THE PHYSICS MAJOR

AAPT Hears About SSU Physics Grads

Dr. Joseph Tenn spoke on "What Physics Graduates Do," to the Northern and Southern California sections of the American Association of Physics Teachers (AAPT) when the sections met jointly at California Polytechnic State University, San Luis Obispo in April 1988.

"Thanks to our graduates' willingness to return those pesky questionnaires, we now have information on the post-graduation activities of all but twenty of the Department's 199 graduates," Tenn reports. "I still hope to hear from those twenty."

For many years SSU has led the California State University system in the percentage of students majoring in physics. In Fall 1985, for example, 0.53% of the undergraduates in the nineteen-campus system were majoring in physics; at Sonoma State the figure was 1.87%. Second highest was 0.88% at San José State.

One of the reasons presented was the diversity of degree programs at Sonoma State: The B.S. is one of the most rigorous physics programs in the nation; the B.S. with a concentration in Applied Physics, established in 1985 and featuring a senior design project, is rapidly growing in popularity. Meanwhile the B.A. with the calculus advisory plan offers the flexibility to tailor one's program to any of a number of aims–engineering, teaching, scientific programming, optics, or electronics, for example. The B.A. with the algebra and trigonometry advisory plan has produced mostly technicians with a few people in scientific sales among its twenty-three graduates.

The purely descriptive B.A. once interested students intent on careers in science journalism or sales or elementary school teaching; attractive to few students in the 1980s, it is being dropped as of 1988-89.

Some of the results of the survey of graduates are presented in bar graphs and quotes elsewhere in these pages.

Barnebey and Cominsky Win Awards

Professors Thomas A. Barnebey and Lynn R. Cominsky of the SSU Department of Physics and Astronomy have been awarded $2500 prizes for Meritorious Performance and Professional Promise for 1988. Barnebey, proprietor of Sound Solutions Acoustical Consulting Services, has taught part-time for the Department since 1974. Cominsky is in her second year on the faculty. This brings to eight the number of such awards made to members of the Department since the California State University system initiated the annual prize in 1985. Only 35 of Sonoma State's 440 permanent and temporary faculty received the awards.

Image Processing Course Coming

In fall 1988 Dr. Gordon Spear will present a special topics course: Image Processing in Astronomy. The course will use the SSU Department of Physics and Astronomy's new Charge Coupled Device detector and related image processing system. Students will learn image enhancement and restoration, object detection and classification, pseudocolor, and pattern matching, using CCD images obtained both at the SSU Observatory and elsewhere.

The Joys of Research

Dan Wilcox

Sonoma State University has a number of faculty who are currently doing research. One of these is Dr. Lynn Cominsky. This year she is analyzing data from an x-ray burst source.

This is a binary star system with one of the stars a near-normal star and the other a neutron star. The neutron star is very small (10 km in diameter) but very massive. The neutron star's gravity pulls material off of its nearby companion star, forming what is called an accretion disc orbiting the neutron star. As this material is pulled into the neutron star, its gravitational potential energy is emitted in the form of x-rays. Because the material on the neutron star burns unstably, there are bursts of x-rays, hence the name "x-ray burster".

In 1984, Dr. Cominsky discovered that x-ray burster MXB 1659-29 has a 7.1 hour orbital period. She was able to discover this period because the orbital plane is seen nearly edge on; no x-rays are detected when the companion star is between us and the neutron star. The eclipse lasts 15 minutes.

This past year I have had the privilege of doing some undergraduate research by helping Dr. Cominsky reanalyze the data on this star to determine the orbital period to a higher degree of accuracy. To begin with, most of my time was spent getting existing FORTRAN computer programs to run on SSU's infamous Prime computer. These programs analyzed the data to try to determine the period by lining up eclipses from many different years.

When we had trouble improving the orbital accuracy, I wrote some programs that graphically illustrated how each eclipse fell with respect to the others. This just showed us what we already knew, that the eclipses didn't line up well, no matter what period we chose. Our only hope was that some new data we were to receive would help us out.

So in the break between semesters, we went to the Naval Research Lab in Washington, D.C. They had some data from the HEAO A-1 satellite that had not been analyzed. We spent a week in D.C. working in a real research facility. This was a great experience for me. To be able to work in the real world was quite enlightening. We accomplished some of what we set out to do. We got some data that had better accuracies for the times of some eclipses.

