RESONANCES

NEWS OF INTEREST TO FLORIDA STATE UNIVERSITY PHYSICS ALUMNI

Spring 2012

A Message from the Chair

Welcome to the Department of Physics newsletter for Spring 2012!

As you will see, the past 12 months have again been filled with numerous success stories of our students, faculty and staff and also many wonderful events, such as our fall Open House. As you know, this is a very special department indeed, with a wonderful family atmosphere in which we all help each other to succeed. We are very serious about our physics, but we also have fun along the way! I hope you get a flavor of this from all the smiling faces and exciting highlight stories contained in the following pages starting with the fabulous piece about FSU alumnus Jeffery Parker.

Many thanks to Dr. Kun Yang for compiling the newsletter and to Scott Baxter for putting it so expertly together.

Very best regards to each and every one of you! Please don't hesitate to drop me a line at chair@physics.fsu.edu.

Go Noles!

Mark Riley

Chair
Raymond K. Sheline Professor of Physics

A Smooth and Silky Career

The seemingly pedestrian razor blade you utilize every day is really something quite extraordinary. Its components are crafted from advanced composite materials and thin films. Its design draws from novel engineering solutions to reducing friction. And its ability to make anyone's face, legs and back silky and smooth is owed to talented physicists, like Jeffrey S. Parker, who have chosen the personal care industry as their professional playground.

Jeffrey Parker

Parker, 39, is a Senior Scientist at Procter & Gamble (P&G)'s South Boston Innovation Center. The materials physicist, who received his PhD from Florida State University in 2003, has been with the company since 2007. He was on track to have a conventional academic career, completing two postdocs, including one at the University of Minnesota's Materials Research and Engineering Center, when fate nicked him.

"I was approached by a P&G recruiter," he recalls. "I wondered what they wanted from me, a physicist." Turns out P&G Beauty and Grooming was expanding its market reach with a recent acquisition of the Gillette Company. They needed physicists and materials scientists who could understand the physics behind blade movement and architecture, in order to design and improve high profile products like Fusion ProGlide Razors, which incorporate many blades. Parker visited P&G's technology center "out of pure curiosity," and realized "there was definitely enough technical challenges to keep my interest," he says. According to Parker, what swayed him to pursue employment with the cosmetics giant was the fact that the consumer problems he would be solving would allow him to flourish as a physicist, the problems would always be fresh and exciting, and there would be plenty of other scientists and resources to aid him in his technical and engineering endeavors.

Once Parker started at P&G, he soon realized there was another advantage to serving as a shaving scientist–it is inherently a multidisciplinary endeavor, which means that he would have the opportunity to learn about different fields. "There's so much overlap [between subjects], you can't just be a physicist," he says.

Parker's role at P&G Beauty and Grooming involves every aspect of research and development for blades and razors, marketed under the Gillette brand. His responsibilities include fundamental and applied research, testing and developing products, and collecting feedback to improve the quality of his designs. He contributes to the marketing of products, providing the lay-person-friendly language for packaging and advertisements that properly communicate the product's value. He also

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'Smooth and silky' — *continued from page 1*

consults with the production department to ensure they can scale up the design as they produce it in a plant. "It's one thing to make it once, and quite another to make it a billion times," he says.

Parker is further charged with claims support, an important division in any consumer products company. For every razor that a firm claims "will give you a 45% cleaner shave," there is a claims support unit that clarifies the accuracy of such a statement before it is used in promotions. Parker assists claims support in testing the current shaving products for their strength, accuracy, friction reduction, and overall shaving comfort.

Here's a fun fact to keep in mind while you are gliding that razor across your precious, precious face: the blades used for shaving are some of the most sophisticated and sharp cutting surfaces on the planet. In particular, "Fusion blades are thinner than a grain of sand, and the blade tip radius is smaller than a brain cell or the wavelength of visible light," describes Parker. "This level of ultra-high precision engineering is amongst the highest in the consumer goods industry."

