THE PHYSICS MAJOR

Department of Physics and Astronomy

SONOMA STATE UNIVERSITY

Passionate for Science and Making a Difference

By Associate Prof. Jeremy Qualls

For many decades the United States has held a comfortable position as a world leader in science and technology. A key component to this is generating a workforce with adequate skills to address an ever increasingly technological world with limited resources. But what are the critical skills? What does it mean to be a scientist in modern times? Addressing these questions has become the central focus of STEM education. STEM is an acronym for Science, Technology, Engineering, and Mathematics - one that requires attention from learning institutions and politicians. The lack of a sufficient workforce of STEM educated students was stressed by President Obama in his State of the Union Address this January and many senators and members of Congress have echoed such concerns.

Profs. Cominsky and Qualls at Seawolf Decision Day with the Science 120 booth

The issues come into focus when we look locally, here at SSU. Only 22% of SSU STEM majors graduate within 6 years within STEM. Although 55% of our students are graduating, more than half of them are not finishing as a STEM major and that's a big problem. It turns out that this behavior is prevalent throughout the US and not just at SSU.

(Continues on p.6)

Undergraduate Women in Physics Conference

By Rebecca Salvemini

At 6:30 pm on Friday, January 13, 160 undergraduate women gathered together at the Stanford Linear Accelerator Center (SLAC). At the same time, another 650 women gathered at five different schools around the country for the start of the seventh annual Undergraduate Women in Physics Conference. Among these 800 women were three Sonoma State physics majors, Crystal Ewen, Kalie Miller, and myself, Rebecca Salvemini. We had never attended this type of conference before and were very excited for what was to come.

The conference began with a welcome speech given by Patricia Burchat, a professor of physics at Stanford University. The talk was followed by a buffet dinner at the SLAC cafeteria. From the very beginning of the conference, we were able to meet many other women from all over the country who are studying physics. We had the privilege of staying in the SLAC guest house, which gave us another opportunity to get to know other women physics majors from other schools. Saturday consisted of three lectures, two panels, a poster session, and a dinner at Buca Di Beppo hosted by Google. We received information on quantum mechanics, health physics and particle physics. Panels gave us the opportunity to ask many of the questions that may have come up throughout our undergraduate career. We even got to listen to the experiences of our very own department chair, Dr. Lynn Cominsky. On Sunday, we were given the option to attend two different workshops that interested us most. Crystal, Kalie, and I all chose to learn more about applying to graduate school and jobs in the industry. These workshops were especially helpful in giving us an idea of the best path for us to take after graduation from SSU. The conference ended with two more lectures with information about the formation of the structure of the universe, and the quest for the Higgs Boson at the Large Hadron Collider in Switzerland.

At most schools in America, women in physics classes are the minority. The reason this conference was so amazing was the fact that we were all surrounded by others who share many of the same experiences and the same excitement about their physics classes that we do. The Undergraduate Women in Physics Conference gave us the opportunity to meet these women, to learn about what many physicists do after they graduate, and to gain experience and knowledge about networking and making the best decisions about our future careers when we graduate.

Rebecca Salvemini, Kalie Miller and Crystal Ewen at the Google-hosted conference dinner

SPS Research: Creating Plasma

By Jude Rowe

The beginning of my journey in exploring plasma began by deciding on the purpose for the project and then seeking out a means to fund its creation. Before building could begin there was much to learn, and only once it was completed could I show and explain what I had learned.

The purpose of the device is to explore the creation of plasma generation and create a display that may be used for education and outreach. I personally find application of knowledge to be invigorating and so a secondary purpose involves exploring plasma. I hope that the device will draw interest by future students at SSU to explore their own passions in science. My own plans involve using a solenoid to move the plasma, observing how magnets affect plasma, and observing the change in plasma state when pressure or gas changes. After building the device I have been able to make observations that led me to explore with interest the probability of ionization and determining the density of plasma.

Generating Plasma at SSU

Funding was attained in the form of a $1550 grant. This grant was received through our Society of Physics Students club. My peers in the club unanimously supported my application for the funding. Thank you for your support SPS!

Building the device required working all winter break of 2011, from four to eight hours a day to learn how vacuum systems work and assemble the plumbing for the project. Steve Anderson was instrumental in this process of education as he assisted in creating the device. Fine tuning the vacuum system took almost as long as the creation of the device in total. The information learned now is able to be passed onto my peers who are interested in plasma as well.

Sharing the device has been fun and rewarding. I have tabled at several events so far. The most exciting experiences involved club days and Seawolf day. While the device was on display many people asked questions on how it worked and found the process of its creation fascinating. In general throughout all of the tabling that amounts to only a few hours there have been around a hundred people who asked questions.

Overall the experience of brainstorming, funding, building, and sharing science has been rewarding. I look forward to discovering more about plasma and being able to share those experiences as well.

SSU Undergraduate Research Award

By Matthew Fontana

The growth of zinc oxide (ZnO) nanowire arrays on arbitrary substrates (silicon, conducting glass etc.) is a growing area of active research. ZnO nanowires are well characterized and express a large bandgap in the UV region at room temperature finding applications in electronics and photonics. Furthermore, ZnO nanowires have a large surface area to volume ratio making them especially well suited for chemical sensing. This is especially important as detection of hydrogen gas is needed for emerging technologies which require hydrogen as a point-of-use fuel source.

