

Research Comes Into Focus

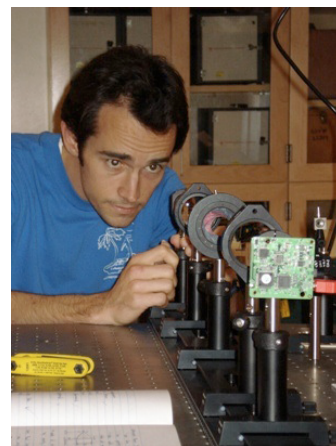
The SSU Department of Physics and Astronomy is dedicated to its students and to fostering a conducive and welcoming learning environment. The cornerstone of this philosophy is in having both faculty and student alike engaged in research. The remodeling of Darwin Hall was completed in August 2006, and since then the Department of Physics and Astronomy has been making the most of the new facilities. In addition to the SSU observatory, the Keck lab located in Salazar Hall, and access to off campus telescopes, four labs in Darwin Hall have seen tremendous development and use. Those four labs include a new High Magnetic Field Materials Science Lab, a new Adaptive Optics Lab, the Hall Measurement System, and the Thin Film/Sample Prep Lab.

During the 2007-2008 academic year fourteen physics majors worked on independent research projects in astronomy, optics, materials science, instrumentation design and control.

At the start of the Fall 2007 semester, the department welcomed Dr. Scott Severson and Dr. Jeremy Qualls. Armed with years of experience, the two have quickly started up independent research labs and incorporated SSU students into their work. In addition Dr. Hongtao Shi and Dr. Gordon Spear have continued to work with students, developing additional new infrastructure and research projects.

Scott Severson has enjoyed his warm reception as an Assistant Professor in the Department of Physics and Astronomy and has undertaken an ambitious program of teaching, advising, research and service. During his first year, he has taught courses in astronomy and astrophysics, founded a laboratory for astronomical instrument development, and directed the development effort of the proposed Galbreath Wildlands Preserve Observatory (GWPO).

Dr. Severson's research has focused on bringing cutting edge astronomical instrument development to Sonoma State University. He was awarded an \$85,000 grant from the Mt. Cuba Astronomical Foundation that will bring a cutting-edge adaptive optics testbed to his laboratory. Physics major Adam Dye is working with him on an independent study project, "The Development of a Prototype Adaptive Optics Testbed." They are investigating innovative methods to sense and correct the optical effects of turbulence in the Earth's atmosphere. Dye received a travel grant from the Undergraduate Research Grant Program and attended an advanced short course at the SPIE: Photonics West Conference.

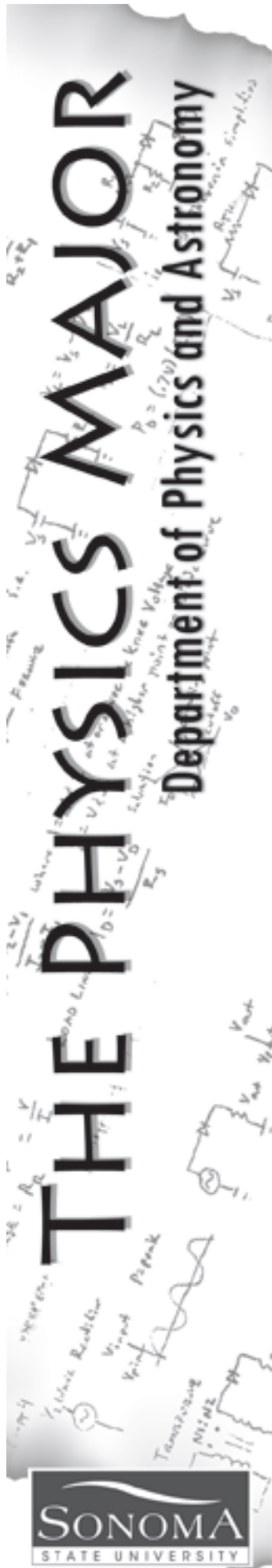


Adam Dye in the new Adaptive Optics Lab

Scott Severson has mentored Physics major Orion Leland in his capstone research project, "Development and Construction of a Fiber-Optic Solar Concentrator for High Flux Solar Cell Testing." This work, done in partnership, with local industry (Sol-Focus, Inc.) is complementary to the GWPO effort in looking for innovative solutions to solar power generation. Their work was featured in an article in the Santa Rosa Press Democrat (December 24th 2007) "SSU student boosting the power of the Sun". Orion also won a travel grant from the Undergraduate Research Grant Program and attended an advanced short course at the SPIE: Photonics West Conference.

Dr. Jeremy Qualls also joined the department this year, bringing with him almost half a million dollars worth of instrumentation as well as active funding from the National Science Foundation. Dr. Qualls' research is in materials science and novel electronic and magnet systems. Current research is centered on magnetism and properties of materials in the high magnetic field/low temperature regime.

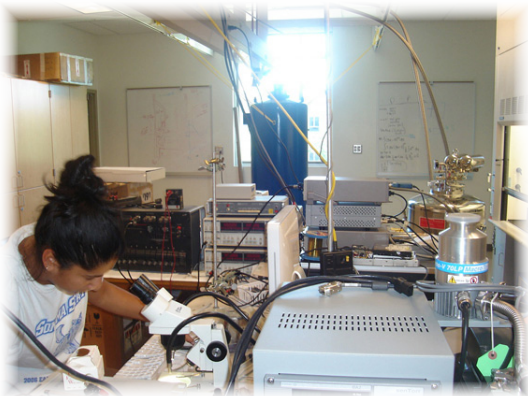
A 17-Tesla magnet system with helium recovery coupled with SQUID capabilities allows exceptional opportunities for researchers and is extremely rare for an undergraduate research program. The installation of the 17-Tesla magnet was not an easy task. Structural, electrical, and safety concerns all had to be addressed. The final component of the helium recovery system has been received and the magnet is scheduled to operate this summer.