The physicist has been instrumental in advancing the Fusion ProGlide line of products, which currently utilizes five blades in its razors. Parker's expertise has helped him analyze and improve on cartridge geometry, how the razor pivots on the handle, and how the blades themselves move. In his quest to make the profile of the razor as thin as possible, Parker helped employ an advanced diamond-like carbon (DLC) coating to the steel along the blade edge. This extreme hardness material (more than 10 times the hardness of the underlying steel) enhances each individual blade's strength and allows the blades to stay sharp even after many uses. Another proprietary coating, Polytetrafluoroethylene (PTFE), is also applied to the blade, which significantly cuts down on friction, he explains. But the DLC coating is especially important to the ProGlide's architecture because it ensures that the blades in the razor can remain thin, delivering significant reduction in "hair cutting forces", and thus a more preferred consumer experience (i.e., fewer toilet paper pieces applied to your bloody face).

Jeff Parker enjoying a seaside break during his days at FSU.

Parker concludes that his work for P&G is not as dissimilar from academia as he would have expected. "When you get down to it, the science is completely the same," he explains. "It's the same tools, methodologies, and thought processes, just applied differently." He still delves into surface morphology, he still measures and analyzes electrostatic forces, and he still uses many of the same instruments that he did when he was a postdoc, such as an atomic force microscope.

But one area that he still finds perplexing is how to find technical solutions for consumer problems, when the consumers are not exactly sure what they want in the first place. "The needs of the customer can be hard to define," he concedes. For example, in a focus group, consumers might indicate that they want a shaving lotion that is more "creamy." But there's just no scientific training that can help Parker and his colleagues understand exactly what "creamy" means to different people in terms of the physics, mathematics and materials expertise that goes into crafting shaving lotion.

But the haziness of certain aspects of his job doesn't take away from the high level of satisfaction he gets from working in the private sector. "In academia you never get to see a commercial for your work on TV or your item on a shelf," he says. "People want to buy P&G products because of the science and engineering we put into them."

Alaina G. Levine is a science writer and President of Quantum Success Solutions, a science careers and professional development consulting enterprise. She can be contacted through www.alainalevine.com.

Three FSU physicists appointed to prestigious APS committees

"In the firm belief that an understanding of the nature of the physical universe will be of benefit to all humanity, the Society shall have as its objective the advancement and diffusion of the knowledge of physics." So reads the prime directive of the American Physical Society, or APS, which was formed in 1899 and currently has over 48,000 members worldwide. Obviously a very well organized governance structure is essential to the successful operation of such a large society in order to fulfill its objective. Vital players in the APS governance are the various high level committees that are charged with specific critical tasks. It is therefore of significant note when FSU physics faculty are appointed as members of prestigious APS committees. In 2011 these include:

Susan Blessing

Paul Cottle

Nicholas Bonesteel

The appointment of **Dr. Susan Blessing** to the APS Committee on the Status of Women in Physics (CSWP). This committee was founded in 1972 to address the encouragement and career development of women physicists. The Committee consists of nine volunteer members appointed by the President of the APS for a three year term. Throughout its 37-year history, CSWP has been an active sponsor of studies, programs and publications to foster women in physics. Dr. Blessing, who joined the FSU faculty in 1994, has worked tirelessly to encourage and support women in all areas and is the Director of the Women In Math, Science and Engineering (WIMSE) program at FSU. She is an icon to the students and this appointment to the CSWP by the President of the APS is national recognition of her contributions in this critically important area.

The second important recognition involves **Dr. Paul Cottle**. Dr. Cottle has been elected as Vice Chair of the Executive Committee of the APS Forum on Education and will become Chair in 2012. The Forum on Education (FEd) exists to involve its members in activities related to physics education, at all educational stages, from elementary to grad school and life-long learning. Again, this is major recognition of Paul's enormous commitment to, and impact in, science education not only in the State of Florida but nationally too.

Dr. Cottle, the Steve Edwards Professor of Physics, joined the FSU faculty in 1986.