This year I have worked with Dr. Hongtao Shi preparing and characterizing ZnO nanowires grown on silicon surfaces. Since desirable optical properties require an ordered array of nanowires, several experiments were performed to determine the optimum growing conditions. This involves using wet chemistry to synthesize ZnO nanocrystals followed by growing a seeding layer of the nanocrystals on a silicon wafer. To characterize the seeding layer, the ZnO-Si wafer is characterized using the scanning electron microscope (SEM) and energy dispersive X-ray spectrometer (EDX) in the William M. Keck Laboratory. The SEM image allows the surface to be imaged with resolution on the order of tens of nanometers and the EDX spectrum allows for elemental analysis to be performed. Once an ordered seeding layer is produced, the nanowires are grown using an electrochemical method and the samples are taken to the optics lab where the optical properties are investigated.

Intense concentration on the EDX

I am very thankful for having the opportunity to work with Dr. Shi and learn the fundamental physics of nanoscience. My research with Dr. Shi has taught me many experimental techniques such as electrochemistry and synthesis of nanoparticles. In addition, I have gained experience with operating the scanning electron microscope and the laser system in the Keck lab. The laser system includes operation of a Nd:YAG laser, high vacuum system and low temperature cryostat which allows studies to be performed as low as 15 K. These skills will greatly assist me with future research projects in graduate school. I would also like to thank Sonoma State University for awarding me the Undergraduate Research Grant which helped with the purchasing of the silicon wafers and chemicals for this project.

NASA Education and Public Outreach Takes Off

By Professor Lynn Cominsky

This year, after several years of preparation and seemingly endless proposal-writing, the NASA E/PO group finally succeeded in getting $550K in new NASA funding for a three-year project entitled S4: Small Satellites for Secondary Students. The goal of this project is to develop a hands-on curriculum for middle- and high-school students that will teach the fundamentals of experimental payload design. The group has partnered with AeroPAC, Rocketry of California (ROC) and the Endeavour Institute to provide flight opportunities on high-powered rockets and tethered balloons. There are over 20 middle- and high-schools in the western states that will be piloting the curriculum once it is developed. The experimental payloads are the size of a soda can and are known as "CanSats" – a concept originated by project mentor and inspiration Prof. Bob Twiggs, formerly of the Stanford Aeronautics and Astronautics Department (and now resident at Morehouse State College in Kentucky).

Things are looking up!

As part of the development effort for this project, E/PO group members Logan Hill ('06) and Kevin John ('07), as well as Prof. Cominsky, all learned how to build their own high-powered rockets (HPRs), achieving Tripoli Rocketry Association Level 2 status. Although Logan achieved his L2 status last year at Snow Ranch (outside of Stockton), Prof. Cominsky and Kevin John's successful L2 flight attempts occurred in September 2011 at the premier HPR launch site in Black Rock, Nevada. The group worked with SSU students Kevin Zack and Rebecca Salvemini during the Spring semester 2012 to develop and flight test the prototype payloads. John's first payload launch at Black Rock did not return any data, so he is leading the effort to redesign it for additional flight hardiness. Meanwhile, Logan Hill is overseeing the balloon payload development effort.

Another novel feature of the program is the use of the "Virtual Classroom" a mobile van with a link to satellite internet that can travel to the remote locations used for launches and broadcast the launch events back to the participating classrooms. Stay tuned, because things are definitely looking up for the E/PO group!

Newkirk Award 2011: Advancing Technology

By Hunter Mills

For this year's Newkirk assistantship project, I have worked alongside Dr. Hongtao Shi to advance the analog to digital conversion of Keck Microanalysis Laboratory's PHI Auger Spectrometer. Before my involvement, there had already been major work set forth installing an operational data acquisition interface for the spectrometer. Various intensity peaks of emissions could be measured—but at this point though, the software could not automatically recognize the corresponding energy for the wavelength peaks; the analog components that control the range were operated manually. My work was to correct this by being able to control the PHI Auger spectrometer completely via the computer, with the current analog inputs being correlated to the outputs.

To perform this task, first we needed to identify what analog components had to be digitized. Second we needed to find corresponding microchips with the same specifications. Third we needed to have these microchips be controlled serially with the computer, either simultaneously or independently. The components that needed to be replaced were comprised of switches and rotary knobs which happened to be comprised of potentiometers versus parallel plate capacitors. We then obtained digital chips with switches of equivalent circuitry, and digital potentiometers that had matching resistance ranges. Some of the original potentiometers had no corresponding readings on the exterior control panel of the unit, so when altering parameters for the trials to hone in on an area of interest, one would need to guess a quarter turn this way, or a half turn that way. With the digital chips, the resistance values can be specifically mapped to the energy to the electron beam, so there is no question to what energy levels correspond to what peak wavelengths. We then used an Arduino microcontroller to communicate with the chips from the computer via USB, and devised a protocol which could control each chip with the accompanying the Arduino software.

What still needs to be done for this project is to unify this new software with the previous software developed. This project has proven to be very instructive and thought-provoking for me, and I am truly grateful for the opportunity to learn a lot about equivalent microchip circuits, microcontrollers, and serial communication. I want to thank Nadenia Newkirk for this opportunity and her gracious support.

Hunter with the PHI Auger Spectrometer

What Physicists Do: 82nd and 83rd Series

By Kalie Miller

Throughout the past year, the What Physicists Do (WPD) Lecture Series had many speakers that inspired students, faculty, and the community with their fascinating talks. A main purpose of the series is to catch the attention of those interested in the physics major, and help those already in the major decide how they would like to incorporate their degree in life after graduation. Another important objective of the series is to inform the students, professors, and community of recent headway that has occurred in the fields of physics and astronomy.