A well equipped 17-Tesla superconducting magnet provides SSU many opportunities to explore basic science and expand our knowledge of electron transport and magnetization.

Dr. Qualls' research is focused on exploring new materials and understanding fundamental behavior of electrons in materials. Four Physics majors have joined Dr. Qualls in exploring a variety of problems. Josh Rose designed an uniaxial pressure device for applying pressure in situ inside the magnet system. After the design stage Josh was able to work with John Collins in the Darwin Machine Shop to build a prototype device. Patrick Brown, in collaboration with the University of Texas Pan American, examined a number of photonic systems based on a novel holographic fabrication technique. Pat was ultimately interested in controlling the photonic band gap and constructing active systems. Gabriela Sanz-Douglass did pioneering work on exploring the high temperature electronic properties of organic charge transfer salts and developed a high temperature testing station for future students. Dakota Decker designed and constructed a 2-axis cryogenic rotator.



Gabi making measurements in the New High Magnetic Field Lab

Dr. Hongtao Shi has continued to develop his existing labs and has four students working with him. Jeremy Dixon developed data acquisition software for the Auger electron spectrometer (AES) in the Keck Lab using LabView. One can now use this system to probe the elements in a sample near the surface, as this is a surface sensitive technique. They also fully tested the argon sputtering gun so that the thickness profile of a sample can be measured as well. Jeremy Dixon ('07) learned the antiquated language of Pascal in order to automate an old Hall measurement system donated by Agilent technologies. We can use such a system to measure the concentrations of impurities in a semiconductor, the sheet resistivity, and the Hall mobility at room temperature and at liquid nitrogen temperature. Magnetic samples can be measured to investigate how magnetoresistance changes as a function of temperature and magnetic field.

Ordered nanochannel array structures have recently attracted increased attention for the fabrication of nanodevices.

Zach Nuño ('07) and Alex McMahon ('07) participated in a project to fabricate self-assembled aluminum oxide arrays in Darwin 301. They used one-step and two-step anodization to make nanometer-scale nanopores which form a honeycomb structure. They are now inserting different materials into these nanochannels to form magnetic and semiconducting nanowires or nanodots. Different properties will be measured to show the dependence on the dimensions of samples. SSU students Charlie Granger and Kenneth Martinelli have also begun research in this area with Dr. Shi.



Nanopore creation in the thin film lab

Professor Gordon Spear has two current SSU students working with him as well as a former student.

Katy Wyman and Dr. Spear are using CCD photometry to study a few dozen semiregular variable stars (SRs) in great detail.

Dr. Spear is working with graduate Ryan McDaniel ('06) to analyze extensive data on the Algol binary AH Lyr as well as on Be Stars. For the binary systems they will be determining physical parameters such as period variation, radii, luminosities, orbital inclination, temperatures, and limb darkening for the component stars. For the Be stars they will compare changes in the emission lines with changes in the brightness or color of the stars. Unfortunately these objects tend to be too bright for ordinary CCD photometry using our equipment. They are hopeful that the techniques they are evaluating for planetary transits will be applicable for photometric monitoring of bright Be stars.

Important characteristics about extrasolar planets can be obtained for systems in which the planets transit across the star and produce eclipses.

Along with student Chris Johnson, Dr. Spear will be evaluating some special techniques this summer that should make it possible to successfully detect these transit events. They will be using the campus observatory (SSUO) and the NASA-funded telescope (GORT) at the Hume observatory in the Pepperwood Preserve.

Dr. Spear is also engaged in a study of the variability of blazars, distant galaxies with super-massive black holes at their cores. It is his goal to develop a classification system for blazar variability based on various statistical diagnostics. It is expected that much more blazar data will become available from the Gamma-ray Large Area Telescope (GLAST) space observatory. This work is being done in conjunction with the Global Telescope Network (GTN) established and managed by the NASA E/PO group.

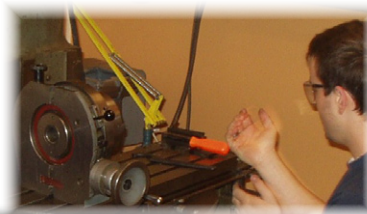
We Have a Machine Shop!

By John Collins ('03)

No job too small, or too big for the NEW SST Design and Repair Center. The recently formed School of Science and Technology's Design and Repair Center is now serving all departments in the SST. The center is located in room 20 Darwin Hall at the west end of the basement right across from the elevator. Students and faculty are welcomed, they can help design and build devices for research and student projects. Recent projects include: a sample gimbal for Dr. Qualls' superconducting microscope, detector housing for Dr. Nielsen in Biology, and a sample strainer for Dr. Shi to aid in his nanopore project. Recently we modified a stir plate to function more appropriately in Dr. Shi's work.

As the name implies we do repairs. In Geology we have helped by repairing line cords frayed from years of use. In Computer Science we came up with some brackets for securing racks for servers. Take a look at your property items listed as "broken"; we can help in the budget crunch by repairing what you have.

Go down to room D020 and take a tour, see the Bridgeport knee mill, the South Bend lathe and find out how they can help in your research or senior project.



Dakota Decker makes sure everything is aligned just so.

