Newsletter of the Department of Physics, University of Arkansas

REFLECTIONS

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New Undergraduate Programs Are Successful, Lead to Record Graduation Rates

Our two undergraduate programs, the Bachelor of Science (BS) and Bachelor of Arts (BA) programs in physics, have been undergoing overhauls for modernization, adaptability to the needs of different students, and relevance to today's graduates. The effects on enrollments and graduation rates have been striking. By Spring 1998, 45 students were enrolled as undergraduate physics majors, with 11 of them graduating this year. This is nearly double the previous record of 6 undergraduate degrees awarded in one year (1994), and a 5-fold increase over the average annual number (2) of undergraduate degrees during the past decade. The numbers of students currently in the "pipeline" indicates that we should be able to maintain a rate of 10 or more graduates into the foreseeable future.

This achievement is the result of several factors: We have thoroughly revamped both the BS and the BA programs in a manner that is in line with national career and employment trends, we are devoting greater attention to advising and mentoring our undergraduate physics majors, the University Physics course has a new look both as regards teaching method and course content, and we are trying harder to talk up the physics program on and off campus.

The new BS program recognizes the need for 4-year graduates to be able to enter directly into industrial employment. At the same time, the program continues to serve those graduates who are headed for PhD programs. Thus, the program now includes four possible "tracks." The Professional Track is similar to the old standard physics degree, and is designed for students who plan to go on to graduate school, perhaps to become a university professor or a researcher. The other three tracks, namely Optics, Electronics, and Computational, capitalize on our department's research strengths in optics and solid-state physics, and are designed for students who want to do applied research and development in industry immediately following their 4-year degree.

All four tracks require a total of 40 credit hours in physics or astronomy. The first 24 credit hours are identical for all four tracks, which means that students needn't decide on their track until their junior year. All students complete University Physics I, II, and III, and Modern Physics, during their first two years, followed by 1-semester courses in Electricity & Magnetism, and Quantum Mechanics. This completes the first 24 credit hours. The remaining 16 credit-hours are quite different in the different tracks: Professional Track students take courses in Mechanics and Thermal Physics plus 10 credit-hours of physics and astronomy electives; Optics Track students take the Optics course plus two optics electives and one physics elective; Electronics Track students take two courses in hands-on electronics experimentation, courses in Thermal Physics and Solid State Physics, and one physics elective; finally, Computational Track students take the Mechanics course and several electives in physics, math, and computer science.

Another innovation in the BS program is our revamping of the University Physics course. We are now teaching this during 4 semesters instead of 3. UP I is now nearly entirely devoted to mechanics, with only a brief introduction to waves and heat. UP II is nearly entirely devoted to electricity and magnetism, with a brief section on geometric optics. UP III covers waves, physical optics, thermodynamics, kinetic theory, and an introduction to quantum mechanics. The fourth semester of introductory physics is now called "Modern Physics," and includes special relativity, statistical physics, quantum physics, and a survey of nuclear and particle physics.

In addition to these changes in content, notable pedagogical changes have occurred in UP II. Dr. Gay Stewart has broken the traditional single large lecture section down into smaller groups within which there are elements of lecture, lab, and drill combined. With the help of modern "peer instruction" and "active learning" techniques, there is far more student-student and student-teacher interaction than in the past. The talents of faculty members and of graduate teaching assistants are combined in a creative way to provide students with more individual attention, while not putting unreasonable demands on faculty and graduate student time.

These University of Arkansas innovations are beginning to have some impact across the nation. Dr. Stewart will present this research as part of an NSF Faculty Enhancement Conference this summer at Harvard. Dr. Stewart will also present a poster at the conference on our successful UP II course.

While other physics departments are suffering declining enrollments, ours is seeing an increase. Since the new UP II course began in Fall 1994, no physics major who has passed the course has left the major, and new majors are recruited in the course every year. The course sees large gains in confidence in physics in all students, but particularly in women. While women enter the course far less confident than men, and with a less positive attitude about science, by the end of the course there is no statistically significant difference between men and women in confidence or attitude. This is a result that is independent of the gender of the instructor as well!

