been eaten away by bugs. We collected our measurements and after a more extensive tour of the upstairs, bid our host goodbye and were on our way.

With measurements in hand, our next task is to model these cavities. To do this, I will try to construct one using several skulls from my own modest collection. I will attach a speaker and a microphone to the cavity. We can drive the speaker at a range of frequencies using a function generator. From this model, we hope to be able to see which frequencies are trapped in the chamber.

This will finish the research for me, I will be moving out into the world to find my place in the workforce. This opportunity to do research was one I never imagined possible. Working with a professor like Dr. Hichwa has been a highlight of my time here at Sonoma State. I am thankful for the opportunities given me by faculty, staff, and generous donors, and I encourage all the other Physics majors to explore them while they are here.

Everywhere we looked there were skulls!

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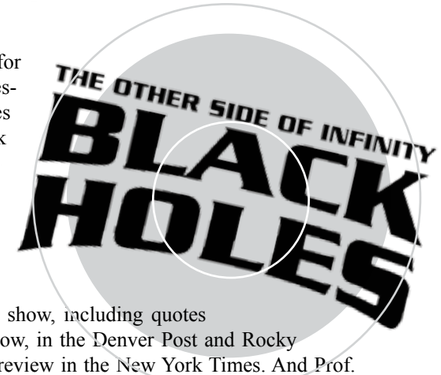
THE PHYSICS MAJOR

Department of Physics and Astronomy

SONOMA STATE UNIVERSITY

Physics &Astronomy Department in the News



This has been an exciting and newsworthy year for the Department of Physics and Astronomy. Professors Shi and Spear were both featured in articles in the Press Democrat that described their work in nanotechnology and the plans for the new Observatory at the Galbreath Wildlands Preserve, respectively. The NASA E/PO group helped to develop a planetarium show "Black Holes: the Other Side of Infinity," which premiered at the Denver Museum of Nature & Science in January, 2006. Many articles were written about the show, including quotes from Prof. Cominsky, science director for the show, in the Denver Post and Rocky Mountain News. The show also received a rave review in the New York Times. And Prof. Hichwa was a multi-media star, appearing in the Press Democrat, recounting his industry experience and how it inspires his teaching as well as being interviewed on NPR's "Talk of the Nation: Science Friday" regarding his work teaching and studying the physics of music. You can find the link to the NPR show by Googling "talk of the nation hichwa."

Department Begins Move Back into Darwin Hall Changes Ahead! - *By Prof. Lynn Cominsky, Department Chair*

After what has seemed like an eternity to most, but in reality was slightly less than two years, the P&A department, along with the rest of the School of Science and Technology, has finally begun the move back into the newly remodeled Darwin Hall. Life in "cubicle-land" was not fun, and students struggled to find their instructors, who were temporarily housed at the outer edge of the campus, next to the NASA E/PO building. It will all prove to be worth the wait, however, once students and faculty settle in to our new quarters. We will have two lower division teaching laboratories, named "Newton" and "Maxwell," each capable of holding 24 students. A complex of advanced laboratories will include dedicated spaces for the equipment newly donated by JDSU (see accompanying article by Prof. Hichwa), and many different types of coaters, evaporators and other equipment capable of creating new types of thin films. There will be an entirely new nuclear laboratory (see article by Prof. Dunning) and lab space for astronomical image processing, essential for analyzing all the data that will be coming in from our department's robotic telescopes.

Probably the biggest change will be the increased sharing of facilities with the Chemistry Department. Students from both departments will share a study room, faculty will share a conference room and work space, and the two departments will also share an Administrative Coordinator. Cathi Cari-Shudde, who has been supporting Chemistry and Geology during the past semester, will move to the third floor, to support the Chem and P&A departments, sometime during the summer. Welcome Cathi! We also extend our thanks to Gayle Walker, who has served as the Department's Administrative Coordinator for many years. Gayle will be taking over the Geology duties, and also will continue to support the Computer Science department. And last but not least, I will probably continue to chair the Chemistry department for one more semester, until the new chemistry faculty can get settled in, and a new chair can be appointed.

New Darwin Nuclear Lab

Major Gifts to Benefit Physics & Astronomy Department

By Prof. Bryant Hichwa

The Physics & Astronomy Department is the recipient of three major research and teaching tools. JDSU of Santa Rosa has donated an industrial scale thin film coating platform. In addition, they have also donated a tandem Van de Graaf accelerator. The accelerator is used in two configurations. The first is for Rutherford Backscattering Spectrometer (RBS) measurements and the second is Proton Induced X-ray Emission (PIXE) experiments. The University of Iowa has donated a Positron Emission Tomography (PET) scanner which will be used in combination with the Van de Graaf accelerator to spatially image very short-lived isotopes in a complex structure.

Van de Graaf accelerator - Rutherford Backscattering Spectrometer configuration

The thin coating machine will become part of the mainstay of Dr. Shi's and Dr. Hichwa's research on ferromagnetic and electrochromic thin films, respectively. We will have the ability to create innovative complex thin film structures with this machine. We will have the capability to thermally evaporate, e-beam evaporate or sputter these films. We will also be implementing a Chemical Vapor Deposition (CVD) deposition system which we acquired at auction several years ago.

