Magnet System Comes Online

By Assistant Professor Jeremy Qualls



On May 4 a group of students and technicians brought a *Cryomagnetics* 17-tesla superconducting magnet system online. This event signifies the inclusion of a powerful new instrument to probe the frontier of science as well as a testament to the collaborative spirit of SSU. The magnet system greatly expands the resources available not only to students but to the scientific community as well. The project was supported by a \$237,000 grant from the National Science Foundation grant award NSF-0421366, SSU start-up funds, and resources from the School of Science and Technology. The high field will allow researchers to map out the electronic states of conductors and probe the correlation between crystal structure and observed behaviors.



17-tesla System Operates at Full Field . From Left to Right: Bill Garcia, Steve Anderson, and Jeremy Qualls

The highlights of the system include the ability to provide incredibly high magnetic fields, extremely low temperatures down to 1.5 K, and the ability to measure sample properties. The system has the added advantage of being able to apply high pressures to samples or to rotate them in the presence of the field. The tesla is the SI unit for magnetic fields named in honor of physicist and pioneer Nikola Tesla. The magnitude of the Earth's magnetic field is only around 50 microtesla. It is extremely rare to find fields even close to a tesla in nature. A 17-tesla field is large enough to quantize electronic ground states of conductors and levitate

diamagnetic materials such as water. By combining the new capabilities with the existing instrumentation provided by the Keck labs, SSU has an incredible ability to explore science in materials. The SSU magnet system took a full two and a half years to make operational. The first time it was cooled here in Darwin Hall, the inner chamber ruptured and the 1000-pound system had to be shipped back to the vendor to be repaired. At the time, all present were shocked



by the loud sound as well as the realization of how easy it is for a system like this to go awry. During the second time it was cooled, the seals gave way to ice formation inside the magnet and the system had to be warmed up. However, the third time the system was cooled was truly the charm. It now works perfectly. Students in the PHYS 366 Intermediate Physics Laboratory course have already begun using the system to characterize samples with temperatures as low as 4 kelvins. The experiences gained here using these fields at low temperatures are hard to find outside of major national labs and provide our students with a unique and invaluable experience. The helium reliquifier used by our system is the first of its kind and was a prototype designed by Cryomech. With the successful operation of our liquifier, many other systems have already been built and sold. As helium is a limited and endangered resource, the technology developed for our magnet has already led to significant recovery of helium in labs around the world.

Many features that had to be developed would not have been possible without the strong support of technicians and the School of Science and Technology. A big thanks goes out to Steve Anderson, Nels Worden, Bill Garcia, Austin Powell, Lynn Cominsky, Saeid Rahimi, and all the others who made this possible. It was truly amazing to see so many facets of the University coming together to make this happen, and the result is something unique for students and scientists to use for years to come.



First Data from the Magnet System. Credit: Bill Garcia.

Cosmology in the Classroom

By Logan Hill ('06)

Space. It's big, sure. But how is it shaped? How is it structured? How has our Universe changed over time? Undoubtedly if you have taken an astronomy course you've touched on some of these concepts. Yet cosmology is rarely treated to its own course. More often it is wrapped together in other astronomy courses, touched on almost as a side note or afterthought. The SSU Department of Physics and Astronomy regularly offers ASTR 350, a Cosmology course that focuses on these topics at a General Education level.

Dr. Lynn Cominsky wrote in her ASTR 350 Cosmology course introduction, "Many claim that we are now living in the "Golden Age of Cosmology" due to the many recent advances in our understanding of the Universe that have resulted from these new precision measurements. The most recent information, therefore, will often be found on the Internet..." How right she was. With the implementation of many new satellite observatories, such as WMAP and Planck, a veritable treasure trove of the aeon is being revealed to us about our Universe. And while this information is





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The power spectrum of

the cosmic microwave

stored in that microcosmic series of tubes; the internet, it is stored across hundreds, if not thousands, of sites.

Additionally, many universities and colleges lack cosmological courses, either because they do not have the funding, the enrollment, or the staff with the expertise or background to teach such a course. The NASA E/PO group here at SSU (see "NASA E/PO: Gamma-ray Bursts, Cosmology, & High Power Rockets" in this newsletter for more information on the group and its activities) is currently tackling this need for cosmology education, with the help of a new \$500K grant from NASA. They have partnered with Chicago State University and the University of Nevada, Las Vegas to develop an online course that professors from any university or college anywhere in the world can use. The latest data on cosmology will be collected together for this course from across multiple missions.