Turning now to the BA Physics program: This program's goal is nearly unique in the nation, but it is one that we and many other observers believe is essential to the health of our profession. That goal is to provide a degree program for students who wish to study physics as a background for future employment in some field *outside* of physics. In our high-tech, science-oriented society, nearly every profession can use individuals with a strong science background. Examples include law (science in the courtroom, environmental law, patents), business (high-tech firms, business statistics), science education, journalism (science reporting, energy and environment news), creative writing (science fiction, prose and poetry reflecting our scientific age), communication (technical writing, communications industry), history (history of science and technology), philosophy of science, music (acoustics, instrument design, electronic music), and such science-related fields as medicine, anthropology and sociology. Training in physics and mathematics is thought by professionals in many fields to provide a unique background whose usefulness transcends the boundaries of the professional disciplines. In our increasingly technological society, scientific literacy is ever more important for the successful employee.

Many students plan careers in fields that are somewhat different from their college major subject. Students headed for careers in, say, law or business often begin by obtaining degrees in, say, history, English, or political science. We believe that many students would find more satisfaction and benefit in physics as a background for such professions. In addition, the BA Physics program is directed toward students who are headed for more directly science-related fields such as medicine, or science teaching.

The BA program is less intense technically than the BS program, and broader. It requires 24 credit hours of physics, and four courses in mathematics. The entry-level physics course is the two-semester algebra-based College Physics course rather than the calculus-based University Physics course. Students take a modern physics course designed for the BA program, and 12 credit hours of physics and astronomy electives. Because BA students should be proficient in some field outside of physics, they must select nine credit hours at an advanced level in some "special emphasis area" of their own choosing, outside of physics.

We have cooperated with the School of Law, the Department of Journalism, the Business College, and other branches of the university to develop four-year courses of study toward the BA Physics degree that also fulfill the professional requirements for employment or for further education in these related areas.

The new BS program will appear in the University Catalog for the first time this Fall. The new BA program appeared for the first time only two years ago. We are proud of both of them, and feel that they will lead to continuing success in our undergraduate program.

From the Chair

Dear Friends,

It is my pleasure to bring you greetings from Fayetteville. Another eventful year has gone by. The Physics Department has continued to make progress in all of its varied activities.

Our new BS degree program has been approved by the various College and University Committees. The program calls for more laboratory experience and computer skills for our undergraduates and offers them three new career paths in addition to the traditional PhD-bound path. It becomes effective beginning this Fall.

With higher standards for admission to the University and an increased emphasis on quality, both the number and quality of students are expected to rise. We are emphasizing involvement of physics majors in research. Several of our majors have participated in NSF-sponsored competitive Research Experience for Undergraduate (REU) programs around the country. The Physics Department won its own REU center in optics via an NSF grant to Professors Henry and Oliver.

The Department also established a new fellowship to support undergraduate involvement in research with a $20,000 gift from Emeritus Professor Richardson.

Our efforts to modernize and streamline our undergraduate program are beginning to pay off. This year the Department granted 11 baccalaureate physics degrees, far exceeding our previous record of 6. Our congratulations to Professor Gay Stewart who was honored by the Fulbright College with an Outstanding Advisor Award for her mentoring of physics majors.

During the 1997-98 fiscal year the department's share of external grant support was the highest in the college reaching almost $2 million. Faculty members published 60 articles and presented 40 contributed and invited talks at national and international conferences. Professor Paul Thibado became the third faculty member to win the prestigious NSF Faculty Early Career Development (CAREER) Award. The Department strengthened its condensed matter and modern optics, a major step forward that was recognized when Chancellor White opened the Department's Semiconductor Growth and Characterization Facility this Spring. This $1.7 million facility combines state-of-the-art in semiconductor growth using molecular beam epitaxy (MBE) with a powerful scanning tunneling microscope (STM).

I thank you all for your continued support of the Physics Department. We would love to hear from you about the progress of your careers and job opportunities for new graduates. Any comments you might have about your studies at Arkansas and our current program will be greatly appreciated. Please stay in touch and keep us informed of your current addresses.

With my best wishes,

Surendra Singh, Chair

State-of-the-art MBE-STM Facility: First in the Nation

During the last year, the physics department successfully brought on-line a state-of-the-art semiconductor device fabrication and characterization facility. Our new facility was officially opened by Chancellor John White during a ribbon cutting ceremony in April. The ceremony was a fantastic success. Over one hundred people attended, and several articles were written in the local city and campus papers. In addition, the ribbon cutting and several interviews were shown on television.