Another notable appointment for 2011 was the election of **Dr. Nicholas Bonesteel** as Secretary-Treasurer of the Division of Condensed Matter Physics (DCMP) of the APS. This is a major recognition of Dr. Bonesteel by his peers especially so given that the DCMP is the largest of all APS divisions with over 6000 members. In addition, the DCMP (with support from several other Divisions) sponsors the March Meeting of the APS, the largest APS meeting. As the DCMP Secretary-Treasurer, Dr. Bonesteel maintains the Division records, has responsibility for all of the funds at the disposal of the Division, and generally assists in communications between the Officers of the Division, its members, and the APS leadership.

Dr. Bonesteel joined FSU's physics faculty in 1994.

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NSF Awards FSU Physics $5 Million For Nuclear Research

Barry Ray
SPECIAL TO RESONANCES

For more than five decades, Florida State University has been home to one of the nation's most respected programs in experimental nuclear physics. Now, that program has received a major vote of confidence from the National Science Foundation in the form of a $5 million grant to fund ongoing research into some of the fundamental properties of matter.

The three-year grant will support a continuing research project titled "Studies of Nuclear Reactions and Structure" that was previously awarded $4.4 million by the NSF in 2008. Using FSU's John D. Fox Superconducting Accelerator Laboratory, members of the physics faculty use the NSF funding to conduct cutting-edge research in experimental nuclear physics while also preparing graduate students for high-level careers in such fields as defense, homeland security, nuclear medicine, industry, academia and basic research.

"This award not only maintains the continuous federal funding for this world-renowned experimental nuclear physics group but actually includes an 11 percent increase over the previous NSF grant," said Samuel L. Tabor, the Norman P. Heydenburg Professor of Physics at FSU and director of the accelerator laboratory. "Such an increase is obviously unusual given the present funding climate in Washington and represents strong affirmation of the outstanding quality of research being carried out here."

The NSF grant will enable purchases of expensive research equipment and provide support for a number of graduate students and some of the lab's staff. Such funding will "allow us to remain on the world frontier of nuclear physics research," Tabor said.

A key element of the accelerator laboratory is the RESOLUT rare ion facility, a particle collider that has been used to conduct nuclear experiments since 2007. With RESOLUT, researchers are able to fire a beam of atomic particles through a steel tube at speeds approaching 60 million miles per hour — roughly one-tenth the speed of light — and then to observe the nuclear reactions that occur. Knowledge of such reactions is critical to the field of astrophysics and the interpretation of observations made by astronomical observatories around the world. (Read more about the knowledge that researchers are seeking to acquire via RESOLUT at www.fsu.edu/news/2007/08/14/star.light.)

Samuel L. Tabor

"Within this laboratory, most of our research is basic, fundamental research in nuclear physics, nuclear structure and nuclear reactions," Tabor said. "We're trying to learn the fundamental nature of matter — how the nucleus is built, what holds it together, how it behaves. We're also studying how nuclei behave in reactions deep inside stars to better understand our universe."

While such basic research may not yield results that are immediately apparent, it does lay the foundation for the applied research that often follows. It can take decades before basic research leads to medical or technological breakthroughs; for example, magnetic resonance imaging (MRI) machines, which have revolutionized modern medicine, have their origins in basic scientific research that started way back in the 1930s.

More immediately, the John D. Fox Superconducting Accelerator Laboratory's most tangible benefit is the students whose newly acquired knowledge enables them to make an immediate and positive impact on society.

"Right now, we have around a dozen doctoral students conducting their dissertation research in this laboratory," Tabor said, as well as a large number of undergraduates who also use the facility.

"Our students have great career possibilities because of all the high-tech skills they've learned," he said. "Some of them remain in fundamental nuclear physics research while others go out and work in areas related to national defense, homeland security, medical physics and a variety of other applications, all of which are of great benefit to the nation."

Tabor also pointed out the lab's positive economic impact.