*If you get a chance, talk with the professors and students about their research.
Tours of the labs and facilities are available and welcomed.*

ALUMNOTES

Roberto Ramirez ('72) teaches mathematics and physics at Windsor High School. In 2008 he added another to his large collection of honors when Harvard University awarded him its Singer Prize for Excellence in Secondary Teaching.

Zee Betty Hakimoglu ('75) President and CEO of ClearOne Communications in Salt Lake City, won Frost & Sullivan's 2007 Audio Conferencing CEO of the Year award.

Peter Conwell ('76) is an assistant professor of physics at Westminster College in Utah. He earned his Ph.D. in computational physics at the University of Utah. He writes, "I try to do with my students what you did for us—help them, nurture them, but hold them to a high standard."

Scott Anderson ('78) is the editor and primary author of *Science for People*. He has written several books on computer graphics and animation. His latest book is *Human*

Embryonic Stem Cell: An Introduction to the Science and Therapeutic Potential, coauthored with Dr. Ann Kiessling of Harvard University. He writes, "The entire philosophy of physics is instrumental in almost everything I do. The scientific method is crucial to all my work (even programming and writing) and the world would be a better place if more people understood it."

Dennis Goodrow ('78) is vice-president of software development at BigFix, Inc. in Berkeley, a company that creates and sells software and services that allow large organizations to have real-time visibility and control over their desktop, mobile, and server computers. He writes, "A physics background provides a foundation and perspective that allows one to approach and contribute to most technical subject areas. I've used that foundation to build a career in software engineering."

Establishing Foundations

*By Profs. Scott Severson, GWPO Director,
and Gordon Spear*

The generous gift to Sonoma State University of the Galbreath Wildlands Preserve (GWP) and the associated observatory development funds have given the Department an extraordinary opportunity for the creation of an enduring resource for education and research. Administered by the School of Science and Technology, GWP consists of 3,670 acres of land sixty miles north of SSU in Mendocino County. The astronomical observatory (GWPO) will consist of an advanced robotic telescope that will run on power generated on-site through renewable energy technologies. Scott Severson has been active in shaping a large scale plan to design, fund, and construct this advanced facility. The proposed 1-meter diameter remotely-operable telescope is appropriate for projects requiring sustained observations over long time periods at a dark and remote site

Current work on the project is proceeding on several fronts. Environmental studies of suitable observatory sites are underway as are plans to enhance the preserve's roads in an ecologically sound manner. We are currently characterizing one site in particular to demonstrate the astronomical performance available at this dark location. A preliminary energy budget and solar power generation specification for the observatory have been completed with participation from the Department of Environmental Studies and Planning. Instrumental in this work were Sonoma State undergraduates Orion Leland and David Cranford.

The GWPO effort includes a plan to involve our students at every stage of development. When operational, student and faculty research will be disseminated to local K-12 schools in an effort to enhance student interest in the sciences.



As part of the Galbreath Wildlands Preserve Observatory project, we are evaluating the suitability of locations within the preserve for establishing a 1-meter class telescope. One of the most important characteristics of an observatory site is the stability of the atmosphere. This stability is termed astronomical “seeing” and is commonly measured in terms of the angular size of images of stars measured in arcseconds. Since stars are so extremely distant, they resemble point-like sources. Any stellar image size greater than the diffraction limit introduced by the telescope optics is a distortion introduced by the atmosphere. This distortion limits the resolution of any images and the ultimate precision attainable for observations. We have obtained a seeing monitor to measure seeing on a regular basis. However, preliminary evaluations on campus suggested that the monitor gave results that were not in agreement with our experience measuring seeing at our campus observatory (SSUO). We evaluated this issue with Ryan McDaniel ('06) by calibrating the seeing monitor results. We ran the seeing monitor on-campus at SSUO while simultaneously obtaining images of star fields with the Epoch 0.25-m Newtonian telescope. The seeing monitor is now calibrated against these data. This work is being prepared for publication. The seeing monitor will be installed at the Galbreath Preserve this summer to begin a study of the astronomical seeing at the proposed observatory site.



“The telescope will play an important role in astronomy education, including supporting authentic student research. The telescope will represent an enormous leap in the astronomical observing capabilities of our department.”

SPS Gains Momentum

By Aimee Santos, SPS Co-President

The Society of Physics Students, SPS, completed another successful year in multitudinous ways. The Stanford Linear Accelerator, SLAC, at Stanford University, was the students' first fascinating and inspiring trip of the year. Here, the students were informed of collisions of particles which are propelled to very close to the speed of light. The next get-together proved the close-knit relationships the students have with department faculty. Dr. Tenn and Dr. Shi had never played Wii up until the Halloween party, but they unforgettably achieved top scores, leaving students in awe. Both professors are now known as "Wii-Sharks."

Fundraising did not prove to be a concern for the SPS this year. The club profited from manuals made for physics laboratory courses, which provided for club expenses and travel. Numerous requests have been made for additional help with introductory physics courses, but unfortunately, lower division physics does not have Supplemental Instruction. In order to help resolve this issue, this past spring the ardent-natured physics majors provided free tutoring (donations gratefully accepted) on a biweekly basis for their fellow students. Many students have come to these free sessions taking the invaluable opportunity to get their questions answered.

The SPS became more involved in the community by putting on an educationally brilliant presentation full of mind-blowing physics demonstrations for the Sonoma County Office of Education's "Science Day." School children, ranging from sixth grade through high school, were briefed on topics such as angular momentum, virtual images, and waves. The show concluded with the colossal humming resonance of heated air which passed through a large tube.