The 82nd series was jump started with an astronomy talk from Brenda Frye from the University of San Francisco. Her talk described how the Milky Way came to be, which was more than an exciting way to gain interest in the series. Having the series start with an astronomy talk was amazing, for this demonstrated that there are many fields available with a physics degree. Throughout the 82nd and 83rd WPD series, there was a plethora of physicists and astrophysicists from many different colleges that caught everyone's attention and Dr. Frye was only the beginning of this most captivating year.

Dr. Peter Hosemann, one of our 83rd WPD series speakers

Since there were so many astounding speakers this semester, only a few will be mentioned in recap of such a successful year for the WPD series. Dr. Peter Schwartz from California Polytechnic State University, San Luis Obispo traveled all the way up north to speak of an amazing opportunity for students, working in San Pablo, Guatemala helping with carbon reduction using innovative and affordable technology. Another speaker, Dr. Carolyn MacKenzie from Lawrence Livermore National Laboratory, gave a talk just as captivating on how she practices heath physics across the entire world by finding and removing radioactive sources. Dr. Ed Prather was dynamic in talking about innovations in astronomy education. Recently Andrew Leker, CEO of Electrified Games, gave an inspiring talk on how physics can form the basis of a successful entrepreneurial career. The WPD series ended with Dr. Peter Hosemann from the University of California Berkeley, speaking of Material Science in Nuclear Applications.

Although these are only a few examples of the extremely appealing lectures that occurred throughout the past year, they show how the series catches the attention of numerous people, creating interest in physics and astronomy. These series are two of the best seen thus far, and one can only imagine what the Fall semester has in store, as we eagerly look forward to being inspired during the What Physicists Do 84th Series!
http://www.phys-astro.sonoma.edu/wpd

SPS: Busy Busy

By SPS President Kalie Miller

As the 2011-2012 school year comes to an end, the Society of Physics Students (SPS) club at Sonoma State University looks back on the many achievements and goals met throughout such an amazing year.

To start the year off, the club recruited many new members. We were surprised and delighted to recruit more new members this year than ever in the past. This was accomplished in many different ways. For example, club members participated in the Big Night event at the beginning of the semester. They also had a booth at the Club Fair and visited all physics and astronomy courses at the start of the semester, both of which helped inform new students about the club and its activities. SPS even had zip-up sweaters and t-shirts that featured our own Professor Shi. SPS has also continued to hold study and tutor times throughout the entire year in order to not only help one another with homework and tests, but also hold times to tutor SSU non-majors weekly. This has been a great way to reach out to those in need of additional help in their physics courses.

Throughout the first semester, the club achieved more than imaginable. From the start, a huge field trip to the Stanford Linear Accelerator Center, in which other departments joined as well, was organized. The trip greatly increased knowledge and interest in potential job fields related to the science majors, and was a wonderful bonding experience for the club members and other departments that joined as well. Throughout the rest of the semester, SPS also volunteered at Bellevue Elementary School in Santa Rosa. There, SPS members brought multiple demos and conducted presentations for an after school program hoping to increase the interest of young children in the sciences before reaching higher grade levels. Some demos brought to the elementary school included those describing angular momentum, liquid nitrogen, and even just engaging conversation with the students by asking questions such as "Why is the sky blue?" or "What do you think physics is?"

The elementary students were more than interested in learning about science and were extremely enthusiastic about all of the demos brought to the classroom, which made the visit worthwhile and made SPS very glad our presentation was a success in getting younger children interested in the sciences.

SPS also took an extremely fun and informative field trip to the California Academy of Sciences in San Francisco. Through this experience, we learned a ton about science, not only about physics and astronomy, but also about biology, geology, and many other sciences, as well as becoming closer as a club and bonding while spending quality time with one another.

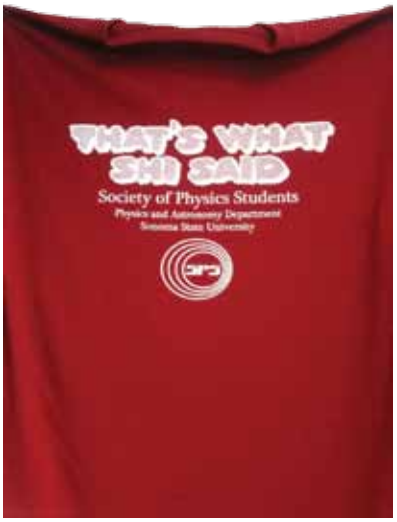
Other events SPS participated in throughout the year have also been tabling and presenting demos at the Bay Area Science Fair held at the Infineon Raceway, and partaking in the campus-wide canned food drive and book drive.

During Winter Break, the three officers of the SPS club, Kalie Miller, Crystal Ewen, and Rebecca Salvemini, were granted the amazing opportunity to attend the Undergraduate Women in Physics Conference at Stanford University. The conference included many different forums, attended by women from around the United States, (See accompanying article by Rebecca Salvemini.)

