THE PHYSICS MAJOR

X-Ray Diffraction Expands

John Dunning

Sonoma State University has a new $114,000 Rigaku X-ray diffraction machine. Purchased with a National Science Foundation grant to the Chemistry, Geology, and Physics & Astronomy Departments and matching funds from the University, this equipment substantially upgrades our capability to analyze compounds on the basis of their crystal lattice spacings.

X-ray diffraction is a powerful analytic technique for compounds which have crystalline structure. The computer-controlled machine obtains the diffraction pattern of a sample digitally by counting the number of photons scattered at each angle. The pattern is then compared with a 40,000-compound x-ray diffraction file on an IBM PC. We have already succeeded in unraveling unknowns containing three components. This is a far cry from the old days when we could only identify pure compounds from among a list of 20 simple cubic systems.

Remember when your powder sample partially fell off the sample holder as the holder rotated to larger angles? No more. In the new system, the sample is completely horizontal and stationary. Instead, both the detector and the x-ray source rotate. This results in much better relative intensities at all angles.

Remember the days of spending almost an hour scanning an unknown at 2 degrees per minute? Useful data can now be obtained at 10 degrees per minute.

Dr. Poland is presently integrating this instrument into the Physics 316 laboratory. Dr. Rustad is doing the same for the physical chemistry people. Dr. Vennum is gearing up

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Far Infrared Astronomy at SSU

Marie Malak

SSU Observatory Director Gordon Spear has been awarded a National Aeronautics and Space Administration research grant to make use of data obtained by the infrared astronomy satellite (IRAS) in 1983.

He will research objects that vary in brightness with time.

"The real science is going to come from what we do with the data," he notes. "The first step in interpreting that data is to get all of the needed information in one place. Being a variable star person, one of the first things that came to mind was, I wonder if any of the variable source objects I'm familiar with are in the *IRAS Catalogue*."

One cannot simply look up an object by name in the catalogue. One first must find its coordinates in some other source, then search through the catalogue's lists, hoping to find the coordinates of the desired object among them. Even when one finds the object, the only information given is a code leading to yet another reference catalogue. The *IRAS Catalogue* doesn't list such things as optical brightness or variable type.

Dr. Spear thought that such basic information should exist in one document. Surprised that it didn't, he applied for an Astrophysics Data Program research grant and was subsequently awarded $122,000 to produce the *IRAS Catalogue of Variable Sources*.

The catalogue will better equip the astronomical community to work with variable objects visible in the far infrared (FIR). This region is significant because corrections due to interstellar absorption in other wavelength regions

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Sonoma State University

Eric Weiss Bound for Seattle

The future looks bright for Sonoma State University student Eric Weiss. In June he will receive a B.S. in physics. In the fall he will start working on a Ph.D. at the University of Washington, where he will be supported by a teaching assistantship in the physics department. And he will get a taste of research in experimental particle physics this summer at the Argonne National Laboratory. Actually, he expects to spend at least half his summer at the Fermi National Accelerator Lab, which is where his supervisor does experiments.

Working at the two labs will be a homecoming for Weiss, a native of the Chicago-area. The road back home has been a circuitous one.

After high school Eric spent three years as a kosher butcher in Oakland, where he claims to have been a "wild guy." At age 22 he tired of the work and decided to become a teacher. Seeking a peaceful place to study, he chose Sonoma State and enrolled in the Hutchins School of Liberal Studies. There he read and discussed a great variety of books, until *In Search of Schrödinger's Cat* by John Gribbin and *Taking the Quantum Leap* by Fred Wolf convinced him that he wanted to know more about quantum mechanics. Switching to physics, he found that he had some catching up to do, especially in mathematics. He says that he learned algebra and trigonometry from the review sections in the back of his calculus book (a practice not recommended by his advisor).

An energetic tutor and outstanding student, Eric is one of two 1991 physics graduates (with Marie-Christine Raude-Rozet) to be awarded graduation "with distinction" by the faculty.

Still interested in quantum mechanics, he intends to specialize in high energy physics. His departing words: "I am really grateful to the Department and the faculty for the amount of time they have given me. They have made a big difference in my education."

A Great Year for SPS

Nickolas Melville and Paul Somerville

The Society of Physics Students showed no cartoons this year and only two episodes of "STAR TREK–The Next Generation."

Under the direction of co-presidents Nickolas Melville and Paul Somerville and secretary-treasurer David Miller, the year started off with a fresh order of SPS T-shirts, including a limited edition of fluorescent yellow. Shirt sales were brisk for a second re-issuing, leaving only seven T-shirts unsold by the end of the school year. Most probably there will be yet another order in the future. Look for some exotic colors and maybe even a new design.