While we were in Washington it snowed about a foot. That shut the city down completely so we got a day off. Since Lynn is a native of Buffalo, the snow didn't slow her down. So we toured the city and saw a fabulous Georgia O'Keefe exhibit at the National Art Gallery. We then went across the mall to the National Air and Space Museum. We saw many interesting displays, including a mock-up of the Uhuru satellite that Lynn had worked on before becoming a graduate student. We then went up the mall to the Lincoln Memorial and the awesome sight of the Vietnam Veterans Memorial's black contrasting with the white snow. Reading those names carved in that stone caused an emotion I will long remember.

When our data collecting in Washington was through, I flew back here, and Lynn went on to the Marshall Space Flight Center in Huntsville, Alabama to collect more data from the Einstein Observatory satellite.

Back here, we resumed our quest for the perfect period. Upon analyzing the data, Dr. Cominsky noticed that all the satellites were using local earth time. This meant that at different times of the year, the earth, and therefore the satellites, are farther away from the star under observation. We then corrected the satellite's times to a common time base (the time at the Sun for each observation).

When we then reanalyzed the data, the eclipses lined up beautifully with a specific period. I then used a graphing program on the Macintosh to graph the different eclipses. I also graphed many other parts of the data that were of interest. These are all going into a paper that Dr. Cominsky is writing to report her findings.

Since Dr. Cominsky has received a new grant to study another x-ray burst source, she went to Amsterdam during spring break to get data from the European x-ray observatory, EXOSAT. Unfortunately for me, I won't be here to help analyze this data. So another lucky undergraduate will get some valuable research experience.

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New Equipment in the Department

The SSU Department of Physics and Astronomy continues to acquire new equipment, enhancing the already noteworthy laboratory program. A sample of recent developments:

The Applied Nuclear Laboratory
This fall a new large-area alpha particle spectrometer will make possible energy-sensitive measurements of α particles from uranium and thorium ores and from man-made sources. Dr. John Dunning is planning an expanded carbon-14 experiment using the liquid scintillation counter and a new set of quenched ^{14}C standards. The new x-ray detector will be put to good use detecting fluorescent radiation from samples excited by α particle bombardment, by uranium x-rays from a radioactive sample, by electron capture, and by x-rays from the x-ray generator in the basement of Darwin Hall. One experiment will be a demonstration of Moseley's law using elements from argon to uranium.

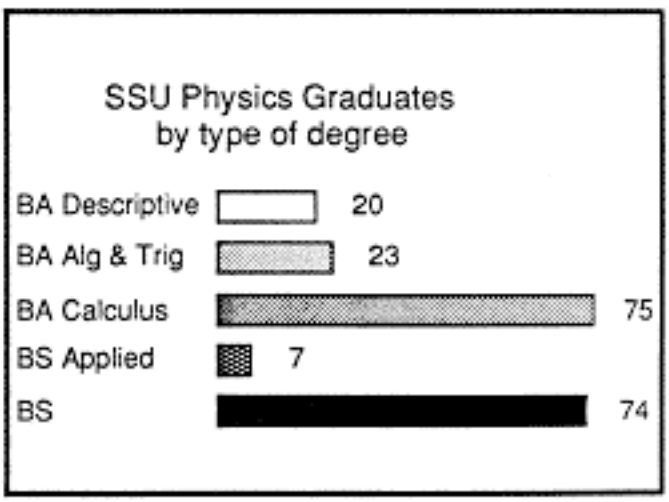
These x-ray techniques for determining elemental composition will be compared with the standard method of using gamma rays from neutron activation of samples. According to Dr. Dunning, a new era began with the purchase in 1985 of a sophisticated multichannel analyzer linked to a personal computer for analysis.

The Lasers and Holography Laboratory
This spring Dr. Sam Greene has introduced several new experiments: Students doing laser spectroscopy of the iodine molecule used the new digital storage oscilloscope and x-y recorder to print out the spectral lines. Data were taken directly with a Macintosh computer. Next year a more sophisticated data interface, MacAdios, will take data directly into a new Macintosh SE. Students also investigated transmission of music and information on a laser light beam using an acousto-optical modulator, built an inertial laser scanner, and made holographic gratings along with a rainbow hologram. Next year Dr. Greene plans to have students transmit information down an optical fiber using an infrared laser. (See another article regarding the speed of light measurement.)