Our new facility is a multi-chamber stainless steel system measuring approximately twenty feet by ten feet. Within the walls of the chambers is the best vacuum one can produce on Earth, that is, an ultra-high vacuum (10-14 atmospheres of pressure). Within an ordinary room, air molecules can only travel one-billionth of a meter before colliding into another air molecule. Within the ultra-high vacuum facility an air molecule would travel several hundred miles before hitting another. To obtain such ultra-low pressures, we consume over 1000 gallons of liquid air (i.e., liquid nitrogen) per week to cool several major sections of the facility to a temperature of minus 200 degrees Celsius. Operating this complex facility requires five full-sized racks filled with sophisticated electronics, three personnel computers, and two workstations. In addition, the room was specially designed to provide a dust-free and vibration-free working environment.

There are two broad classes of semiconductors. Everyone has heard of silicon-based semiconductor devices. Silicon electronics make up the chips inside our computers and represents a trillion dollar a year industry. The primary manner in which silicon devices are manufactured is by using a particle accelerator to implant ions into a crystal of silicon. With the aid of magnetic steering fields the ions can be positioned at any three dimensional point inside the silicon. This technique allows millions of transistors to be "written" into a single chip.

Our new semiconductor fabrication facility focuses on another class of semiconductors called III-V compound semiconductors (examples include GaAs, InP, GaN). These semiconductor devices have very different properties when compared to silicon. Their development has resulted in new technologies that would be impossible with silicon. For example, every compact-disc (CD) player uses a III-V laser to read the information off the disc. Fiber optic communications uses lasers and detectors made from the III-V semiconductors. Cellular phones, direct satellite TV, and global positioning systems all are possible because of III-V semiconductors.

Unlike silicon-based devices, which are produced primarily by ion implantation techniques, the III-V device structures must be formed by depositing one plane of atoms after another onto a crystal surface until the entire device structure is "grown." This fabrication technique is a form of vapor phase growth called molecular beam epitaxy (MBE), and it is precise enough to allow the deposition of material to be controlled down to less than a single plane of atoms. We can now fabricate any arrangement of atoms we desire, literally allowing us to artificially produce crystals that would never occur in nature. For example, we can produce layers so thin that the properties of the electrons trapped inside these layers are governed by quantum mechanics. Since, the quantum behavior of electrons is so unusual, there is a tremendous opportunity to produce a new class of electronic devices which have been termed multi-functional devices. That is, the electronic characteristics of a single multi-functional device duplicate the properties of over one hundred conventional electronic devices. This necessarily leads to faster, lower-power consumption electronics.

Because compound semiconductor device fabrication occurs solely at a semiconductor surface, the better one can control and manipulate the motion of atoms on surfaces, the more sophisticated the device structures one can achieve. Consequently, there is a critical need for atomic-scale characterization of the device structure during the fabrication process. To address this need, the Physics Department at the University of Arkansas has combined, for the first time, the state-of-the-art in III-V device fabrication (gallium arsenide, for example, is a III-V material) using MBE with the powerful atomic-scale surface characterization of scanning tunneling microscopy (STM). This is a relatively new characterization technique that utilizes quantum mechanical tunneling to produce the world's most powerful microscope, one that can image individual atoms. Since atoms are the smallest building blocks of semiconductor devices, the ability to image them represents the ultimate and final step in structural characterization. Our department is the first in the nation to combine the state-of-the-art in III-V device fabrication in the important area of telecommunications with the state-of-the-art in atomic-scale characterization.

Paul Thibado, a new physics faculty member, played an important role in bringing the unique facility on-line. His research interests span from the basic physics of atoms moving on surfaces to making the next generation of high speed transistors. During the last year he won several major research grants, awarded by the National Science Foundation, Office of Naval Research, Research Corporation, and the Arkansas Science and Technology Authority which total almost 1.5 million dollars. Thibado also won the prestigious National Science Foundation-Career award. This is a very competitive program designed to identify the nation's most promising young scientists. The Career grant focuses on developing our understanding of how individual atoms move on a material surface. This is one of the most basic bits of information required to fully understand the device fabrication process.

