

# Physics Matters

Department of  
Physics and Astronomy

Winter 2007–2008



WASHINGTON STATE  
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World Class. Face to Face.

# Greetings from the Chair

Having just returned from 13 months in Europe, spent mostly in Dresden, Germany, I have been feverishly working to catch up on departmental matters. In the midst of this frenzy, I was struck by a question from our budget manager, **Tom Cowger**: “Should we purchase a new display case?” We now have so many graduate students and undergraduate majors that our departmental display case, which has served us since “forever,” is too small to accommodate all of our student, faculty, and staff photos.

Even though Tom’s question surprised me, it shouldn’t have. The department began several years ago to overhaul its methods of recruiting quality students, both at the graduate and undergraduate levels. We coupled these efforts with enhancements to our teaching and research programs, and the fruits of those efforts are now materializing. For example, our graduate student population has increased from 44 to 60 students in just two years! In this edition of *Physics Matters* we are highlighting a couple of new programs that have impact on our graduate studies and help to account for the substantial increase in our graduate student population.

First, I would like to mention a Department of Education program called “Graduate Assistantships in Areas of National Need,” or GAANN. This highly competitive program (there is an approved list of fields which includes physics and astronomy) provides significant stipends and other inducements to help departments recruit and retain excellent doctoral students. Beyond recruitment and retention however, the GAANN program has proven to be an excellent resource for us.

For example, in order for us to compete successfully for a GAANN grant, we developed new professional educational experiences and opportunities, created program assessments for self-improvement, and provided a mentor system for the students. Our proposal won five GAANN fellowships per year for three years. Through the educational training and experiences that we now offer, we better serve individuals who have a primary interest in becoming educators.

Second, Matt McCluskey spearheaded a National Science Foundation grant to provide “Research Experiences for Undergraduates” (REU). This may sound like a program that provides for, well, what its name suggests. However, students from across the country are competing for less than a dozen spots in our REU program. The result is that we can fill the positions with a broad range of superb students who otherwise would never get to know our faculty and their excellent research programs. While the goal is for students to engage in quality research projects, some of them will choose WSU for their graduate studies. My



own experience with two REU students is that they performed publication-quality research beautifully. Who knows, maybe I will see them here for graduate school in the future.

Sukanta Bose successfully competed for research fellowships, which we named Millennium Fellowships. Funded through the Graduate School, the fellowships help us recruit graduate students who are already research oriented and get them into research groups as soon as they arrive. We received five fellowships per year for two years, with the possibility of a renewal. It seems clear when considering the long-range potential of the GAANN, REU,

and Millennium programs, as well as existing programs such as the Institute for Shock Physics Fellowships, that our department is providing a broader range of graduate opportunities for our students. We are not content with this progress and more recruitment efforts are underway that you may hear about in future issues of *Physics Matters*.

With the increase in graduate students and undergraduate majors, we have a need for additional faculty. As part of this growth we are happy to welcome a new faculty member, Yi Gu. Yi, who hit the ground running from day one to get his laboratory developed, is an experimentalist in nanoscience and engineering. Please see page 11 for more on Yi Gu. Additionally, the department is conducting three searches this year. One is to fill an assistant professor theory position, a second is for an assistant professor in astrophysics, and a third is our prestigious William Band Distinguished Theoretical Professorship. It will be a very busy year for our faculty and staff. On the unfortunate side, we lost John and Pamela Blakeslee this fall when a Canadian lab lured them away from WSU, but we do wish them well in their new endeavor.

Overall, the department keeps getting better and better. There is not enough space to describe all of our efforts and successes, but hopefully you will find the developments described here interesting and newsworthy.

Sincerely,  
Steve Tomsovic  
Chair, Department of Physics and Astronomy

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# Grant Enriches Program for Graduate Fellows

Expanding and enhancing our graduate program has become a priority for the Department of Physics and Astronomy. Our focus is to attract the best and brightest students to the department, with particular attention to underrepresented groups. To support this mission, in 2005 the department applied for and received a highly competitive, federally funded grant from the Department of Education—a Graduate Assistantships in Areas of National Need (GAANN) grant. The three-year, \$370,000 grant provides a year's support for five or six students each year of the grant cycle.

The national GAANN program is designed to enhance the teaching and research skills of doctoral students. GAANN fellows receive instruction through a wide variety of learning methods, are provided opportunities to build exceptional classroom and laboratory skills, and participate in outreach and community service. During their first year, each fellow is assigned to a faculty mentor who teaches at the lower-division level. As teaching assistants they receive special training in the development and implementation of demonstrations, computer-based conceptual aids, internet resources, learning and teaching goals, testing and grading methods, syllabus preparation, and standards of conduct for students. Additional professional training continues into their second year.

GAANN students receive monthly stipends for tuition and fees, health insurance, and textbook costs, as well as funds to travel to major conferences. Professional meetings are seen as important opportunities for students to strengthen their communication skills, broaden their horizons, and help them understand the need for a professional network.

Every GAANN fellow develops a unique relationship with their faculty mentor. Fellow **Grant Eastland** was assigned to work with instructor **Michael Allen**. Allen and Grant updated the department's 100-level astronomy labs by introducing computer-based exer-

cises that simulate either astronomical data collection or dynamical processes. The hardware to run the simulations was patched together in a two-year effort by **Tom Johnson**, the department's scientific and technical support person.

"Grant tested several software packages and selected the one he felt best suited the learning objectives of the course," said Allen. "He chose a package that models the diffusion of photons out of the center of the sun. To compose the exercise, he had to run all the simulations several times, and then decide in which order they should be presented to students. Grant wrote sequential instructions and then composed follow-up questions designed to invoke critical thinking. He finished his project at the end of last spring semester and his lab exercise is being used by students for the first time this fall."

Eastland has a master's degree from Oregon State University and taught physics for two years at Blue Mountain Community College at Pendleton, Oregon, prior to coming to WSU. Even with this experience, he found his GAANN project to be challenging and edifying. "The GAANN Fellowship program has really helped me to develop the skills I need to become what I want to be, a teacher. After completing my master's in applied physics, I taught college physics without the benefit of much training. However, I found that I loved physics and I want to make teaching at a college or university my career. The GAANN experience has been rewarding and I would not trade it for anything."

Instructor **Nicholas Cerruti**, who joined the physics faculty last fall, also got his physics doctorate from WSU. Having been on both sides of the fence at WSU, he has a unique perspective as a faculty mentor. "I had the pleasure of working with and getting to know two GAANN fellows, **Tony Smith** and Grant Eastland. They each conducted review sessions for my large calculus-based general physics

*continued on page 9*



GAANN Fellows 2006–2007: Left to right: Justin Eld, Anthony Smith, Christopher Hamner, and Grant Eastland (not pictured, Christina Ellis).



GAANN Faculty Mentors 2006–2007 Left to right: Fred Gittes, Nicholas Cerruti, Pam Blakeslee, Michael Allen, and Peter Engels (not pictured, Sukanta Bose).

## REU 2007 “Extreme Matter”

Undergraduate students from all over the country gathered to participate in the physics and astronomy department’s first ever, ten-week Research Experience for Undergraduates (REU). It began when the department applied for and received a coveted three-year, \$240,000 National Science Foundation REU grant. The national REU program is designed to get undergraduates involved, hands-on, in research. WSU’s physics REU focused on Extreme Matter.

The department’s REU recruitment target was students from four-year colleges that have limited research facilities. Eleven students were chosen (out of an applicant pool of 183) to work with a faculty mentor group of well-funded researchers with proven track records. In addition to receiving hands-on research mentoring, the students attended seminars that highlighted current topics in extreme matter. The students received compensation for travel and living expenses. A lineup of social events helped round out a very collegial sense of community for the group.

A glimpse of our busy and productive REU 2007 “Extreme Matter” research summer follows.

Please encourage students interested in learning more about the our REU program to visit our Web site at [physics.wsu.edu](http://physics.wsu.edu).

**Jana Vitamanti**, physics and astronomy REU coordinator, organized the 2007 event. She processed applications and correspondence and secured lodging for the first cohort. She was efficient, helpful, and understanding and the REU students looked to her for solutions to their day-to-day challenges. The department appreciates Jana’s efforts and thanks her for a job well done. “My first impression of the REU students was great,” said Vitamanti. “They seemed excited, and anticipated a fun couple of months learning something new. The students were eager to be in a new place and enjoyed WSU’s state-of-the-art Student Recreation Center, which allowed them an outlet from work and study. I kept in touch with them through e-mail and they were always gracious in their responses. My hope is that our REU program has been a very good experience for them and that they will share their fun moments with their family and friends.”