The Solid State Laboratory
Dr. Saeid Rahimi's lab will begin the fall semester with a new quartz tube furnace which can be used for making superconductors and simple semiconductor components such as diodes and transistors. Students measure conductivity and the Hall effect between temperatures of 77 K and 450 K. These measurements reveal the energy band gap, conductivity type, and impurity ionization energy of samples. Photoconductivity experiments involve use of a modern lock-in amplifier, a monochromator, and a frequency-controlled light chopper. Students also measure characteristics of p-n junctions and metal-semiconductor contacts to determine some properties of semiconductors, and they make capacitance-voltage measurements. Most experiments now feed data directly into a computer.

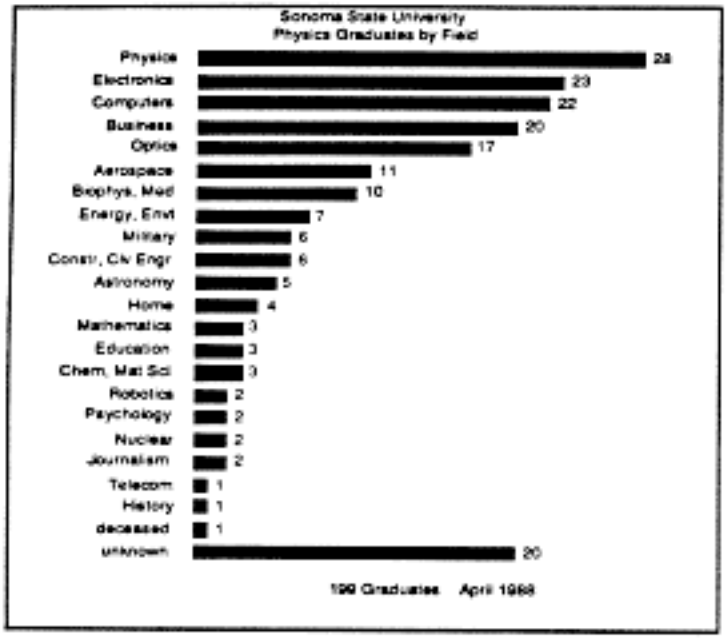
Introductory Laboratories
Dr. Rahimi's revision of the Physics 209 labs is reported elsewhere. Introductory lab courses benefit from such new equipment as additional Michelson interferometers and gas cells for index of refraction measurements, new 5-mw helium-neon lasers and equipment for diffraction measurement of human red blood cells, a new ("first class" according to Dr. Dunning) air track with a sonic ranger position detector, more digital timers and a new digital storage scope. All voltmeters are now digital.

The Observatory
A new Celestron-11 telescope will replace the C-10 which has been in use since 1972. Even more important, a CCD-based image processing system will bring SSU astronomers up-to-date.



Alumquote

In Electronic Engineering, I have found that a Physics background is extremely helpful toward understanding the subject. I feel that starting in Physics does not limit one's options for the future as circumstances or desires change. Jon Jurgovan, '85, grad student, E.E., CSU, Fullerton, planning to attend law school.



New SPS President: Francis Moraes

The newly-elected president of the SSU chapter of the Society of Physics Students has found a home in the Department of Physics and Astronomy. Bored in high school, Francis Moraes passed a proficiency test to get the equivalent of a diploma and enter SSU the first time at the age of 16. A music major then, he found that the bad habits, such as nonattendance at classes, which he had developed in high school did not serve him well.

So he left. For the next few years Moraes worked as a baker and played his bass in a blues band in Sacramento. He soon found himself reading physics books while his goods were in the oven. This led to another try at higher education.

At Santa Rosa Junior College Francis had to start with intermediate algebra and work his way up to calculus. He did so well that last year he finished among the top ten students in the national junior college mathematics contest. He also found himself quite interested in chemistry, the theoretical part, that is; he did not enjoy chemistry labs. Physics was the most fun.