The significance of this facility for our students, faculty, and community cannot be overstated. By fabricating devices in a manner identical to companies, our school is a training ground for the future scientists working in this industry. In addition, faculty can now directly interact with industry on research issues that will impact the companies' productivity. Lucent technologies (formerly AT&T Bell Labs) has agreed to form a partnership with our research effort. We have also formed a research partnership with the Army Research Laboratory (ARL), where we will manufacture a new device that can allow ultra-fast optical switching. The possibility of this interaction leading to a manufacturing business located in the Fayetteville area is very high. Never before has the basic physics of atoms moving on surfaces been so closely tied to industry as it is with next generation of devices.*

Robert D. Maurer Lecture 1998

Nobel Prize-Winning Physicist Lectures on Lasers

Lasers have come a long way since the first ruby crystal in the 1960's, Nobel prize-winning physicist Nicolaas Bloembergen told a University of Arkansas audience Thursday night, translating into a $20 billion market today. "In the 1960's, it was considered a solution looking for a problem," Bloembergen said of the first laser development. "Now, it's different. Now there are many problems solved by lasers."

Bloembergen, professor emeritus at Harvard, pioneered work on nuclear magnetic resonance with Edward Purcell and Robert Pound, as well as development of energy transfer schemes. He was awarded the Nobel Prize for physics in 1981 for his work on nonlinear spectroscopy and optics. Bloembergen spoke to a full house in Giffels Auditorium in Old Main. His presentation, "Lasers: Physics Impacting Your Life" was part of the Robert D. Maurer Lecture Series, named after the physics department alumnus and inventor of the first telecommunications-grade optical fiber. The lecture was sponsored by the physics department.

The word "laser," Bloembergen explained, is an acronym for "light amplification by stimulated emission of radiation." Because of the nature of the light amplification process, he said, light rays go in the same direction at the same frequency, and a coherent phenomenon occurs. Lasers have some common characteristics, including a high chromaticity (of color and wavelength), directionality (relating to direction in space), and high intensity and power. With the directional quality of lasers, he noted, distances such as from the Earth to the moon can be measured to within one inch of accuracy. On a large scale, they can be used to see changes in distance from one point on the Earth to another, detecting possible shifts in tectonic plates. On a smaller scale, they can be used to align underground or underwater pipelines and tunnels, such as the tunnel under San Francisco Bay.

The directionality of lasers also enables laser communication. Lasers can focus onto an area of an optical fiber of one micrometer squared, or as Bloembergen explained, "one thousandth of a cross-section of a human hair, if you can imagine that," making them practical in large cities where there is no more room to lay copper cables for communication. "One optical fiber can carry 400,000 simultaneous telephone conversations," he noted, "so it can do more than 100,000 copper wires."

There are now more than a dozen optical fibers from the East coast to Europe, with a similar number extending across the Pacific. Lasers are also important in the development of optical discs for mass storage requirements, Bloembergen said, and in the automotive industry for heat treatment of metal cylinders in combustion engines, as well as laser beam welding systems.

Lasers can also cut materials like paper, textiles, and diamonds, and one of their most interesting uses, he said, is in medicine. They have many uses in surgery, such as to repair detached retinas or remove port wine stains, and their use is cleaner, with less blood loss, and more precision than standard surgical instruments.

Bloembergen sees laser use increasing in scientific applications, and said there is an "enormous push" now for high-powered, semiconductor lasers. Bloembergen has authored two monographs, "Nuclear Magnetic Relaxation" and "Nonlinear Optics," and published more than 300 papers in scientific journals. He was president of the American Physical Society, and has won a number of national and international awards, including the Lorentz Medal of the Royal Dutch Academy of Sciences and the U.S. National Medal of Science. A reception followed his presentation.

By Dana Gieringer, The Morning News of Northwest Arkansas, Reprinted with permission

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Alumni Profile: Thomas O. Callaway, PhD 1973

Professor Tom Calloway recently swept the awards field at Stephen F. Austin State University in Nacagdoches, Texas, when he was named the 1998 Regents Professor and also recognized with the 1998 University Teaching Excellence Award. His physics colleague Professor Robert Gruebel (PhD from U Arkansas, 1968) comments that "The Department in Fayetteville maintains pretty close contacts with its progeny and can be rightly proud of Tom. Paul Sharrah, Glen Clayton, as well as Charles Richardson, Don Pederson, Art Hobson, Ray Hughes, and Otto Zinke all contributed to developing one fine physicist and teacher."

Tom received his B.S. in 1965 and his M.S. in 1966, both from West Texas State University in Canyon, Texas. He served in the U.S. Army as Commanding Officer of the 49th Signal Detachment in Vietnam during 1968-69, receiving the Bronze Star for meritorious service. Following his PhD from the University of Arkansas, he was appointed Assistant Professor of Physics at SFA in 1973. He was Chair of Physics during 1979-1988, and was appointed Professor of Physics in 1984.