"This laboratory brings significant money into the local economy," he said. "It provides some of the highest-tech jobs in Tallahassee. We hire highly skilled staff members, we hire a number of graduate students, and we provide valuable revenue to the Tallahassee area and to Florida."

While Tabor is the lead researcher on the NSF-funded project, several other members of the Department of Physics will also play a very active role. They are Paul Cottle, the Steve Edwards Professor of Physics; Mark Riley, the Raymond K. Sheline Professor of Physics and chair of the department; Associate Professor Ingo Wiedenhöver; Associate Professor Grigory Rogachev; and research physicist Anthony Frawley.

"This grant tells us that we are very highly respected in the United States and throughout the world," Riley said. "Some of the scientists who reviewed our grant proposal for the NSF are from outside the U.S., so getting an increase in funding speaks volumes about the quality of our work as perceived by our colleagues around the world. And believe me, not many other labs are getting increases right now."

Blessing receives 2011 Ross Oglesby Award

ELIZABETH BETTENDORF
SPECIAL TO RESONANCES

Young women with a passion for science and engineering usually know they've met a kindred spirit in Florida State University physics professor Susan Blessing.

High school students who meet the brilliant scientist with the beautiful smile and the contagious love for physics sometimes submit their college applications based on just one encounter. Members of Florida State's Women in Math, Science and Engineering Living Learning Community (WIMSE) — a group that Blessing directs — find their confidence and nurture new friendships with other young women in the sciences.

On Saturday, the Garnet and Gold Key student leadership honorary presented the 2011 Ross Oglesby Award to Blessing, who is the Nancy Marcus Professor of Physics and whose research has been carried out at the Fermilab near Chicago. (She's a member of the team whose experiments lead to the discovery of the top quark in 1995.)

"Researchers have known for years how important it is for young women in science and engineering to work with women mentors," Paul Cottle, Florida State professor of physics, wrote in a nomination letter for Blessing.

"After meeting professor Blessing, many women students considering majors and careers in these fields are willing to take on these challenges," Cottle added. "With the nation facing an economically-crippling shortage of scientists and engineers, no mission on the FSU campus could be more important than giving our women students the opp Garnet and Gold Key, the university's oldest honorary, presents the award each year during Homecoming to a nominated member of the faculty or staff who has served students and the university with exemplary commitment and integrity for a decade or more. In keeping with tradition, the honorary keeps the identity of the winner a closely guarded secret until the award presentation.

Florida State's Oglesby Award was established in honor of Ross Oglesby, a member of the leadership honorary, who served as dean of students and professor of government before he died in 1973.

Past winners have included Florida State University President Emeritus T.K. Wetherell and retired Provost and Executive Vice President for Academic Affairs Lawrence G. "Larry" Abele.

Blessing, who received her doctorate in experimental elementary particle physics in 1989 from Indiana University, joined the Florida State physics faculty in 1994. She is a venerable researcher and has hundreds of scientific publications to her name. Her current research involves searches for exotic elementary particles with names such as glueballs and leptoquarks.

And recently, Blessing expanded her already hectic schedule to make room for a prestigious appointment to the Committee on the Status of Women in Physics of the American Physical Society, which is the national professional society of physicists. The nine-member group of scientists is trying to find ways to boost the number of women in the profession.

Juan Escalante, President of Garnet & Gold Key, presents Dr. Susan Blessing with the Ross Oglesby Award.

Still, her most rewarding mission may be the most humble: convincing Florida's most talented high school students that majoring in physics can lead to a fulfilling career and that Florida State's world-renowned physics program is an amazing place to study.

"I first met Dr. Blessing before even coming to FSU at a Preview Day," wrote second-year physics major Rebecca Hallock in a nomination letter to the Oglesby Award committee. "That meeting with her encouraged me to come to FSU, apply to WIMSE, and continue pursuing physics."

Hallock told a story about how she needed help in her current "Physics Problem Solving "class taught by Blessing. One day after class, Hallock, who did not completely understand a question on a quiz, asked the professor for help.