Francis transferred to Sonoma State as a physics major in the fall of 1987, and he has been thriving ever since. Currently enjoying Dr. Tenn's modern physics class and Dr. Cominsky's course in signal processing, he is looking forward to more upper division courses next year. He has started working for Dr. Cominsky on her research: he is currently learning the Unix operating system on the Prime computer and also reading about accretion-driven stellar x-ray sources.

One of Francis' goals for SPS is to encourage more experimentation outside of classes. During spring vacation he and his friend Eric Edwards drove to CSU campuses in Bakersfield and Chico to measure the altitude of the sun. Using a method attributed to the third century B.C. Greek scientist Eratosthenes, the two came up with a polar circumference of the earth of 25,009 ± 253 miles = 40,247 ± 405 kilometers. Recall that the meter was originally defined with the intent that the earth's polar circumference be exactly 40,000 km, and you see that their result was excellent. (Edwards, a history major with a strong interest in astronomy, initiated the measurement as an independent study project under Dr. Spear's direction.)

Francis has other aims for SPS. He hopes to start a chapter of the national physics honor society ΣΠΣ within SPS, and to get students more involved in the community, perhaps helping local high school physics students.

"What I like most about Sonoma State is the accessibility of the professors," Francis reports. "When I have a question I am impatient for an answer. Here I see every physics professor almost every day. I am very glad I decided to come here."

General Physics Lab Revitalized

In Spring 1988 Dr. Saeid Rahimi was awarded released time by the university's Faculty Incentive Program to revitalize the second semester general physics laboratory course (Physics 209B). The move was in coordination with the Department's recent policy that special attention must be given to the introductory laboratory courses in parallel with the ongoing modernization and improvement of the upper division labs.

Dr. Rahimi has now completed a full set of new and remodeled experiments and prepared a laboratory manual for the course. The various experiments now fit into a harmonious whole. Effort has been made to purchase enough additional equipment so that no more than two students will need to work at any one setup. Revised electronics and optics experiments will help students better understand the concepts taught in the parallel lecture course, Physics 210B. Student response to the new look of the lab course has been quite favorable.

Alumquote

[Physics is the] key to obtaining jobs in high-tech industries. Michael McBride, '75, Director, Sales and Marketing, Laser Scanning Products.

Radio Telescope Receives Awards

Lynn R. Cominsky

The SSU Interferometer Radio Telescope project has recently obtained a donation of $3816 worth of stepper motors and encoders from the Parker-Hannifin Foundation (Compumotor Company), which will allow the telescope dishes to be moved and pointed under computer control. In addition, the project has obtained a $1674 grant from SSU Enterprises, Inc. to purchase special low-loss coaxial cable to link the dishes to the receiver electronics.

The SSU Interferometer Radio Telescope is currently under construction by students belonging to the Society of Physics Students, in conjunction with faculty from the Department of Physics and Astronomy, including Dr. Lynn R. Cominsky, Project Advisor, and Dr. Gordon Spear, SSU Observatory Director. The system, to be located on the roof of Darwin Hall, will consist of two 3-meter satellite TV dishes, motors for moving the dishes under computer control, cables to link the dishes to the receiver electronics, and an Apple II computer to store and analyze the data.

The Compumotor donation was the result of work done by Daniel Nottingham, a student in Dr. Cominsky's Microprocessor Applications class, who is now hooking the motors up for a Senior Design Project. He was assisted in selecting and obtaining the motors by William Stockton, an SSU graduate from the Computer and Information Science Department. Mr. Stockton also built and arranged for the donation of parts for the Heliostat, which tracks the sun and obtains a solar spectrum, and which is mounted on the roof over the Darwin lobby.

The first grant obtained for the radio telescope project was an award for $1600 from the Allied Foundation/National Society of Physics Students. This grant allowed the purchase of the two satellite dishes as well as some small ancillary electronic components. The receiver electronics (estimated value more than $10,000), built by Bruce Erickson, Clyde Underwood, and Paul Vella of the Hewlett Packard Microwave Analysis Division in Rohnert Park with materials donated by the company, is also being modified after a year's use in a single element Quagi radio telescope on the Darwin Hall roof. The enlargement of the system to a two-dish interferometer will allow imaging observations of radio sources and will increase the sensitivity substantially.