REU intern **Amanda Roberts** (top photo, center), with her faculty mentor **John Blakeslee** and graduate student **Regina Barber DeGraaff**, analyzed the globular clusters around the galaxy Centaurus A using data from the Spitzer space telescope at mid-infrared wavelengths. She credits Blakeslee with explaining any concepts she didn’t understand. “He was very helpful and taught me a lot about computer programming and using Unix. He’s



very good at explaining how the programs we use work.” Amanda attends Whitman College in Walla Walla, Washington.

Blakeslee found the REU experience to be a great way to get students motivated about research. “I really enjoyed having Amanda as an REU student for the summer. She exceeded all my expectations for undergraduate research and continually impressed me with her knowledge and initiative. Her results are definitely of publication quality. And because of her summer’s experience, Amanda is now seriously considering WSU for graduate school. The program was a success all around.”

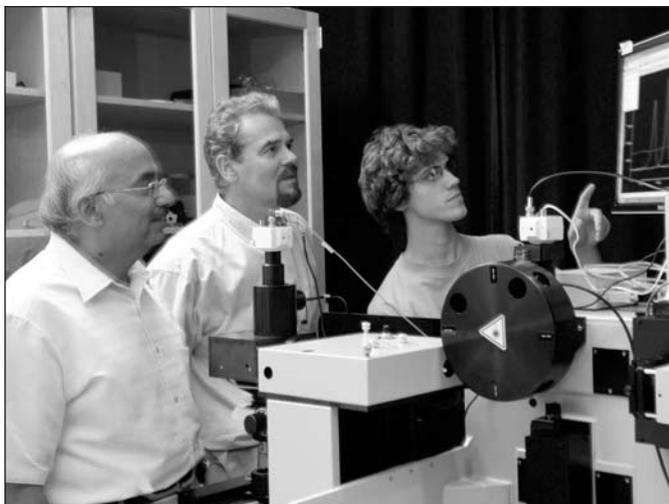
**Kurt Zimmerman**, senior project engineer in the Institute for Shock Physics, spent the summer working with REU intern **Brad Hartl**. They worked with **Eryn Cook**, an optical engineer intern (not pictured), on characterizing the flyer impact tilt of a laser shock experiment at ISP. Brad attends Montana State University, Bozeman. Zimmerman and Cook resoundingly approved of the REU experience. “The Institute for Shock Physics had the



pleasure of hosting Brad Hartl. Brad was involved in optimizing and characterizing the performance of our laser driven flyer system, which is a novel experimental method at ISP. In just a few weeks time, Brad learned how to work effectively in scientific environments, use a variety of state-of-the-art instruments, and learned how to take and analyze data. His good hand skills, patience (and at times persistence), and fresh perspective on problems were very helpful. It's safe to say that Brad saw first hand the fast pace and continuously changing aspect of scientific research. We believe that the experience he gained over the summer will be useful as he continues his education and decides how best to use his skills."

**Gustav Borstad** completed his internship with Regents Professor **Yogendra Gupta**, director of the Institute for Shock Physics, and with REU mentor **Zbigniew Dreger**. Gus is demonstrating acetonitrile under high pressure in a diamond anvil cell using Raman Spectroscopy. Gus is a student at the University of Wisconsin, LaCrosse.

Borstad credits Dreger, the Institute for Shock Physics senior staff



scientist, for providing the necessary guidance and information while allowing Gus to be "fully involved with each step of the research. I enjoyed my time at Washington State University. Every aspect of the experience was good, from the living arrangements to our contact with the physics department to the seminars, lab tours, the research itself, and the poster presentation. I feel specifically that the research-related activities furnished an opportunity for personal growth. I also enjoyed the various events that were planned for us. I would not hesitate to recommend the program to anyone I know."

Dreger was equally impressed with Gus. "Participating in the REU program was a very rewarding experience. It was a pleasure to work with Gus, a dedicated and bright student. Gus was exposed to state-of-the-art equipment in a research-focused scientific environment and he learned how to perform experiments and analyze data related to the materials' response to static high pressure. In particular, I was impressed by his fast growth from an inexperienced student to a confident and knowledgeable researcher. This was a truly remarkable

transformation. In a very short time, Gus obtained and analyzed original data of publishable value. We both benefited personally and scientifically from the REU program and had a very enjoyable and productive time. I believe that this experience will help Gus to make the right choices in his future scientific career."

Working with Professor **Gary S. Collins**, **Ashley Dorwart** studied the local structure of solids by observing local environments of radioactive probe atoms using hyperfine interaction methods. Collins and his group enhanced Ashley's understanding of solid-state physics. She studies at Nebraska Wesleyan University, Lincoln.

Collins was highly impressed with Dorwart. "Ashley is a student



who takes initiative. A physics major at her university, she spent her junior year abroad studying in Ecuador. It was a pleasure to have her working in my lab over the summer. While the two-month REU summer program passes all too quickly, Ashley became involved in all aspects of our work, from sample preparation to spectral fitting to poster presentation. A publication is in the offing that will include her work as well as that of several graduate students."

**David Zartman** with his faculty mentor, Professor **Philip Marston**, spent the summer investigating Universal Serial Bus (USB) interfaces for communicating with new oscilloscopes in order to run experiments using Labview with new hardware. David found Marston very supportive of him doing research independently. David studies at the University of Northern Colorado, Greeley.

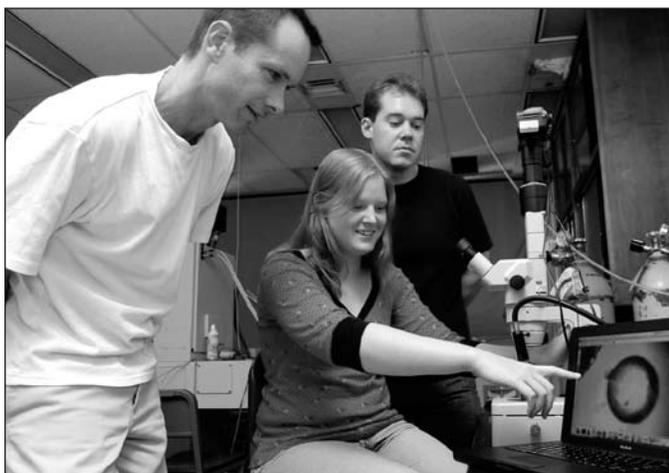
Marston compared Zartman's REU experience to one of his own. "I found that David was productive and interested in the assigned task, which included some difficult issues in computer programming involving 'Labview' and some poorly documented recently purchased equipment. David interacted well with graduate students. He also benefited from the WSU summer school program since he was able to take a class and transfer the credit to his home university. In some regards, I consider the experience analogous to one I had the summer between my junior and senior year of college when I worked at Oak Ridge National Laboratory independently on a computer programming task with only minor supervision."



*David Zartman with mentor Philip Marston*

**Matthew McCluskey** with intern **Martha Roseberry** and WSU graduate student **Gabriel Hanna** collaborated on research using a Moissanite anvil cell to view the effect of high pressure on the volume of a polymer microsphere. “Dr. McCluskey was a friendly, amusing, and interested advisor who allowed me to do the research myself while giving useful instruction and advice.” Martha is a student at the College of Wooster, Ohio.

McCluskey, newly appointed chair of the Graduate Studies Committee, is very pleased with the department’s REU. “Many of the students have expressed an interest in coming to WSU for graduate school. This program will provide a boost to our already stellar graduate program.”



**Marissa Umbel**, shown below on the right, with her faculty mentor **Susan Dexheimer**, used a photothermal deflection spectroscopy technique to acquire a spectrum of band tails in amorphous silicon and silicon germanium alloys. Marissa found Dexheimer very helpful in showing her the process and techniques of spectroscopy and optical alignment. Marissa is a physics major from Indiana University, Bloomington



“Marissa’s research experience involved photothermal deflection spectroscopy, a technique useful for measuring optical absorption associated with band-tail and sub-gap defect states in amorphous and nanocrystalline semiconductors,” said Dexheimer. “This project gave her the opportunity to gain hands-on experience working with optical instrumentation, as well as to learn about the physics of optical spectroscopy and semiconductor materials.”