This year SPS sponsored two programs on graduate school. The first was an enlightening video, the second an informative presentation by Dr. Joe Tenn. Many options and opportunities were exemplified during the discussion, which helped dispel some irrational fears of graduate school–and replace them with some more realistic ones.

By far the most exciting event of the year was the SPS field trip to Berkeley. The trip included the Center for Extreme Ultraviolet (EUV) Astrophysics and the Advanced Materials Lab at Lawrence Berkeley Laboratory, the EUV vacuum calibration and solid state camera labs at Space Sciences Laboratory, and the notorious annual party at Professor Lynn Cominsky's residence. We had a great time learning about all of the hardware, software, and methods of operation in the "real world" of physics. We often hear about research at the "What Physicists Do" lectures, but for many of us this was a rare experience to see it first hand. It was an inspiration.

For the future we hope to start an SPS Ping Pong team–in order to study mechanics of motion of white hollow spheres in a hostile environment. Look for it.

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Get Applications in Early

As the popularity of Sonoma State University increases, state funding is going in the opposite direction. The result is that more people are being turned away each year.

The closing date for applications for Fall 1991 admission was January 29, 1991. According to Dean of Admissions and Records Frank Tansey, students who hope to gain admission in Spring 1992 should apply soon.

"We are not expecting to accept Spring applications much beyond August if at all," Tansey reports. "Fall 1992 applications begin on November 1, and we are expecting a heavy application cycle then as well. We expect to have the maximum number of applications we can accommodate by December."

The SSU Very Small Array (VSA)

Greg Sprehn

Named after its counterpart, the Very Large Array in New Mexico, the SSU VSA radio telescope became truly operational as an interferometer in April 1991. Fringe patterns of the sun had a period of 36 seconds, confirming the 0.15-degree resolution predicted by the 80-meter baseline. We are probably the only undergraduate university in the country with a working radio telescope interferometer.

Great feats are not accomplished overnight. The dream of a radio telescope on the roof of Darwin started with Dan Nottingham ('89) in the spring of 1986. Berkeley radio astronomer David Cudaback came over and helped the group get started. (He has continued as a consultant ever since.) Soon the group had a small dipole detecting the sun at 1.4 GHz. Hewlett-Packard engineers Bruce Erickson and Clyde Underwood ('74) committed their expertise and are still with the program today.

When Professor Lynn Cominsky joined SSU in Fall 1986, she took a keen interest in the project and began drumming up grant money. René Woolcott ('90) built a second prototype, four fishbone-like yagis on a steerable equatorial mount, while Dr. Cominsky prepared for the next step: dual parabolic reflectors.

In 1987, while students were assembling and modifying the parabolic dishes, the H-P engineers presented the receiver, a high-tech low-noise custom design that would convert 21-centimeter radiation from the sky into an analog output voltage.

In 1988 Compumotor donated motors and controllers that could be developed into automatic control of dish positioning. Three facets of the project, the mechanical assembly, the electronic support, and the positional control were all proceeding simultaneously towards first light with the most sophisticated system yet mounted on Darwin Hall.

The spring of 1989 brought great joy to the VSA group. First light using a single parabolic dish and the H-P receiver proved the system components were working as designed. Years of dedication by a constantly evolving student work force and the diligence of the project's champion, Dr. Cominsky, were validated. But it was still only a step on the journey; the students went back to work assembling the components of the second dish, and dragging cables across Darwin for the final setup of the pair of dishes.

The VSA was blessed in 1990 when Joan Ghiglieri, a technical writer in search of a project, chose the radio telescope and produced a slick manual, complete with photos, drawings, and a stylistic blue cover. This booklet served as the starting point for the fall, when new students arrived to replace the graduating members of the team.

Fall 1990 VSA student coordinator Al Modeer, in collaboration with the tenacious Dr. Cominsky, wrote a successful proposal to the Sonoma State Enterprises, Inc. special projects fund, and the group received $2800 to purchase a disk drive for the Sun computer. This will allow us to accommodate the extensive image analysis code necessary to perform reduction of the data to be collected from the working interferometer.

Al also presented a 25-minute speech and slide show about the VSA to the regional Society of Physics Students meeting at the Exploratorium in November. The word is out: Sonoma State has an interferometer.