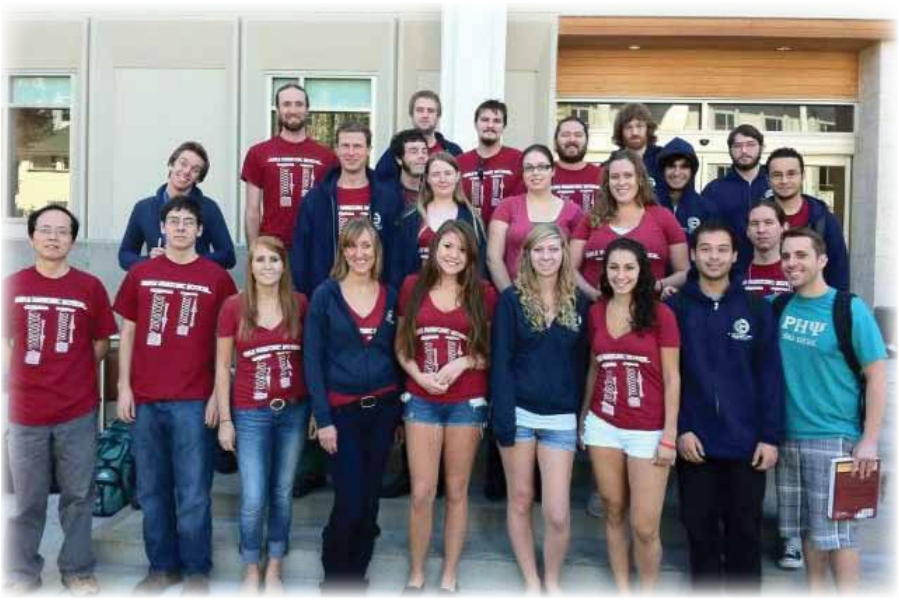
Throughout the second semester of the year, SPS has participated in the Club Fair once again, as well as competing in GEEK WEEK. Although we did not win GEEK WEEK this year, the club had a great time working as a team during each competition to try and win each game. It was a blast working together and having fun throughout the entire week; competitions like these really show how close friends we have really become.

SPS also participated in Seawolf Day, where we tabled and helped to recruit potential new physics majors, as well as giving tours of the department and laboratories. We also tabled at Earth Day Week at SSU in order to spread the word of our club to the campus, plus many other events. We have ordered new shirts this semester as well, which is always an exciting new addition to the club!

As the year comes to an end, the seniors graduating on May 12, 2012 will be presenting their hard work they have been completing throughout the year/semester before saying goodbye to the department. The past years have been such an amazing experience for all of the seniors, especially this last year, and as they look back on all the club has completed and that they have accomplished, it is safe to say that the Physics and Astronomy Department is by far one of the most amazing departments at Sonoma State University, as we are such a close and supportive group of individuals.



SPS's awesome 2012 T-Shirt!



This has been a remarkable year for the Society of Physics Students, and as it is passed down from one group of officers to another, there are only further exciting opportunities and successes to come from such an amazing group of students!

Students interested in joining SPS should go to : *http://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.

Passionate for Science and Making a Difference

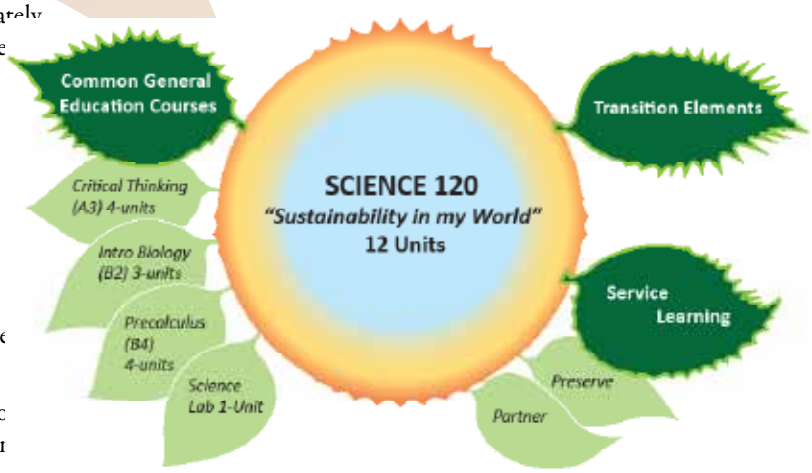
(continued from p.1)

Always at the forefront of education outreach and development, Professor Lynn Cominsky and Dean of Science and Technology Lynn Stauffer began looking at ways to address STEM education at SSU. A science education S.W.A.T. team was put together to develop a three-pronged approach to improve SSU's graduation success in the sciences and attract more majors. In the summer of 2011, SSU was awarded close to a million dollars from The National Science Foundation through its STEM Talent Expansion Program (STEP) for our efforts. The funding success rate for this particular program is extremely low at less than 8%. That we received this support is a great testament to the strength of what we are trying to do and the quality of the people we have working on it. From a global perspective, producing STEM majors is a concern not only for SSU but also the nation. We hope that the work we do here will pioneer future program developments that will help increase STEM majors at other universities as well.

Our proposal "S3: STEPping up STEM at SSU" has a three-pronged approach. First, it includes the development of a new STEM-oriented First Year Experience (Science 120) to immediately immerse incoming students into "scientific inquiry", while developing a personal connection to the institution and community. Second, it will create a coherent and expanded recruitment structure to increase the diversity of SSU's STEM population and advising pathways. Finally, it brings in MESA's (*http://mesa.sonoma.edu/*) best practices to the larger population of STEM majors, including the creation of new Academic Workshop courses for gateway classes in Chemistry and Physics, additional mentoring, and new undergraduate research opportunities.

As a physicist and a leading team member, I'm very excited to be part of this work and the opportunities it brings to SSU. In preparation, for the last twelve months, I have been completely immersed into learning about and studying the regional ecosystem. Without exception, I have been absolutely amazed by all I've seen hidden in the Northern California landscape and how it reveals a deeper connection between us all. I was very fortunate for this once in a lifetime opportunity to have kindred spirits and experts to share late hours hiking, studying, and observing the rare and hard to find phenomena. It has been a model collegial experience with collaborators openly sharing the things they love for the advancement of science. I only wish a program like this existed for me when I was a student.