**Shirley Leu** spent the summer learning various procedures to grow titanium dioxide nanotubes for use in dye-sensitized solar cells. Shirley was thankful to have chemistry Professor **Jeanne McHale’s** assistance in interpreting the results and guiding the direction of her research. Shirley studies at Louisiana State University, Baton Rouge

McHale, a highly respected faculty member in the Department of Chemistry, was invited to participate in the summer internship program. She writes: “We all know that the REU program is an excellent opportunity for undergraduate students to get turned on to the excitement of scientific research. But it’s also a benefit to the mentors as well, who get to work with enthusiastic students who may have fresh outlooks on longstanding problems the lab is



Shirley Leu, left, with Jeanne McHale

addressing. It can be a little intimidating to be thrown into a lab with more senior researchers, grad students, and postdocs who have been thoroughly immersed in the field for a long time. But in our group we all help each other, so there is plenty of support for younger students if they are willing to put in the effort. Shirley was faced with a huge learning curve concerning some new techniques, but she met the challenge and made lots of progress in the last couple weeks of the summer. Her work to synthesize titanium dioxide nanotubes actually got us into uncharted territory, and is forming the basis for present and future studies in our lab. I would be happy to have another REU student like Shirley, and I am ecstatic to learn that she plans to apply to our graduate program.”

**Russell Follett** (below right) worked with Professor **Kelvin Lynn**, director of the Center for Materials Research. His research involved using piezoelectric devices to turn sound into energy. Russell credits Professor Lynn with guiding his research in ways that made him question methodology. “Dr. Lynn helped me come up with new ways to run experiments.” Russ is studying at Colorado State University, Fort Collins.

Lynn, along with Materials Science graduate student **Romit Dhar** (not shown), found Russ to be a willing participant in a worthwhile program. Lynn characterized Russ as “a bright and motivated



student” who has good laboratory skills. “He learned the project in a short time and was inquisitive in nature and often asked questions pertinent to key ideas for the research. Russ was open to learning and had new ideas. We often had long discussions regarding the experiments and the results....We made good progress in the project and will publish the results with Russ as a coauthor.”

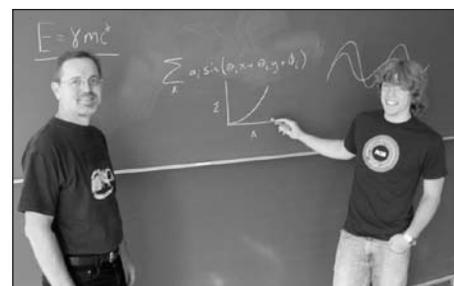
Two summer students got unanticipated trips abroad along with their REU internships. The mentor assigned to **John Elton** (top left) and **Scott Clark** (bottom right) was department chair **Steven Tomsovic**, who was working in Dresden, Germany, on a Martin Gutzwiller Fellowship last year.

“John and Scott were extremely excited when they learned that they would be carrying out their research at the Max Planck Institute for the Physics of Complex Systems.

They couldn’t believe that they were going to spend the summer in Germany. John even had a working knowledge of the German language. His research focused on a problem involving a certain kind of instability fluctuation in chaotic systems, and Scott worked on the statistical nature of extreme intensities of states found in quantum mechanics. Both of them got off to great starts and kept advancing. Along with another collaborator, **Arul Lakshminarayanan** from the Indian Institute of Technology of Madras, we hope to finish writing up John and Scott’s research for publications later this fall. Overall, it has been a great experience for all of us.”

Pictured here, John stands in front of the Max-Planck-Institut für Physik komplexer Systeme, where he studied fluctuation properties of KS entropy over periodic points of a chaotic map. John studies at Georgia Institute of Technology, Atlanta.

Scott Clark studied the extreme value statistics associated with random superpositions of plane waves and how their eigenfunctions correspond to known chaotic quantum systems. Scott studies at the University of Oregon, Corvallis.



The Department of Physics and Astronomy and University Publishing would like to acknowledge authors for three articles published in the Winter 2006–2007 edition of *Physics Matters*. Cherie Winner, science writer for WSU News Service, contributed two articles, “WSU Physicist First in Northwest to Produce Rare Form of Matter” and “Molecular Design: Breakthrough May Unleash Full Speed of the Internet.” Pacific Northwest National Laboratory media specialist Bill Cannon wrote “All That Glitters,” first published in *Washington State Magazine*, August 2006. We profusely apologize for the omission of their bylines.

# Life in the Ultrafast Lane

A nanosecond, one billionth of a second, is short, but it is an eternity for physics professor **Susan Dexheimer**. She uses cutting-edge laser techniques in the *femtosecond* regime to detect physical phenomena that occur on ultrafast time scales. A femtosecond is  $10^{-15}$  second, or a millionth of a billionth of a second. Femtosecond laser pulses are short compared to the time scales of atomic-scale motions in molecules and solids, and of charge carrier interactions in electronic materials. Therefore, femtosecond spectroscopy stands out as a powerful tool to time-resolve processes that are otherwise too fast to study.

Current research in Dexheimer's laboratory involves ultrafast dynamics in emerging electronic materials, and includes both fundamental physics as well as issues important for future applications. One major research focus involves probing the underlying physics of how electronic excitations interact with atomic motions. These experiments use ultrashort light pulses to time-resolve fast changes in the local atomic structure, and have succeeded in resolving the formation dynamics of localized electronic states, processes important for understanding conductivity mechanisms in molecular and nanoscale electronic materials. The Dexheimer research group also carries out research on photoinduced charge carrier processes in semiconductors, promising for solar cell applications. "It turns out that what happens to the electrons right after they have been generated by light has an enormous impact on the efficiency of a solar cell," said Dexheimer. The state-of-the-art photovoltaic materials studied in this work come from collaborations with materials scientists at the National Renewable Energy Laboratory, a Department of Energy national lab, and also with WSU chemistry professor **Jeanne McHale**.

Dexheimer has been advancing the emerging technique of time-resolved THz (far-infrared) spectroscopy in her studies of ultrafast photoconductivity. Fast dynamics in the far-infrared spectral range have only recently begun to be explored, and these techniques have the potential to address a wide range of problems in condensed matter, molecular, and biological systems.

Dexheimer is the editor of the book *Terahertz Spectroscopy: Principles and Applications*, which will be published later this year by Taylor and Francis as a part of their Optical Science and Engineering Series, and will be the first book to provide a comprehensive treatment of fundamental principles, instrumentation, and applications of these recently developed techniques.

"Designing and building complex instruments and adapting them for specific experiments is an integral part of our work. The combination of rigorous basic research with practical 'hands-

on' experience provides an ideal training ground for students," said Dexheimer. Graduate students and postdocs in her research group have been well-prepared to enter positions in both academia and industry, given their background in both basic and applied work. A number of undergraduate students have also worked with her, carrying out research that advanced their interest in pursuing scientific careers.

Dexheimer's research on the dynamics of localized photoexcitations has been funded by more than \$1 million in consecutive grants from the National Science Foundation, beginning with a prestigious NSF Faculty Early Career Development (CAREER) award, which she received in 1998. Her work on materials for photovoltaic applications has been funded by an exploratory grant from the NSF and by a \$365,000 Department of Energy National Renewable Energy Laboratory grant. In addition, Dexheimer has been largely responsible for the development of an ultrafast laser facility funded by a \$397,000 NSF Major Research Instrumentation grant. "Professor Dexheimer's work is an important part of the department's focus area in materials and optics," noted acting chair Matt McCluskey. "Our emphasis on understanding interactions between photons and materials makes us unique in the northwest, and Professor Dexheimer is a leader in that effort."

In addition to being a world-class researcher, Dexheimer is a popular and rigorous instructor. Her course on optics is in especially high demand. She also provides valuable, high-visibility service to the scientific community, and has recently completed a six-year term on the committee for the International Conference on Ultrafast Phenomena, the leading conference in her research field.

## La Rue Family Endowed Scholarship in Physics

On behalf of the La Rue family, WSU associate professor of electrical engineering **George S. La Rue** has created a scholarship for physics undergraduates. The endowment honors the tradition of the La Rue family at Washington State University. George's father, **Jerrold A. La Rue**, attended WSU for one and a half years as a physical science major. World War II interrupted his education and he graduated in meteorology from the University of California, Los Angeles, after the war. **Jean La Rue**, Jerrold's brother, obtained his bachelor's degree in mathematics from WSU in 1943. The new La Rue Family Physics Scholarship joins an existing fund that supports electrical engineering students. The Physics and Astronomy Department greatly appreciates the La Rue family's thoughtful donations.