Blessing was in a hurry to catch a flight, but she still invited Hallock to come to her office and patiently helped her work her way through the problem.

"That really meant a lot to me," Hallock recalled in her heartfelt letter, "and it helped me to better understand the material."

To learn more about Blessing or the WIMSE program, contact her at (850) 644-1032 or sblessing@fsu.edu.

Scientist taps sun's ancient power for cutting-edge research

KATHLEEN LAUFENBERG
SPECIAL TO RESONANCES

Sometimes, you have to go back to go forward. Sounds strange, but it's what one National High Magnetic Field Laboratory physicist did when he harnessed the primal power of the sun to solve a perplexing, high-tech problem. And he had two unlikely candidates as his helpers: a rural elementary-school teacher and a college undergrad.

At the heart of scientist Irinel Chiorescu's dilemma — and his research — is something so tiny, you can't even see it under a microscope: a photon, the smallest bundle of radiant energy. Chiorescu (Key-oh-REZ-coo) studies this mysterious unit of energy in hopes of creating the first quantum computer.

"In our research projects, we are measuring the energy of one single photon," said Chiorescu, who earned his advanced degrees from France's Joseph Fourier University in Grenoble, "and the energy of one single photon is very small."

Most days, you can find the tall, Romanian researcher hovered over his "pit magnet" — a 200-pound, refrigerator-sized machine sunk right into the floor. His experiments are all done inside of it, so everything in his lab happens around the man-made magnet.

"We are studying very small signals," said Chiorescu, an associate physics professor at Florida State University. "We need to amplify the signal so that it's easily readable and something we can measure." To do that, he uses special electronic amplifiers to crank up the volume. But there's a catch: When he amps up the sound of the weak signals, he also increases something he doesn't want: electrical noise. The electricity that powers our homes contains a noise that — even though we can't hear it — can wreak havoc in super-sensitive experiments.To reduce this unwanted buzz, scientists often turn to battery power. Chiorescu, however, wanted to try solar-powered batteries. He hoped that, in addition to being environmentally friendly, solar power would prove to be ultra-clean (i.e. noise-free), too.

To see if his idea would work, the FSU Physics Department awarded him a $7,500 grant.

"The project scientifically is very interesting and very important," said Mark Riley, the chair of FSU's Physics Department. "New ways of utilizing solar power should be encouraged."

No sooner had Chiorescu received the grant than two eager assistants arrived: a fifth-grade teacher and a University of California at Berkeley undergraduate. Together, they brainstormed a plan of action: Create a model, then have Mag Lab staff install solar panels, build a battery console and wire the system.

Chiorescu's industrial lab — with its electronic consoles, large liquid-helium containers and a wall featuring hand-written equations and diagrams — is a vastly different space from Jodie Martin's bright classroom full of student art at Medart Elementary School in Crawfordville.

But Martin wanted to challenge herself. So she applied to the Mag Lab's Research Experiences for Teachers, a summer program that pairs K-12 teachers with scientists for an intensive, six-week plunge into real-world science.

And a challenge it was, she said.

"I did learn a lot about solar energy, but I also learned so much more. I learned more about the (periodic table of) elements, and now I can talk about silicon and how it's used in solar panels and how it allows electrons to move more easily."

Chiorescu also mentored undergraduate Akshita Dutta, a sophomore at the University of California at Berkeley and one of 22 students selected for the lab's Research Experiences for Undergraduates summer program.

The two women put their heads together and created a working model of a solar-energy storage system, which Martin kept to use with her fifth-graders. Having three sons at home has shown her that the model definitely captures kids' attention.

"Every one of my three boys couldn't resist playing with it," she said. "They've all had to take it outside and see how much sun they could store with it."

But Martin gained other insights at the lab, too.

"I felt the frustration a student feels trying to learn something new. There were times when I got very, very frustrated and really just wanted to give up."

Martin uses a variety of items to demonstrate a solar cell to a pair of her students

She struggled with advanced math calculations until she convinced herself she couldn't do them. Chiorescu, however, insisted she could.