The RBS machine will allow us to reverse engineer the thin films which are made in the coating machines. We will be able to determine film thickness, density and stoichiometry through the RBS measurements. With these instruments we will be able to deposit complex thin film layer structures and immediately measure what we have produced with the RBS system. The RBS will also allow a variety of collaborations with other universities and industrial partners to reverse engineer unknown thin film structures.

Dr. Hichwa has in the past used the PIXE capability to investigate a wide variety of material systems. PIXE allows us to measure trace elemental concentrations down to parts per million (PPM) and in some cases parts per billion (PPB). Some of the interesting studies have included 1) mapping out early Iron Age trade routes in the Middle East via measurements of unique trace metal content in iron pots as well as smelting debris from archeological digs and 2) determination of trace metal content in women's cosmetics (not so trace as it turns out).

The main use of the modern PET scanner is to provide functional information about biological systems. PET measures physiological function, while the MRI scanner provides anatomical (spatial) information. In our labs we will not measure true biological systems. We will instead use "phantoms" or mock-ups of biological systems.

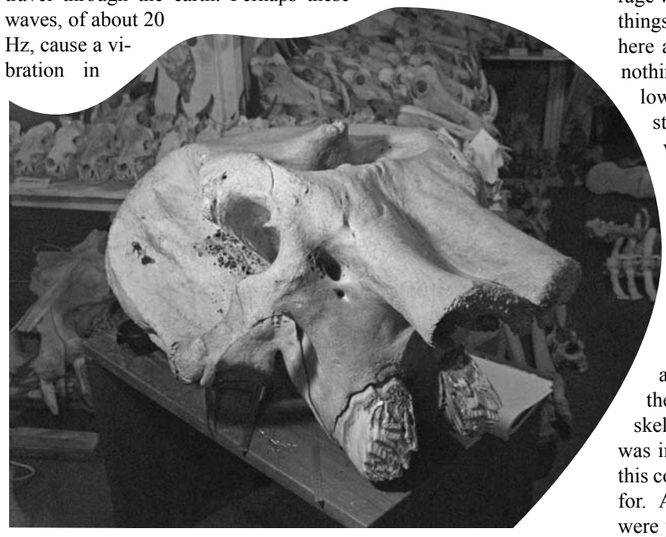
We are very excited about receiving these major gifts of modern state of the art equipment. We plan to incorporate these tools into our advanced laboratories and in some specialized cases into our introductory laboratories. Imagine an undergraduate education experience that will allow a student to get "hands-on" work with such tools. As we prepare students for the high-tech world of tomorrow, they need to be able to see physics applications in medicine, semiconductor and ferro-magnetic materials, optical thin films, lasers and photonics. This equipment will provide a strong base to achieve these goals.

Physics from an Elephant's Ear

By Daniel Nicholas, Newkirk Assistant 2006

I never thought I would spend my last semester as a Physics student peering inside the cavities of an elephant's skull but that is precisely where I found myself. There I was, on the second level of a three-level basement, in an old stucco neighborhood of San Francisco. I was surrounded by thousands of animal skulls, plus the occasional human skull. Mini-mag in one hand and calipers in the other, with my nose 2 inches from the bone; I went about my work. Not sure what I am doing? Well, let me go back to the beginning, where it all started.

As an underemployed husband and father of two, I am always on the lookout for additional revenue streams with which to bankroll my less-than-lavish lifestyle. After speaking with Dr. Hichwa, I submitted my application for the Horace Newkirk Assistantship and to my great pleasure, out of the thousands of applications, mine was chosen for the spring award of 2006. And so began the journey that brought me to that clean, well-lit, very well organized, but a little morbid, basement in San Francisco. The focus of my research would be the acoustics of elephant hearing with a focus on the resonant properties of sinus cavities found in an elephant's skull. The impetus for this research came from Dr. Hichwa's trip to Africa. There he saw and photographed an old elephant skull. In the photo, you can see that under the top plate there is a honeycomb of small chambers leading deeper into the skull. He speculated that these cavities are Helmholtz resonators that the elephant uses to filter communication from other elephants. Other research has shown that elephants have the ability to communicate over great distances by emitting low frequency waves that travel through the earth. Perhaps these waves, of about 20 Hz, cause a vibration in the elephant's bones which then is transferred to the cavities. The cavities could filter out the background noise, leaving intelligible elephant speak, and just like that, we have it. Next we publish, then press junkets, dinners with heads of state, a lecture series….. but I get ahead of myself again.



Former zoo elephant with tusks and lawer jaw removed

My first task was to estimate the size of cavities needed to filter out all but the frequencies emitted by the elephants. Using the classic formula for a Helmholtz resonator I manipulated it to solve for the chamber volume. From these early estimates we decided that it was worth moving on to the next step. Dr. Hichwa made an appointment with the California Academy of Sciences in San Francisco so that we could measure the cavities in their elephant skull. We arrived and were shown up to the sixth floor where, under the watchful glass eyes of an 11-foot-tall bear, we unpacked the skeleton. We soon had the skull out and on the floor; to our great disappointment the skull was in very good shape. Remember, the one in the picture from Africa had the top plate missing. This one only had a few small holes in it. After additional time to study the skull, we found that we could use a thin wire and a flashlight to probe the holes and thereby get our measurements. Satisfied with our initial measurements we packed up the pachyderm, thanked the caretaker of all the dead animals, and went on our way.