### Graduate Fellows from page 3

class. Being in a large auditorium in front of many students was a new experience for both of the fellows. Hearing their differing insights—Tony’s as a recent physics undergraduate and Grant’s as a former college instructor—was beneficial to me, especially their descriptions of the difficulties students were having. I enjoyed the chance to mentor each of them.”

Physics instructor **Pam Blakeslee** is accustomed to having graduate student assistance for her lower division courses. Even so, as a mentor, she appreciated the specialized nature of the GAANN program. “Advising GAANN students has been my privilege. The best way to learn how to teach is to actually do it. This is what my GAANN fellows did. They held office hours so students could get extra help. They conducted demonstrations and worked problems during lecture, and they helped with the grading. I have learned more as a teacher than I did as a student, and I hope the same is true for them. Introductory physics lectures tend to be rather large so their help was gratefully received by the students and by me.”

Doctoral student Tony Smith, who graduated from Central Washington University, believes his time in the GAANN program last year was well spent. “As a TA, I was mentored by Drs. Nicholas Cerruti and Pam Blakeslee, for physics 201 and 202. I graded tests for both professors, which helped me develop skills for grading large numbers of papers accurately and in a timely fashion. We decided that my project would be to conduct review sessions to help students prepare for finals. I had been a TA before, but had never conducted a full class session, so this was a new experience. I think students benefited from hearing concepts explained a different way and based on the practice problems.”

Confidence in the classroom is something that comes with experience for many educators. Faculty mentor **Peter Engels** found the GAANN program to be especially encouraging to his GAANN student, **Christina Ellis**. He explained, “Christina had a unique opportunity to look behind the scenes of teaching a large introductory physics class. She designed lectures and homework sets and prepared lecture demonstrations. She also held office hours and tutored a lab section. Her close interaction with students provided her with instant feedback from the class, and seeing students advance their understanding of physics was a great and continuous reward for her work.” He adds, “the GAANN scholarship turned out to be a real win-win situation. It allowed Christina to get interesting new insights into the art of teaching from a teacher’s perspective, and the students in the class surely appreciated the extra help they received.”

Christina, who has a bachelor’s degree from Knox College in Galesburg, Illinois, shares Peter’s assessment. “The GAANN program helped me focus on teaching physics and on how students learn, while at the same time I was learning for myself. It helped me be more comfortable talking in front of a large group and made me realize how much time and effort goes into becoming a *good* teacher. I appreciate the opportunity to experience all these things so that I can become a better teacher and a better physicist at the same time.”



*The newest cohort of GAANN Fellows is busy with their teaching assignments. The department looks forward to following the careers of all participants in the GAANN program.*

**Fred Gittes**, clinical associate professor, has spent most of his career perfecting the art of teaching. He was especially interested in working with would-be educators. “I have very much enjoyed having GAANN students helping with my courses. Over the years, it has been my experience that while graduate students have technical knowledge, many lack some of the more essential communication skills that can only come from practicing in front of a large audience. Students who are a bit nervous speaking in front of the class, as opposed to informally working with lab groups, most often benefit from large group interactions. Most of the introductory classes are designed such that they allow the fellows opportunities to improve their delivery. This in turn builds their confidence and helps them become better teachers. I saw this happen last year.”

One of the goals of the WSU GAANN program is to attract graduate students to the physics program. Fellow **Justin Eld** earned a bachelor’s degree in physics from Concordia University, Seward, Nebraska. He believes the GAANN program has great potential as a recruitment tool. “I think offering GAANN fellowships is an effective and competitive way to help recruit good physics students. For someone who is vacillating between disciplines, for example, between physics and chemistry, he or she might be more inclined to choose physics if offered a GAANN Fellowship. I also like the idea of putting more of an emphasis on physics education.”

**Chris Hamner’s** two semesters in the GAANN program exposed him to a broad range of interests and backgrounds. “My TA appointments consisted of two distinctly different experiences determined by the needs of my faculty advisors. First semester I assisted Professor Pamela Blakeslee with her lecture sessions by setting up and providing demonstration experiments for her undergraduate physics course. Second semester I assisted my faculty mentor, **Sukanta Bose**, in building a lab for demonstrating interferometry (specifically Mickelson Interferometry) to an undergraduate astronomy class. I very much enjoyed both of these experiences.” Chris came to WSU after receiving a bachelor’s degree in physics from the University of Washington.



**Graduating senior John Leraas with Regents Professor Tom Dickinson**

## WSU Scholarship Only Part of the Equation

It's a common sight to find graduate students spending countless hours working in laboratories. It is far less common to find undergraduates working one-on-one with faculty. For those who do, it can mean the difference between going to graduate school or looking for a job right out of college. **John Leraas** knows the meaning of hard work and he also understands the fantastic opportunities he has had as an undergraduate major in physics.

*Q: What attracted you to WSU?*

**A:** To be honest, financial incentive is what brought me to Washington State University. I got a full-ride scholarship, which was tough to turn down. It wasn't until I actually got to WSU that I found out how good the undergraduate physics program was. You can learn about physics nearly anywhere; it's a universal discipline and the textbooks are pretty much standard. However, WSU is a research university that brings in a lot of money and a lot of good people. WSU really encourages undergraduate research and possesses the resources to make the most out of the experience. So finances aside, I'm glad I came to WSU.

*Q: Describe your research in a way that can be understood by a broad audience.*

**A:** I have been working with Regents Professor **Tom Dickinson** conducting research on laser-material interactions. When you hit a material with a laser you generally do something like break bonds, knock off electrons, and/or heat the material. We hit the material with a laser, collect the particles, and use them to make inferences about what is happening at the sample surface during the laser pulse. We are essentially trying to see how the material breaks down. This is important because etching, or cutting, materials with a laser is becoming more and more common and has certain advantages over mechanical processing. Our work is with lasers with very low wavelengths, which results in much more precisely controlled cuts. These lasers can make cuts significantly smaller than the width of a human hair. By understanding the etching process we can develop and use better etching techniques. More precise etching means smaller electronics that can go in your phone, computer, or iPod.

*Q: Do you plan to go to graduate school? If so, where and what do you want to study?*

**A:** I do plan on going to graduate school, but am still in the process of choosing where and what I want to do. I have a number of interests, so I'm not exactly sure which one I want to follow. I'm glad I've done physics though because even if I were to choose graduate

study outside of physics I feel that I will be prepared. I'm planning on applying to a number of places and hoping something interesting jumps out at me.

*Q: Outside of the usual course work, what preparation, if any, would you recommend undergraduates make before entering graduate school?*

**A:** I would recommend any undergraduate in physics to do research. Not only is it a way to test your discipline and analyze what you like and dislike, but it also gives insight into what physics is really about. A lot of people think of physics and think of books full of equations, but the real problems that people are tackling can't be modeled by equations yet—that's why they're interesting and that's why the research is being funded.

*Q: Describe your experience at WSU as an undergraduate.*

**A:** Toward the end of my first year at WSU I approached my advisor to see what a physics major should be doing during the summer to stay competitive. He looked at me, leaned back, and said, "Well...I guess I can give you a job, but you have to work at least 50 hours a week and stay all summer." Since I hadn't been asking for a job I was a little surprised, but accepted. That was the beginning of my real involvement with the WSU physics program. Since then I have been doing research pretty much continuously on some level while at WSU. Along with my research experience I have been able to compete in several undergraduate research competitions and have been published once in the *Journal of Applied Physics* with a second paper submitted for review. Research has been a large part of my physics undergraduate experience. A lot of it has been made possible by grants from the university that are specifically designed for undergraduate research. I've always been able to feel that if I really want to work on a project, there will be a way to fund it.

I also had the opportunity to study abroad for a year in Wales through an exchange with the Honors College. I would recommend studying abroad to anybody. I was able to learn a lot, maintain great grades, and have a great time. People think it's a bit weird for someone in science to study abroad, but I can't think of a more natural thing. Science is a universal discipline, and the physics in Wales occurs the same way that it does in Pullman.