If you have an interest or deal with environmental issues on a professional level, I invite you to contact me. We are always looking for speakers and partners.



Starting in Fall 2012, SSU will begin its pic freshman year experience: Science 120 "Sustai in My World." This twelve-credit, year-long c first-time freshmen immerses students in real world issues of environmental sustainability through hands-on work. These include outdoor field experiences at the SSU Field Stations, Nature Preserves, and along the Copeland Creek Watershed. By design, it is an integrated course for students exploring their interest in the environment and considering a science major other than biology (biology majors will have a different course path). Through real-world problem solving done in collaboration with faculty, peer mentors, and community partners, students will learn biological principles, mathematical reasoning, and critical thinking skills. These skills will be directly utilized to help understand and address global issues in the context of our local environment and Sonoma County's watershed.

During the first semester, each week consists of lecture, discussion, skill building sessions, and a laboratory experience. During the second semester, students progress through projects of their own design to solve real problems and answer questions that address community needs. The program incorporates numerous community partners and works with them towards constructive solutions. Additionally, students will learn skills to transition socially and academically to university study and receive a broad introduction to SSU's science departments, campus research efforts, and student organizations.

If you had a chance to make a difference and be part of something larger than yourself, would you? Would you be willing to work hard being a part of a positive solution and face difficult problems? Can you think freely and critically? Do you know yourself? These are exactly the kind of questions we are asking our students and I am proud to be a part of this effort to use science to address the needs of the environment.

The program is funded by grant NSF DUE- 1068445. The Principal Investigator for the grant is Dean Lynn Stauffer. Members of the core team include: Jeremy Qualls and Lynn Cominsky (Physics and Astronomy), Nathan Rank (Biology), Brigitte Lahme and Ben Ford (Mathematics and Statistics), John Sullins (Philosophy), Claudia Luke (Director of SSU's Field Stations and Nature Preserves) and Julie Greathouse (Student Services). Additional SST personnel who are participating in the development of the curriculum include: Suzanne Rivoire (Computer Science), Farid Farahmand (Engineering Science), Carmen Works (Chemistry) and Michael Smith (Geology). NASA E/PO staff member Kamal Prasad is leading the effort to recruit and train student mentors.

https://www.sonoma.edu/aa/flc/nonresidential/science.html

Kamal Prasad, director of peer mentors

Team members exploring the SSU preserves

ALUMNOTES

Michael McBride ('75) *is retired. He was formerly a regional sales representative for Gallagher Fluid Seals and a sales manager with Research Electro-Optics, Inc. A past president of the SSU Alumni Association, he earned his M.A. at the American Graduate School of International Management in 1977.*

Sharon Gilkison Morganelli ('76) *is a disclosure analyst with Jones Hall, a municipal bond law firm in San Francisco.*

Dennis Goodrow ('78) *is a senior technical staff member at IBM Tivoli in Emeryville, developing products and services that enable enterprises to manage the security and compliance of desktops, servers, and mobile computing devices.*

John R. Johnson ('80) *is retired after working as an hardware or software engineer at Ford Aerospace, Rockwell Avionics, Lockheed Space Operations Company, Daden Engineering and KW Microwave in southern California. He designed hardware and software components and systems.*

Claude Plymate ('81) *is Telescope Engineer/Chief Observer for the Big Bear Solar Observatory 1.6-meter New Solar Telescope. He was formerly site manager of the National Solar Observatory's McMath-Pierce Solar Telescope at Kitt Peak. He received the AURA Technology and Innovation Award in 2001 and earned an M.S. in astronomy from the University of Western Sydney in 2002.*

Donald W. Martin ('83) *is an instructional assistant in mathematics at Berkeley City College. He was formerly a telescope operator at Kitt Peak National Observatory.*

Michael Rogen ('84) *is retired after many years with Maxon Precision Motors, Inc., Burlingame, where he was vice president of electronics sales and marketing. He is now studying Chinese.*

Keyvan Farahani ('85) *is the Chief of the Imaging Guided Interventions Branch of the Cancer Imaging Program in the National Cancer Institute. He was formerly an assistant professor of radiological sciences and biomedical physics at UCLA, where he received his Ph.D. in 1993.*

Christopher Cook ('88) *is director of thin films development at Axsun Technologies, A Volcano Company, in Billerica, MA. He previously built a thin film laboratory while simultaneously working at MIT's Lincoln Laboratory and earning an M.S. in electro-optics engineering at Tufts University.*

Gregory M. Crawford ('88) *works in biotechnology sales with Novo Nordisk, a manufacturer of rDNA origin medications for the treatment of diabetes. He lives in Tracy.*

Robert Lahaderne ('94) *is an engineering manager with the Design Assurance team at Medtronic, Endovascular in Santa Rosa. Formerly a senior process engineer at SpectraSwitch, Inc., he earned an M.B.A. at the University of San Francisco in 2007.*

Mallory Roberts ('94) *is an astrophysicist with Eureka Scientific and a lecturer in physics at Ithaca College. He also makes science-themed documentary films with Les Films Kookaburra. He earned his Ph.D. in astrophysics at Stanford University in 2000.*

Scott Fraser ('95) *is teaching physics at Cal Poly San Luis Obispo. He earned a Ph.D. in physics, with a dissertation on black holes and extra dimensions, at the University of California, Santa Barbara in 2010. Previously he earned a certificate of advanced study in theoretical physics at the University of Cambridge after spending a year at the University of Heidelberg on a Barry Goldwater Scholarship.*