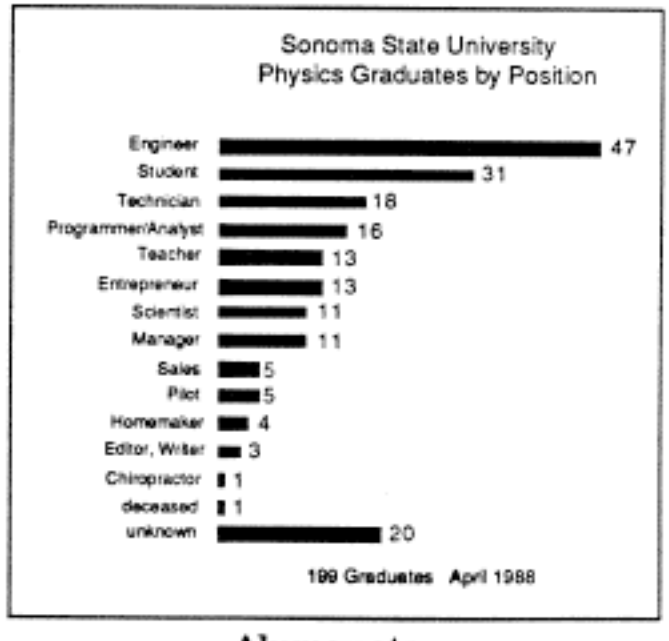
Chris Ray off to Davis

When Chris Ray received his B.S. at Sonoma State in June 1987 it was with a double major and with double honors. His major departments had voted him graduation with distinction in both physics and applied mathematics. He had twice been SSU's highest scorer in the prestigious Putnam mathematical contest, and it was clear he was graduate school-bound. There were a few bills to take care of first, however. Ariel was three, and Kyle had just been born.

Now, after a year of working as a carpenter, Chris has accepted a teaching assistantship at the University of California, Davis, and he, Stacy, and the kids will soon be off. Teaching will not be new to Chris: he tutored in SSU's Learning Center for several years, and, this spring he is teaching one course for the Department of Physics and Astronomy.

Teaching popular optics is "a challenge," according to Ray. It has forced him to find new ways of looking at optical phenomena, and to find alternative ways to explain them.

At Davis, Ray expects to specialize in theoretical physics. He is especially interested in nonlinear dynamics. As a senior he did some independent study in chaos under the supervision of Drs. Duncan Poland and Thomas Barnebey.



Alumquote

Physics helped me to think logically which helps in troubleshooting. Denise Paquette, '85, satellite operations associate engineer, Lockheed Missiles and Space Corp.

Ken Ritley In Demand

Senior physics major Kenneth A. Ritley of Sonoma State University is on his way.

He has just been awarded a teaching assistantship at the University of Massachusetts, Amherst which will support him while he works on a doctorate in theoretical physics. He is also one of a small group of students from throughout the nation to be selected for a summer research program at Brookhaven National Laboratory on Long Island.

At Brookhaven he will work on positron scattering experiments to determine the structure of surfaces. No stranger to research, Ken spent last summer in the Student Research Participation program at Oak Ridge National Laboratory in Tennessee, where he worked on simple ionic models for the new high-temperature superconductors. He described this work, in which he computed the Madelung energy of the material known as 1-2-3, in a "What Physicists Do" lecture in February.

The work at Oak Ridge led to coauthorship of a paper presented to the American Physical Society at its March meeting in New Orleans and also to a forthcoming article to be submitted to the *American Journal of Physics.*

Ritley, who also published a book review recently in the *Journal of Undergraduate Research in Physics,* reports that he is quite pleased with the choice he made when he left Irvington High School in Fremont four years ago. "I chose to come to Sonoma State over larger universities because I knew the opportunities I would find here would help me to best realize my goals," he says. "The ability to associate with the faculty on a personal level and take advantage of their guidance and personal insights have been the most valuable part of my education at Sonoma State."

Ritley also appreciates the university's strong math department. Nearly a double major, he finished second at SSU and among the top 22% nationally in the W. L. Putnam mathematics competition in his junior year.

Preparing for graduate school, Ken has again done his homework. A year ago he visited a number of universities in the Northeast and came away most impressed with UMass. "As at Sonoma State, I found dedicated faculty interested in student concerns," he explains.

Currently teaching himself German in his spare time, Ritley is ready for the next step.