This last summer I got an internship experience with nLight, a high intensity laser diode company out of Vancouver, Washington. I heard about this opportunity through the WSU Honors College. It was a great experience. I worked with great people on interesting projects and it helped greatly in guiding my future career choices.

*Q: What are your long term plans?*

**A:** I'm a bit fuzzy on my long term plans, but I'm planning a career in industry. I had my first experience in industry and I really enjoyed the amount of available resources and being surrounded by a number of really smart people working on the same thing. I think the particular direction I take will have a lot to do with the problems and people that I am exposed to.



## The Department Welcomes a New Physicist

The Department of Physics and Astronomy is pleased to announce the addition of a new faculty member this fall. Assistant Professor **Yi Gu** is an experimentalist working in

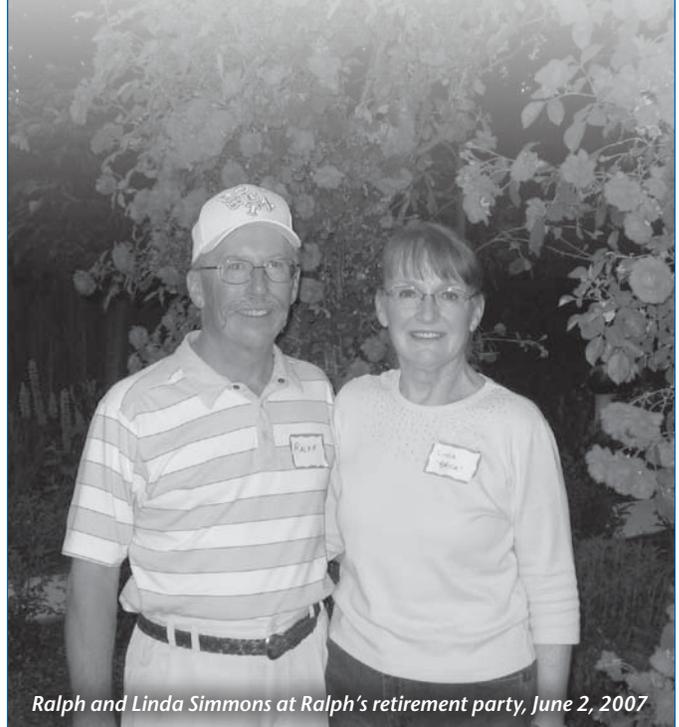
the field of nanoscience and engineering. His research interests and activities include bottom-up synthesis of low-dimensional materials (e.g. nanowires) with an emphasis on controlled incorporation of functional impurities, development of multi-purpose (optical, electrical, and magnetic) scanning probe microscopy techniques that will enable a correlated local investigation of fundamental physical properties, and the exploration of novel device concepts based on a fundamental understanding of physics and materials science in the nanoscale.

Yi did his undergraduate work in materials science at Shanghai Jiaotong University in China, where he worked on vacuum deposition of metal multilayers. His doctoral work in applied physics was done at Columbia University, where he studied optical properties of semiconductor heterostructures including multilayers and self-assembled quantum dots. He was the first to prove the formation of type-II quantum structures in a Zn-Se-Te multilayer system using optical techniques, and his investigation on this material system also shows a continuing transition in the optical emission properties between few-atom systems (e.g. isoelectronic atom clusters) and many-atom systems (e.g. quantum dots); such a continuing transition has been theoretically suggested but was never confirmed experimentally. In addition, he developed a novel approach combining optical techniques and simple model calculations to obtain simultaneously the size and the chemical composition of individual self-assembled quantum dots. He also studied the effects of various metal catalysts in ZnO nanowire synthesis procedures.

Before coming to WSU, Yi spent three years as a postdoctoral fellow at Northwestern University, where he developed new scanning probe microscopy techniques that combine optical and electrical characterizations to quantitatively probe charge carrier transport in various semiconductor nanowire devices. He looks forward to setting up his research program at WSU, integrating rational nanomaterial synthesis, investigation of properties (such as spin manipulation and transport, phonon transport, and electrically controlled structural phase switching) that are both fundamentally interesting and technologically relevant, and the development of novel devices and hierarchical device integration schemes.

## Ralph F. Simmons Jr. Graduate Fellowship in Physics

**Ralph Simmons** ('79 Ph.D.) received more than a fond farewell at his June 2, 2007, retirement party from Hewlett Packard. Ralph's wife, **Linda**, arranged with the College of Sciences and the Department of Physics and Astronomy to surprise her husband with the announcement of the creation of a Ralph F. Simmons Jr. Graduate Fellowship in Physics to honor his outstanding career. Ralph was hired by HP's Disc Memory Division in the spring of 1979. During his 28-year tenure at HP, he became an internationally recognized authority on magnetic recording. Ralph holds several patents and has published many articles. He also holds the title Distinguished Scientist, an honor received by fewer than one percent of HP's engineers and physicists, based on a rigorous set of criteria, including contributing major, lasting technical impact to HP business; displaying leadership in technical prowess, collaboration, and knowledge sharing; and demonstrating abilities to identify emerging technologies and opportunities that span technical disciplines and products. Ralph studied theoretical physics at WSU under the tutelage of Professor Emeritus **James Park**. Ralph was in his second year at WSU, just finishing his master's degree, when he met Linda at a physics party at the Ram Pub. They were married in December 1977. They have two children, **Tiffany** and **Nick**, and three grandchildren.



*Ralph and Linda Simmons at Ralph's retirement party, June 2, 2007*

## Good News from Around the Department

- The Space Telescope Scientific Institute (STScI) has awarded **John Blakeslee** a two-year, \$420,829 grant to study the “structure formation and evolution of galactic core and nuclei.”
- **Doerte Blume** spent five months of sabbatical leave at the Istituto Nazionale per la Fisica della Material Bose-Einstein Condensation Center in Trento, Italy, and five months as a visiting fellow at JILA, an institute associated with the University of Colorado in Boulder and the National Institute of Standards and Technology. Doerte’s JILA Visiting Fellowship was a prestigious and highly competitive award that allowed her to do research on the theoretical description of atomic many-body systems.
- **Sukanta Bose** was granted a year’s sabbatical to collaborate with experts at the Max Planck Institute, Friedrich-Schiller University, and the Inter-University Centre for Astronomy and Astrophysics (IUCAA) in India. He will analyze data from earth-based gravitational-wave detectors, such as Laser Interferometer Gravitational Wave Observatory (LIGO). He will also design techniques for space-based detectors to search for signals from binary black holes, neutron stars, and unknown astrophysical sources.
- **Nicholas Cerruti** joined the physics department last year as a faculty instructor. He is a faculty mentor for the GAANN program and very committed to his teaching. In March, Nicholas and his wife **Minyoung** welcomed the birth of their first child, **Rebecca**.
- **Gary Collins** continues to study lattice locations and diffusion of solute atoms in solids. Since the summer of 2006 he has carried out research with quite a number of coworkers, including postdoctoral associate **Farida Selim**, graduate students **John Bevington**, **Arriety Lowell**, **Xiao Wang**, and **Sean Jiang**, WSU undergraduate students **Stephanie Lage**, **Morgan Emerson**, and **Ben Norman**, REU student **Ashley Dorwart**, and Pullman High School senior project students **Kyle Slinker** and **Justin Ahn**. Gary attended the XIV International Conference on Hyperfine Interactions, held in Igaussu Falls, Brazil, in August 2007, where he presented a plenary oral paper and a poster paper.
- **Susan Dexheimer** received news that she has been awarded a \$360,000 renewal of her National Science Foundation grant “Dynamics of Localized Excitations in Condensed Matter Systems.”
- It seems that **Tom Dickinson** was in the air more than he was on the ground for two months in the fall of 2006. He gave several invited talks at various laboratories and meetings in the United States and abroad. In September he was at Los Alamos National Laboratory,



*Doerte Blume with graduate student Kritika Kanjilal and research associate Ryan Kalas.*

University of Virginia at Charlottesville, International Conference on Advanced Laser Technologies in Brasov, Romania, Fifth European Science Foundation Invited Workshop on Nanotribology in Antalya, Turkey, and Paul Scherrer Institut in Villigen, Switzerland. In October he delivered talks to the Chemical Engineering Department at WSU, Department of Materials Science at the University of Tennessee, Materials Science Division at Oak Ridge National Laboratory, and keynote address for the New Breakthroughs in Nanotechnology Series at Oak Ridge.