Bryant & Diane Hichwa Research 2011 Award:
Exploring Zinc Oxide
By Cristhyan Alfaro

Data storage is one of the hottest research fields in physics and engineering. There are many researchers working on different methods to store data in secure and long-lasting places; and these have commercial applications as well. For example DVD players work with a red laser of wavelength 640 nanometers and can store up to 9 gigabits on double-layer discs. Blu-ray players work with a laser of wavelength 405 nanometers and can store up to 50 gigabits on double-layer discs. Theory tells us that lasers which operate with smaller wavelengths can have a smaller area of focus meaning that the beam is narrower; therefore more data can be stored on discs. The natural evolution of this idea would lead us into making lasers with even smaller wavelengths so that even more data can be stored which leads us into UV lasers of wavelengths less than 400 nanometers.

I have been working with Dr. Hongtao Shi since the spring of 2011 on the doping of the semiconductor zinc oxide (ZnO), which has UV emission light of 375 nanometers. In order to excite the material, we used a pulsed laser of wavelength 355 nanometers; however, measurements are difficult to make since it is not a continuous light source. During spring of 2011, I explored different setups and light sources so that we could have a continuous light source but sadly the source light in the UV region was not strong enough to have a significant excitation from the material and the emission light of the source mercury lamp is too close to that of ZnO which makes it difficult to differentiate between the source and the material light. Therefore the project adopted the pulsed laser with a few modifications to optimize the signal to noise ratio.

During the summer of 2011, I dedicated myself to make measurements of the photoluminescence of ZnO along with different percentages of various doping materials such as magnesium, copper, and phosphorous. Along the summer experience, I learned how the procedure for data intake reflects the quality as well as the meaning of the data. Our work has been accepted by the Material Research Society (MRS) and was presented this spring by Dr. Shi at the MRS Conference in San Francisco, which attracts about 5,500 scientists from all over the world. This was a truly educational experience that I will value for the rest of my career. I want to especially thank Bryant & Diane Hichwa for their support of science education through the funding of this excellent program.

Professor Emeritus Bryant Hichwa and Cristhyan Alfaro discussing Cris' summer research accomplishments.

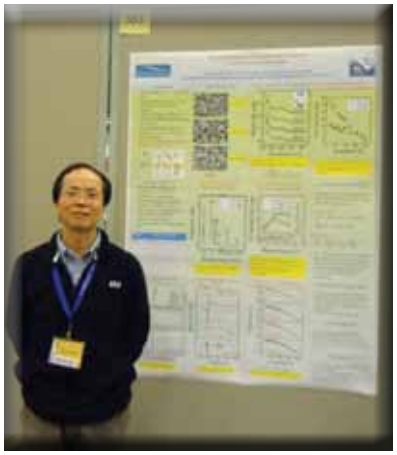
Scholarship Renamed to Honor Professor Duncan Poland

To ensure his legacy will live on for generations to come, the Physics and Astronomy departmental scholarship has been renamed to honor Professor Duncan E. Poland, who passed away July 19, 2011 at the age of 77. Professor Poland was a founding member of the department, who served as chair for many years. During his 36 years at SSU, Professor Poland was also a university vice president, the chair of the Natural Sciences division, and the head of the faculty union. He was a well-loved and integral part of the SSU community, and his contributions went far beyond the classroom, touching every aspect of campus life and having a tremendous impact on thousands of students. A brick honoring his accomplishments has also been placed in the Alumni Grove on campus.

Donations in Professor Poland's memory may be made to the Duncan E. Poland Physics & Astronomy Scholarship Fund, E0231.

In short...

This past fall, Associate Professor Scott Severson gave a talk about science education at TEDxSantaRosa. TEDx is a program of local, independently organized events that bring people together to share "ideas worth spreading" in the model of the world renowned TED (Technology, Entertainment, Design) conferences. Dr. Severson's talk, entitled "Science Education, Or How I Stopped Worrying and Came to Love a National Crisis," discusses why the teaching and learning of science can be difficult and why it is so important to our nation's future. A video of the 18-minute talk is available at ***http://youtu.be/08lLv2KILn4***



Dr. Shi presenting his work on "Mg-induced Enhancement of ZnO Optical Properties via Electrochemical Processing" at the Materials Research Society conference in San Francisco.

Prof. Cominsky, as chair of the California-Nevada Section of the American Physical Society, joined a group of California scientists in visiting Capitol Hill on April 19, to argue for increased science funding. The group visited with staff members from both California senators, as well as the offices of five Congressional representatives. They met in person with Rep. Lois Capps from Santa Barbara, and Dr. Cominsky also met up unexpectedly with Rep. Lynn Woolsey in the hall on the way to her office.

From left to right: Chris Palmstrom (UCSB), Daniel Cox (UCD), Arthur Ramirez (UCSC), Prof. Cominsky, Kenneth Ganezer (CSUDH) and Tyler Glembo (APS) in Senator Nancy Pelosi's office on Capitol Hill.