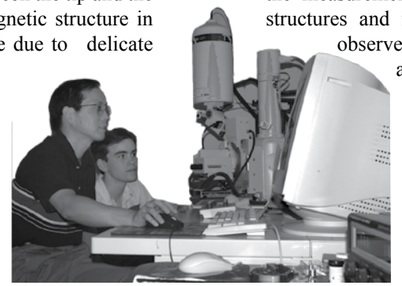
A few weeks later we went back to San Francisco to look at another skull. This one belonged to a private collector, a retired biology teacher with a passion for rattlesnakes. Now we were told this fellow had a large collection of bones but no description could have prepared us for what we were about to see. We entered the house and were shown a large collection of African artwork. We were led down into the garage which was dark and cluttered with all manner of things. All through the house we had glimpsed bones here and there, the occasional gator skull or horns, nothing really bizarre. Then we arrived two floors below the entry level, the lights came on and we were struck by the image of ivory on blue. Everywhere we looked there were skulls. In front of me, on the floor, there were the leg bones of a giraffe; sitting next to them was the skull. Off to my left, I found all the monkeys. From the floor to the ceiling, there were skulls. Every inch of wall space had shelves built to hold the collection. Tables along the walls with shelves underneath held more. There was even row upon row of sea lion skulls sitting on shelves attached to the floor joists above, hundreds of them in all. Among the collection were many snake skeletons, expertly rebuilt to display the snake as it was in life. Truth to tell, my words cannot describe this collection adequately, that's what the pictures are for. Among these bones we found our elephant and were pleased to see that some of the outer bone had

Magnetic Force Microscope in the Keck Laboratory

By Asst. Prof. Hongtao Shi, Keck Laboratory Director

As magnetic devices such as computer hard drives have become smaller and smaller, an evaluation technique with nanometer (1 nm = 10^{-9} m) scaled spatial resolution has become necessary. To meet this need, the magnetic force microscope (MFM) was developed about 15 years ago. The MFM is a close relative of the atomic force microscope, using a magnetic probe instead. The long-range magnetic interaction between the tip and the magnetic sample can reveal the magnetic structure in the sample down to nanometer scale due to delicate piezocrystals in the microscope.

The Keck Laboratory acquired an Atomic Force Microscope a few years ago from Pacific Nanotechnology. In the past few months, we've been testing magnetic tips and different magnetic samples. The fact that no sample preparation is necessary and that a high lateral resolution (~ 50 nm) can be reached make it a powerful tool for investigation of sub-micron magnetization patterns, in addition to other existing characterization techniques in the Keck Laboratory, such as X-ray diffraction and the scanning electron microscope. As we are moving back to Darwin this summer to make our own samples, it is possible to apply external magnetic fields during the measurement. The field dependence of domain structures and magnetic reversal processes can be observed. We can also separate topography and magnetic features, allowing pure magnetic images to be achieved. Topographic and magnetic details from the same scan can be related to each other.



Prof. Shi and Dakota Decker use the Scanning Electron Microscope in the Keck Lab

Interested students will have the opportunity to learn this technique, as this will be part of our experimental physics laboratory courses in the future.

Donations Make a Big Difference

Private donations to the Department of Physics and Astronomy play an important part in supporting our public programs, and our students. Donations from Nadenia Newkirk and from Michael and Sheila McQuillen again supported students doing research during the spring and summer. Many donors contributed to keeping the weekly "What Physicists Do" series going for the 70th and 71st semesters, allowing us to bring in several lecturers from outside the Bay Area. This year's "What Physicists Do" lectures, held in Schulz 3001 courtesy of the library, continued to attract crowds ranging from high school students to retirees. The series included several tributes to Albert Einstein as part of the World Year of Physics. Lawrence Badash of the University of California, Santa Barbara spoke on "Einstein the Peacenik," and other speakers discussed such Einstein-related topics as gravitational lensing, black holes, and the Gravity Probe B mission. Attendees heard the latest results of solar system exploration: Karen Meech of the University of Hawaii on Deep Impact, Chris McKay of NASA Ames on the Cassini/Huygens mission to Titan, and Donald Brownlee of the University of Washington on Stardust. The series also included SSU grads Jerilynn Schisser ('03) and Brooke Haag ('01), while Dr. John Dunning talked about his father's and his work with neutrons.

This year we thank the following donors:

Physics & Astronomy Public Programs: Richard M. Bell, Donald and Diane Farmer, Josh Fiden, Ed J. Le Du (Forestville Mini Storage), Francis and Patricia Marshall, Robert and Bertha Rains, David Gillett, James ('71) and Judy Hill, Richard Kidd, Kenzie and Frances MacInnes, Nadenia Newkirk, Joe and Eileen Tenn, Steve Wishny.

Physics & Astronomy Equipment & Supplies: David C. Munton ('82) and Wen-Hua Teng, Duncan and Marion Poland.

SSU Observatory: Jo-Ann and Joseph Smith, Teresa Bippert-Plymate ('84) & Claude Plymate ('81)

Physics & Astronomy Student Development: Mike and Sheila McQuillen

Physics & Astronomy Scholarship (endowment): Lynn Cominsky and Garrett Jernigan.