Professor Harry Downing, the current Chair of Physics, comments that, after arriving at SFA in 1975 "I realized that he was one of the hardest working, as well as extremely productive, faculty members that I had ever seen. My impressions of him have not changed after 22 years. Dr. Callaway still considers the education of our students as a personal challenge, and he is optimistic that he can make a difference. I am convinced that he does make a difference. He has taught almost all courses in our department and has written several laboratory manuals for our programs. He has personally created two of our most important courses. [The first of these] provides incoming freshman physics and engineering majors an opportunity to develop the necessary skills to be successful in our extremely challenging introductory physics course sequence. [The second] provides elementary education pre-service teachers the opportunity to develop skills in hands-on activities in physics [and thus] addresses a badly neglected area in teacher preparation."

Professor Downing states further that Tom "has been very instrumental in leading this department into the multimedia era, using very sophisticated multimedia presentations in our PHY 101 courses for 4-5 years, and teaching and encouraging the rest of us to employ this technology in our own classes. He is encouraging and pursuing ideas about distant learning and has taught three classes that employ this technology." Furthermore, "One of [Tom's] greatest impacts...relates to the Minority Mathematics and Science Education Cooperative Grants [under a] program operated by the Texas Higher Education Coordinating Board. He has maintained grants with them since 1988 totaling over $500,000."

In addition to all of this, Tom has found time to do research and to direct graduate students. He has directed six Master of Science theses, published 16 research articles in refereed journals, presented 20 papers at professional physics conferences, and received 16 external grants in addition to 8 SFA faculty research grants.

In a recent interview with the Nacagdoches Daily Sentinel, Tom was asked why he chose this career. He replied "I originally planned to go into forestry. When I arrived at West Texas State University, in the Texas Panhandle where there are no trees, I changed to physics. I still don't know why, but I've never regretted it." When asked what are his pet peeves, Tom replied "Negative criticism."

Asked who were the most influential people in his life, his response was "My mother, who taught me the value of hard work, and Glen T. Clayton. I consider him to be the best role model for a college professor that I've ever known." Clayton was Professor of Physics at the University of Arkansas during 1960-1972; in 1972 he went to SFA as Dean of Science and Mathematics and Graduate Dean and remained there until his untimely death.

When asked what are his goals, Tom replied "It's more of a mission. To promote the love of learning in children by using science as the vehicle."*

Richardson Senior Fellowship

The Department has established the Richardson Senior Fellowship to support undergraduate involvement in research with a $20,000 gift from Emeritus Professor Charles B. Richardson. The experience of our recent graduates indicates that participation in research at the undergraduate level is a valuable educational experience for students planning to go to graduate school. In addition, many employers consider research experience a highly desirable qualification in job applicants. The fellowship will be awarded each year to an outstanding physics senior to allow him/her to participate in frontier research being carried out by one of the groups in the Department. Your tax deductible contributions to this or any of the other scholarships--the Sharrah Scholarship, or the Ham Fund, will be greatly appreciated. Please write your checks to the UA Foundation and indicate the scholarship to which your gift should be accredited. You may send your checks to the Physics Department.*

UA Institutes New Admissions Standards Beginning This Fall

Beginning this Fall, entering freshmen must present 16 units of high school core courses, where a "unit" means a full year--two semesters--of courses. These 16 units must include 4 units of English, 3 units of social studies, 3 units of natural science, 3 units of mathematics, and 3 units of electives chosen from English, foreign languages, oral communications, mathematics, computer science, natural sciences, and social studies. Entering freshmen must also present either (1) a high school grade-point average of 3.0 or higher, or (2) an ACT composite score of 20 or higher (SAT 930), or (3) significant evidence of the student's potential to succeed at the University. "Significant evidence" may include such information as the high school core grade-point average, rank in class, letters of recommendation, or evidence of leadership, community service, special talents, or other indicators that the student is prepared for college work. For freshman transfer students the revised requirements are 24 hours of transferrable course credits from any accredited institution of higher education with a grade-point average of 2.0 or higher. *

Note: This information was correct when it was written (in 1998) but may not be current. Please go to http://apply.uark.edu for current information.