In between traveling Tom found time to write a grant. He and his group were awarded a Department of Energy three-year, \$412,500 grant to study “Laser Material Interactions Relevant to Analytic Spectroscopy of Wide Band Gap Materials.”

- **Peter Engels** received the College of Sciences Young Faculty Performance Award. Readers may recall that Peter was in the press a great deal during 2006. His WSU lab is the first in the Pacific Northwest to produce Bose-Einstein Condensate (BEC), a rare and “weird” form of matter in which atoms behave like waves rather than like particles. In other good news, the National Science Foundation awarded him a three-year, \$330,000 grant to research “Nonlinear Quantum Hydrodynamics in Ultracold Bose and Fermi Gases.” The same day Peter heard from NSF he also heard that he would receive a \$16,000 WSU seed grant that is designed to encourage and promote research among new or incoming faculty.
- **Mark Kuzyk** and colleagues K.D. Singer and J.E. Sohn’s 1987 article, “Second-order nonlinear-optical processes in orientationally ordered materials: relationship between molecular and macroscopic properties,” *J. Opt. Soc. Am. B* 4, 968, was number 39 of the top 50 cited articles in the 90-year history of the *Journal of the Optical Society of America*. ([www.opticsinfobase.org/abstract.cfm?URI=josab-4-6-968](http://www.opticsinfobase.org/abstract.cfm?URI=josab-4-6-968)) The theory presented in this paper is commonly called the SKS model.
- **Matt McCluskey** had a plethora of good news this past year. In addition to serving as acting chair for the department, he was awarded a three-year National Science Foundation grant totaling \$415,993 for work on “Vibrational Spectroscopy of Defects in Zinc Oxide.” In collaboration with University of Idaho physicists Leah Bergam and You Qiang, Matt was awarded a three-year grant for \$372,948 from the Department of Energy. He and his colleagues will be studying “Magnetic and optical properties of ferromagnetic ZnO nanoclusters.” And finally, Matt was instrumental in the department receiving financial support for a three-year, \$240,000 Research Education for Undergraduates (REU) grant from the National Science Foundation and Air Force Office of Scientific Research.
- **David Thiessen** will be very busy over the next two years investigating “Open-channel Capillary Flow in Helical Support Structures.” His NSF award is for \$222,810.
- **Steve Tomsovic** spent a great year working on a Gutzwiller Fellowship at the Max Planck Institute for Physics of Complex Systems

in Dresden, Germany. He also squeezed in six weeks in Paris, France. While in Dresden, Steve opened new lines of research into the statistical extremes of quantum wavefunctions and classical chaos, hosted two REU students who were ecstatic to be working in Germany, and had the pleasure of collaborating again with a former visitor to our department, Professor Arul Lakshminarayan from the Indian Institute of Technology in Madras, Chennai, India. In Paris, he worked on new derivations of the influence of residual interactions on ground state properties of many-electron systems.

- **Lai-Sheng Wang** received the coveted Humboldt Research Award in 2006 for his lifetime achievements in nanoscience research. As part of the award Lai-Sheng was invited to do research in Germany. He and his colleagues are recognized as being the first to create hollow nanoscale cages of gold atoms, the first known metallic equivalent of the buckyball. For more on his award go to [www.emsl.pnl.gov/docs/inbriefs/humboldt20061109.pdf](http://www.emsl.pnl.gov/docs/inbriefs/humboldt20061109.pdf).

- Astronomer **Guy Worthey** has been awarded a two-year, \$136,758 NASA Space Grant entitled "Space-Based Photometric Systems and Stellar Population Models." Guy, who is serving as associate chair for the department this year, is a man of many talents. He made his stage debut this fall as the beloved "Scarecrow" during the Regional Theatre of the Palouse production of *The Wizard of Oz*. He performed with his son Patrick, 12, who was cast as a munchkin. Guy's role required him to sing, dance down a yellow brick road, and even fly in the production.



## Small-Town Girl with Big-Time Dreams

**Aubrey España** and her husband **Felix** enrolled at WSU in the fall of 2000 as undergraduate transfer students. Aubrey received her bachelor's degree in physics from WSU spring of 2003. Since Felix was still working on his engineering degree, she enrolled for graduate work with the intent of getting a master's degree in physics. Since then she has passed her qualifying exams and was invited to work on a doctorate. The following is an account of how a small-town farm girl from Walla Walla, Washington, decided to make physics her life-long pursuit.

*Q: What or who inspired you to study physics?*

A: I always loved math and science. One of my favorite subjects in science was learning about our solar system and the universe, so when I started planning for college, I decided I would major in astronomy. But during my senior year in high school I took my first physics class and loved it. I've been hooked ever since.

*Q: What attracted you to WSU?*

A: WSU is close to my hometown, Walla Walla. Also, when I visited the campus I was really impressed with the attention I was given. The [Physics and Astronomy] department took time to meet with me and give me a tour. None of the other campuses I visited did this for me. I also liked the fact that I could choose what type of physics I wanted to "specialize" in, for example biophysics, optoelectronics, astrophysics, etc.

*Q: Outside of the usual course work, what preparation, if any, would you recommend undergraduates make before entering graduate school?*

A: I would have to say that understanding all of the basic physics concepts that are taught in the usual course work is essential. Often times it's possible to get an A or B in a class, yet not actually come

out with a good understanding of the material. If you have a good basic understanding of the general physics concepts, it makes a huge difference when you take graduate classes.

*Q: Describe your research in a way that can be understood by a broad audience.*

A: My research is in the field of physical acoustics. I focus on understanding how sound interacts with plastic targets suspended underwater. The current experimental setup I use enables me to hang targets underwater in such a way so as to simulate an object buried beneath the ocean floor. I then send sound waves at the target and analyze the scattered sound field. The goal is to understand exactly how the sound is interacting with the target and how this affects the scattered sound field. If we can achieve this understanding, then ultimately we could get to a point where by looking at the sound scattered by some unknown buried object, it would be possible to know something about its shape and/or material composition.

*Faculty mentor Phil Marston observes graduate student Aubrey España as she hangs a target to the mounting system in a water tank.*



# Student Awards and Recognition

## Physics Textbook Scholarships 2006–2007

Benjamin Arthurs  
Christopher Bates  
Morgan Emerson  
Kimberly Hansen  
Brice Kosnik  
Jon Leiner  
John Leraas  
Sarah Myers  
Benjamin Norman  
Bobbie Riley  
Brandon Shibley  
Svetlana Stadnik  
Urszula Szafruga  
Jonathan Thompson  
Nicholas Ulrich

## The Claire May Band Scholarship in Physics

Christina Ellis, Knox College, Galesberg, Illinois  
Katrina Epperson, Stanwood High School, Stanwood, Washington

## Granted Degrees, August 2006–May 2007

### Bachelor of Science

Jason Burt  
Christopher Corkum  
Morgan Emerson  
Brice Kosnik  
Stephanie Lage  
Jonathon Leiner  
Kenneth MacCabe  
Gordon Misch  
Steve Pearce  
Philip Peterman

### Master of Science

Gabriel Hanna  
Arriety Lowell  
Erik Wemlinger

### Doctorate

Curtis Osterhoudt  
Xavier Perez-Moreno  
Aaron Rogan  
Weiya Zhang  
Lifeng Cui (*Materials Science*)  
Slade Jokela (*Materials Science*)  
Francis Morrissey III (*Materials Science*)  
Jalal Nawash (*Materials Science*)

## Distinguished Student Awards and Accomplishments, 2006–2007

### Undergraduates



### Outstanding Undergraduates

**Katrina Epperson** won multiple scholarships: NASA Space Grant, Honors College, National Society of Collegiate Scholars, and Phi Eta Sigma. She also participated in a Nano-Bio Engineering REU (Research for Undergraduates) at the University of Notre Dame last summer.

**Christopher Bates** and **John Leraas** won third place in the annual Sigma Xi Scientific Research Society (WSU Chapter) Faculty Association for Scholarship and Research competition.

**John Leraas'** senior thesis, "Breakdown of Poly(vinylidene fluoride) under 157nm Laser Irradiation" received the Honors College's Pass with Distinction award. The college recognized the quality of John's academic commitment and performance in making the award. The special designation will become part of John's permanent transcript. John spent last summer working on an internship at nLight Corporation at Vancouver, Washington.