Science at Work Endowment (to support What Physicists Do): John Max (Max Machinery, Inc.)

Sol & Edith Tenn Scholarship: Joe Tenn.

John Dunning Retires

By Prof. Joe Tenn

After 37.5 years on the faculty at Sonoma State Professor John Dunning is retiring.

The son of a noted physicist, Dr. Dunning entered Yale University as an engineering major, but was greatly influenced by his summer jobs, the first as a technician's assistant at an aircraft company. He found physics easier than his other subjects, and he gravitated toward it, especially after working the second summer at Brookhaven National Lab.

The third summer he had a research fellowship at Yale, somewhat like the McQuillen summer research award at SSU. He ran the cyclotron and coauthored a paper in the Physical Review. After graduation he became a Carnegie Teaching Fellow, and taught at Yale for a year while earning his M.S.

Becoming intrigued by electron scattering, he chose Harvard, which was building an electron accelerator, for further schooling. Physicists there were in a hurry to get results with their new machine, so Dr. Dunning did an experiment scattering 6-Gev electrons off neutrons and wrote it up quickly, getting his PhD at age 27 in 1965. He then accepted a position as a lecturer at Harvard, teaching one course and continuing research in particle physics.

In 1967 Ambrose Nichols, the founding president of Sonoma State College, came recruiting for faculty. Dr. Dunning accepted but put off coming until finishing the experiment he was working on and seeing his three graduate students finish.

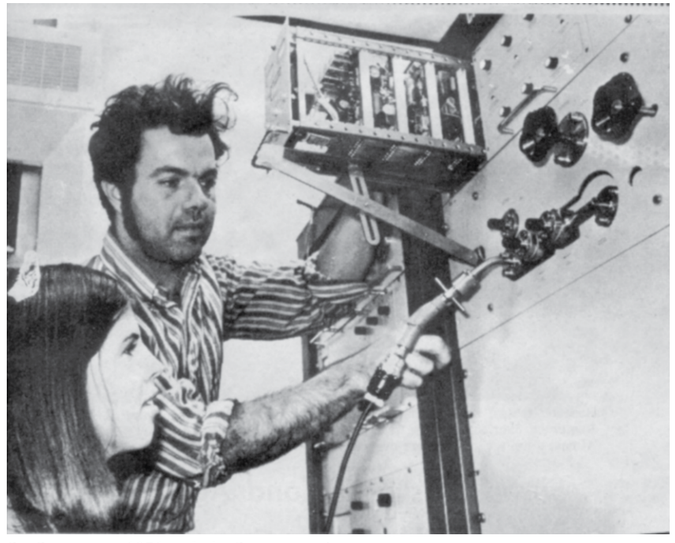
He arrived at the young college in Rohnert Park in January 1969, and found that "The buildings looked pretty stark, and the trees were small, but it was a dynamic campus. Sonoma County was beautiful and almost unpopulated. Funds were readily available for equipment, and there was a chance to build a new program."

Realizing that this was not a place to do particle physics he decided to switch to applied nuclear physics. For retraining he spent a summer at Los Alamos National Lab doing classified work while learning how reactors work and what they could be used for. Neutron activation was an important technique he brought back to Sonoma State. The Department got a neutron source free from the Atomic Energy Commission, and Dr. Dunning ordered detectors and started nuclear physics courses.

A later summer spent at Oak Ridge National Lab brought more experiments, including some wet chemistry, to the nuclear courses at SSU.

In addition to being a highly popular teacher of introductory physics courses, Dr. Dunning is most proud of the nuclear physics and x-ray diffraction courses he taught for many years and of obtaining and maintaining the equipment for them. He points out that the x-ray lab was a great success because companies also used it, and they paid into a fund to maintain and upgrade the equipment. In addition he learned just what was being done with such equipment in the industrial world and was able to teach his students techniques they would be able to use after graduation.

He is also very proud of Don Herriott, one of SSU's Distinguished Alumni in 2003. As a student in the early 1970s, Don helped set up the nuclear lab. He used a punched card computer to do the first computation of abundances of trace elements in a sample sent to a reactor for neutron activation.



Dr. Dunning in 1971 with the Department's new mass spectrometer.

Asked about today at SSU, Dr. Dunning replies, "We are adapting to the 21st century, and I am proud to be a part of it. Most significant to me was the coming of the Scanning Electron Microscope equipped with Energy Dispersive X-ray Analysis. We are using it to analyze samples from the Geysers with a geologist. I am also coauthor of a paper on Mars analogs from Australia, collected by geologist Kathy Benison of Central Michigan University." The two have never met; she saw the equipment on the SSU website, and contacted him.

Regarding the future, Dr. Dunning hopes to continue teaching somewhere. His parting words are "I appreciate the thirty-some years here, and I wish the Department well. I plan to leave the place with the x-ray and nuclear labs running."