Greg Sprehn took over as student coordinator in Spring 1991. A reentry physics major with a radio communications background, he brought valuable skills and experience to the project. Dedicated help this year also came from Ben Owen, John Newton, Loren Novatne ('89), Mark Atkinson, Holly Jessop, and other helpful students too numerous to mention. They finished the cable terminations, identified and assembled the missing components, put the whole thing together and successfully detected the sun in interferometer mode on April 17. By May 8 the second brightest source in the sky, supernova remnant Cassiopeia A, had been detected as well. It appears we do indeed have the first working interferometer at an undergraduate university.

But this is not a closed-end experiment. Development continues with the addition of two donated (Dr. C. comes through again) low noise amplifiers from Mini-Circuits of New York. These state-of-the-art pups mount in the dishes and increase the sensitivity of the system substantially.

Characterization of their noise figure, signal-to-noise ratio, and overall interferometer sensitivity continues as Greg's senior project for 1991-92.

This is a real fine instrument, folks, right here on the roof of Darwin, accessible to any student interested. The big universities reserve the best for the graduate students. Here at Sonoma State, we have the opportunity to see, touch and *use* the VSA without competition. If this isn't your field, just be proud we did it here first. If it is, drop by Darwin 329 and you can play a part in history, too. We meet briefly on Tuesdays at noon and then go to work on the VSA, always welcoming student participation.

Contributions are Important

In this era of budget cutbacks, private contributions have become increasingly important in helping to maintain the high quality of physics education at Sonoma State University. Both direct and endowed accounts have been set up to receive charitable contributions from interested sponsors. Funds are drawn from the direct accounts by the Department of Physics and Astronomy as needed. Donations to endowed accounts are invested by the SSU Academic Foundation; only the earnings from these are used to support programs and scholarships. All contributions made to either type of account are under the direct control of the Department, according to its chairman, Dr. Duncan Poland.

Endowed accounts that support scholarships for physics majors are the **Physics and Astronomy Department Scholarship Fund** and the **Joseph S. Tenn Scholarship Fund**. Awards are made through the university scholarship program. (Of course physics majors are eligible for many other scholarships as well.)

A new endowed account, the **Science at Work Fund**, was established recently by John Max, president of Max Machinery Company in Healdsburg, to support the "What Physicists Do" public lecture series. More than 500 lectures, demonstrations, and films, including talks by eight Nobel prize winners, have been presented in the series since 1971. The fund enables the department to bring in prominent scientists from outside the immediate area. This year's featured speakers included Professors Edwin Salpeter of Cornell University, Joel Primack of the University of California, Santa Cruz, and Lillian McDermott of the University of Washington. Salpeter and Primack both spoke on cosmological topics, and McDermott, the 1990 recipient of the American Association of Physics Teachers' Millikan Lecture Award "for notable and creative contributions to the teaching of physics," presented "What We Teach and What is Learned–Closing the Gap."

The Department also has three direct fund accounts: the **Radio Telescope Project** account, the **Public Programs** account and the **Department Equipment** account. The **Radio Telescope** account is used to purchase equipment for the student-built interferometer system on the roof of Darwin Hall. New research projects and improvements to the radio telescope will be aided by future donations.

The **Public Programs** account provides direct funds to support the "What Physicists Do" lecture series and Public Viewing Nights at the SSU Observatory. Income from endowed funds is not yet sufficient to sustain these programs.

The **Department Equipment** account supports the purchase of new materials for use in the laboratories. (This year there was very little equipment money from the state; next year there will apparently be none.) Contributions from Fred Aves have been used to purchase a Mach-Zehnder fiber interferometer setup for the laser laboratory and a hard disk drive with removable 45-megabyte disks for collecting and storing laboratory data.

Contributions to these accounts may be sent to Prof. Poland, with a note indicating which account you wish to support. Checks should be made out to the SSU Academic Foundation. All contributions are tax deductible.

Thank You!

The Department of Physics and Astronomy wishes to express its gratitude to the following donors to the funds described above:

PHYSICS & ASTRONOMY PUBLIC PROGRAMS

Mr. Robert Jerome Abbey, Rohnert Park; BOC Group, Inc., Murray Hill, NJ; B. R. Burmester, Petaluma; Mrs. Ruth M. Clary, Petaluma; Mr. John A. Fairbank, Cotati; Mr. Timothy P. Finnegan ('84), Burlingame; Mr. Will C. Gipple, Novato; Ms. Lucy D. Kortum, Petaluma; Dr. & Mrs. Robert Kuehnert, Vacaville; Mr. & Mrs. Francis V. Marshall, Petaluma; Max Machinery, Inc./John Max, Healdsburg; Mr. & Mrs. Bernard H. Meyers, Novato; Moon Valley Circuits/Michael Miller, Glen Ellen; Mr. Horace L. Newkirk, Santa Rosa; Mr. & Mrs. Robert K. Rains, Santa Rosa; Mr. & Mrs. Gregory D. Rose, Sonoma; Mr. Gary Stein, Bakersfield; Dr. & Mrs. Dale Trowbridge, SSU; Dr. Robert S. Tuttle, Santa Rosa.