**Gordon (Wendell) Misch** received a WSU Writing Portfolio Award, fall 2006.

**Nathan Moore** took the first place award in the 2006 Pacific Northwest Chapter of American Vacuum Society Undergraduate Poster Competition (\$250 prize).

**Bobbie Riley** completed an internship at Hewlett Packard in Boise in the summer of 2007.

With monetary assistance from the department, **Morgan Emerson** ('07 B.S.) was able to attend a conference for undergraduate women in physics held at the University of Southern California. There were 78 attendees, many of whom gave talks and presented posters on their research. Morgan toured research labs at USC and received information about applying to graduate schools. To learn more about women and minorities in the sciences go to [www.cbpf.br/~women-physics](http://www.cbpf.br/~women-physics) or [physics.usc.edu/~wiphys/conference](http://physics.usc.edu/~wiphys/conference). Morgan and her new husband, **Brice Kosnik** ('07 B.S.) moved to Eugene, Oregon, for graduate work at the University of Oregon.

### College of Sciences Undergraduate Research Mini-grant Awards (\$2,500)

**Benjamin Arthurs** studied “Atomic Force Microscopy Investigations of the Deposition of Brushite Crystals on Poly(vinyl alcohol) Hydrogels in a System that Mimics Calcification of Cartilage” with his faculty mentor **Sukanta Bose**.

**Benjamin Norman** researched “Lattice Locations of Solutes in ‘Mirror’ Phases” with faculty mentor **Gary Collins**.

**Sarah Myers** worked on a project, “Testing Einstein’s Theory of Gravity by Tracking a Black Hole Death Dance.” Her faculty mentor was **Sukanta Bose**. Sarah also won a William and Mary Lynn Graber Entrepreneurship and Innovation Leadership Endowment in the Sciences award (\$1,000).



*Physics and Astronomy’s Undergraduate Student Awards Ceremony. Front row: Bobbie Riley, Katrina Epperson, Sarah Myers, and Morgan Emerson; back row: Urszula (Ula) Szafruga, Nicholas Ulrich, Ben Arthur, Brice Kosnik, and Brandon Shibley.*

### Undergraduate Research Poster Competition (Physics and Mathematics Division)

First prize: **Collin Atherton**, faculty mentor, Peter Engels

Second prize: **Urszula Szafruga**, faculty mentor, Mark Kuzyk

Honorable mentions: **Christopher Bates** and **John Leraas**, faculty mentor, Tom Dickinson

### Regents Scholar



*“Kristin, are you sure that’s not radioactive??” Kristin Schimert, 2007 Regents Scholar, with Tom Dickinson.*

### Graduate Students



*Physics and Astronomy Awards Ceremony Graduate Students. Front row: Jennifer Schei, Shiva Ramini, Christina Ellis, Grant Eastland, Jiajia Chang, and Samuel Teklemichael; back row: Jalal Nawash, Arriety Lowell, Gabriel Hanna, Anthony Smith, Christopher Hamner, Justin Eld, Francis Morrissey III, and Juefei Zhou.*

### Graduate Assistance in Areas of National Need

The GAANN Fellowship is a program designed to enhance teaching and professional development.

#### GAANN Fellows 2006

Grant Eastland  
Justin Eld  
Christina Ellis  
Christopher Hamner  
Anthony Smith

#### GAANN Fellows 2007

Justin Eld  
Kevin Daily  
Brooks Harrop  
Violet Poole  
Szymon Steplewski  
Christopher Varney

### Millennium Fellows

Millennium Fellowships were created for students who are ready to focus on a specific line of research. The Millennium Fellowship is an attractive alternative to a teaching assistantship; it provides support for the first year of study to work in one of our world-class laboratories or theory groups.

#### Millennium Fellows 2006

Jiajia Chang  
Prashant Kumar  
Shiva Ramini  
Samuel Teklemichael  
Likun Zhang

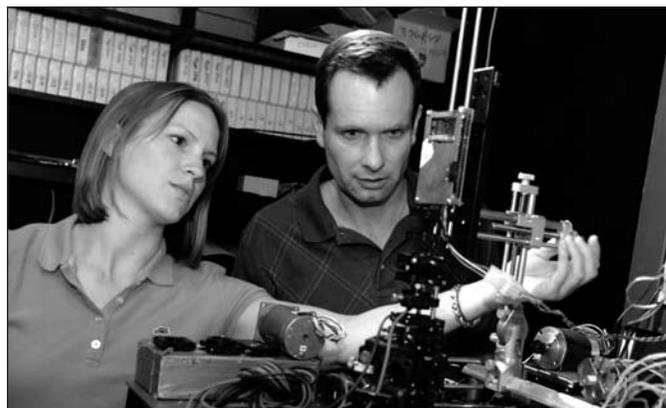
#### Millennium Fellows 2007

Thilina Dayanga  
Shaon Ghosh  
Wei Lu  
Afsoon Soudi  
Xianjun Ye

### American Association of Physics Teachers 2007 Outstanding Teaching Assistant Awards

Xia Jiang  
Xiao Wang  
Erik Wemlinger

### Poncin Award



*Jennifer Schei with her graduate mentor, Matthew McCluskey.*

For the second year, **Jennifer Schei** received a Poncin Fellowship for biomedical research. Jennifer received one of the ten awarded annually in the state of Washington. During the Wiley Exposition, Jennifer also received a second place award for work on imaging action potentials using reflection and transmission near infrared birefringence video microscopy in the College of Sciences division. The Wiley Exposition is put on by Graduate and Professional Student Association.

### College of Sciences Outstanding Graduate Student Award

The College of Sciences presented **Juefei Zhou** with the Outstanding Graduate Student Award. Using a computer, Juefei modeled a new class of molecules that he predicted will have a large nonlinear-optical response. His work received wide international attention and recently a set of molecules has been identified that meet his design criteria and confirms his predictions. His work has many applications such as speeding up the Internet, testing chips, and photodynamic cancer therapies. In recognition of the significance of his research, Juefei also received the department's Anderson Prize for Physics with a check for \$1,000.



*Juefei Zhou*

## In Memoriam

**Harrold Brook Knowles**, who taught for several years in the WSU physics department, died on February 20, 2007, in Oakland, California. Knowles received his doctorate in physics from the University of California, Berkeley, in 1957 where his advisor was Luis. W. Alvarez. His career took him to positions at Lawrence Livermore Laboratory, Yale University, Washington State University, Los Alamos National Laboratory, BDM, Rocketdyne, and Arinc. As professor of physics, he mentored over 10 graduate students. He was a private consultant for universities, hospitals, and scientific and technical companies. He also developed patents, testified in court trials, applied for grants, and conducted research. His research

emphasis was on particle physics and dosimetry, accelerator design, and shielding, with professional forays and collaborations in many other scientific areas.

Professor Knowles was an outstanding lecturer and is remembered fondly by his students. A favorite memory of **Steven Langford** ('89 Ph.D.) occurred on March 1, 1976; Knowles "wore a leek to his undergraduate E&M class, ostensibly in honor of St. David's Day. He felt this behavior was sufficiently unusual to prevent him from being considered for the position as department chair, which had recently been vacated. Devoted to teaching and research, he wanted to leave no question about his lack of interest in administration."

# Student of Light

## Recent Grad Transcends Boundaries

By Cherie Winner, *Washington State Magazine*, Fall 2007

"When you come to a fork in the road," said Yogi Berra, "take it." **Xavier Perez-Moreno** has done just that.

Last spring the effusive, pony-tailed Spaniard received a doctorate conferred by Washington State University and The Catholic University of Leuven in Belgium. WSU officials think he is the first Cougar to earn a doctoral degree jointly with a foreign institution.

Xavi (SHAH-vee), as his friends call him, clearly isn't big on either/or choices. Besides bridging universities on two continents, his dual degree also combines different kinds of research and departments: theoretical physics here, experimental chemistry at Leuven.

But Xavi didn't set out to break institutional barriers. He simply went where his restless curiosity led him—and where his advisors encouraged him to go.

When he arrived at WSU in 2000, Xavi thought he was headed for a career in theoretical physics: he was long on ideas, short on lab work. That began to change when he took **Mark Kuzyk's** course in optics.

