the transition from petroleum-based energy to renewable forms. His talk included discussions on solar cells and electric vehicles. Dr. J.C. Séamus Davis' (UC Berkeley) lecture, "Imaging of Quantized Vortices in High-Temperature Superconductors," described how scanning tunneling microscopy was used to study different materials and how a new understanding of these materials could bring changes in electronics and power transport.

The "What Physicists Do" lecture series has been continually providing lectures on the most current developments in physics and astronomy since 1971. The series has had eleven Nobel Prize winners as well as many other notables in the physics and astronomy community. The lectures are intended for the general public and bring audiences from many disciplines other than physics. The series has grown in popularity with students and has many regulars from the community who have been attending weekly for years. The fall 1999 series, which will be directed by Dr. Lynn Cominsky, resumes in September and promises to be another semester of of excellent talks.

DAVID GOLDKIND ('82) is a high-tech manufacturing consultant in Grass Valley. *Due to the thorough background starting at SSU I was able to attain the senior staff engineer position [at Spectra-Physics] with only a B.A.! I owe a great deal to SSU for the personal attention, fantastic instructors and quality classes which allowed me to be competitive with others with higher degrees.*

JACQUES SCHLUMBERGER ('82) is president of Michel-Schlumberger Benchland Wine Estate in Healdsburg. He and his wife, Barbara, also an SSU graduates, recently donated $1 million toward the construction of the new music center at SSU.

SPS Has Great Year

Tim Graves, SPS President

The SPS has had an incredible year. It started out with a field trip to the Lawrence Berkeley National Laboratory, where we saw some of the latest uses of x-ray synchrotron radiation at the Advanced Light Source (ALS), and learned about its many applications.

After spending the afternoon at the ALS we paid a visit to the UC Berkeley Space Sciences Laboratory. There we learned about the new 10-meter antenna for receiving data from several of the research satellites that are going to be put into orbit around the first decade of the 21st century. We were also given a tour of the High Energy Solar Spectroscopic Imager (HESSI) facilities. We saw a demonstration of SatTrack, a program that enables the group to track over 50,000 different objects that are orbiting the earth. This program can track objects that are on the order of 10 cubic centimeters. After seeing the software and data analysis facility that HESSI will utilize, we took a look at the detectors that will be used on the spacecraft itself.

As part of our public outreach objective the SPS sent two representatives to one of the local junior high schools to give the students a taste of what physics is all about. One of the students there was quoted as saying, "I never thought physics could be so much fun." The SPS intends to take this message of real world physics to some of the other schools in the area.

In the spring we took a trip to Six Flags Marine World to perform some amusement park physics. We spent the day experimenting with gravity on rides that can accelerate you up to 6 g's. We used a makeshift accelerometer and some video recordings of the ride to measure some of the physical processes that the riders are undergoing.

In May we celebrated the end of the academic year with a grand party hosted by Dr. Saeid Rahimi and his wife. The evening was filled with good food, soccer, and lots of laughs.

It was a good year for the SPS. Our attendance for club events increased by a factor of three and our majors are really becoming a close-knit group of friends. Hopefully next year will be just as great.

Local Industry Attractive Choice for Physics Graduates

R. Allan Baker

You are a recent graduate from Sonoma State University in physics and you really don't want to move out of the area. What options are available to you? It may surprise you to discover that the telecommunications industry is thriving right here in our own back yard. Sonoma County is no longer acclaimed only for its wine and scenic redwoods but is fast becoming a leader in telecommunications, electronics and optics.

In Santa Rosa, Optical Coating Laboratory, Inc. (OCLI) is the world's largest independent manufacturer of optical thin film coated components used to manage light. OCLI's products can be found in computer monitors, displays, telecommunications systems, photocopiers, projection imaging systems, satellite power systems and aerospace and defense systems.

Flex Products, Inc, OCLI's wholly owned subsidiary, designs and manufactures thin film coatings on flexible substrates using high vacuum roll-to-roll processes. Flex supplies critical pigments for use in anti-counterfeiting applications, energy-conserving window film, photoreceptor components for copiers, and light interference pigments for commercial paints.

Founded in 1939 by Bill Hewlett and Dave Packard in a garage, Hewlett-Packard (HP) is now among the top 20 on the Fortune 500 list. The second largest employer (after OCLI) of SSU physics grads, HP has plants in Rohnert Park and Santa Rosa. There are more than a dozen telecommunications firms in the county.

But, does an SSU graduate in physics have a real opportunity to land a career in one of these fast moving companies. The answer is a resounding "yes!" Many of our courses provide excellent preparation for careers in local industry. Some instructors even work there. Dr. Bryant Hichwa, head of Research and Development at OCLI, currently teaches the upper division optics class at SSU. Dr. Charles Carniglia, also at OCLI, taught the electricity and magnetism course at SSU last year.