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PHYSICS & ASTRONOMY SCHOLARSHIP

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JOSEPH S. TENN SCHOLARSHIP

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A Summer at Maria Mitchell

Holly Jessop

Maria Mitchell was the first female American astronomer. As a young amateur astronomer on Nantucket Island in Massachusetts, Mitchell discovered a comet in 1847 which won her a gold medal from Denmark and a budding reputation in the astronomical community. From a background of observational work at home and dedicated self-instruction, Maria Mitchell went on to establish a successful program of astronomy at the new Vassar College for women. Well-loved by all who knew her, she was an inspiring and dedicated teacher whose legacy has continued at the observatory established on Nantucket in her memory.

I had the good fortune to participate in the Maria Mitchell Observatory summer program in 1990, along with five other students. Joining an active program in variable star monitoring and research, I worked on three variable stars of the RR Lyrae type. These stars pulsate with nearly regular periods on the order of a few to several hours. Important as indicators of distance and for studies of stellar properties and evolution, these variables and their periods of pulsation are actively monitored for change.

I began with CG Coma Berenices, a star discovered in the 1960's and whose period had been determined over ten years ago. I was interested to know whether this period had changed since that time. I gathered magnitude estimates from over 200 photographic plates taken from 1964 to 1990. To estimate CG Com's brightness on each plate, I used comparison stars whose magnitudes I determined using an iris photometer. After obtaining light curves of phase vs. photographic magnitude, using the previously published elements, I plotted the "observed minus calculated value" to obtain the period's rate of change. I found that the pulsation period of CG Com had remained constant.

GY Coma Berenices was analyzed in the same way as the first variable, but was found to have a period which had been consistently changing a small amount. Discovered at MMO in the early 1970's, GY Com's period was not known with much precision. To confirm the ephemeris I utilized an MMO computer procedure that performed a date-compensated discrete fourier transform to sets of data. The resulting period from this analysis was similar to the first, establishing it as non-spurious.

A third RR Lyrae variable whose period was known to undergo rapid changes in the past proved true to its reputation. I discovered that not only is there change in the length of the period, but there is also change in the shape of the light curve of this star.

I immensely enjoyed every aspect of my summer work at MMO. Underneath the final results for these projects, there lies a great deal of education, tribulation, joy, and growth. I saw each project from start to finish: formulation of the problem, data collection, analysis, and interpretation, and was allowed to choose my own course of progress and pace. I used computers extensively for the first time (performing an extremely large number of calculations that Maria Mitchell would have completed by hand). I acquired experience with other instruments such as the iris photometer and the telescope, especially when I had to repair them! I personally added five photographic plates to the collection, which I prepared, exposed, and developed. I presented my first hour-long talk, on the subject of cataclysmic variables, and also gave two lectures for children. I enjoyed the public star parties we hosted, despite being the popular object of attack by many mosquitoes. At these events I was able to find celestial objects that I had been unsuccessful at finding in the past, and was rather ecstatic and encouraged by their appearances in the eyepiece throughout the summer.

I am now preparing to submit, "Updated Periods for Two RR Lyrae Stars in Coma Berenices," to the *Journal of the American Association of Variable Star Observers*. I am giving a short oral presentation of this paper at the association's conference in Rhode Island this May as well. At Sonoma State I am involved with research projects at the observatory and with the SPS radio interferometer. I am looking forward to another undergraduate research position at the Stanford Linear Accelerator Center this summer.

Laser Lab Automated

For the past two years Dr. Sam Greene has been developing automation in the SSU laser lab. Data are now taken digitally directly into the computer. The program is built around the Macintosh IIcx computer and some powerful software called Labview. Details will be revealed in a talk Dr. Greene will give in the Fall 1991 "What Physicists Do" series.

What Physicists Did

Miriam Tobin ('90)

They came from as far away as the Harvard-Smithsonian Center for Astrophysics and Cornell University and as close as our own Physics & Astronomy Department. Those wonderful lecturers of the fortieth and forty-first "What Physicists Do" series informed, instructed and entertained the scientifically-minded community in and around Sonoma State.