Semiconductor Properties Probed

Last year Dr. Saeid Rahimi, together with Professor H. Henisch of Pennsylvania State University, received funding for a research proposal titled *Space Charge Controlled Capacitance in Metal-Semiconductor-Metal Structures.* The experimental work was carried out in the Solid State Laboratory of the SSU Department of Physics and Astronomy with undergraduate students René Woolcott, Jr. and Eric Anderson making significant contributions. The two contributed to the instrumentation, measurements, and computer programming.

It was during this work that the phenomenon of "negative capacitance" was observed in several types of semiconductors.

Dr. Rahimi believes that the role of deep level impurities in the exhibition of negative capacitance in some materials such as gallium arsenide is a significant one. The study of concentration and ionization energies of such impurities may clarify some of the questions raised recently. One standard tool for obtaining such information is Deep Level Transient Spectroscopy (DLTS). In April Dr. Rahimi and Woolcott attended a workshop on DLTS given by the Materials Research Society in Reno. Woolcott is constructing a computer-controlled measurement apparatus for this purpose. The system is expected to be operational by summer, when the role of deep level impurities in negative capacitance will be studied.

Alumquotes

My physics background has contributed significantly to my studies in engineering and my thesis work. The applied courses (nuclear lecture, lab, semiconductors, senior design project) were most pertinent to what I'm doing now. George Amorino, '86, graduate student, bioengineering, CSU, Sacramento and research assistant, UC Davis.

[Physics] encouraged analytical reasoning. Richard Ferguson, '87, Pilot Trainee, U.S. Air Force.

All of the classes I have taken have been valuable in some way. Keith Brister, '82, graduate student, applied physics, Cornell Univ.

I had an excellent background in physics to move forward in the technical work environment. Laurel Allen Highland, '83, Research and Development Engineer, Optoelectronics-Textron

The Hewlett-Packard Connection

There are many connections between Sonoma County's largest employer and its university. It's not just all the Hewlett-Packard equipment in the labs, or that the company has built a plant within sight of the campus.

Currently at least eleven H-P employees are enrolled as SSU physics majors, most of them technicians seeking bachelor's degrees to advance their careers. They include Paul Bauer, Anthony Blume, Gregory Brahms, Robert Close, Greg Connor, Leon Fossett, Mark Hawk, Michael McClendon, Robert St. Clair, and Daniel Swearingen. Most are full-time workers who take a course or two each semester. Jon Davis, after several years of this exhausting routine, has taken a leave from H-P in order to be a full-time student this spring.

The company is also a significant employer of the Department of Physics and Astronomy's graduates. Currently Ross Goodwin ('78) and Brenton White ('84) are marketing engineers, and Clyde Underwood ('74) is a research and development specialist, all at H-P in Rohnert Park. For many years the department's first graduate, Patricia Marriott, was a software development engineer with the company in Santa Clara. Senior student David Marshall is currently working at H-P as an intern.

Several Hewlett-Packard employees have taught part-time in the department, bringing special expertise to some of the laboratory and electronics courses. This semester Kenn Wildnauer is teaching the Physics 216 laboratory and Rob Bordow is teaching the laboratory portion of the microprocessor applications course. Val McComber, Susan Palm, and Edward Ng have taught in the past.

Hewlett-Packard also employs a number of graduates and students in other SSU departments, notably Computer and Information Science, Chemistry, and Management. Both university and company profit from the interaction.

What Physicists Did

Alan Gering

The classic saying, "I can see it in my mind's eye," was given altogether new and substantial meaning during the "What Physicists do" lecture series for 1987-88. Dr. Donald A. Glaser, speaking on the physics of the human visual system, presented evidence for the actual replication of images in the pathways of the brain. Dr. Glaser was awarded the Nobel Prize in 1960 for his invention of the bubble chamber. He was the seventh Nobel laureate to speak in the Sonoma State series.

The year was a treat for the mind and for the eye. Dr. Phillip Marcus treated us all to some of the best movies ever generated by a Cray supercomputer for his model of the atmosphere of Jupiter and explanation for the presence of the Great Red Spot. This explanation was picked up by the news services several weeks after the lecture; once again Sonoma State's lecture series is on the leading edge of information and discovery. But another of the treats was very old news; some of the very first typeset documents were the object of study by Dr. Bruce Kusko and the PIXE project. The Gutenberg Bible, the Vinland Map, and the Calov Bible (once the personal bible of J. S. Bach) were analyzed nondestructively for the elemental contents of their paper and ink. One of the ambitions of this project is to form a historical data base by traveling about the libraries of Europe with a portable particle accelerator in a van!