"He said, 'oh, students often make this mistake. I'm not going to help you because I know that you can figure it out."

That same evening, the worried Martin surprised herself — by doing the math.

"The next day, I thanked him. After I got it figured out, I was so confident in myself, I felt like I could do anything!"

She wants the memory of that exhilaration to guide her with her own students when she sees them struggling.

Dutta, a chemical-engineering major, likewise came away from her lab internship with an unexpected bonus. At Chiorescu's urging, she wrote a paper, "Solar Panels as a Source of Noise-Free Power," and presented it at her university's undergraduate research symposium.

"It was a fantastic experience," Dutta said. "It motivated me to try and apply what I learn in my classes to the real world."

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St. Petersburg women begin physics careers at FSU

When St. Petersburg High IB program graduate Kristen Collar arrived at Florida State University in the fall of 2007, she knew she liked science and math but wasn't sure how that would translate into a career. Fortunately, she was invited to join FSU's Women in Math, Science and Engineering (WIMSE) Living Learning Community, where Kristen lived with 30 other women with similar interests during her first year at FSU. WIMSE's Director, Physics Professor Susan Blessing, helped Kristen secure a research position at FSU's National High Magnetic Field Laboratory during her first year. By the time Kristen was a co-author for the first time on a scientific publication in December, 2008, she was hooked on a career in physics.

This fall, Kristen will begin a Ph.D. program in physics at Duke University.

Kristen Collar (at left) and Rebecca Hallock

Regrettably, Kristen's story is all too rare. Only 21 percent of the bachelors' degrees awarded in physics go to women, and that percentage is declining. The reluctance of young women to enter the field of physics certainly isn't due to the lack of economic opportunity for graduates in that field. Even new bachelor's degree graduates in physics do well: A report recently released by the American Institute of Physics showed that new bachelor's degree graduates who enter the private sector have starting salaries that average $50,000 per year. At the master's degree level, new graduates in the private sector start at an average of $60,000 per year, and at the doctoral level $83,000.

Last fall, a member of St. Petersburg High's graduating IB Class of 2010, Rebecca Hallock, joined Kristen in FSU's WIMSE community. This spring, Rebecca earned a spot in the university's highly regarded nuclear physics laboratory as an undergraduate researcher. Given the small number of women entering the field of physics, the two women from St. Petersburg High qualify the high school as a regular pipeline for new women physicists. Rebecca earned a place on FSU's President's List with her first semester grades, and the maturity with which Rebecca approaches her work has impressed the Physics faculty.

"Neither Kristen nor Rebecca had settled on a physics career before coming to FSU," said WIMSE Director Susan Blessing. "They didn't know about the opportunities in the field. By arranging research positions for them very early in their time here, we were able to show them what the career possibilities are."

FSU undergrads tackle University Physics Competition

The University Physics Competition is an international contest for undergraduate students, who work in teams of three at their home colleges and universities all over the world, and spend a weekend in November, 48 hours, analyzing a real-world scenario using the principles of physics, and writing a formal paper describing their work. The 2011 contest began on Friday, November 4, 2011, at 6pm MDT, and lasted 48 hours. 77 teams submitted solutions for judging before the 48 hour deadline had elapsed. 28 teams selected Problem A, which analyzed the costs associated with using a launch tower to get payloads into orbit. 49 teams selected Problem B, which examined the physics of shooting a basketball for three points.

Two teams from FSU participated in the competition. The team comprising Zach McDargh, Anthonay Hazel and Luis Barrera tackled the basketball problem, and finished as Accomplished Researchers. The team comprising Ashley Huff, Derrick Vangennep and Jesse Raffield received one of five silver medal designations for their treatment of the launch tower problem. Congratulations to the members of both teams.

On October 1, 2011, the Physics Department held its bi-annual open house, The Flying Circus of Physics. The event targets children and families to generate interest in science and let them see what we do. We enjoyed exceptionally good weather—and the largest turnout we've ever experienced. As shown in the photos, guests and staff alike had a great time!