In the fall Dr. Sallie Baliunas of the Harvard Smithsonian Center for Astrophysics discussed work at Mt. Wilson Observatory on starspot cycles that might tell us about the sun's impact on climate change. Dr. Art Huffman of UCLA discussed space travel, Dr. Edwin Salpeter of Cornell University gave us some new thoughts on the expansion of the universe, and Dr. Gibor Basri of UC Berkeley described observations of new stars with possible protoplanetary disks.

Dr. Douglas Osheroff of Stanford described what happens to helium three near absolute zero. Author and physicist Nick Herbert discussed *Quantum Reality*, and Ian Brown of LBL delved into the realm of ion "sourcery."

Our own Dr. Lynn Cominsky described research conducted at SSU on binary X-ray pulsars and gave an overview of current understanding of the phenomenal neutron stars.

Dr. Natalie Roe of LBL concluded the fall series with the "The Physics of Beauty," an inside peek into the nature of the beauty quark.

The spring series was kicked off explosively by Dr. Richard Klein of Berkeley. He discussed novel approaches to hydrodynamics on supercomputers that allow us to understand the physics of supernova blasts and the radio hot spots observed in their remnants. Dr. Charles Alcock of the Lawrence Livermore National Lab described a forthcoming search for some of the invisible 90% of our galaxy.

Dr. Dana Backman of NASA-Ames discussed infrared observations made with space and ground-based telescopes that yield indirect evidence of planetary formation, Dr. Joel Primack of UCSC explored the beginning and the end of time, and Dr. Carol Christian of Berkeley informed us on current techniques used to obtain sharper astronomical images.

Dr. Lewis Epstein of the City College of San Francisco was the highlight of the spring talks with the entertaining "Is Physics a Religion?"

Our very own Dr. John Dunning, Jr. excited us with information about the new X-ray diffractometer. He explained why X-ray diffraction is the analytic technique of choice for many crystalline materials.

Finishing off the forty-first series, Dr. Lillian McDermott of the University of Washington described recent investigations of student difficulties in physics and how the results of these studies can be used to guide instruction.

Alumnotes

JOHN PROUD ('73) teaches physics and astronomy at Punahou school in Honolulu. John earned his teaching credential at SSU and his M. Ed. at the U. of Hawaii in 1984. This year he has been on sabbatical, based in San Francisco, with time to attend courses at the Exploratorium and lectures at SSU.

DAVID NIELSEN ('74) is a computer specialist with the Environmental Protection Agency in Las Vegas. He has published several papers on the use of lasers for water quality assessment.

JOHN P. NORTON ('74) is business editor of the *Pueblo Chieftain* in Colorado. He is enrolled in the MBA program at the Univ. of Southern Colorado.

JAMES A. McBRIDE ('75) is a financial consultant for Merrill Lynch in Santa Rosa and the current president of the SSU Alumni Association.

SCOTT C. ANDERSON ('78) is founder and president of Anderson Studios, a computer graphics and educational software company in Rohnert Park. He and his wife recently founded another company, Wild Duck, which is now distributing his popular animation program, Fantavision.

ROY W. HARTHORN ('78), the chief of building and zoning for the city of Santa Barbara, is the current president of the central coast chapter of the International Conference of Building Officials.

RICHARD HERTZ ('78) is proprietor of a public opinion, polling, and market research firm in Bodega Bay. He conducts polls throughout California for television stations and newspapers. He earned an M.A. in political science at SSU in 1989.

RICHARD K. DeFREEZ ('80), an associate professor of applied physics and electrical engineering at the Oregon Graduate Institute of Science & Technology, was recently elected to the executive board of the Oregon Academy of Science. He has authored or co-authored more than 50 scientific papers.

DAVID M. KELSON ('80) does sound recording for motion picture studios. He has worked on *Top Gun* and *Back to the Future*.

DOUGLAS GREENWOOD [formerly **SPINKS**] ('81) is a systems information analyst for American Home Shield, Santa Rosa.

MARY C. SILBER ('81) is a postdoctoral researcher at the center for dynamical systems and nonlinear studies at the Georgia Institute of Technology.

DAVID MUNTON ('82) is teaching mathematics at Austin Community College and finishing up a Ph.D. in physics at the University of Texas, Austin.

On to SLAC

Monika Ivancic

I've been attending Sonoma State for almost two years now, and feel that I am surrounded by bright and challenging people in the Physics & Astronomy Department. I began my college education at UC Santa Cruz as a mathematics major. After a couple of years, I decided that math wasn't my "cup of tea," and because of financial difficulties I transferred to SSU. Here I began taking general education courses, not quite sure what I should major in. Then I took a general physics course with Dr. Saeid Rahimi, and did very well in it. The following semester I began the calculus-based physics series, and with much encouragement from Dr. Tenn and Dr. Rahimi decided to become a physics major. All my life I've done well in the sciences, and there are many opportunities in this world for someone with a physics degree.