Department Plans Major New Astronomical Observatory

By Prof. Gordon Spear, Observatory Director

The Department of Physics and Astronomy, in conjunction with the School of Science and Technology, has begun the development of a major new astronomical research facility. This facility will be used for advanced research and for instruction at all levels in astronomy, physics, engineering, and environmental maintenance. We are planning to establish a 1-meter class research quality telescope in the nature preserve recently donated to the University. This preserve, known as the Galbreath Wildlands Preserve, is located in an isolated region in southern Mendocino County. Sky brightness maps indicate this is one of the darkest regions in Northern California, and it is expected that the seeing should be quite good. However, because of the isolation, this will not be an easy observatory site to develop. There is no power, no phone service, and no roads except for a former logging road. Our model for the observatory is that it should be operable completely remotely using the Internet. It will not be necessary for anyone to be present while the telescope is functioning and collecting data at night. This is similar to the mode of operation for our smaller facility, GORT, in the Pepperwood Natural Preserve, which was developed and is maintained by NASA grants to

GORT Observatory

Dr. Lynn Cominsky. Our model also requires that the facility will be totally "off the grid" and will generate its own power using alternative means (most likely solar). It is also our intention that the observatory will be developed and maintained using the latest "green" principles for construction and energy management.

The project officially began this January with my appointment as project director. A technical working group consisting of myself, Tim Graves (NASA Information Technology Consultant), and Dr. Kevin McLin, has been meeting to define the technical parameters for the project. We plan to conduct site surveys to identify the location with the best seeing and meteorological conditions. Since much of the preserve is above 1500 feet, the costal marine layer fog is not expected to be a problem. Student Mark Wollam has designed and built a solar powered instrument shelter for our site survey instruments for his senior project. This system will be installed near the end of the spring 2006 semester and will begin recording data. We will also be directly measuring astronomical seeing using a portable telescope and CCD camera during the summer. Student Kevin John, who has been awarded, this year's McQuillen Summer Research award will be spending part of his time working on the site survey.

Prof. Spear and Tim Graves with the Site Survey Solar Unit for GWPO

This project promises to provide substantially enhanced capabilities for astronomical research for students and for future faculty. It is also our intention to make available substantial amounts of telescope time for K-12 students and their teachers who wish to engage in projects involving astronomy.

Through the generosity of the Galbreath family, and the efforts of Dean Saeid Rahimi, a matching donation of $700,000 has been provided as seed money for the project. However, substantial additional funds will be required through grants and further donations since the cost for a 1-meter class telescope itself is in the vicinity of one million dollars!

Please contact me, or any member of the department, if you might be interested in working on the project, or if you might be able to contribute in some way to the establishment of this major astronomical facility.

GALBREATH WILDLANDS PRESERVE OBSERVATORY

Astronomical Research with the 2005 McQuillen Award

By Ryan McDaniel

Last summer I had the privilege of doing research with Dr. Spear through the McQuillen Summer Research Award. Let me start by pointing out that the research that I did would not have been possible without this generous contribution made by the McQuillens. My research consisted of two major observing programs using the telescopes at the on campus observatory (SSUO) and the remotely operated telescope located at the Pepperwood Nature Preserve (GORT).

One part of my summer research involved collecting spectral data on Be type stars. This research was done using the department's new SBIG self-guiding spectrograph and new high efficiency ST-7 camera attached to the Mathis telescope at SSUO. Be type stars consist of mainly B class stars that have emission lines. The emission lines are caused by stellar activity including disk and shell formation around the rapidly rotating stars. By observing the changes in these lines, it is possible to indirectly determine how the star is changing. A total of fifteen stars were observed for this part of the project. Several stars showed obvious changes in the emission lines over the course of the summer observing season. Along with help from Dr. Spear, I also corresponded with an astronomer in Germany on observing and reduction techniques.

The other half of my research involved observing a poorly studied eclipsing binary system, AH Lyr. Few observations had been made of this system since the 1940s. Over the course of the summer, using the Epoch at SSUO and GORT at Pepperwood, a nearly complete light curve was built. This data included several primary and secondary eclipses, allowing for period refinements to be made. Analysis of the light curve is currently underway using computer simulations to derive physical characteristics for the component stars in the system. Assistance on this project came from Dr. Spear, Steve Anderson, and Tim Graves. David Rau, a history major with a great interest in astronomy, spent many nights observing with me.

There are many exciting research projects in the department waiting for willing students, especially in Astronomy. Anybody interested in doing research should talk to a professor as soon as possible!

AlumNotes

Jeff Kavanaugh *('94) is an assistant professor of earth and atmospheric sciences at the University of Alberta. Formerly a postdoctoral researcher in the department of geography at the University of California at Berkeley, he earned his Ph.D. in earth and ocean sciences at the University of British Columbia in 2000. His specialty is glaciers.*

Susan Milligan DeFelice *('98) is an estate and trust manager with Lifetime Advocacy Plus in Seattle.*

J. Scott Berry *('00) is a computer software engineer for Techrizon in Lawton, OK. He was formerly a graduate student and teaching assistant in physics at Oregon State University.*

"My advice to any students looking for a job in a technical field such as RADAR is to major in physics and take as many mathematics, electronics, and computer programming classes as you can…"

Sarah Silva *('02) is the program manager in the NASA Education and Public Outreach Group at Sonoma State University.*

Mark Loguillo *('03) is an Instrument Systems Scientific Associate at the Spallation Neutron Source at Oak Ridge National Laboratories. He was formerly a systems engineer with United Space Alliance working with hazardous gas detection systems in and around the space shuttle at the Kennedy Space Center.*