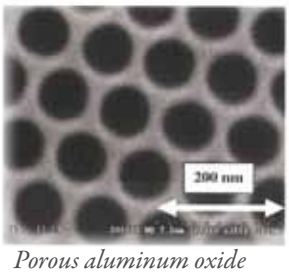
APS Congressional Visit Day California Delegation

Dr. Saeid Rahimi chose to participate in the Faculty Early Retirement Program (FERP) starting Fall 2011. Saeid joined the Department of Physics & Astronomy in 1982 and after 18 years of teaching was appointed Dean of School of Natural Sciences, which he later helped to rename the School of Science & Technology. Following ten years of service as dean of the school, Saeid was named Interim Provost and Vice president for Academic Affairs in 2010. Dr. Rahimi is credited for bringing the electrical engineering program to SSU and for his instrumental role in establishing the Engineering Science Department at Sonoma State. Saeid also helped SSU acquire the 3,600 acre Galbreath Wildlands Preserve with a $1 million endowment for SSU, as well as many millions of dollars of additional donations and grants. Among his many professional accomplishments, he is particularly proud of receiving excellence in teaching awards as a graduate student at Penn State, and as faculty at SSU. He is also proud of a W. M. Keck Foundation grant that initiated the creation of the Micro analysis laboratory which has been heavily utilized by physics students and faculty since its establishment in 2000. Saeid is currently teaching the Communication at the Digital Age course for the Engineering Science Department. Dr. Rahimi has enthusiastically taught more than 25 different lecture and laboratory courses in the Department of Physics & Astronomy. "I am grateful for the privilege of serving this wonderful university for the past 30 years and am extremely happy to have an opportunity to complete a full circle and come back to teaching after more than a decade of administrative service," he said.

McQuillen Scholar 2011:
Nanometer Scale Architecture
By Michael Harris

Summer research is one of the best ways to spend the summer vacation between semesters, and it is even more important for students studying the natural sciences, as science is built on experiments and research. By getting a chance to perform actual research, and real experiments, students can see what their field of study is actually like, which can help guide them towards the area they are most interested in. When I first started into physics, the introductory lab classes had very simple and straight forward experiments, timing a ball as it rolls, or measuring the distance traveled. All the students know that these are just teaching tools, and many wonder what real scientists do. This past summer, I got to find out firsthand what real science is like.

Much to my surprise, there were a lot of similarities between the actual experiments, and the lab work from physics and chemistry classes. The subject I was researching with Dr. Hongtao Shi was to fabricate nanometer scaled porous aluminum oxide (1 nm is one-billionth of a meter) using an electrochemical method, taking a piece of ultra-pure aluminum foil, and treating it with acid and electricity to create tiny honeycomb patterns on the surface. A few hundred holes with a diameter between 100 and 200 nm could be lined up across the width of a human hair. One can tune all available electrochemical parameters to manipulate these samples. The measurements of perchloric acid, phosphoric acid, ethanol, chromic acid, and other chemicals were all measured by hand, and while the measurements were as precise as humanly possible, humans aren't very precise creatures. What about the voltage or time? Once again, those were as precise as we could measure them, with the voltage to the hundredth's place, and the time to the second. Where were the measurement robots I was expecting? What does all this mean for science? Great things, as it means that worthwhile experiments can take place without expensive equipment. While there are experiments out there that require computer controlled precision equipment, this was not one of them.



Porous aluminum oxide

I spent a large amount of time designing a new chemical cell to create samples in, as the one we were using at the start of the summer had been created years before, and was starting to get old. This involved learning to use Google Sketchup, and spending lots of time in the machine shop working with John Collins, learning how to use the equipment to shape metal and plastic. The new chemical cell has more precise measurements than the previous one, with all the details required to make exact duplicates.

Learning how to use the Scanning Electron Microscope was a very interesting task. In order to see the small nanostructure in our samples, we couldn't use a normal optical microscope, as the optical wavelength of photons is too long. So we used high energy electrons which produced much shorter wavelengths. It took some effort to become good at the microscope. Once I got the hang of it, I was soon able to compare samples, and quickly figured out how to improve the quality and consistency of the results. Then we started trying to put metals into these holes, in the hopes of growing nanometer scaled wires for data storage applications. This project is still ongoing, searching for the right parameters to make that happen in the near future.

All in all, I learned a great deal, and helped advance nano-physics. I also learned about myself, and discovered that while I am still interested in science, research, and technology, the human error, even though minimized, bothers the perfect pure math part of my mind. I am more interested in the sort of research that does require computer controlled precision robots, and so my scientific interest has shifted to be more aligned with that sort of research as a result of being able to take part in this wonderful summer research project.

AlumNotes

Sean Fraser ('95) *is teaching physics and astronomy at Moorpark College in Moorpark, CA. He was previously a lecturer in physics at the University of California, Santa Barbara, where he received his M.A. in 2002. He earned a certificate of advanced study in theoretical physics at the University of Cambridge in 1996 after spending a year at the University of Heidelberg on a Barry Goldwater Scholarship.*

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 a component engineer for mirrors and polarizers at the National Ignition Facility 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.*

Tom Bittancourt ('03) *is a metrology process engineer at GE/PrimeStar Solar in Arvada, CO.*

Tyana Stiegler ('03) *is a graduate student and research assistant in physics at Texas A&M University. She is currently working on the LUX (Large Underground Xenon Detector) Project, a dark matter direct detection experiment in South Dakota. She earned a master's degree in physics at the University of California, Davis.*

Michelle Valencia [formerly Jones] ('03) *is teaching observational astronomy at Mendocino College. She has been a docent at Taylor Observatory in Kelseyville.*

Thank You for Your Support!

In these difficult financial times, we especially appreciate the contributions of our generous donors, who have allowed us to maintain our departmental traditions and have greatly helped support our students. Private donations have been crucial in the growth and continuation of excellence in the Department of Physics and Astronomy. As the State of California budget worsens, the cuts into education spending deepen further. It is donations from private individuals that allow us to maintain a healthy program.