I've been enjoying the introductory series of physics courses and laboratories. Now I'm even enjoying my math classes, finding out how the information fits into the rest of my life. This year I'm taking general chemistry, of which the difficulty isn't comparable to physics, but I'm learning how the fields are closely related in certain aspects. Although the more difficult classes still lie ahead of me, I am planning to graduate in two years. Right now this seems like a century, but with all the work, the time will fly. This year I applied to several summer science programs and was accepted at the Stanford Linear Accelerator Center. I am quite honored to be in this summer program and am looking forward to the research and projects that I will be involved in there. Working at SLAC will give me a taste of what a career in physics research is like.

My plans for after graduation are still open. In some ways I'd like to go into teaching, yet in others, I'd prefer to do research. I'm still unsure about graduate school. If I have enough energy left after Sonoma State, I will definitely pursue a Master's degree. At this point such goals are quite farfetched. Working at Stanford this summer will give me more experience in the field, and I will have an easier time deciding what to do next. I am certainly glad I became a physics major; doors of opportunity are continually opening.

Michael Fink to Davis

SSU physics major Michael Fink is looking forward to a summer of research at the Crocker Nuclear Laboratory of the University of California, Davis, where he was selected to work on energy problems.

Publications from Department

This year saw a number of publications by members of the SSU Department of Physics and Astronomy.

Dr. Saeid Rahimi's ongoing development of the semiconductor laboratory led to the appearance of "Controlling the temperature of solid samples," by Saeid Rahimi, René Woolcott Jr. ('90), and Vern Shuck in the *American Journal of Physics* in December 1990. Shuck is the School of Natural Sciences electronics technician. A more technical article, "A Microcomputer-Controlled Linear Heater," by Shuck and Rahimi has been accepted for publication in the *Review of Scientific Instruments*.

"Multi-mission observations of 4U 1538-52" by Dr. Lynn Cominsky and Francis Moraes, ('90), appeared in the *Astrophysical Journal* 1 April 1991. It is the result of NASA-sponsored research on x-ray pulsars performed at SSU over the past two years.

Dr. Joseph Tenn has published "Bruce Medalists Profiles" in every issue of *Mercury* since Jan/Feb 1990. These are brief biographies of prize-winning astronomers.

Norman Sperling, who has taught astronomy courses part-time for the Department for several years, has published articles in periodicals ranging from the popular magazine *Astronomy* to the *Proceedings of the International Astronomical Union Colloquium on the Teaching of Astronomy*.

Alumnotes

JIM PISANO ('82) is a computer consultant for the psychology department at the Univ. of Virginia.

LAUREL ALLEN HIGHLAND ('83) is now a laboratory processing assistant at Hewlett-Packard in Santa Rosa and a proud mother.

DONALD W. MARTIN ('83) is a training coordinator for Airco Coating Technology in Concord.

TERESA BIPPERT-PLYMATE ('84) is a research technician at the University of Arizona Steward Observatory, where she is also working on a master's degree in astronomy.

GARY JOHNSON ('84) is a senior operations engineer with the Italian Space Organization. Formerly a pilot in the U.S. Air Force, he has worked on space shuttle mission control for NASA and Rockwell. He has earned master's degrees in physics and biochemistry.

DAVID LAPP ('84) now teaches physics and calculus at Tamalpais High School, Mill Valley. He led a group of American physics students on a summer 1990 People to People tour of the Soviet Union. He earned an M.S. in physics at DePaul Univ. in 1990.

The Joy of Projects

Marie-Christine Raude-Rozet

If you lack confidence in your ability to do experimental physics, then you should try working on a project. I think that it is a very good complement to theoretical courses, and it is enjoyable, too. The fun of it is that you get to create your own research project with the very valuable guidance of a faculty member. It is important to choose a professor you feel comfortable with and who is encouraging.

So what was the object of so much fun and reward for me?

My first project was for Dr. Lynn Cominsky's Microprocessor Applications course (but I still got to choose my own project). It was "A computer controlled motor with optical feedback."

The goal (partially achieved) was to control the motion of a linear stepper motor with a Macintosh II computer, and to run an optical feedback check in the form of a He-Ne laser interferometer. The computer controlled the distance, speed, and direction of the motor motion. I counted the interference fringes resulting from the motion with a programmable Fluke meter, and then converted the measurements to distances. All programs were written in MacForth, a language which offers a fast and relatively easy interaction between a computer and external hardware.