> The group is using Kendall Hunt Publishing/Great River Technologies to develop a comprehensive and robust online interface for the course material, so that educators have a choice to either teach it as a "standard" physical class or use the interface for a completely virtual classroom environment.

The current timeline will have the first section, approximately 1/3 of the entire course, ready for testing by Spring of 2011. With all the major discoveries in cosmology over the past few decades, from fine details of the Cosmic Microwave Background to Dark Energy to the webbed super-structure of galaxy clusters distribution, it is high time that everyone has the opportunity to learn about our Universe.

Sonoma State University is now an Affiliate of California Space Grant Consortium

The California Space Grant Consortium, is one of 52 NASAsponsored higher education programs, designed to provide activities that increase the understanding, assessment, development, and utilization of aerospace resources and to expand the educational, scientific, and research base of all aerospacerelated fields. Sonoma State University is now an affiliate of California Space Grant, enabling SSU students to apply for NASA internships and other opportunities. For more information, see *http://casgc.ucsd.edu/*

Cominsky Elected a Fellow of the APS

Lynn Cominsky, Chair of the Physics and Astronomy Department, has recently been elected a Fellow of the American Physical Society (APS). Election to Fellowship within the APS is limited to less than one half of 1% of the society's membership, and is a recognition of Cominsky's outstanding contributions to physics. Her Fellowship Certificate reads, "For her seminal work to promote student and teacher education using NASA missions as inspiration." Additionally, Cominsky was also elected to be Vice-Chair of the California section of the APS, and to the Executive Committee of the APS' Division of Astrophysics.

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Let's Run While It's Still Cold

By Associate Professor Hongtao Shi

The global semiconductor industry has enjoyed phenomenal growth in the past few decades and has had an unprecedented impact on our society. Since the electrical conductivity of a semiconductor can be tuned between that of a metal and an insulator, one could make devices for various applications such as radio, computers, telephones, etc. On the other hand, wide bandgap semiconductors, such as GaN and ZnO, have huge applications in optics and optoelectronics. In fall 2009, we successfully fabricated wide bandgap zinc oxide in the laboratory, using electrodeposition. With the low temperature cryostat we have in the Keck microanalysis laboratory, we were able to cool the material down to 15 K or – 440 °F, which is extremely cold! In order to observe the UV light emission as a function of temperature, one has to illuminate these samples with a deep UV light source such as the YAG laser, located in the laser lab. Tim Hessong, who was working on the project then, had to cool the sample down in the Keck lab first, then move the cryostat as quickly as possible to the laser lab. It only took a minute or so before everything was settled down in the laser lab. By then the temperature of the sample had already risen to 30 K. Nevertheless, we were so happy to be able to see the strong dependence of the light emission from these samples as a function of temperature and annealing. When I gave a talk this semester in the Engineering Science department, this work was very well received. Thanks to the SSU Facilities Services, who installed another circuit in the laser lab, now we don't have to carry the cryostat back and forth any more. We are in the process of completing that project while looking into how impurities affect the optical properties. For sure, we will miss those days when we had to run a 50-meter race from one lab to the other to minimize the thermal loss during the sample transport.



Tim Hessong and the Janis Cryostat.

ALUMNOTES

Jim McBride ('75) is an independent wealth management advisor in Petaluma. He did similar work for 18 years with Merrill Lynch in Santa Rosa and has been the business editor of KFTY Channel 50. He earned a second bachelor's degree in mathematics at SSU in 1976 and an MBA at Pepperdine University in 1983.

Alan Gilbert ('77) retired in 2008 after 28 years as a programmer analyst and software engineer. After graduation he taught math and science in Swaziland as a Peace Corps Volunteer.

Ross Goodwin ('78) is a managing partner with the Bennett Valley Group, Inc., a marketing and consulting firm in Santa Rosa, and also teaches business courses at College of Marin and Dominican College. A former chair of the Bennett Valley School Board, he earned an M.B.A. at the University of California at Berkeley in 1980.

Johannes Raab ('79) is an auditor with a large insurance company in Munich, Germany. He earned a Ph.D. in experimental particle physics at the University of California, Santa Barbara in 1987 and did postdoctoral research at CERN, the University of Mainz, and the Max Planck Institute.