These companies are growing rapidly and are actively seeking local graduates to staff engineering and research positions. The faculty and staff at SSU have a close working relationship with the leaders in local industry to help fill career opportunities with qualified graduates in physics. Many of these companies have paid intern programs that introduce undergraduate physics majors to the world of industry before graduation with the hope that they will stay with the company after graduation. Chris Addiego ('98) started with OCLI as a summer intern and stayed with them as an engineer after he graduated.

"I have found that having a broad technical background has allowed me to bridge the gap between hardware and software. It is relatively uncommon for people to have skill sets that merge the two. Staying current in the fast moving telecom and software fields is 'high maintenance' however." Clyde Underwood ('74) is a test engineer who writes software that tests the firmware embedded in HP's microwave test instruments. Clyde helped build the Very Small Array radio telescope atop Darwin Hall. Many of our graduates feel an allegiance to SSU for getting them started.

"We have quickly become a leader in active and passive thin film solutions for the telecommunication industry…" says Robert Lahaderne ('94), currently working on custom display products at OCLI. His department supplies conductive coatings for shielding and heater applications within the display industry. He works closely with Bill Oakes ('96).

Careers are available for our graduates who want to remain in local industry. Amy Weber ('97) says, "I am very happy here at Next Level Communications. I started as an intern in January 1997 and work on optics development and test within the hardware engineering department. I am challenged every day and enjoy my work." Willie Rodriguez ('97) went to HP, Cherie Copeland ('95) to Advanced Fibre Communications, Scott Rowlands ('86) to Alcatel, and the list goes on. Many SSU physics graduates find exciting and progressive careers in local industry.

FREDRIC BLAU ('83) is a songwriter and musician in Cleveland. His professional name is Johnny Quasar.

DOUGLAS McKENZIE ('83) is an applications engineer with Dillon Force Measurement in Santa Rosa. *My physics degree is perfect for my current position at Dillon. I am a problem solver!*

JOHN REINECKE ('84) is a technologist working with fiber optics at Optical Coating Laboratory, Inc., Santa Rosa.

MICHAEL BROWN BICK ('85) is a lab assistant, tutor, and graduate student in physics at San José State University.

BENJAMIN BURRESS ('85) is the Education and Public Outreach Coordinator for the Solar B observatory, to be launched in 2004. Based at the Chabot Science Center in Oakland, he was until recently head observer at the Naval Prototype Optical Interferometer Observatory in Flagstaff, Arizona.

MILTON HAGLER ('85) is a partner in VietCAD, the master reseller of Autodesk products in Vietnam.

JOHN REYNA ('87) is a software developer with Lucent Technologies in Naperville, Illinois. Formerly an accelerator operator at the Fermi National Accelerator Lab in Batavia, Illinois, he earned a second B.S., in computer science, in 1995.

DAVID MARSHALL ('88) is an information technology consultant at Humboldt State University, where he earned an M.S. in mathematical modeling in 1998.

KENNETH A. RITLEY ('88) is a postdoctoral researcher at the Max Planck Institute for Metal Research in Stuttgart, Germany. He earned his Ph.D. in physics at the University of Illinois in 1998 with research on single crystal thin films of the rare earth dysprosium.

DANIEL SWEARINGEN ('90) is a senior developer at C-call.com in San Francisco and the principal of PolyWeb Services in San Rafael. He earned an M.S. in physics at CSU, Northridge in 1991 and an M.S. in astronomy at Indiana University in 1997.

DAVID PIAZZA ('91) is a graduate student in science education at the University of Washington. He has taught physical sciences in Japan and at El Molino High School in Forestville since earning his teaching credential at SSU.

MARIE-CHRISTINE RAUDE-ROZET ('91) is teaching science in SSU's precollege program, helping manage her husband's catering business, and raising two children.

HARVEY HECHT ('92) is a system support analyst for Napa County.

WILLIAM C. OAKES ('96) is an engineer working on the manufacture of dielectric interference filters for the telecommunications industry at Optical Coating Laboratory, Inc., Santa Rosa. *While the courses at SSU offered a great deal of insight into the physical world, the problem solving techniques and methodologies that I learned have been most useful in my career.*

DAVID E. MILLER ('96, physics and mathematics) is a graduate student and teaching assistant in physics at Purdue University.

JOHN H. HAYES ('97) is a computer specialist with the High Energy Astrophysics Division of the Smithsonian Astrophysical Observatory in Cambridge, MA.

RODNEY G. LEE ('97) is teaching physics and integrated science at Marin Catholic School. He is also a student in SSU's teaching credential program.

JAMES SNYDER ('97) is an engineer at Deposition Sciences, Inc. in Santa Rosa. *The laser/photonics lab and semiconductor labs are applied to my work almost daily. The BA degree has served me well so far.*

CHRISTOPHER ADDIEGO ('98) is an engineer at Optical Coating Laboratory, Inc., Santa Rosa.

STEVEN BECERRA ('98) is a technician for Teleco in Ventura.