Tiffany Borders *('04) is a graduate student and teaching assistant in astronomy at San Diego State University. Formerly a telescope operator at the Very Large Array of the National Radio Astronomy Observatory in Socorro, NM, she worked at NRAO and also at the Hubble Space Telescope during summers while a student at SSU.*

Corey McCarthy *('04) is a pilot flying international cargo on Boeing 747s for Focus Air. He graduated from the Commercial Airline Pilot Training program at Embry-Riddle Aeronautical University in Daytona Beach, Florida in 2005.*

Tedman Torres *('04) is a graduate student and teaching assistant in physics at Arizona State University, where he is working on Single Molecule Fluorescence of Bio-molecules at the new Biodesign Institute.*

Marta Fuentes-Filp *('05) is a graduate student and teaching assistant in physics at the University of Iowa.*

Ryan Quitzow *('05) has accepted an assistantship in physics at the University of Oregon, where he will begin graduate school in the fall of 2006.*

Year's End, yo!
Year's End

By Logan Hill
NASA Education and Public Outreach Group

It was a wild and crazy year for the folks at the NASA E/PO; full of activities and fun for all. "Like, it was summer camp all squished into a full year!" exclaimed Sarah Silva, the group's project manager. "Totally," continued Dr. Plait, "it was totally awesome like camp, so awesome, only I didn't get poison ivy this time, which was awesome." The two giggled for several minutes before screaming out the names of several conventions that they or other members had attended over the course of the school year. "CSTA! NSTA! AAS!" they cheered. "AAS was so rad," they said in unison, "like, we totally kicked double A S," Silva continued, "Our workshops are the total best!" The American Astronomical Society's annual convention at the beginning of the year had been the largest AAS in the society's history, which may have contributed to the fun. In addition to going to AAS, Dr. Lynn Cominsky and Sarah Silva also attended the Astronomical Society of the Pacific's annual meeting last September, in Tuscon, AZ. "Arizona is so killer," Dr. Cominsky remarked, "the desert night is, like, super sick for star-peepin'!"

Dr. Cominsky is also currently the chair for both the Chemistry and the Physics & Astronomy departments, which has been a heavy work load, "like, the people are cool, but, it's like, you know, two jobs, on top of everything else."

This summer the E/PO group will be hosting their annual Educational Ambassador (EA) training here at SSU. There are 19 EA's, from all over the country, that will be attending the "Effective Professional Development Strategies: A Real Time Case Study" workshop. EAs from past workshops have remarked, "Dude! It totally blows your mind, teaching how to teach science! It's like buttered philosophy, thinking about thinking, you know. Totally righteous!"

Sarah Silva has been instrumental in organizing the EA workshops, testing her tutorials, activities and lectures at the many conferences she has attended throughout the year. "Like they totally don't know what they're, like, in for when they come to my workshops! They think they can, like, just sit back and watch!?" Ms. Silva replied to her own statements by cackling for several minutes and then pouring herself some tea.

In addition, the group will also be sponsoring the Physics in Music workshop, run by SSU physics graduate David Lapp (*'84*).

The group is also preparing for the launch of the GLAST satellite (Gamma-ray Large Area Space Telescope) next year, "It soooo needs to get into outer-space," Tim Graves the group's Instructional Technology Consultant said, "Outer-space! Wooh! GLAST rulez!" Graves also had traveled to the Los Angeles area to help construct components of the satellite last summer. He has also been instrumental in helping with the 1-meter telescope that is being planned to be built at the Galbreath Wildlands Preserve in Mendocino County. In addition, Graves has been working with Roseland University Prep High School students in teaching them about telescopes and astronomy.

Roseland University Prep was also donated a telescope and given a party at the Hume and GORT Observatories on the Pepperwood Preserve.

On a sad note, NASA cut the budget from the NuSTAR project, which was a satellite designed to study high energy X-ray sources in the universe. "It sucks," said just about every member of the group at some point. Funding from Swift and XMM-Newton are currently in the process of senior review, and the group will know the outcome of the review by this summer.

Phil Plait has continued to work on debunking the Moon Hoaxers through his website, Bad Astronomy, as well as through radio, internet radio, and conventions. "They're like worms, slimy icky thought-eating worms! [Moon Hoaxers] just keep reproducing their crap asexually and I'm the boot to stomp it out," Dr. Plait remarked while cleaning the bottom of his shoes with a 20 GW laser.

In real big news, planetarium big, "Black Holes: The Other Side of Infinity" premiered at the Denver Museum of Nature & Science in January. It is an epic show, detailing the lives and times of black holes. Liam Neeson narrates and the Science Director and Consultant were Dr. Cominsky and Dr. Plait, respectively. "Black holes," Dr. Plait said to which Dr. Cominsky replied, "hmmmm, black holes," after which both blankly stared off into space, deep space.

On the group's attractive side, Aurore Simonnet designed the logo for the Galbreath telescope. In addition she is working on updating the Newton's Laws posters and an Active Galaxy pop-up book. A Swift (bird) model plane and her GLAST card game have been finally published. "Thanks," she said in response to compliments about her work, "Art is the only thing that keeps these [the E/PO] people sane," which hasn't stopped her from putting up simple locks and traps around her cubicle.