Richard (Rick) DeFreez ('80) is a senior scientist for both Met One Instruments, Inc. in Grants Pass, OR and Photon Systems, Inc. in Covina, CA. He earned his Ph.D. in applied physics at the Oregon Graduate Institute of Science and Technology in 1985. He was honored as one of Sonoma State University's Distinguished Alumni in 1995.

James Patrick ('83) is a military pilot based in Arizona.

Antoinette Davis ('84) is the executive director of the Activities & Attractions Association of Hawaii. She earned an M.B.A. at the University of Hawaii in 2002.

Douglas Epperson ('88) teaches physics and astronomy at West Valley College in Saratoga. He earned his Ph.D. in physics at the University of California, Santa Cruz, in 2001 after doing research at the HERA accelerator in Hamburg, Germany.

Iad Mirshad ('89) is an applications engineer with Therma-Wave, Inc., a maker of metrology systems in Fremont. He earned a Ph.D. in experimental nuclear physics at the University of California, Davis in 1995.

Daniel Nottingham ('89) is a marketing manager for Kronos, Inc. in Chelmsford, MA. He formerly participated in rocketlaunching experiments for the Boston University Center for Space Physics.

Katherine Rhode ('89) is an assistant professor of astronomy at Indiana University. In 2009 she was awarded a prestigious Faculty Early Career Development Program award by the National Science Foundation. She earned her M.S. in 1997 at Wesleyan University and her Ph.D. in astronomy in 2003 at Yale University.

Fausto Morales ('90) is the Director of Organization at Neo Metrics, a Business Intelligence consultancy based in Madrid, Spain. He also invents and publishes logic puzzles, and was interviewed recently for the "Once a Physicist" column in the June 2010 issue of Physics World. He earned an M.S. in physics at the University of Michigan in 1991 and an M.S. in mathematics at Bowling Green State University in 1993.

Adaptive Optics Laboratory Awarded National Science Foundation Grant

By Assistant Professor Scott Severson

The National Science Foundation has awarded a Major Research Instrumentation grant of over \$630,000 to a three-institution collaboration including Pomona College, Caltech and Sonoma State University. We will develop and deploy a lowcost, remote-access, natural guide star adaptive optics system for the Pomona College Table Mountain Observatory (TMO) 1-m telescope. The system, which we call CCAO-CAM, will offer diffraction-limited imaging simultaneously at visible and near-infrared wavelengths. The correction of atmospheric "twinkle" will deliver an order of magnitude improvement in point source sensitivity and angular resolution relative to the current atmospheric "seeing" limit. With these improvements comes the ability to take higher resolution images of fainter astronomical sources; galaxies, nebulae, stars, and planets. In addition to these scientific and technological objectives, CCAO-CAM will serve the important additional role of introducing adaptive optics to a broad audience that includes, but is not limited to, physics, astronomy and engineering students. The primary training objective for this instrument is to introduce adaptive optics technology and techniques to a broad range of students and to train a generation of undergraduates in both astronomical research and instrument design. The breadth of our collaboration will be critical in accomplishing this final objective optimally. The collaboration between public (Sonoma State University) and private (Pomona) undergraduate institutions will create the large and diverse pool who will benefit from this project.

Work on the project begins this summer, with Professor Scott Severson and Sonoma State University student Blaine Gilbreth working with their southern California colleagues. The CCAO-CAM project was funded by NSF through the American Recover and Reinvestment Act.

A CAD model of the basic optical layout of the CCAO-CAM instrument. A view of the instrument mounted at the Cassegrain focus of the Table Mountain Observatory 1-meter telescope (left) and a zoomed-in view showing the adaptive optics bench mounted below (right).



AlumNotes

Daniel Swearingen ('90) is the Director of Studio Operations of Autistry Studios, a non-profit organization to help teens and young adults with social, communication, and learning difficulties become successful independent adults, in Marin County. A longtime programmer, webmaster, and businessman, he earned a master's degree in physics at California State University, Northridge in 1991, and a second master's in astronomy at Indiana University in 1997.

Paul Kohlmann ('92) graduated from the Empire College School of Law and was admitted to the California Bar in 2009. He remains a senior engineer and manager of the science and technology labs for Flex Products, a division of JDSU in Santa Rosa.

Holly Jessop ('93) is a Ph.D. student in zoology at the University of Hawai'i at Manoa. She earned her M.S. in tropical conservation biology at the University of Hawai'i at Hilo in 2008. She was awarded a prestigious Environmental Protection Agency Greater Research Opportunities Fellowship f or Graduate Environmental Study. **Greg Sprehn ('93)** and his wife provide technical and scientific consulting services to medical device startups as Rivendell Heights, Inc. He has been a physicist in remote sensing, chief scientist in radiological imaging, and vice president of engineering in ophthalmic imaging. He has been awarded several patents in image processing and fiber-optics.