A weekend camping trip to the Robert Ferguson Observatory concluded a busy year for the SPS. Star gazing with a 14-inch CCD-equipped telescope, 24-inch reflector, and 8-inch refractor complemented campfire s'mores and charred hot dogs. Astonishingly, the telescope was able to adapt to solar observations during the day.

Students interested in joining SPS should go to www.students.sonoma.edu/clubs/sps/index.shtml Prospective and current physics majors are encouraged to view the web-site for any news and upcoming events.

sit vis vobiscum.



This year's T-shirt design!



No problem too hard!



Tutoring session



Science Day



SLAC Trip

NASA E/PO Boldly Goes

By Chip McAuley and Professor Lynn Cominsky

<http://epo.sonoma.edu>

When someone tells you that the NASA E/PO team has been working faster than the speed of light this year, don't be so sure it's a physical impossibility. The group works daily on multiple projects supporting the educational and outreach objectives of key NASA high-energy astrophysics missions. From gearing up for the GLAST (Gamma-ray Large Area Space Telescope) launch, to developing a Supernova Educator Unit for classrooms, and even building a Supernova Toolkit for the general public and youth groups, the NASA E/PO group is reaching boldly into the cosmos.

Topping the list of NASA E/PO activities is preparation for the GLAST launch. The upcoming launch has mobilized the group to create an array of engaging and fun education materials to help teach students mission science and objectives. Team members have contributed to the following related projects: the GLAST Litho (one page, describing mission science and suggested student activities), a GLAST Fact Sheet (a four-page color informational brochure to be distributed at the launch), a paper model that can be assembled to make a mini-GLAST, and the GLAST Media Guide (the ultimate science writer's guide to the GLAST project and gamma-ray astronomy). Program Director Dr. Lynn Cominsky, Scientific Illustrator Aurore Simonnet and Science Writer

Chip McAuley, among other team members, contributed to these projects.

In January, Cali Calmecac, a predominantly Hispanic K-8 charter school in Windsor, had a grand opening of an after-school program that included a GLAST paper model activity, further getting these engaging science learning tools into the hands of students. This is part of NASA's commit-

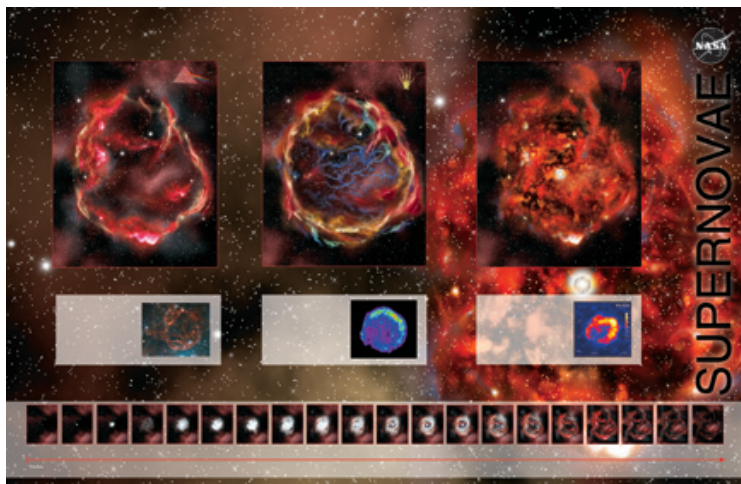
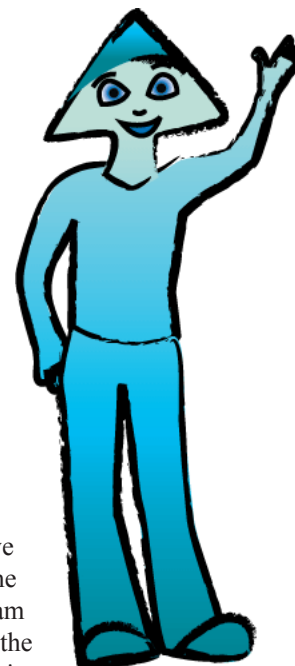
ment to reaching out to traditionally underrepresented student populations and assisting them into beginning educations and, eventually, careers in science. SSU grad Kevin John ('07), now employed in the group as the Educational Science Support Assistant, and Diversity Program Coordinator Dr. Ellie Galvez-Hard have been running a weekly after-school program with these students focusing on robotics and improving science skills. Meanwhile, if it's a satellite by any other name. . . well, it could be the GLAST Satellite Renaming Suggestion Box, which attracted 12,000 entries. While the popular press repeatedly referred to this renaming as a contest, it was really a chance for the general public from around the world to help contribute to the historic renaming of the satellite. After developing the website, the NASA E/PO Group put their heads together and provided input to the NASA naming committee about the best ideas. The selected name will be announced after launch.

Beyond GLAST, NASA E/PO has been working on a supernova of excitement. GLAST and XMM-Newton missions contributed to the recently completed Supernova Educator Unit, which can be downloaded from: <http://xmm.sonoma.edu/edu/supernova/>

This unit includes a 50-page comprehensive educator guide, expansion animations, supernova matching game cards and plenty of additional visuals to engage students. And for those still hungry for more, try the SUPERNOVA! Toolkit. This project was supported by XMM-Newton, Swift and GLAST through a contract to the Astronomical Society of the Pacific, which developed activities and resources to be used by members of the Night Sky Network, astronomy clubs and at other public venues where people like to look at big "explodey" things that while dramatic, happened in the distant past. Aurore Simonnet, GTN Director Kevin McLin, and Kevin John contributed to the supernova projects. The Swift-sponsored Newton's Law posters have also hit the streets at educational sites across the nation. You may have seen them at the Santa Fe Gamma-ray Burst Meeting, the California Science

PUBLIC OUTREACH

UNIVERSITY



tended by thousands of prospective students, and also supported the Expanding Your Horizons program for 8th grade girls by staffing the NASA booth. Likewise, Education Specialist Kamal Prasad's work with a weekly after-school club that encourages Roseland University Prep students to participate in STEM fields culminated with the students winning second place in the Agilent-MESA robotics competition this month.