Sometimes the fun of physics is that we get to start all over again. Dr. Paul Boynton of the University of Washington presented evidence for the existence of a composition-dependent Fifth Force which acts at a range of up to one kilometer. His results suggest a repulsive force; other experimenters in the field have also found a slight repulsive effect, but there are also a number of experiments which suggest that the force is attractive. Does it exist? Stay tuned; no doubt there will be more questions and answers in next year's series.

No less distinguished were the presentations by SSU's own Dr. Gordon Spear and Dr. Saeid Rahimi on their work on Cepheid variable stars and negative capacitance respectively.

Altogether, twenty-four speakers addressed significant issues in the theory, applications, history, and teaching of physics. Superconductors, gravitational lenses, robots, lasers, quarks, and the origin of the universe all had their day as topics in the distinguished lecture series. As a significant science forum the series is unique in northern California and draws regular attendance from the greater Bay Area, Vacaville, Lake County, and points north.

Little known but useful facts: we could have had the Lick Pyramid in downtown San Francisco instead of the Lick Observatory near San Jose; "What Physicists Do" is heading into its 36th semester; the 34th and 35th series were produced by professors Lynn Cominsky and Joseph Tenn respectively; it wouldn't be the same without Miriam Carolin's hospitality.

Signal Processing Course Begins

Physics 445 Theory of Signal Processing was offered for the first time this spring. Despite the course title, the emphasis was on applications rather than theory. Dr. Lynn Cominsky, who developed and taught the course, unofficially subtitled it, "everything I wish I Had Learned Before Going to Grad School." Among the subjects studied were distribution functions, curve fitting, and Fourier theory. Students wrote programs to analyze data from various sources, including real research data.

Alumquotes

Knowledge of Physics is essential in thin films. Paul Le Febvre, '85, senior thin film engineer, Optical Coating Laboratory, Inc.

The computer training that I received at SSU was the starting point for my computer-oriented career and graduate research. Jim Pisano, '82, graduate student, astronomy, University of Virginia.

The things I learned at SSU have kept me in good stead. I was informed by my supervisor that he was very pleased with my performance Juan Reyna, '87, accelerator operator, Fermi National Accelerator Laboratory.

The physics program at SSU not only provided a good technical base, but more importantly, forged an ability for abstract thinking which can be productively applied to almost any career path. Even now, after earning an M.S. degree from M.I.T. and working for 5 years as an engineer in Silicon Valley, I still have great respect and affection for the people that I knew at SSU. Frank Van Gieson, '79, senior engineer, Western Digital .

[My physics] is the strongest point in my background even though I also earned a B.A. in biology. Kitty Chelton, '81, graduate student, biophysics, UC Davis (now a radiation safety technologist at UC Davis Medical Center, Sacramento).

My Physics, Math, and, of course, Computer experience is extremely valuable–in fact essential–for my job. Scott Anderson, '75, independent software writer, creator of FANTAVISION.

The Speed of Light and the Road to Stockholm

Iad Mirshad and Ken Ritley

What travels 2.85×10^8 meters per second and was recently measured by two senior physics students? Light, of course! Iad Mirshad and Ken Ritley recently designed and conducted an experiment to measure the speed of light in Dr. Sam Greene's Lasers and Holography course.

"We were tired of taking the speed of light on faith all these years," said Ken. We felt that it was about time we measured it for ourselves." The two used a rotating notched wheel constructed by Department Technician Steve Anderson to send a pulse of light down the third floor of Darwin Hall. They used a 100 MHz oscilloscope to measure the time between when the pulse left and when it returned. "Finding the rate is easy," Iad explained. "We know distance = rate × time, and we measured the length of the hall."

The commonly accepted value for the speed of light is very nearly 3×10^8 m/s. Ken and Iad don't dispute this value, but attribute the difference between their value and the accepted one to experimental error. According to Iad, getting a mechanical apparatus to function quickly enough is difficult indeed.