Lisa Christensen ('94) is a technical writer and editor at the SLAC National Accelerator Laboratory, where she was formerly an accelerator operator. She earned a teaching credential and a master's degree at Stanford University in 1995.

David Lamb ('94) is an advanced physics research specialist in the Optical Systems Division of 3M in St. Paul, MN. He received his Ph.D. in physics at the University of Alabama in Huntsville in 1999.

James Snyder ('97) is a research engineer in the Applied Physical Sciences Laboratory at SRI International in Menlo Park. Formerly he was a program manager at Deposition Sciences Inc. in Santa Rosa.

Brooke Haag ('01) earned her Ph.D. in nuclear physics at the University of California, Davis in 2009. She is a physics instructor at Hartnell College.

SPS: The Next Generation *By SPS President Austin Powell*

The Society of Physics Students (SPS) here at Sonoma State has completed another exciting school year. Although we had one of the largest graduating classes last spring, we also had several new recruits to the club. In between studying, we ventured to local nuclei of knowledge such as UC Davis and the California Academy of Sciences. These trips were made possible mostly by the funds from our club treasury. Back home at the SSU campus, we were able to offer free group tutoring to many students struggling in physics classes. As the Spring semester began to wind down, we hosted the Physics and Astronomy table on a sunny Seawolf Day.

Despite having fewer club members, our outreach to SSU students was very active. After reorganizing the study room on third floor Darwin, the club began offering free physics assistance there every Tuesday. This was thanks to the aid of generous club members volunteering their time! And if free tutoring were not enough, we shared our hard won club pizza with these students.

I t was exciting

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to see how other SPS clubs were faring at the zone meeting at UC Davis. It was enlivening also to be able to interact not only with our SPS peers, but also with physics doctoral candidates on their experiences as graduate students. We were privileged enough to get a tour of UC Davis' "76-inch isochronous cyclotron" called Crocker Nuclear Laboratory.



SPS members, 2009-2010

This year's awesome club T-Shirt!

Senoms State SPS Physics and Astronomy I know where I am... but I don't know where I am going.

During the tour, we were able to see some technology which was still a very significant source of information despite being over three decades old. During that tour, we saw how operators were able to use the cyclotron as non-invasive treatment for melanoma. Overall, we got some great results from our trip to UC Davis!

Despite a small turnout overall on Seawolf Day, physics and astronomy was a hot subject for upcoming college students. With the aid of some of the department instructors and club members, we gave interested students a thorough tour of our resources. Hopefully we will be getting some more club members in the fall!

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.

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NASA E/PO: Gamma-ray Bursts, Cosmology, & High Power Rockets. By Logan Hill ('06)

This has been an exciting year for the NASA Education & Public Outreach (E/PO) group here at Sonoma State University, for several reasons. But first, what is the NASA Education & Public Outreach group?

Run by Dr. Lynn Cominsky, who is also the chair of the Physics & Astronomy Department, for those who are new to SSU, the E/PO group is funded by several high energy NASA satellite missions to develop, test, and distribute educational materials related to the missions and the science behind them. These materials are created not just for K-12 and college educators but the general public as well. There are four primary missions that the E/PO group supports: Fermi, Swift, XMM-Newton, and NuSTAR. Where Fermi and Swift's primary focus is gamma rays; XMM-Newton and Nu-STAR are x-ray oriented.

Helping the full time staff are several student assistants: Brandon Baker, Jarod Fahle, Kathy Morrison, Diamante Rueda, Juanita Tenorio, and Bryce Terrell. Each helps maintain the stability and smooth-running of the E/PO group. Diamante and Juanita are instrumental in making sure the group's administrative and logistical needs are met, while Brandon, Jarod, and Bryce are kept under lock and key reducing data and managing the remote observatory, GORT, which is located in the hills north of Santa Rosa. Kathy has recently joined the group to help develop the on-line cosmology course and to work with middle-school students.



EA Daryl Taylor with students in Connecticut.