Not to be missed is a forthcoming NASA E/PO webcomic called *Epo's Chronicles* about a sentient spaceship observatory and its humanoid companion Alkina, that uses real NASA science as they explore the universe. The comic, which features a fictional story line with both recent and classic scientific discoveries by supported NASA missions is an effort to educate the young and the young at heart in a creative and engaging way and will soon be available weekly on the NASA E/PO Website.



The comic is being developed by Kamal Prasad, Chip McAuley, Kevin John and Aurore Simonnet and is already being translated into Spanish and French.

Teacher's Association annual meeting, or at many presentations at the national and regional meetings of the National Science Teacher's Association.

And speaking of looking at stuff, there's Viewspace, where you can, literally, view space. Except it's on the second floor in the Schulz Information Center on a big HD screen sponsored by the NASA E/PO group. This 24/7 feed from the Space Telescope Science Institute brings dramatic images of the cosmos right to Sonoma State University. Watchers will see the best of planetary, space, and Earth science. . .all of it done by NASA. Highlighting the majesty and mystery of the universe, the ViewSpace exhibit helps not only to engage the sense of wonder, but inspires future scientists and space explorers.

In addition to staff members of the NASA E/PO team, students from the Sonoma State University Physics and Astronomy Department and other majors have been integral to the success of this year's endeavors. Working together, staff members and students form a bond that leads to even greater success. Students like Eric Lundy, Dakota Decker and Patrick Brown, Diamante Rueda and Sabrina Colias all contributed greatly to NASA's education and outreach efforts. For example, working with Project Support Coordinator Laura Chase, Rueda and Colias worked at SSU's Seawolf Day, which was at-

The NASA E/PO group is poised for great adventures in the days to come as they continue to enter new territory in the education of students and the general public about the world of NASA high-energy astrophysics. For the NASA E/PO team it's an exciting time to be working; when new laws of physics may be found and even the answer to the very nature of the mysterious dark matter may be realized. For more information contact Dr. Lynn Cominsky at lynnc@universe.sonoma.edu (Chip McAuley is a special consultant science writer/producer in the SSU E/PO group and is an instructor in the Communication Studies Department.)

74th and 75th What Physicists Do Series

By Bill Garcia

Always informative and always bringing to the forefront new fields of study, the “What Physicists Do” series went on for its 74th and 75th series this past year. With topics ranging from the macroscopic scale of colliding galaxies to the generation of nanopores a mere 60 nanometers in diameter, the topics of physics and astronomy were very well-explored and shared, even the not so well-explored questions were discussed. The year kicked off with a presentation from one of the department’s newest additions, Dr. Jeremy Qualls. He described his work with ultra-powerful magnets and the work he was planning to do right here at SSU.

A popular and critical topic that had a small group of speakers this semester was the issue of global warming. Audrey Chang from the National Resources Defense Council presented information on how California’s energy cutbacks and waste prevention methods have met and in some ways exceeded our expectations for pollutant generation. Equally pressing was the information that Dr. Inez Fung presented which implies that our carbon dioxide pollution is helping to accelerate the warming of the Earth. Dr. Tom Slanger of SRI International gave some more insight into these topics with his exploration of the Earth’s upper atmosphere, which could lead to a better understanding of the atmospheres of other planets.

Always working to optimize our modern world, Drs. Mark Topinka and Michael Fulton gave some very real and soon to be readily available alternative energy resources. By improving how we think about energy cells, their presentations showed us new ways to perfect energy collection and production of solar cells. In the same energy saving boat was Dr. Ali Shakouri, who shared his work with nano-structured semi-conductors and how we can use the technology to capture excess heat and convert it into useful electricity.

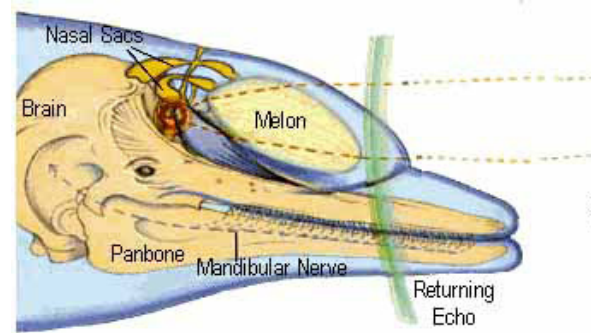
In a talk on a topic not always touched on by the physics world, Douglas J. Mudgeway gave us some historical insight into the American space program and the contributions it received from the brilliant mind of William H. Pickering. Guest speaker Dr. Raymond Hall discussed the philosophical question of what science really is and showed us that human flaws can occupy even the most apparently well-rationalized theories.