News and Notes

THIS YEAR'S PHYSICS GRADUATES

Joanne Gold , Bachelor of Arts; she begins Law School here at U of A this Fall.
James Michael Harrington , Bachelor Of Arts; he begins Law School at Georgetown University in Washington, D.C., this Fall.
Lucas Barrett Post , Bachelor of Arts; he will be pursuing an M.S. degree here.
James Lewis Clem , Bachelor of Science with honrs (Magna Cum Laude). He will be going on to graduate school.
Jonathan K. Earls , Bachelor of Science.
Brian Thomas Hart Bachelor of Science; he will be joining our new ACEMI (Arkansas Center for Electronic-Photonic Materials Innovation) program for an M.S. degree.
Michael J. Parker , Bachelor of Science will be working for an optics company in Colorado.
Forrest William Payne , Bachelor of Science.
Robert Quinn , Bachelor of Science.
Stephen R. Skinner , Bachelor of Science will be going to graduate school.
Robert Ryan West , Bachelor of Science.
Marwan Albarghoti , Master of Arts; he will continue for a Ph.D. under Dr. Oliver.
Ahmad M. Al-Yacoub , Master of Arts; he will continue for a Ph.D. under Dr. Singh.
John Hillis Carter , Master of Arts; he will continue for a Ph.D. under Dr. Lieber.
Kai He , Master of Arts.
Kim Fook Lee , Master of Arts.
Joao Sergio Afonso , Doctor of Philsophy, Directed by Prof. Chan.
George L. Bennis , Doctor of Philsophy, Directed by Prof. Gupta.
Kaiyuan Chen , Doctor of Philsophy, Directed by Prof. Chan.
Hongxiao Meng , Doctor of Philosophy, Directed by Prof. Salamo.
Zheng Lu , Doctor of Philosophy, Directed by Prof. Xiao.

GRADUATE STUDENT NEWS

Sergio Afonso and **K.Y. Chen** have successfully defended their PhD dissertations in the area of superconductivity.

Kai He completed his MA under the direction of William Harter by doing computer simulations of an ancient war machine called the "Trebuchet" which was originally thought to have been invented by the Turks around the 10th century. Kai found evidence that it was actually invented almost 1000 years earlier in China! The machine uses gravity alone to hurl objects to a range nearly a hundred times its length. Kai's model made of plastic picnic utensils throws a bolt across the classroom.

NEW GRADUATE STUDENTS

Daniel Bullock , BS from Arkansas Tech University

Timothy Clingan , BS from Henderson State University

Horace Crogman , BS from Midwestern State University

Miguel Martinez , BS from University of Arkansas at Little Rock

Amjad Nazzal , MS from Yarmouk University, Jordan

Craig Nelson , BS from Eastern Illinois University

Steven Skinner , BS from University of Arkansas at Fayetteville

Melody Thomas , BS from Carroll College

Hongjun Yao , MS from Fudan University, China

Renpi Yu , MS from Zhejiang University, China

UNDERGRADUATE STUDENT NEWS

Crystal Bailey, LeAnn Brown, Winfred D. Byrd, Nicholas Farrer , and **Clinton Wood** won upper class scholarships for the coming year**. Joshua B. Hamblen** won the Paul C. Sharrah scholarship for the second year in a row. **Jeremy M. Massey**won the Admiral Bryson scholarship for astronomy.

The Society of Physics Students initiated a free tutoring center for use by students in UPI/CPI. Quite a number of students took advantage of the center. SPS held a very successful banquet celebrating 50 years of SPS and 30 years of Sigma Pi Sigma. Eight of our undergraduate physics majors were inducted into a revitalized Sigma Pi Sigma. These were the first inductees in many years, and one more indication of the growing strength of our undergraduate program. The new Sigma Pi Sigma members are **Crystal Bailey, Winfred Byrd, James Clem, Joanne Gold, Joshua Hamblen, Brian Hart, Nguyen Loann, Luke Post,** and **Steven Skinner.**

Joshua Hamblen will spend the summer in the REU (Research Experience for Undergraduates) program in physics at the University of Colorado at Boulder, where he was one of ten accepted from 176 applicants!

ALUMNI NEWS

Calling all alumni! Email (ahobson@comp.uark.edu) or write to us and tell us about the interesting things you've been doing!

Arlis Dodson (MS 1994) works with a Terminal Doppler Weather Radar System at the TVR company in Norman, OK.