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This past year has been exceptionally fruitful for high energy astrophysics, and these missions are at the forefront of these new discoveries. The E/PO group manages the Gamma Ray Burst (GRB) Real-Time Sky Map (http://grb.sonoma.edu/), which is practically ablaze with GRBs detected by Swift, Fermi, and a few other observatories. GRBs are detected roughly once a day, and are among the most powerful, energy-releasing events in our Universe. The Real-Time Sky Map site has been recently updated to include a new interface that displays burst summaries, star fields, light curves, which mission(s) detected the event, as well as having a real-time updated sky map of the locations of the bursts.

One of the ways that the E/PO group promotes discoveries like these to the public is through its Educator Ambassador (EA) program. A cadre of master teachers, from across the country, travel to regional and national education conferences and conventions to give workshops using the materials and activities developed by the E/PO group. These EAs are highly trained teachers and every two years come to the EA Training Conference here at Sonoma State in order to brush up on the latest findings in astronomy and cosmology as well as to share their workshop experiences to better hone the E/PO group's materials. This summer will mark the fifth EA Training Conference, the first having been held in 2002.

be it!

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The E/PO group also has an ongoing online comic strip that supports all of its NASA missions through a science-oriented science fiction story of Alkina and her sentient ship Epo.

Epo's Chronicles: http://www.eposchrona takes the reader around our Milky Way as



This is where the signal beacon is coming from.



Photons race through the cosmic foam

One of the great discoveries made by these missions comes from Fermi, which detected a gamma ray burst from an exceptionally large distance: a pair of gamma-ray photons reached the Fermi Gamma-Ray Space Tele-

scope only 900 milliseconds apart after traveling for 7 billion years. Fermi's measurement gives us rare experimental evidence that spacetime is smooth as Einstein predicted, and has shut the door on several approaches to gravity where space-time is foamy enough to interfere strongly with light (*http://www.nasa.gov/mission_pages/GLAST/ news/first_year.html*). This event has placed an upper limit on the size that quantum foam can be, indicating that specific theories with quantum foam above this limit are not correct.





Level 1 certification flight of Prof. Cominsky's "scratch-built" rocket at Snow Ranch in April 2010.

EA Linda Smith works with a student in New Jersey



Arduino Based Science Payload prototype for a CanSat, developed by Kevin John (*07).

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Lift off! We have a lift off!!!

In addition to supporting NASA missions, the E/PO group also develops their own astronomy and science based programs. One such program, the Online Cosad mology Course, is detailed in another article in this Newsletter (See "Cosmology in the Classroom"). Another program in the works is the High Powered Rocketry and CanSat program. Across the U.S., there are many middle school and high school



science classrooms that teach some basic rocket science, usually with water rockets or small Estes rockets. Yet after that there is a huge gap, with experimental University-built NASA payloads in sounding rockets as the next step. The E/PO group is developing a high school level rocketry program that will help bridge that gap by having students not only build high powered rockets capable of 5 – 15 thousand feet altitudes and higher, but also design and build their own science payloads for those rockets. The payloads will fit inside a soda can, hence the name "CanSat."

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icles.org is updated every Monday with an ongoing storyline that the protagonists search for Earth in the distant future.

For more information on the E/PO group and its projects visit *http://epo.sonoma.edu*

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Remote Interactive Avatar

Newkirk Assistantship 2010: Adaptive Optics System and Telescope Preparation By Blaine Gilbreth

Because of the varied fluctuations in the earth's atmosphere, images of celestial objects taken from terrestrial telescopes can be fuzzy and inadequate for scientific analysis. Light comes from distant objects extremely far from earth and then suddenly just as it gets down through our atmosphere, the light becomes distorted. Fortunately, Adaptive Optics is a methodology used to correct the distorted light on the ground to obtain extremely clear and precise images that otherwise would be less useful.

For this year's Newkirk project I have worked with Dr. Scott Severson on an adaptive optics telescope that will eventually be built at the Galbreath Wildlands Preserve up in Mendocino County. We are putting together the adaptive optics system first on the optics bench in the lab, where we test and build the equipment and write some of the software. I have mostly worked on the wave front sensor (WFS), an integral part of the adaptive optics system. The WFS consists of a CCD camera and a lenslet array which together detect the overall shape of an incident light wave. It then takes that information and communicates with a deformable mirror that literally deforms by appropriate troughs and hills so that reflected light off the deformable mirror is no longer distorted—removing the effect of the atmosphere all together. I am building the lenslet array holder which has to be machine made out of aluminum in the machine shop. It has been challenging and a learning experience to create small and precise optical equipment. Also, we were running into trouble with the configuration of the CCD camera because it can only be used by third party software and the configuration files are not working correctly. So I had to learn the low level AIA serial commands to directly speak to the camera in order to find a way to change the integration time. We have also been making some physical changes and additions to the overall system on the optics bench. Most notably we introduced another beamsplitter as a convenient way to have two light sources running at the same time-the white light source and the laser guide beam.