The stars are often where physicists keep their heads and three speakers shared what they could see from their perspective this semester. New SSU professor Dr. Scott Severson gave a presentation on his work with adaptive optics and seeing through the obscuring mist of our earth’s atmosphere. Dr. Holland Ford came from Johns Hopkins University to give a very informative presentation on low mass stars and how much more likely we are to find earth-like planets in these environments than anywhere else. Columbia University radio astronomer Dr. Jacqueline Van Gorkom showed us her recent work observing and helping to develop models of the evolution of galaxies. Looking to the star in the middle of our own solar system, Dr. Thomas Berger shared a vast array of information about the strangely orbiting solar observation satellite Hinode and how the information it gathers can

help us better understand stars outside our own solar system. Dr. Maryam Modjaz spoke about our recent observations of supernovae and what this information means to the physics community. Dr. David Wittman shared with us his knowledge of new Very Large Survey telescopes for gathering more information on a much smaller time scale. Perhaps the most pertinent of the Off-Earth talks was that of Dr. Donald Yeomans of JPL, which explored the methods we are using to detect near earth objects and trying to deflect them before they come too close.

The spring semester’s series also had two more of our very own SSU professors come to speak on dynamically different topics. Dr. Hongtao Shi of the Department of Physics and Astronomy presented a very informative discussion about his successful experiments with generating nanofibers and nanopores in his on-campus laboratories. Two weeks prior to that Dr. Shailendhar Saraf of the Engineering Science Department presented information on the new field of gravitational wave astronomy. Dr. Saraf is working on lasers used in attempts to detect gravitational waves from astronomical objects and helping to resolve the issues that stand in the way of doing these experiments from Earth.

In conclusion, I would note that one particular speaker made quite a statement to me. This was SSU physics graduate Dr. James Aroyan (’87) with his discussion of dolphin echolocation and complex computer modeling.



His talk was very informative and presented new ideas to us about our aquatic cohabitants of earth. In addition to this work he had many accomplishments I found very inspiring. Dr. Aroyan, being an SSU alumnus and speaking in a series with such esteemed speakers means a lot to me as an SSU physics student. It means that everyone here in our Department has the ability to not only work in developing fields of science, but also to be part of that cutting edge, inspiring others to do the same.

Dr. Joe Tenn, who has run the series for many years, reports that he is currently organizing the fall series, which will resume Sept. 8. For details see:

<http://phys-astro.sonoma.edu/wpd/>
or the Schultz library for the recorded talks on DVD.

Thank you Donors!

Private donations have become increasingly important to the Department of Physics and Astronomy as state appropriations have waned.

The Department's public programs, the "What Physicists Do" lecture series and Public Viewing Nights at the SSU Observatory, are funded entirely by private donations. The printing of the posters and travel expenses for the speakers have long been paid for by donors, mostly—but not all—members of the community who attend the lectures. There is probably enough on hand to present the Fall series, but the very existence of a Spring series is dependent on the donations that come in by the Fall.

The Department has also bought some equipment with donations (made last year; there were none this year) to another foundation account. While the taxpayers contributed a significant amount towards the equipping of the newly-remodeled Darwin Hall, the state funds ran short, and donations made the difference.

Another area where donations are the only source of funds is the financial support of students. The Horace L. Newkirk Assistantship and the Mike and Sheila McQuillen Summer Research Award support students to do research with faculty. And three scholarship funds, the Physics and Astronomy Scholarship, the Sol and Edith Tenn Scholarship, and the Joseph S. Tenn Scholarship, are supported by donors as well.

This year we have received contributions from the following generous people, listed by account number. If you would like to join this group, see <http://www.phys-astro.sonoma.edu/PublicSupport.html> or contact the SSU Development Office at (707) 664-2712 or contact the Department.

Current Funds:

C0020 Horace L. Newkirk Student Assistantship Fund
Joseph & Eileen Tenn.

C0141 Public Programs

Richard Bell; Stephen Bursch; Donald J. Farmer; Robert A. Fisher; Ed J. Le Du, Forestville Mini Storage; William & Lucy Kortum; Kenzie & Frances MacInnes; Carl & Linda Marschall; Francis V. & Patricia Marshall; Michael & Sheila McQuillen; James & Melinda Moir; Martha D. Peterson; Meng-Chih Su; Robert S. Tuttle.

C0143 Observatory Fund

Jo-Ann and Joseph Smith.

C0144 Student Development Program

Anonymous; Keyvan F. Farahani ('85); Stephan R. Crandall ('82); Duncan E. Poland; Bryant & Diane Hichwa; Michael & Sheila McQuillen.

S0265 Physics and Astronomy Scholarship

Chris ('96) and Drue Rostel.

Endowment Funds:

E0208 Horace L. Newkirk Student Assistantship Fund
Nadenia Newkirk.

E0231 Physics and Astronomy Scholarship

Lynn Cominsky and Garrett Jernigan.

E0304 Sol & Edith Tenn Scholarship

Joseph S. Tenn.

The 2008 Newkirk Award Project: Investigating Semiregular Variable Stars

By Katherine Wyman

Every night the sky lights up with thousands of mysteries, and every night humankind is working hard to reveal the forces responsible for them. The composition of Dark Matter, the source of the Gamma Ray Bursts, or which came first: the stars or the galaxies? The list goes on and on. Some of these we've been making progress on, and some have become even more mysterious the more we learn about them. Possibly one of the most poorly understood stars we know of is the semiregular. A variable star like a Mira Variable has a simple light-curve with a regular rise and fall variation with time (Fig.a). SemiRegulars, as you may be able to guess from their title, exhibit a much more complicated luminosity variation over time (Fig.b).