Rikvold, Reina join prestigious ranks of AAAS Fellows

The Florida State University has long been recognized internationally for the high quality of research conducted on its campus. Now, two FSU physicists have been elevated to the rank of fellow by the American Association for the Advancement of Science (AAAS).

The Florida State physics faculty member selected as AAAS fellow for 2011 is Per Arne Rikvold, Distinguished Research Professor and the James G. Skofronick Professor of Physics, "for distinguished contributions to computational statistical physics and its interdisciplinary applications in condensed-matter and materials physics, electrochemistry, computer science, biology, and engineering."

"The research challenges that interest me most lie at the interfaces between physics and other areas, such as materials science, chemistry, computer science, biology, and engineering. So I am extremely honored to have my contributions recognized by AAAS, an organization that particularly emphasizes and encourages interdisciplinary research. I am grateful to the many students, postdocs, and senior collaborators who have made my work possible, and to the Department of Physics, Florida State University, and the National Science Foundation for their support." he said.

"The central theme of my research is computational nonequilibrium statistical physics. This interdisciplinary field concerns systems that consist of a very large number of interacting entities, which could be atoms, molecules, animals, people, or the components of complex engineering systems. I have applied methods from statistical physics to nanomagnetism, electrochemistry and catalysis, computer science, evolutionary biology and ecology, economics, and power-grid engineering," Rikvold explained.


Per Arne Rikvold and Laura Reina

The Florida State physics faculty member selected as AAAS fellow for 2012 is Laura Reina, and her AAAS citation is "for distinguished contributions to the field of theoretical high energy physics and in particular for precise calculations of particle production at the Tevatron and the LHC."

"It is at the same time exciting and humbling to receive this recognition. The AAAS is a very broad scientific organization that promotes the advancement of science around the world, fostering research, education, international collaborations, public engagement in science. I am humbled in having been selected this year to promote the image and role of Physics in the advancement of society," she said.

Professor Reina's research focuses on elementary particle physics, i.e., the study of the nature of elementary particles and their interactions, interpreting data from high energy colliders (the Tevatron at Fermilab, Batavia, IL, and the Large Hadron Collider at CERN, Geneva, Switzerland) to unveil fundamental principles that will allow us to understand more primordial dynamics, like the ones that can explain the initial evolution of the universe. In particular, she contributed theoretical predictions that are now used to search for new particles (like the Higgs particle) at the Large Hadron Collider, for which preliminary evidence or absence of evidence is expected soon.

"The fact that these researchers come from across the scientific spectrum of our campus shows the breadth of excellence that Florida State has in the sciences among its faculty members," said Kirby Kemper, vice president for Research.

The AAAS honors are another tangible sign of the strength of the university's faculty, said Kemper.

"The diversity of research areas covered by these new AAAS fellows vividly demonstrates the broad areas of excellence present on the FSU campus," said Kemper, who holds the title of Robert O. Lawton Distinguished Professor of Physics at the university. "FSU is proud to have these distinguished individuals as members of our faculty."

The American Association for the Advancement of Science is the world's largest general scientific society. It has more than 127,000 individual and institutional members and 262 affiliates, serving 10 million scientists in fields ranging from plant biology to dentistry. The association also publishes *Science*, which, with an estimated total readership of 1 million, has the largest paid circulation of any peer-reviewed general science journal in the world.

'Tapping the sun'— *continued from page 6*

After the teacher-student team completed its work, it was time for Mag Lab staff—Andy Powell, an electronics engineer, Richard Brooks, the maintenance and construction superintendent and others—to jump in and make the project a reality.

They built a portable, electronic console to house eight batteries (each about 50 pounds and a bit bigger than a car battery). They mounted three solar panels on the roof above Chiorescu's lab, and then wired the system to the magnet. Fortunately, the grant covered all the material expenses.