Blaine Gilbreth designing an Adaptive Optics Framework

Also, a lot of calibration and preliminary testing needs to be done to establish the seeing conditions of the potential locations for the telescope at the Galbreath Wildlands Preserve. We are currently working on two methods to determine the atmospheric seeing. One is the Hartmann-Mask method which detects the differential image motion of light split up using a telescope cover with a lot of pupils that can be put on the top of a portable telescope. I have been writing a program using IDL to automate the calculations in finding the seeing parameter. More recently we have been collecting data using a seeing monitor which tracks Polaris through the night and then analyzes the FWHM (seeing quality measurement) during the night to determine the statistical fluctuations. So far we have determined great seeing quality (about 1 arcsecond). It is exciting to be part of the initial stages of this project and I am greatly enjoying all the opportunities I have as an SSU Physics major. These experiences are invaluable and I feel very fortunate to be the recipient of the Newkirk award this year. I want to thank Nadenia Newkirk for endowing this generous fund.



Alumni Spotlight

by Brooke Haag

I was a physics major at Sonoma State University from Fall 1999 through Spring 2001. Looking back on my experience, I most appreciate the fact that the physics majors were a close knit group, the benefits of small class sizes, and our engaging professors.

After finishing at SSU, I moved on to a PhD program at UC Davis where I recently finished my dissertation work in the field of relativistic heavy ion physics. It was in graduate school where I first developed an interest in teaching and spent as much time as possible in the classroom with the intention of obtaining a position at a community college.

I am currently the only full-time Physics Instructor at Hartnell College, a community college in Salinas, California of about 10,000 students. As a former student of Hartnell, I have enjoyed the position, often working closely with the best students at the college. I am also adviser to the Hartnell physics club. It is a local chapter of the Society of Physics Students and has been nationally recognized for its consistently outstanding outreach efforts to the community.

Tenn's Bruce Medalists Website Archived by Library of Congress

In April SSU Professor Emeritus Joe Tenn received an unexpected request from the Library of Congress. Would he allow the Library to include his website, The Bruce Medalists, in its online research collections? "Of course I said yes," Dr. Tenn told us. According to the Library website, "The Library's traditional functions of acquiring, cataloging, preserving and serving collection materials of historical importance to the Congress and the American people to foster education and scholarship extend to digital materials, including Web sites," and the Library, in conjunction with national libraries of several other



Inside the Library of Congress

countries, is building the International Internet Preservation Consortium.

The Bruce Medalists site, under development for about 20 years, includes Dr. Tenn's brief biographies, photos, and links to other biographical materials, obituaries, and historical materials about each of the now 103 astronomers awarded the Catherine Wolfe Bruce Gold Medal of the Astronomical Society of the Pacific (ASP). There are also extensive bibliographies of materials by and about each medalist, with links to those items which may be found online, often in obscure places.

Noted historian of astronomy Robert W. Smith wrote in the Journal for the History of Astronomy last year, "The website run by Joe Tenn of Sonoma State University (http://www.phys-astro.sonoma.edu/BruceMedalists/) provides a wealth of detail on the winners of the Astronomical Society of the Pacific's Bruce Medal, which include figures such as Campbell, de Sitter, Lindblad, Hubble, Milne, and Shapley. The section on Hubble, for example, provides an impressively full listing of papers about Hubble and is arguably the single best starting point for anyone aiming to master the literature on him."



ALUMNOTES

Justin Flory ('02) is a graduate student and research assistant pursuing a Ph.D. in the new biological design program at Arizona State University. After graduation he worked seven years as an engineer in the diabetes care division of Abbott in Alameda and at Symmetricom, Inc. in Santa Rosa.

John Collins ('03) is the equipment technician for the School of Science and Technology at Sonoma State University.

Julia Maisen ('03) is the digital asset coordinator at Monterey Bay Aquarium in Monterey.

Tedman Torres ('04) earned his Ph.D. in biological physics at Arizona State University in 2009 with a dissertation on fluorescence correlation spectroscopy. He is now a postdoctoral researcher at the H. Lee Moffitt Cancer Center & Research Institute in Tampa, FL.