For the past three semesters, I have been working with Dr. Gordon Spear on observing a handful of semi-regular variable stars (SRs). Many of our stars are classified as Asymptotic Giant Branch Stars, which means that they have ended the hydrogen burning phase of their life. Our own Sun will reach this point in another 5 billion years or so. After this, the star will have run out of its available fuel supply and will start down the short road towards stellar death. It is during this phase of its life that a low-mass star, similar in size to our Sun, may become a Mira Variable, before slowly expelling its outer layers in a beautiful stellar death known as a Planetary Nebula. Dr. Spear believes that SRs may be the stepping stone between a hydrogen-burning star and a Mira variable. Mira variables exhibit a characteristic "phase-lag" when observing them in visual light versus infrared light, (Fig.c). One of our goals is to find a similar lag in a class of SRs.

SRs have not been studied in any great detail since the time when all of astronomy was done with photographic plates. Our underlying goal here is to observe these stars with modern equipment with hopes of better understanding the forces that drive these stars to behave the way they do. The majority of our research was conducted using data obtained from the telescopes of SKYNET. SKYNET is a system of robotic telescopes first developed to do supplementary observations on Gamma-Ray Bursts. However, between GRB announcements, SKYNET

serves as an educational resource through an online scheduling control system where students across the country can submit astronomical research jobs. Our images are corrected for unwanted signal noise using the computer program Maxim DL, after which we record our star's brightness as it changes over time.

Working with Dr. Spear has been a tremendously valuable learning experience. The Newkirk award has allowed me to further my experience with research in astronomy and I am extremely grateful to the Newkirk family as well as the faculty and staff of SSU for giving me this amazing opportunity and providing the students with such a rich learning environment. This experience has taught me much about what is necessary in a research setting, and in a future career. Best wishes to the grads and good luck to the undergrads, we'll need it!

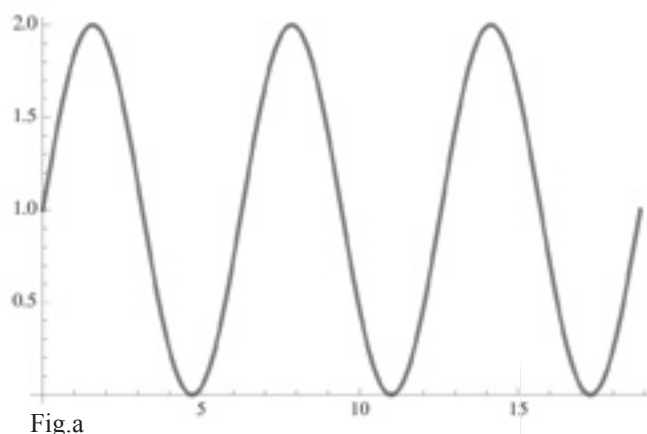


Fig.a

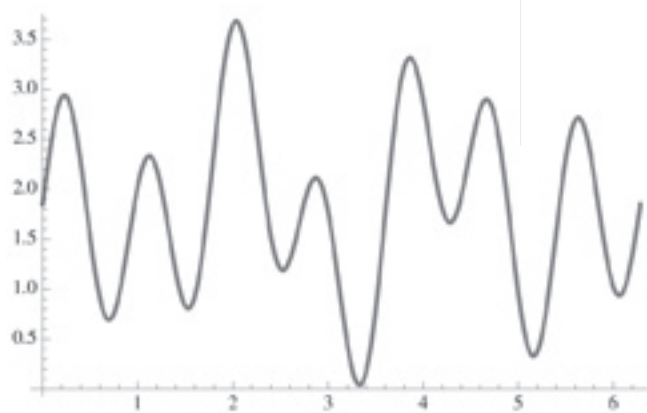


Fig.b

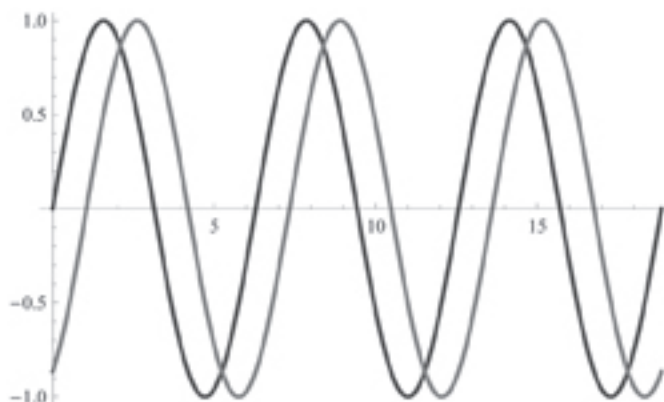
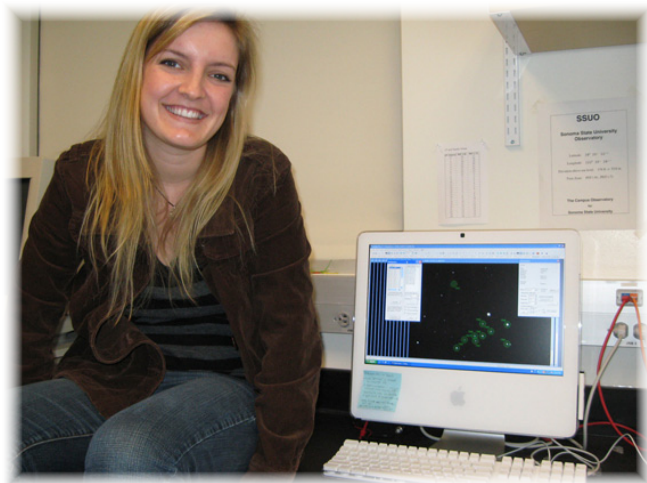


Fig.c



ALUMNOTES

On a happy rainy day...
Ron Bleau ('79) is a Senior Staff Research Engineer with Lockheed Martin Aeronautics Company in Ft. Worth, Texas, where he conducts system engineering and R&D for product improvements. He writes, "I retain fond memories of the academic environment of inquiry, and am pleased that my work supports similar continued inquiry in the scientific and technical worlds. The philosophical approach and disciplined mind are critical to defining a challenge / task / goal, and the proper attitude and scientific approach can take one about halfway towards attaining the solution space."