Tom Callaway (PhD 1975), Professor of Physics at Stephen F. Austin State University, Nacogdoches, Texas, has been recognized as the 1998 Regents Professor, and has also received the 1998 University Teaching Excellence Award. See the accompanying Alumni Profile article on Tom's career.

Robert Gruebel (PhD 1968) is Professor of Physics at Stephen F. Austin State University, Nacogdoches, Texas.

Shao-zheng Jin (PhD December 1995) is now working with Nortel, Canada's biggest telephone company.

Julia (Smith) Kennefick (BS 1989) completed her PhD in astrophysics from Caltech in 1995. After a postdoctoral appointment at Ohio State (1995-97), she moved to Oxford University, England, where she is engaged in a search for faint quasars at high redshift. She is married to Daniel Kennefick, a fellow physicist from Caltech.

Zheng Lu has taken a job at MEMC Crystal Technology in Saint Louis, the world's second largest silicon growth company.

Jon Osborn (MS 1997), is managing the computers in an elementary school in his hometown, Indianapolis, IN.

C. Wang (PhD 1994) is working at McDonald Software system in Dallas, TX

Karen Williams (MS 1988) received her PhD in physics education from the University of Oklahoma in May 1998. Her dissertation topic was "An investigation of meaningful understanding and effectiveness of the implementation of Piagetian and Ausubelian theories in physics instruction." This research has shown that the two theories are not vastly different at all. Rather, the two theories use different terminology to explain learning. Such research has direct application to college physics instruction.

Marvin Young (PhD 1988) has joined Worldcom in Tulsa, OK

FACULTY NEWS

Mark Filipkowski received a major piece of equipment, a Bruker spectrometer for solid-state NMR, costing $160K. He is designing probes to use with this instrument for studying the structure and electronic properties of magnetic multilayers.

Julio Gea-Banacloche received a grant from the National Security Agency to do research on the feasibility of quantum computers. Some earlier research of his was mentioned in a feature article in the September 1997 *Physics Today* (p. 35). And an instructional computer simulation he developed last year was chosen to be included in an electronic, interactive supplement for a College Physics textbook (Jones and Childers *Contemporary College Physics*, 3rd ed.).

William Harter's 20-year-old prediction of a subtle form of spontaneous symmetry breaking has been observed in high resolution spectra of SiF4 by researchers at the University of Paris in Vilateneuse. The effect which Harter named 'superhyperfine structure' involves resonance between two very weak fields, and is roughly analogous to an automobile being rolled over by its radio antenna. Even more pronounced effects are expected in C60 or "Buckyball" molecules.

Michael Henry , together with William Oliver, obtained a 3-year NSF Research Experience for Undergraduates (REU) grant to establish an REU site here on cutting edge optics and optics-related materials physics. This program will attract up to ten promising undergraduate physics majors for 10 weeks during summers to work with our department's research groups, and will encourage them to continue pursuing an education and career in science. Last summer we brought in our first group of REU students and ten more have been accepted for this summer. NSF aims to broaden the nation's talent pool by encouraging more students to pursue science and engineering graduate degrees.

Art Hobson finished work on the second edition of his textbook, *Physics: Concepts and Connections* (Prentice Hall, 1995), to be published this summer. It has been adopted at over 85 campuses. Hobson also spoke at an international physics education conference in Sopron, Hungary, and at the University of Freiburg and the University of Tuebingen in Germany. There are plans to translate and use the book in China.

Claud Lacy's most interesting discovery was an eclipsing binary star, V907 Sco, that has, once again, stopped eclipsing. Lacy and his Danish co-investigators now believe they know what's going on in this system - it's actually a triple star. The third star causes the orbital plane of the eclipsing binary to wobble, turning the eclipses on and off--a behavior that is unique among all known eclipsing binaries.

Michael Lieber received a NATO grant to support his collaboration with Hubert Klar of the University of Freiburg, Germany, and Akram Mukhamedzhanov of Texas A&M. The three are working on the quantum mechanical problem of three interacting charged particles. They will get together in June in Freiburg. Professor Lieber also presented a paper at the AAPT meeting last summer in Denver, and will present one at the 16th International Conference on Atomic Physics in Windsor, Ontario this August.

William Oliver was chosen to participate in a national AAPT/NSF-sponsored Workshop for New Physics Faculty, and also chosen to be one of 35 faculty members from around the country to participate in a Faculty Enhancement Workshop this June at Harvard University. In addition, he and Michael Henry wrote an NSF Research Experience for Undergraduates (REU) proposal to establish an REU site here on "Modern Optics and Optical Materials," and obtained funds for three years. For more about this program, see Michael Henry, above. He was promoted to Associate Professor.