As the school year comes to a close, the group bids a sad farewell to the Physics & Astronomy Department, which will be moving from its temporary location next door to the E/PO group's secret location and back into the newly renovated Darwin Hall. "They're going where?" exclaimed Mr. Graves upon learning that they were moving back, "let me get my nail gun, let's see those partiers go anywhere after I'm done with them!"

As a final note, the group has welcomed a new member, Laura Chase, into its fold. When asked how she is enjoying her new job she simply replied, "Well. They are a little strange here, they steal refrigerators from astronomers you know." In addition, the group is planning on hiring long time student Logan Hill as a full time member once his degree is completed this spring. The only comment Ms. Silva had was, "Like, sure. He'll do." When asked for a response, Mr. Hill simply smiled and said, "Of course I'll do fine, I've got dirt on all of them."

Note: Only the author was hurt after writing this article and none of the above quotes were actually used by any of the people said to have said them. Though if they did talk like that, that's just about what they would have said.

http://epo.sonoma.edu

AlumNotes

Norman Basham *('85) is a senior software architect at Information Builders, Inc. in El Segundo, CA.*

Jon M. Jurgovan *('85) is a senior patent attorney and partner in the Intellectual Property - Electronics and Computer Technology Group of Alston & Bird LLP in Atlanta. He earned an M.S. in electronic engineering at California State University, Fullerton and a J.D. at Washington & Lee University in Virginia.*

"As a patent attorney, I use what I learned at SSU nearly every day. My SSU education in physics covered the fundamentals of mechanics, optics, electromagnetism, quantum physics, computer programming, etc., all of which are relevant to understanding and protecting inventions in the diverse fields in which I work. My SSU physics degree has helped me immeasurably throughout my career."

George Amorino *('86) is an assistant professor in radiation oncology at the University of Virginia , where he does research in the radiosensitization of prostate cancer. He earned his Ph.D. in cellular and molecular radiobiology at Colorado State University in 1995 and his M.S. in biomedical engineering from California State University, Sacramento in 1988.*

Mary Stowell *(formely Howland) ('86) is optical engineering manager at Signet Armorlite, Inc., a manufacturer of ophthalmic lenses in San Marcos.*

"Those time consuming lab classes turned out to be extremely important."

Valerie J. Leppert *('87) is an associate professor in the Division of Engineering and director of the Foster Family Center for Engineering Service Learning at the University of California, Merced. She earned her Ph.D. in materials science and engineering at Northwestern University in 1994.*

Katherine Rhode *('89) has accepted a position as assistant professor of astronomy at Indiana University, to start in 2007. Currently she is an NSF Astronomy & Astrophysics Postdoctoral Fellow, dividing her time between Yale University, where she earned her Ph.D. in astronomy in 2003, and Wesleyan University, where she earned an M.S. in astronomy in 1997.*

Bill Kobabe *('90) is pursuing a teaching credential in the CalState TEACH program while teaching at the SunRidge School in Sebastopol.*

Fausto Morales *('90) leads the data mining unit at the Global Payment Systems Division at Grupo Santander banking group in Madrid, Spain. He earned an M.S. in physics at the University of Michigan in 1991 and an M.S. in mathematics at Bowling Green State University in 1993.*

"The greatest benefits from my physics background at SSU have been the solidity and versatility of the education I received."

Applied Nuclear Poised for Darwin Return

By Prof. John Dunning

Gamma detection will prosper. This spring in temporary quarters, our high resolution Germanium gamma ray detector was put to good use analyzing particulate air samples and observing natural uranium spectra in the Hot Luggage Laboratory. Here we used an improvised lead brick chamber that yielded only a 3/1 room background rejection for the 1461 keV gamma of K-40. Many of these gammas came from the floor, and we could not support lead shielding in that direction.

Much more lead is coming back from storage to the new Darwin Radioisotope Laboratory. Steve has already planned a portion of a new bench top to properly support 10+ cm of lead surrounding the detector. We hope to exceed the 13/1 background rejection previously enjoyed in the old Darwin 10. Superior low level gamma counting will again be routine.

The familiar green glove box and a modern hood will be present. This will reenable our ability to receive neutron activation samples from a reactor. The Hot Hair experiment familiar to many of you can be undertaken by a new generation of students.

Beth Harmony using the Germanium Gamma-ray detector

The arrival of the JDSU-donated linear accelerator will vitalize our capability to produce short half life radioisotopes for study. For example, the ^{23}Na (d,p) reaction produces the same ^{24}Na (15 hours) that we used to obtain via neutron activation. Pair production from the 2754 keV decay gamma is detected by the presence of 511 keV gammas and by both the one escape (2754 – 511) and two escape (2754- 1022) peaks in the gamma detector. Actually measuring these events will continue to excite future students.

Beta detection will receive a huge boost. Our new Beckman series 6500 beta counter system will be installed, and introductory liquid scintillation counting can again be a part of our curriculum. This counter has a cosmic ray rejection system based on pulse shape which facilitates low level beta counting of environmental water. Water from deep underground wells will be among the early studies. The pulse shape system also facilitates alpha counting on the same samples. We share this instrument with Dan Crocker in Biology. This proximity will help our students to become more familiar with the use of radioactive tracers in biochemistry.