Kenneth Aline ('81) is a materials and process engineer with Lockheed Martin Advanced Technology Center in Palo Alto. He has worked on the Hubble Space Telescope, the Spitzer Space Telescope, and numerous other satellites. He writes, "My background in physics has allowed me to understand the engineering behind the process and gave me the opportunity to bring a practical hands-on application to problems, a different perspective from the traditional approach."

David Goldkind ('82) is a consultant on management and process engineering with Rebecca Robinson Associates, Inc. in Rough and Ready, CA. He also does consulting in optics. He writes, "[My years at SSU were the] most wonderful times of my life, I will always remember them with the greatest fondness. THANKS!!!!"

Joanne del Corral ('83) has been a lecturer in the SSU Department of Physics and Astronomy since graduation. She teaches several introductory laboratory courses. She writes, "My physics education at SSU took me from someone initially threatened by sophisticated equipment into someone not only capable of their use, but someone who could effectively use them in a learning environment."

Teresa Bippert-Plymate ('84) is now working at Steward Observatory as Interferometry Technical Specialist for the Terrestrial Planet Finder Testbed project. She was previously the technical writer for the SOLIS project at the National Solar Observatory. She writes, "My interest in Astronomy was piqued by an SSU class and now it's my career."

Tom McMahon ('85) works at the University of Arizona, where he is the project manager for the Large Binocular Telescope Interferometer. He writes, "My position is a hybrid System Engineer/Manager where I direct 10-15 people on technical tasks. I have to make decisions based on knowledge of physics, math, statistics, etc, all of which are based on my educational foundation of which SSU is an integral part."

Richard Ferguson ('87) is a pilot with United Airlines, flying out of San Francisco. He served as an officer

in the U.S. Air Force after graduation from SSU. He writes, "[Important skills learned at SSU include] critical and analytical thinking inasmuch as my profession is based entirely on physics - flying and pressure differentials, thermodynamics, even weather patterns."

Nancy Kunnari ('90) is an engineering manager at Atmel Corporation in San Jose. She writes, "I attribute a great deal of my career success to my SSU Physics education. I graduated with the confidence to tackle challenging problems in a lab setting, and have built my career doing so."

Jason I. Alexander ('92) is CEO of a startup company, Vivaray, in San Jose. He writes, "Basically in the world of business, one is more valuable and can provide higher caliber effort if well versed both in technical and non technical aspects of the job."

Daniel R. Hale ('96) teaches physics and astronomy at Folsom Lake College. He earned an M.S. in physics at Michigan State University.

Justin Wolfe ('01) is an engineer at the Lawrence Livermore National Laboratory. Formerly an engineer at Optical Coating Laboratory, Inc., Santa Rosa, he earned an M.S. in optical sciences at the University of Arizona. He writes, "Introduction to optics and OCLI placed me in my current career path."

Justin Flory ('02) is an engineer in the diabetes care division of Abbott in Alameda. He formerly worked in research and development at Symmetricom, Inc. in Santa Rosa. He also plays in the American Philharmonic — Sonoma County

Julia Maisen ('03) is a technical writer in San Jose.

Sean Greenwalt ('05) is assistant project manager at Solaris Inc., an installer of solar photovoltaic systems in Sebastopol, CA.

Ryan McDaniel ('06) is an associate engineer at Deposition Sciences, Inc. in Santa Rosa and is also helping out the astronomy program at SSU. He writes, "[Helpful skills acquired at SSU include] the ability to think critically about a problem, and then find a solution that might not have been thought of before."

Zachary Nuño ('07) is working at CDG, a Boeing company, in Cypress, CA. He writes, "The heavy math training helps with logic reasoning and problem solving. Thinking about the abstract in the physics education helps with viewing real items as just an arbitrary variable to help with organizing work."

Josh Rose ('07) is a technician at TriAccess Technologies in Santa Rosa.

Michael Youmans ('07) is a laser technician at Spectra-Physics in Mountain View.

On a happy rainy day...



Class of 2008

Jeremy Dixon, Danielle Beddow, Patrick Brown, Dakota Decker, Orion Leland, Gabriela Sanz- Douglass, and Charles Granger. Not pictured, Alex McMahon, and Josh Rose.

The Physics Major - No. 33 June 2008

Published by:

Department of Physics and Astronomy

Sonoma State University

Rohnert Park, CA 94928-3609

(707) 664-2119

phys.astro@sonoma.edu

<http://phys-astro.sonoma.edu>

Edited by: Jeremy Qualls

Written by: Jeremy Qualls, Lynn Cominsky, Joe Tenn, Scott Severson, Gordon Spear, Bill Garcia, Hongtao Shi, Aimee Santos, Katherine Wyman, John Collins.

Photos by: Jeremy Qualls, Steve Anderson, Aimee Santos, John Collins, Hall Cushman.

Layout and design by: Aurore Simonnet



Department of Physics & Astronomy

Sonoma State University

1801 E Cotati Avenue

Rohnert Park, CA 94928-3609