The *What Physicists Do* lecture series is supported in part through donations. Dr. Scott Severson (*scott.severson@sonoma.edu*) is now running the series, and welcomes any suggestions that you might have for future speakers. We have just completed our 83rd semester of the popular series, which was greatly augmented this year by a kind donation from the estate of long-time WPD attendees Robert and Bertha Rains. We miss seeing them and still fondly remember the wonderful brownies that Bertha used to bring.

This year we also received a number of generous donations in the form of support for undergraduate researchers. We have now have three research assistantships available to Physics majors: The Horace L. Newkirk Endowed Assistantship, which has supported students in the Spring semester for each of the past 17 years, and our two summer assistantships: the Mike and Sheila McQuillan award (now in its 11th year) and the Bryant and Diane Hichwa award (now in its second year). The research experience has a dramatic impact on the students, providing them with skills that propel them into graduate programs and successful careers in science. The Department also offers scholarship funds for Physics majors, including the Sol and Edith Tenn scholarship and the Joseph S. Tenn scholarship. This year, the Physics and Astronomy scholarship was renamed to honor the memory of Duncan Poland. The support from these three funds has been especially important as tuition fees for students have greatly increased.

If you would like to support our program and students please see ***http://www.phys-astro.sonoma.edu/publicSupport.shtml***, contact the SSU Development Office at (707) 664-2712 or contact the Department.

Current Funds:

#C0141 Public Programs
Richard M. Bell, Carolyn Clary-Macy, Bernard H. Meyers, Ed J. LeDu (Forestville Mini Storage), Francis V. Marshall, Ned and Joanne Phipps, Miriam (Tobin) Jewell ('90), Bob Fisher, Joe and Eileen Tenn, James Pedgrift and the estate of Robert and Bertha Rains.

#C0142 Physics & Astronomy Equipment and Supplies
David Munton ('82) and Lauren Novatne ('89).

#C0143 SSU Observatory
Jo-Ann Smith.

#C0144 Student Development Program
Michael T. and Sheila McQuillen, Bryant P. and Diane Hichwa.

Endowment Funds:

#E0185 Charles and Norma McKinney Fund
The Charles and Norma McKinney fund supports public programs.

#E0208 Horace L. Newkirk Memorial Student Assistanship
Established by Nadenia Newkirk in memory of her father to support student research.

#E0231 Duncan E. Poland Physics & Astronomy Scholarship
Lynn Cominsky and Garrett Jernigan, Julie Gullickson, Pamela Gullickson, David Poland, Tobit Poland, Mr. and Mrs. Burrill Coburn, Sydney Edlund, Mr. and Mrs. Fred Linstrom, Dr. and Mrs. James Meyer, Mr. and Mrs. Bernard Meyers, Mr. and Mrs. Peter Oakes, Mr. and Mrs. Eric Pierce, Dr. and Mrs. Robert Sorani, Joe and Eileen Tenn, Mr. and Mrs. Clyde Underwood, Janice Wilson, Mary Wood, Jeanne Schulz, Mary Cryderman.

#E0269 Science at Work Fund
Established by John Max to support What Physicists Do.

Gifts In Kind:

The memorial brick for Duncan Poland was sponsored by former SSU faculty member Gary Sposito.

Frederick Arioli Jr. ('75) JWST NIRCAM posters.

AlumNotes

Tedman Torres ('04) *is an officer in the U.S. Navy, currently serving as the electrical officer in the engineering department of the U.S.S. Preble. He was formerly a postdoctoral researcher at the H. Lee Moffitt Cancer Center & Research Institute in Tampa, FL. He earned his Ph.D. in biological physics at Arizona State University in 2009 with a dissertation on fluorescence correlation spectroscopy.*

David Gray ('05) *is the Equipment Division Manager at Deposition Sciences Inc. in Santa Rosa.*

Elizabeth Harmony ('05) *is a laboratory technician at Broadcom in Petaluma, working in Ethernet Passive Optical Networking (EPON) testing.*

Roman Hewette ('05) *is working on biomedical equipment as a member of the U.S. Air Force at Nellis Air Force Base. He will soon move to Vandenberg Air Force Base, where he will join the 9th Space Operations Squadron to work on space operations.*

Jeremy Dixon ('07) *is an engineer with Soladigm, Inc. in Olive Branch, MS.*

Ryan McDaniel ('07) *is an associate engineer at Deposition Sciences, Inc. in Santa Rosa and is also helping out the astronomy program at SSU.*

Alexander McMahon ('07) *is a Security Engineer for the FDIC. Formerly a software engineer for 3D Research Corp. in Maryland, he is now working on a master's degree in system engineering at Johns Hopkins University.*

Alexander Sevilla ('07) *is an electronics technician at Deposition Sciences, Inc. in Santa Rosa.*

Michael Youmans ('07) *is an engineering technician at Spectra-Physics in Mountain View.*

Charles Granger ('08) *is a graduate student in physics at San Diego State University, concentrating on electro-optics.*

Chris Johnson ('09) *is teaching physics at Elk Grove High School in Elk Grove, CA.*

Eric Lundy ('09) *is a graduate student in mechanical engineering at Manchester Metropolitan University in England.*

Katherine "Katy" Wyman ('09) *is a technical assistant in the Director's Office for the Chandra X-Ray Observatory at the Harvard-Smithsonian Center for Astrophysics in Cambridge, MA. She earned an M.S. in astronomy at Wesleyan University in 2011.*

Kathleen Morrison ('11) *is a student in the teaching credential program at SSU. Currently a substitute teacher in the Cotati-Rohnert Park School District, she intends to teach middle school science.*

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