"It was learning how to use lasers," he recalls. "And I had NO idea. I'm very clumsy still. My friends are always like, 'Xavi, before you use the laser, are you being very careful?'" He laughs. "We spent a lot of time playing with [optical] fibers, and that's when I realized, Oh yes, this is very, very exciting."

He became intrigued with nonlinear optics, and devoted his master's program to exploring Kuzyk's hypothesis that there is a fundamental limit to how strongly any molecule can interact with light. Just as he was finishing that degree, Xavi's visa expired. New post-9/11 laws required him to return to Spain while he re-applied for admittance to the United States. Facing a three-month wait, he asked Kuzyk if there might be some place in Europe he could work until the visa came through. Kuzyk suggested the lab of Koen Clays, a physical chemist at Leuven who had provided the first experimental support for Kuzyk's revolutionary ideas.

Xavi and Clays hit it off, and Xavi decided to stay in Leuven for his doctorate in order to be closer to family. He continued collaborating with Kuzyk as time permitted. A few months after Xavi moved to Belgium, Clays pointed out that Kuzyk was mentoring Xavi at least as much as he was. Leuven had done joint degrees with a university in Sweden; why not try the same sort of program with WSU?

"We weren't sure if we could do it, because it's never been done before," says Kuzyk. "It took us almost the whole time he was in Belgium to iron out all of the paperwork."

Each school had requirements Xavi had to fulfill, some of which were contradictory. In the end, says, Kuzyk, WSU authorities "were pretty flexible about it. I think that if the University had been even a little bit rigid, it wouldn't have worked out."

The result was one of the most successful doctoral programs in Kuzyk's memory. News of Xavi's work has appeared on dozens of tech blogs, and chemists from all over the world are sending him samples to analyze. Not only that, instead of losing a student when Xavi went to Leuven, WSU gained a teacher in Clays, who last year became an adjunct professor in WSU's physics department. During a recent visit to Pullman, the Belgian scientist bought a pile of Cougar paraphernalia, including a bumper sticker that he installed on his office door in Leuven.

"He thinks Pullman is great, and he thinks Washington State University is fantastic," says Kuzyk. "It's kind of ironic, coming from a person who's at one of the oldest universities in Europe, one of the most highly respected universities there."

Lance Leloup, who heads International Programs at WSU, says his office will be happy to facilitate more joint graduate programs, "but the leadership for them has to come at the departmental level. Joint and dual degrees I don't think can be imposed from the top down."

Kuzyk agrees. "If it comes from the ground up, there's a lot more commitment from the people [involved]," Kuzyk says. He and Clays are already looking forward to co-advising another student, who is currently working in Clays's lab. With an agreement now in place between the two universities, the process should be easier this time.

As for what Xavi will do next, Kuzyk thinks he'll thrive best in a situation that gives free rein to his energy and imagination.

During his doctoral work, says Xavi, "Kuzyk and Clays leave me a lot of freedom. They say, 'This is what we allow you to do.' And then if I say, 'But I've been doing this and this and this,' it's, 'Really? You did that? That's good!'"



## Cougar Tracks...Where Are They Now?

**Tom Bartholet** ('70 B.S.) and his nephew, an undergraduate in computer engineering, visited the department last June. When Tom was a student in physics, the department was housed in Sloan Hall and **Edward Donaldson** (now professor emeritus) was the department chair. Plans for the new Webster building were still in the talking stage when Tom graduated. After leaving WSU, Tom went on to Penn State for a master's degree in nuclear engineering. When the bottom dropped out of the nuclear field he got his MBA from Harvard. He worked in technology and engineering in the San Francisco bay area for several years and is now semi-retired and living in Orange County, California.

**Muhammad Hussain** ('93 M.S.) has fond memories of WSU and his advisor and mentor, Professor **Jerry Tripard**. Muhammad went on to get a doctorate from the Universiti Putra Malyasia, in Malaysia. He recently returned there to work on a project studying fluoropolymeric-based proton exchange membranes. His home institution is the University of Agriculture in Faisalabad, Pakistan.

**Marcus Knudson** ('98 Ph.D.) studied under the supervision of Professor **Yogendra Gupta**. Marcus's work was the first to capture the shock-induced phase transition of a material at picosecond time scales. He joined Sandia National Laboratory as a staff scientist in 1999 and is the lead scientist in the effort to use the "Z Machine" for shock physics applications. Sandia's Z Machine uses electrical cur-

rent pulses to generate intense magnetic fields. The force exerted by these fields launches an aluminum flyer plate with an acceleration of 10 billion g's and a maximum speed of 35 km/s—faster than the speed at which the earth orbits the sun (30 km/s) and 50 times as fast as a bullet fired from a rifle. When the speedy flyer plate impacts a target, extreme pressures unattainable by any other method are generated.

Marcus used this novel experimental approach to compress deuterium to enormous pressures, providing an important test of state-of-the-art theoretical calculations. Deuterium under pressure is relevant to problems ranging from fusion power production to the composition of gas giants. This work impacted many

fields and was featured in *Physical Review Letters* and a Sandia news release. Recently, Marcus has turned his attention to carbon, and has found that diamonds aren't forever. Under shock pressures of 10 million atmospheres, he observed the complete melting of diamond. In addition to providing fundamental insight into nature's hardest material, these studies are important because carbon is used as a protective layer in inertial confinement fusion capsules.

**Rob Kroeger** ('79 M.S.) is part of a faculty group at Ole Miss University participating in QuarkNet, a nationwide program involving 60 universities and laboratories across the United States. The goal of the program is to bring high school students, physics teachers, and particle physicists together to further physics education. Teachers and students work with real data from one or more laboratories around the country, learning how to interpret the data and further their understanding of high-energy physics. Rob's role is in providing additional physics background to the high school teachers involved in the project. Rob's advisor at WSU was Professor (Emeritus) **James Park**.

**Ann McEvoy** ('04 B.S.) is working on her doctorate in biophysics at UC Berkeley. She still keeps in touch with Tom Dickinson and recently let him know that she was awarded a 2007 National Science Foundation graduate fellowship. She is working in the physics lab of Professor Jan Liphardt on a synthetic biology project. Ann is trying to program bacteria to perform specific tasks for use in targeted drug delivery/bioenergy. She is using bacteria from *E. coli* mini-cells. The end goal is to understand the basic biophysics of the bacteria's biological processes as well as use them for specific applications.



*Sandia researcher Marcus Knudson holds two flyer plates in his right hand and chambers of his high-tech gun in his left. In the background is the innermost sanctum of Sandia's Z accelerator, where a rapidly expanding magnetic field drives pellets faster than any mechanism on earth.*

### Lai-Sheng Wang Awarded Sahlin Faculty Excellence for Research

WSU awarded **Lai-Sheng Wang** the distinguished Sahlin Faculty Excellence Award for Research, Scholarship, and Arts last spring. Wang is a world-leader in nanocluster research. With his graduate students and colleagues, Wang created hollow nanoscale cages of gold atoms, the first known metallic equivalent of the buckyball. He showed that the most stable form of gold clusters undergo shape transformations, a finding that addresses a key issue in fundamental cluster science: understanding the structural evolution of clusters from a single atom/molecule toward the bulk solid. This work also has potential applications in energy science. In other good news, Wang received the prestigious Humboldt Research Award for his lifetime achievements. Humboldt recipients are invited to conduct research in Germany for six months to one year. And in October, the AAAS council notified Wang that he was elected as a fellow.



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### Dickinson Received the WSU Eminent Faculty Award for 2007

Tom Dickinson discusses research with his students, Katie Blomster, who is currently working at Agilent Technologies in Liberty Lake, Washington, and Rizal Hariadi, who is finishing up his doctorate in biophysics at Cal Tech.

**Tom Dickinson** received the highest honor WSU bestows on a faculty member, the Eminent Faculty Award. Recipients have changed the thinking in their respective fields by making lasting contributions through teaching, research, creative scholarship, and service. They also have made notable contributions to the vitality and strength of the WSU community. Dickinson, the Paul A. Anderson Professor of Physics, is recognized internationally for his contributions in both laser materials research and nanotechnology. For more than 30 years, he has been continuously funded in applied surface sciences and has two major Department of Energy grants, one grant from the National Science Foundation, and two teaching-related grants. He is a charter member of the WSU Teaching Academy. The award includes a \$15,000 honorarium.



Look how we've grown!



*Physics and Astronomy faculty, students, and staff in front of Webster Physical Sciences Building, September 2007.*