This project was a lot of fun, and it was also very rewarding. It allowed me to deal with several aspects of physics work, i.e. designing, building, testing, and improving. The other very satisfying dimension of this project was to see interactions among areas of great interest to me: optics, electronics, and programming.

This spring I did my senior design project, also under Dr. Cominsky. For this I was lucky; I was able to use the facilities of the research division of Optical Coating Laboratory, Inc., where I worked throughout my senior year. I stayed with interferometry but touched on another subject, material sciences. I studied the stresses in thin film coatings by laser interferometry.

Mechanical stress is created in the optical coating when it is applied on a substrate with a different coefficient of thermal expansion. This results in the slight (not visible by eye) curvature of the coated part. To measure this bending I used a very thin disk of fused silica substrate, known as the witness, and measured the deflection of this disk with a laser interferometer. This measurement is important and helps in characterizing the materials.

These two projects were a very valuable experience to me, and I greatly recommend research projects as a way of achieving personal satisfaction and also of acquiring practical experience in the field.

Snedden to Nebraska

Stephanie Snedden likes new adventures. Shortly after a case of "math anxiety" led her to earn a degree in art despite an interest in science, an encouraging brother-in-law convinced her to reconsider, and she started taking algebra and astronomy at a junior college. Soon she was an enthusiastic physics major at SSU. By the time she received her B.S. in 1983 she was helping out at Public Viewing Nights and conducting research on variable stars with Dr. Gordon Spear. She was coauthor of a paper (with Dr. Spear and another student) on the variable star 28 Cygni in a technical journal, and also of a presentation on another star at an astronomical society meeting.

During her last year she worked at Optical Coating Laboratory, Inc. in Santa Rosa as a technician; on graduation she was promoted to engineer and the next few years saw her working in optics. Later she taught karate and did data processing for a small local firm.

But she couldn't keep away from astronomy. Spring 1990 saw Snedden back at SSU, this time as an instructor for an astronomy laboratory course. By this spring she was teaching three astronomy courses, and she liked being back on campus.

"Now that I have been out in the private sector I really appreciate the academic world. I love the college environment," she exclaims. If I am going to be effective, the next step is grad school."

Next year will find her enrolled in the Ph.D. program in astronomy at the University of Nebraska, where she will be a teaching and research assistant.

Her next goal is to earn that Ph.D. and then "keep doing astronomy."

"It will be a challenge," she notes. But Stephanie Snedden has always excelled at meeting challenges.

Alumnotes

BRENTON WHITE ('84) is measurement systems architecture program manager with Hewlett-Packard in Fort Collins, Colorado.

KEYVAN FARAHANI ('85) is doing research in interventional magnetic resonance for his Ph.D. in radiological sciences at UCLA, where he earned an M.S. in biomedical physics. He received both the American Association of Physicists in Medicine Student Research Award and the J.T. Case Certificate of Merit for outstanding research in radiological sciences in 1989.

Far Infrared Astronomy

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cause the largest uncertainties in stellar distances. With the IRAS data astronomers will be able to determine the period-luminosity relationship for Cepheid variable stars in the far infrared where interstellar absorption is negligible. They should then be able to determine variable star distances with greater precision.

"Even more exciting than Cepheid stuff" are other unanswered questions. Within our galaxy IRAS discovered thousands of objects to be variable in the FIR. Many of them have no known optical source. What are they?

Outside our galaxy other optically undetected objects are variable in the FIR. Are they active galactic nuclei, quasars, or what?

Dr. Spear predicts a preliminary catalogue will be ready this year, and that his finished product, perhaps on CD ROM, will be done within the three years of his grant.

During that time he and his students will be transferring IRAS data between the Jet Propulsion Lab in southern California and their computers here at SSU.

The grant funds a third SUN workstation for the SSU Department of Physics and Astronomy, salaries for student assistants, and a slight decrease in Dr. Spear's teaching load, freeing up some time to do the research.

The preliminary work has begun, student assistants are prepared, it is days away from summer when Dr. Spear, whose own thesis was on photometric observations of eclipsing binaries, will begin to conduct FIR variable source research, and make knowable the optically unseeable.

Alumnotes

JON JURGOVAN ('85) is an attorney in Washington, DC. He earned his J.D. at Washington & Lee University and his M.S. in electronic engineering at California State University, Fullerton.

TOM McMAHON ('85) is developing infrared astronomical instrumentation at NASA Ames Research Center. He earned an M.S. in scientific instrumentation at the University of Utah in 1990. Previously he was an astronomical research analyst on NASA's Kuiper Airborne Observatory.

