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UA Physics Department - An Exciting Place for Undergrads

The University of Arkansas, Fayetteville, Department of Physics is proud of the changes we have been making. These changes offer our students broader career paths. Recent surveys of major corporations found that the average college education did not adequately prepare students to take their place in the work force of the future. In many places around the country, enrollment in physics programs is declining, because programs cater only to graduate-school bound physics majors, intent on a Ph.D. At Arkansas, enrollments are climbing, and graduation rates are reaching new highs. We still provide everything a student may need to pursue a Ph.D. Several of our students who have gone away to graduate school in physics have received fellowships to do so, a recognition beyond the usual assistantship. We also provide a rich experience for students who wish to go into industry, teach, program, go on to a professional program such as law, business or medicine, or any number of other alternatives. We have been careful to make sure our program has good career opportunities for students wanting to finish with a bachelor's degree. All of our undergraduates find an opportunity to get involved in a rewarding research experience. Some are staying on to participate in one of our novel new masters programs, an MA designed for students who wish to pursue a career in teaching, and a completely new kind of master of science degree with two options, applied physics, or microelectronics-photonics, designed to give our students an advantage in today's and tomorrow's workforce (see following article). We are also expanding our faculty, bringing in more people committed to giving our students a rich, well-rounded, undergraduate experience (see Spotlight on the Faculty).

Important deadline: March 1, 2000 is the deadline for Physics Scholarship applications.

New Master's Degrees Prepares High-Tech Grads for Industry

University of Arkansas research professor Ken Vickers spent years as an engineering manager at Texas Instruments wishing his new college graduate employees had received a broader selection of courses in their graduate degree programs. Now Prof. Vickers heads a university program that offers exactly the type of training he sought in graduate students.

The ADHE recently approved two new masters degrees, one in microelectronics- photonics and the other in applied physics. They offer a multidisciplinary approach for students that can lead them

straight to jobs in high-technology fields. See next spring's issue for more on the applied physics degree.

"We built our program to make sure we use our strengths," Vickers said. "At the University of Arkansas we have strengths in packaging, in photonics, and in the sub- microscopic world." strengths built largely through the department's leading edge work in laser-photonics and their new semiconductor growth facility; and through the College of Engineering's High Density Electronics Center (HiDEC), which focuses on technological issues in microprocessing and packaging.

"HiDEC has provided a seed for the growth of interdisciplinary research and the corresponding training of graduate students," said Dr. Greg Salamo, University professor of physics. Salamo also noted that University research facilities in this field have greatly improved after several years of financial support fromthe NSF EPSOoR program and the Arkansas Science and Technology Authority (ASTA). "For instance, the $1 million Molecular Beam Epitaxy (MBE) facility gives us capabilities that cannot be duplicated at any other U.S. university," he said.

Instead of isolating the master's degree candidates in one aspect of a field, Vickers designed the microelectronics-photonics program to incorporate technology management, physics, chemistry, and various aspects of career-specific engineering into the curriculum.

"In the future, there will be a growing need for interdisciplinary graduates," said Dr. Leon Alkalai, director of the Center for Integrated Space Microsystems (CISM) at NASA's Jet Propulsion Laboratories (JPL) in Pasadena, Calif. "In particular, at NASA's JPL, we are looking for engineers with a stronger background in physics, computer science, biology and chemistry."

"The graduates of and products produced by this program will be of value to industry in Arkansas," Vickers said. Future plans for the microelectronics-photonics program include an expansion of the program into a multidisciplinary Ph.D. degree. Vickers notes that the $2.1 million grant just received by the program through a NSF Integrative Graduate Education and Research Training (IGERT) award gives the University the resources to rapidly move this program forward."

Focus on the Faculty...Laurent Bellaiche: Computational Condensed Matter Physics

Laurent Bellaiche joined our department in January 1999. He received physics BS. MS. and PhD degrees Summa Cum Laude at the University of Paris VI. His dissertation title was "Theoretical and experimental study of different aspects of the electronic density in BN, LiH and Be single crystals." He became Research Associate at the University of Paris Xl in August 1994, where he provided theoretical support to experimental groups on surface reconstruction and high pressure effects in semiconductors. In September 1995, he was chosen out of 200 candidates to join the National Renewable Energy Laboratory in Golden, Colorado, where he performed calculations on semiconductor alloys. Two years later, Dr. Bellaiche transferred to the Department of Physics and Astronomy at Rutgers University, where he did theoretical investigations of ferroelectric systems. He taught undergraduate and graduate courses at both Paris and Rutgers Universities. He received various academic honors, including four fellowships for materials science studies, and research and teaching awards from the French government and from different Paris universities, and co-authored over 20 journal articles, including 4 in Physical Review Letters and 4 in Applied Physics

Letters during the past two years. He gave invited presentations at APS meetings, about his semiconductor alloys studies at the 1998 March Meeting and about his ferroelectric systems work at the 1999 Atlanta Centennial Meeting, and four other invited talks.

Dr. Bellaiche's primary research interest is the prediction, design, and optimization of materials properties. To reach that goal, he uses and develops state-of-the-art computational and simulation methods. His current research program is divided into three activities: ferroelectric systems, semiconductor materials, and high pressure physics.

The ferroelectric systems have the ability to swell or shrink when zapped with electricity, as well as to give off electricity themselves when compressed or pulled apart. Engineers have exploited this trait for decades to convert mechanical energy to electricity and back again in applications ranging from phonograph needles to telephone speakers. The talented family of ferroelectric systems has recently gained some even more gifted members that display an effect 10 times greater than that of the current family members. These new members could usher in a new generation of devices that would improve everything from the resolution of ultrasound machines to the range of sonar listening devices. One of Dr.Bellaiche's goals is to predict the properties of ferroelectric systems, and to identify the microscopic effects responsible for their anomalous behaviors.

Dr. Bellaiche's interests are shared by several of our experimental physicists, such as Paul Thibado in semiconductors, Lin Oliver in ferroelectric systems and high pressure physics, and Greg Salamo for ferroelectric systems and semiconductors. This overlap should generate fruitful interactions and collaborations, and even more undergraduate research opportunities.

One of Dr. Bellaiche's important goals is to efficiently train undergraduate and graduate students. He intends to do that by leading them to a deep understanding of various fundamental and technological problems, and showing them how these two aspects of science are related at a microscopic scale. The computer skills will also enhance students' ability to compete on the job market.