Gegory Salamo published 11 research papers, including two papers in *Physical Review Letters* , two in *Optics Letters* , and one in *Applied Physics Letters* , and presented 17 invited and contributed talks at various meetings. He received a $1.5 million NSF-EPSCOR award to develop a program in photonics and electronics, and began growth of materials using the new Molecular Beam Epitaxy facility (see accompanying article in this issue) obtained through another NSF award. He is growing new photorefractive optical waveguides and carrying out investigations on quantum dots with atomic-scale resolution. He had one PhD student graduate.

Surendra Singh published two articles, one of them an invited review article in "Frontiers of Quantum Optics and Laser Physics," edited by S. Y. Zhu, M. S. Zubairy, and M. O. Scully (Springer-Verlag, Singapore, 1997), pp 336-351. He also gave two invited talks, at the International Conference on Quantum Optics in Hongkong in January 1997 and at the International Symposium On Lasers in Ahmedabad, India, in Decemeber, 1997.

Gay Stewart won the College of Arts and Sciences' Master Advisor Award, in recognition of her thoughtful advising assistance to our undergraduate physics majors--one reason for the recent strong upswing in our number of graduating seniors. She has continued to work on her NSF-supported project to implement interactive laboratory-based learning techniques at large comprehensive universities. In addition, she has been conducting an annual summer teaching academy program for physics teaching assistants, she published three papers on research in physics education, and has four more papers accepted for publication.

Paul Thibado finished setting up our new $1.7 million semiconductor fabrication and characterization facility. The new facility is unique in the nation, because it combines state-of-the-art in device fabrication with the capability of characterizing the material quality with atomic-scale resolution. He also won several major research grants from NSF, the Office of Naval Research, etc., totaling $1.5 million. These funds allow him to employ 5 undergraduate students, 5 graduate students, and 2 post-doctorates. The new facility was officially opened by Chancellor John White during a ribbon cutting ceremony in April, with over 100 in attendance, TV interviews, and several articles in local city and campus paper. For more information, see Thibado's article on the Molecular Beam Epitaxy facility.

Reeta Vyas directed a summer research project under the REU program, contributed physics questions to Arvest Academic Competition in Education for high school students, and presented science demonstrations for the Science Saturday at the University of Arkansas Museum. She published 4 articles and presented 4 papers at national and international meetings.

Min Xiao published 9 papers in quantum optics, atomic physics, and nonlinear optics. He has been selected to receive the Arkansas Alumni Association's Distinguished Achievement Award in Research. He was invited to participate in the Ninth Symposium of Frontiers of Sciences organized by the National Academy of Sciences at Irvine, California, November, 1997. He received a grant from the Office of Naval Research for $297,500. He was promoted to Professor.

Almost all faculty contributed to the year's total of 60 published articles and 40 contributed and invited talks at national and international conferences.

Thank You! The Paul C. Sharrah Scholarship Fund

To date we have collected approximately $12,000 for the Paul C. Sharrah Scholarship fund. Our goal is to build this endowment to $15,000. We are grateful to all of our friends and alumni who have contributed to this fund in the past and who have continued their support of this. The first two Sharrah Scholarships, awarded last year and this year, went to Josh Hamblen, a fourth-year physics major. Paul C. Sharrah Scholarship Fund contributions were received from the following people: *Mr. John William Dixon, Mrs. Elaine M. Jones, Dr. Carl T. Rutledge, Mr. George K. Wallace*

Other Gifts

Friends and alumni continue to support the department through their annual gifts. We acknowledge support from the following people during the past year: *Mr. Joseph E. Brown, Mr. Arthur W. Pillow, Dr. Thomas O. Callaway, Ms. Donna Price, Dr. Darrell W. Collier, Dr. Syed Golam Rabbani, Mr. John William Dixon, Dr. Charles B. Richardson, Mr. Albert Filippelli, Ms. Candace J. Skoreski, Ms. Betty L. Gabriel, Dr. Alan Tribble, Colonel (Ret.) Billy E. Haney, Mr. Hardy Walton, Jr., Dr. Alan Hughes, Dr. James Watson, Jr., Dr. Yufang Li, Dr. Garvin Wattuhewa*

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