AlumNotes

Keith Waxman *('90) is an instructor of astronomy at Santa Rosa Jr. College, at SSU, and a lecturer at San Francisco State University, where he earned an M.S. in earth and space science in 1994.*

"I teach some of the same principles that I learned from my SSU physics education. My education was invaluable to my teaching career."

Andrew Peri *('91) is teaching part-time in the department of geography and human environmental studies at San Francisco State University, where he earned an M.A. in 2005.*

Raymond Ubelhart *('91) is a lead electro-optical systems engineer for QuickSet International, Inc. in Illinois. He earned an M.S. in computer and engineering science at SSU in 2004.*

Matt Davis *('93) is now chair of the science department at Santa Rosa High School, where he has been a physics teacher since earning his credential at SSU.*

"The great diversity of situations where I had to learn new computer based skills (Unix, VMS, DOS etc.) at SSU helped prepare me to learn new computer skills in my position as a high school physics teacher. "

Holly Jessop *('93) is a graduate student in tropical conservation biology at the University of Hawaii at Hilo, specializing in marine invertebrates and coral reef ecology. She formerly worked in the Education and Public Outreach program of the Chandra X-ray Observatory at the Smithsonian Astrophysical Observatory.*

Paul Somerville *('93) is a partner in MojoJava, a combination Cafe/Motorcycle shop in San Francisco.*

"I use lab technique every day in my motorcycle shop."

Moly-Ti Filament Dislocations

By Steve Anderson
Department Equipment Technician

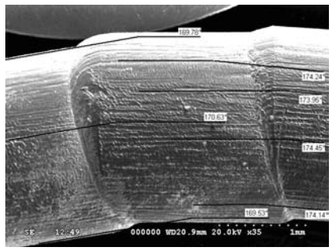
It has been a fun semester to work in the Keck lab, with Prof. Hongtao Shi, Prof. John Dunning and the SEM. They have been teaching P-366 intermediate physics lab in Salazar during the Darwin remodel. Dr. Dunning is running the gamma spectroscopy lab in Carignane, then running back to Keck to use the x-ray diffractometer (XRD). Dr. Shi has done magnetic force microscopy (MFM) with the scanning probe microscope. They are both creative at making new lab experiments. Prof. Shi, as well as teaching electronics, conceptual and advanced classes, is working on the Darwin move-in and has a good eye for materials science.

Prof. Shi noted that a blown filament had odd segmentation, and thought it might be due to a lattice mismatch, not your normal tungsten filament.

Below is an image of the angle steps. We measured angles by tracking the ridges in the image processing application. The ridges had smaller ridges, etc. The angles can indicate the lattice mismatch between the two materials, molybdenum and titanium, similar to the strained silicon being grown on germanium by IBM, recently *http://www.research.ibm.com/resources/press/strainedsilicon/*

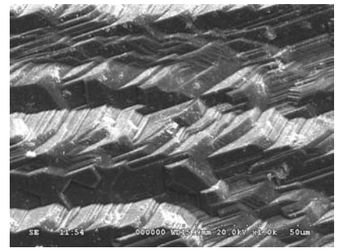
The strained lattice can affect basic material properties like the electron transport speed in the silicon.

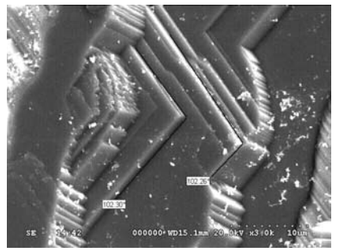
Like it has been for the past 20 years working with Prof. Dunning, it is great to be able to learn so much, so fast, working with the talented faculty here at SSU.



Filament dislocation angles

Filament ridge plates
(If you zoomed in to a black line on #1)





filament ridge plate step angles
(If you zoomed to a line on #2)

AlumNotes

Clyde Underwood *('74) is a quality assurance engineer with the electronic products and solutions group in the signal sources product generation unit of Agilent Technologies in Santa Rosa.*

"I'm certain that part of my success at HP/Agilent is due to my education at SSU."

Frederick Arioli, Jr. *('75) is a software integration and test engineer for the airborne laser program at Lockheed Martin Space Systems in Sunnyvale. For four years he worked on the software for the Spitzer Space Telescope.*

Zee Betty Hakimoglu *('75) is President and CEO of ClearOne Communications. Formerly vice president for product line management of Oplink Communications in San Jose, she earned an M.S. in physics at Drexel University in 1979.*

Mary Silber *('81) is a professor in Northwestern University's Department of Engineering Sciences and Applied Mathematics. She earned her Ph.D. in physics at the University of California at Berkeley.*

Keith Brister *('82) is a manager and senior research associate in the Life Sciences Collaborative Access Team at the Advanced Photon Source at Argonne National Laboratory. He earned his Ph.D. in applied physics at Cornell University in 1989.*

David Munton *('82) conducts research in the Space and Geophysics Laboratory of the Applied Research Laboratories of the University of Texas at Austin, where he earned his Ph.D. in theoretical physics in 1991. Currently he is project manager of a precursor to the Long Wavelength Array, a radiotelescope operating in the range 20-100MHz, to be deployed near the VLA in New Mexico.*

Timothy Finnegan *('84) is a self-employed tax consultant in Kansas. He earned an M.S. in nuclear engineering at the University of Wisconsin, Madison, in 1986.*