Roman Hewette ('05) is an air traffic controller in Las Vegas.

Logan Hill ('06) is a production assistant with the Education and Public Outreach group at Sonoma State University.

Alex McMahon ('07) is a system administrator and software integrator for 3D Research Corp., working on defense contracts in Maryland.

Each spring the ASP notifies

Dr. Tenn a couple of months in

advance so that he may prepare the new pages before the public

announcement of that year's

Dr. Tenn reports that he is

grateful to the Department

of Physics and Astronomy for

continuing to host the site on

medalist.

its web server.

Josh Rose ('07) is a Product Engineer for TriQuint Semiconductor, Inc. in Santa Rosa.

Charles Granger ('08) is a research assistant at MetroLaser Inc. in Irvine, CA.

Gabriela Sanz-Douglass ('08) is a graduate student in mechanical engineering at San Diego State University.

Kevin Bransford ('09) is a graduate student at Portland State University, where he intends to pursue a Master of Public Administration degree.

Michael Duncan ('09) is a graduate student and teaching assistant in physics at California State University, Fresno. He will be doing research in experimental particle physics at CERN this summer.

Kenneth Martinelli ('09) is a quality assurance technician with Northrop Grumman.

Bradley Yearwood ('09) is a senior software engineer at Calix Networks, Petaluma.

Mike and Sheila McQuillen 2010 Research Award

By Brooks Hanley

The SSU Department of Physics and Astronomy offers many great opportunities for students to get involved in faculty research, both formally and informally. One of the formal opportunities is the Mike & Sheila McQuillen Summer Research Award, provided by a generous annual donation from Mike and Sheila McQuillen. In order to receive the award, an upper-division Physics major must choose a project and a faculty member whose interests are most closely aligned to the project and write a formal proposal. Similar to grant proposal processes for government sponsored research at institutions nationwide, the process give students a glimpse into competitive research. The actual research the student performs here at SSU provides an opportunity on par with that undergraduates at major research institutions might have. It is a great asset to the aspiring physicist at SSU and allows a peek into graduate school and a research career.

For the summer of 2009, I was fortunate enough to be provided this once-in-a-lifetime opportunity. As a double major in Physics and Engineering Science, I am highly interested not only in theory and how nature works, but also in the many applications of the theory into practical, useful devices. One such application involves research support by NSF-Award-0609345 started last spring by 2009 SSU Physics student Michael Duncan under Assistant Professor Dr. Jeremy Qualls. The research started as an investigation into the basic properties of magnetic fluids, but I extended the scope of the project.

The aim of my research was to reproduce cutting-edge findings in 2007 by three professors of Chemistry at the University of California, Riverside, Dr. Jianping Ge, Dr. Yongxing Hu, and Dr. Yadong Yin. They wanted to prove that photonic crystals could be used in switching applications. Instead of using mirrors to

What Physicists Do

By Kathleen Morrison

As the academic year once again comes to a close, so concludes another successful season of the "What Physicists Do" lecture series. This series, which is entirely supported by generous gifts from friends of the SSU Physics and Astronomy Department, provides a contemporary view of what is currently happening in the world of physical science. During this time of economic distress, this outstanding

lecture series would not have been possible without private donations and public support. Therefore, we, the SSU P&A community, thank you, our benefactors, from the bottom of our hearts.

This year the WPD series was under the direction of Dr. Scott Severson who took over after Dr. Joe Tenn retired last spring. Professor Severson, who had some rather large shoes to fill, did not disappoint the audience with his diverse selection of topics and speakers. The topics ranged from cutting edge astronomy and physics to science switch laser light, they used microscopic crystals that could react to light in different ways, depending on some external magnetic field stimuli. I set out to synthesize these crystals. The materials I was interested in were photonic crystals of polyacrylate-capped super paramagnetic magnetite (Fe_3O_4) colloidal nanocrystal clusters (CNCs). The clusters are colloids that are around 100 nanometers in size and consist of individual magnetite crystals around 10 nm in size. The CNCs were prepared by hydrolyzing FeCl₃ with the addition of NaOH at around 220 degrees Celsius in a solution containing polyacrylic acid (PAA). The CNCs then self-assemble (combine) with the application of a magnetic field. The hope was that the crystals would attract a small neodymium magnet and that at varying distances would change color, with the spectrum related to the energy of the magnetic field just as the light spectrum varies.