Other students in Dr. Greene's class are also conducting interesting experiments. Linda Rarey and Dan Wilcox have spent time in the machine shop constructing apparatus for their experiment to create Lissajous figures using vibrating mirrors and laser light.

Mark Afifi and Phil Cullen have transmitted music from a compact disk player to speakers using laser beams instead of wires. The music modulates the laser light, generating a signal which is then fed to the speakers. Mike McClendon and Imme Conley have been working on several advanced holography projects. They intend to make diffraction gratings and transmission holograms.

What's next for Ken and Iad? They intend to replace their rotating wheel with an acousto-optical modulator the Department recently acquired to obtain a more precise value for the speed of light. "We are really pleased to have access to this kind of sophisticated equipment," Iad said.

No Nobel prize has yet been awarded to a physics student at Sonoma State.

Society of Physics Students Busy

The SSU chapter of the Society of Physics Students (SPS) had a busy year. There were two field trips–to Lawrence Berkeley Laboratory in the fall and to the Stanford Linear Accelerator and some Stanford University physics research labs in the spring.

Meetings, held every other Tuesday, featured films, videotapes, and talks. Among the speakers were Dan Nottingham on the SSU radio telescope project, Dr. Tom Barnebey on quantum physics, and Dr. Joe Tenn on planning for graduate school. Three SSU physics graduates returned to the campus to speak on "Life in the Real World." They were Kevin Ablett, '83, now a software developer at Island Graphics, Santa Rosa; Brenton White, '84, a marketing engineer at Hewlett-Packard, Rohnert Park; and Laurel Allen Highland, '83, a research and development engineer at Optoelectronics/Textron, Petaluma. As this went to press plans were well under way for a picnic at Armstrong Redwoods State Park May 14.

The chapter was led by officers Debra Khattab, Harvey Hecht, and Robert Ohlson in the fall and Hecht, Glenn Brown, and Miriam Tobin in the spring. Just elected for 1988-89 were Francis Moraes, Don Riddick, Tobin and Hecht.

Alumquotes

I work as an entrepreneur and find it mentally demanding. Sonoma State helped sharpen my mental skills. Roy Skinner, '74, owner, Innovative Publications, licensed realtor and building contractor.

My physics background from Sonoma State has made my entire career possible. William F. Cabrall, '76, systems engineer integrating secondary payloads on the space shuttle, Martin Marietta (now a senior engineer at Boeing).

My education in physics has allowed me to keep up with the rapid changes in technology in the audio field. Richard Williams, '77, audio engineer, Hunter College and recording engineer and producer, Barking Cat Productions.

Alumnote

STEPHEN BECK (BS, 6/86) is a graduate student in physics at San Francisco State University.

Ritley Scores in Research Contest

Sonoma State University senior Kenneth Ritley participated in the second annual California State University Student Research Competition and Conference May 6-7 at San José State University. Ken won second prize ($200) in the Physical and Mathematical Sciences category, describing his research of last summer when he computed the Madelung energy of the high temperature superconductor $YBa_2Cu_3O_7$ at Oak Ridge National Laboratory. Ken was one of only seven undergraduates among the 21 contestants in his category. Altogether, SSU, with less than 2% of the CSU enrollment, won three of the eighteen awards.

AAPT to Meet at SSU

The next meeting of the Northern California section of the American Association of Physics Teachers will be October 29, 1988, and it will be held in Darwin Hall. Dr. Joseph Tenn is local host for the meeting which is expected to bring 100 to 150 high school and college physics instructors to the campus for a day. A highlight of every such meeting is the "show and tell" session where teachers present their most ingenious demonstrations. Section president Clarence Bakken of Palo Alto High School will preside. All are welcome to attend.

Alumnotes

TERESA BIPPERT-PLYMATE (BA, 6/84, physics and art) is studying astronomy at the University of Arizona and working part-time at the National Optical Astronomy Observatories.

CHARLES BULLEN (BA, 6/75, physics and psychology) is a radio electronics officer in the merchant marine and also part-owner and marketing manager of 7 Seas Software.

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Alumnotes

MILTON HAGLER (BS, 6/85) works for Professional Communication Design, Inc., Santa Rosa. He will begin graduate study in computer engineering at San José State University in Fall '88.

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