JAY NOCETO ('85) is a radio frequency systems engineer with Bay Area Cellular Telephone Co. and a proud father.

LEE C. STEELE ('85) is a self-employed technical writer in Mt. View. He has documented telecommunications and electronics hardware and CAD/CAM software.

STEPHEN BECK ('86) is a graduate student and research assistant in physics at San Francisco State University, where he is writing a master's thesis on trapping in solar cells.

L. RUSSELL BEST ('86) is a staff engineer with the department of public works in Santa Paula. He has also been a lecturer in civil engineering at California Polytechnic State University, San Luis Obispo, where he received his master's degree in civil and environmental engineering in 1989.

LYDIA FOWLER ('86) is a certified flight instructor and charter pilot with Dragonfly Aviation in Santa Rosa. She has taught part-time in the Department of Physics and Astronomy and is continuing her research in astronomy with Dr. Gordon Spear.

STEPHEN MESSINGER ('86) is currently teaching on Long Island. He formerly taught science and mathematics at Upper Lake High School. He earned his teaching credential at SSU in 1987.

JAMES AROYAN ('87) is conducting research in biophysics at the University of California, Santa Cruz, where he earned his M.S. in physics in 1990.

DARITH PHAT ('87), an assistant professor at École Centrale, Paris, and a research consultant for Rhône Poulenc Rorer in Antony, France, earned his Ph.D. in bioengineering and spectrochemistry at the University of California, San Diego and École Centrale in 1991.

JUAN REYNA ('87) is an accelerator operator at the Fermi National Accelerator Laboratory in Batavia, Illinois. He is also working on a second degree, in computer science.

MARC AFIFI ('89) received a secondary teaching credential in physical science at SSU in 1991.

JON C. DAVIS ('89) is an electro-mechanical designer at Hewlett-Packard in Rohnert Park.

DANIEL NOTTINGHAM ('89) works in an astronomy research group at Boston University. His work on the aurora has taken him to places ranging from Greenland to the South Pacific.

KATHERINE RHODE ('89) won a prize with her article on the Ultraviolet Imaging Telescope which appeared in the *Griffith Observer* in Nov. 1990. She formerly worked with the UIT at NASA Goddard Space Flight Center, where she is now helping set up a national database for high energy astrophysics. She has two papers in the *American Association of Variable Star Observers Journal* on her research at the Maria Mitchell Observatory in 1989.

CHRISTIAN WAGNER ('89) is a graduate student in the teaching credential program at SSU.

DANIEL WILCOX ('89) is an electronics technician at the Canada-France-Hawaii Telescope in Hawaii.

JAMES GARRETT ('90) is a student in the teaching credential program and a graduate assistant coach with the football team at SSU.

X-ray Diffraction

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to teach a greatly expanded x-ray mineralogy course. Excitement is in the air. It is good to see the sparkle in my colleagues' eyes as they contemplate new investigations. Students want to learn the art.

Ron Leu in Geology was instrumental in clearing the way for the equipment to be housed in a new room next to the older x-ray generator, now dedicated to x-ray fluorescence. Ron's dedicated work during the installation process smoothed over many potential difficulties and is helping us to get much more from the instrument that we otherwise could.

As for myself, I am amazed that x-ray diffraction has worked out so well. The university has granted me a sabbatical for the fall semester. I plan to go to Los Alamos National Laboratory in New Mexico to learn about neutron diffraction. Coherent scattering of neutrons results in information very similar to x-ray diffraction. Use neutrons and you emphasize hydrogen in the material. Use x-rays and you emphasize the heavier elements. Los Alamos will do wonders for my outlook.

Alumnotes

BEN HOOD ('90) is a software consultant in England.

NANCY KUNNARI ('90), a graduate student and research assistant in materials science at the University of Minnesota, gave birth to a son in November.

DANIEL SWEARINGEN ('90) will earn his M.S. in physics at California State University, Northridge, in June 1991 with a thesis on solar astronomy. In the fall he will begin work on a Ph.D in astronomy at the University of Indiana, where he has accepted an associate instructorship.

STEPHEN K. MOSIER ('90) is a systems engineer and project manager for Bank of America in Concord.

MIRIAM TOBIN ('90) is systems manager at the Jewell Ranch, Sebastopol.

KEITH WAXMAN '90 is teaching astronomy at Santa Rosa Jr. College and working as a machinist at Optical Coating Laboratory, Inc., Santa Rosa.

RAYMOND UBELHART ('91) is an applied research engineer at Sola Optical USA., Petaluma. He is also taking graduate math courses at SSU.