After synthesizing the photonic crystals (CNCs) many times and tweaking the process, we had mixed results. The crystals were indeed magnetic (as seen in the image with me holding the fluid and the small metal magnet sticking to the outside of the tube). However, they did not display the desired optical properties and change color as we varied the magnetic field. The crystals were analyzed using the scanning electron microscope with energy dispersive X-ray analysis in Dr. Shi's Keck Microanalysis Lab

in Salazar Hall and were found to consist of the right molecules in the correct proportions, but future research is necessary to determine the exact process by which to get optically correct CNCs.



Brooks synthesizes superparamagnetic materials

education, the possible existence of extra dimensions, and how physics helps shape nuclear weapons public policy. The speakers gave interesting, provocative talks with many presenting to standing room only crowds.

Highlights from the series include: from UC Berkeley, Dr. Paul Kalas, who discovered the new planet Fomalhaut b, Dr. Tom Banks, who discussed nuclear muon capture and Dr. Raymond Jeanloz, who discussed shaping nuclear weapons policy.

Dr. John Conway of UC Davis lectured on searching for the Higgs Boson. From UC Santa Cruz,

Dr. Anthony Aguirre spoke about the inflationary multiverse and Dr. Steven Ritz discussed the Fermi Gamma-Ray Space Telescope. SSU's own Dr. Jeremy Qualls discussed magnetic materials and the 17 Tesla magnet used for student research.

The 2009/2010 WPD series was a tremendous success and leaves us all waiting for next semester en it all begins anew.



Another year has passed, and we reflect back on those that have helped make it possible. We thank our Donors for helping the Department maintain its traditions and offering new opportunities. Private donations have been crucial in the growth and continuation of excellence in the Department of Physics and Astronomy. As the State of California struggles with its budget and continues to make deep cuts into education spending, it is donations from private individuals that allow us to maintain a healthy program.

The "What Physicists Do" lecture series is supported entirely 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 79th semester of the popular series.

This year we received a number of generous donations which support not only our "What Physicists Do" lecture series, but also came in the form of support for undergraduate researchers. The Horace L. Newkirk Endowed Assistantship and the Mike and Sheila McQuillen Summer Research Award continue to support students to do research with faculty. The research experience has a dramatic impact on the students, providing them with experiences that propel them into graduate programs and successful careers in science. Other scholarship funds, such as the Physics and Astronomy Scholarship, the Sol and Edith Tenn Scholarship, and the Joseph S. Tenn Scholarship, also support and provide students with opportunities they would not have if not for the generosity of donors.

We would also like to recognize high school student Ravi Heim-Shankar for volunteer work in the AO lab and Sheila Heim for her volunteer time and expertise in promotions for our public programs.

If you would like to support our program and students please see *http://www.phys-astro.sonoma. edu/publicSupport.shtml* or 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, Lynn R. Cominsky, Duncan E. Poland, Gregory ('93) and Debbie Sprehn, Joseph S. Tenn.

#C0142 Physics & Astronomy Equipment and Supplies James L. Aroyan ('87), Lee C. Steele ('85), Adobe Systems Inc. Matching Gift Program.

#C0143 SSU Observatory Jo-Ann Smith.

#C0144 Student Development Program Michael T. McQuillen, Bryant P. Hichwa, Patrick Colbus ('05).

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 Physics & Astronomy Scholarship Lynn Cominsky and Garrett Jernigan

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

Gifts In Kind:

Agilent Technologies: Donated a Newport RS4000 Isolation table for adaptive optics

Erik T. Kettenburg: Donated Tesla Coil for the Physics and Astronomy Department

SSU Public Viewing Nights

By Assistant Professor Scott Severson

The 2009-2010 season of the Observatory Viewing Nights program provided students and the public with an enriching and motivating astronomical viewing while showcasing the research undertaken by students and faculty in the Department of Physics and Astronomy. Physics majors, serving as docents, gain valuable experience operating telescopes and mentoring their fellow students.



Viewing opportunities are increased through the use of portable telescopes.

Below - Sonoma State students view Mars through the Mathis telescope.





Assistant Professor Scott Severson shares the latest astronomical findings with observatory visitors.

The Viewing Nights take place about twelve times an academic year (weather permitting). Eight are publicized as "Public Viewing Nights" across the campus and in the community, and four are announced only within our Astronomy courses. Serving over 800 total participants, this continues to be a popular program. The Fall 2010 kickoff viewing is September 10th. For more details visit

http://www.phys-astro.sonoma.edu/publicviewingnight.shtml.



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