"The physics department has a history of encouraging outstanding young faculty, and this is an example of us doing that," said Riley, the department's chair. "Irinel is doing fabulous work out at the Mag Lab."

In December, Chiorescu began using the solar-energy system to power his amplifiers and the data-acquisition stage of his experiments.

Ask him about the outcome today, and he smiles.

"The signal is 50 times better now," the professor said. "I am very happy with the results."

FSU students attend annual SPS Zone 6 meeting

SPS Zone 6 Meeting group photo

For the first time in many years, the FSU Physics Department sent a contingent of students to the annual Zone 6 SPS meeting. The meeting took place on April 1st and 2nd on the campus of the Georgia Institute of Technology, and about 70 students from institutions like the host (Georgia Tech), Morehouse College, Jacksonville University, University of Central Florida, Florida Institute of Technology, and from as far away as University of Puerto Rico at Mayaguez were in attendance. The FSU contingent was accompanied by Brendan and Tiara Diamond.

In addition to the slate of talks that usually takes place at such meetings, our students participated in a Physics Jeopardy contest, which they won. One of the FSU contingent, Zachary McDargh, also participated in the poster session. His poster titled "Finite Lattice Size Corrections to the Energy Momentum Dispersion of a Free Field" shared first place with the poster presented by Jennifer Black from Southern Polytechnic University on her "Search for the Rigidity Transition in Lithium Oxide Silicate Glass Systems Using Modulated Differential Scanning Calorimetry (MDSC)".

In summary, our students acquitted themselves very well, and there are hopes that this level of interaction with regional SPS organizations will continue. In fact, the FSU Chapter of SPS will be hosting the Zone 6 meeting next spring.

Jennifer Misuraca wins P.E.O. Scholar Award

Jennifer Misuraca, a graduate student in the condensed matter materials program within the physics departme nt has won a highly competitive and prestigious P.E.O. Scholar Award. The P.E.O. (Philanthropic Educational Organization), one of the pioneer societies for women, was founded on January 21, 1869. Its mission is the promotion of educational opportunities for women.

This Award is a one-time competitive, merit-based award for women of the United States and Canada who are either pursuing a doctoral level degree or are engaged in postdoctoral research at an accredited college, university or institution. In addition to recognizing and encouraging excellence in higher education, these awards provide partial support for study and research for women who will make significant contributions in their varied fields of endeavor.

Jennifer is pursuing research in experimental condensed matter physics focusing on spintronics, where the spin of the electron in addition to its charge provides new functionality to device structures. She is advised jointly by Professors S. von Molnár, and P. Xiong, and her work is funded under a NSF Materials World Network Grant. Her studies have already resulted in several publications including one in Physical Review, of which she is first author. In addition, Jennifer has forged close relationships with collaborators at the Institute of Semiconductors, Chinese Academy of Sciences, Beijing, where she worked for several weeks in 2010. A portion of the $15,000 award will be used to return to Beijing for an extended period during the next, last year of her tenure as a student at FSU.

Jennifer Misuraca

Preparing your students for careers in science and engineering: How is your state doing?

With one glance at the starting salaries of new bachelor's degree recipients in Fig. 1, a teacher or parent can see the career fields to which their high school students interested in the best economic opportunities might aspire: several engineering fields (chemical, electrical, mechanical), computer science, physics, and mathematics.

And which high school courses do these students need to take to prepare best for these fields? Common sense likely suggests higher-level math and science courses. Research agrees: taking physics and calculus in high school is the best preparation for students who want to pursue degrees in science, technology, engineering, and math (STEM).

A group from the Departments of Sociology and Anthropology and the Center for Career and Community Research at the University of South Florida examined the critical role that course-taking in physics and calculus plays in preparing students for bachelors' degree programs in STEM fields.1 Their results are illustrated in Figs. 2 and 3, which depict bachelor's degree attainment rates by the highest math and science courses students have taken in high school. In each figure, the top panel illustrates the attainment rate for a bachelor's degree in any field. The STEM degree attainment rates are shown in the bottom panel.

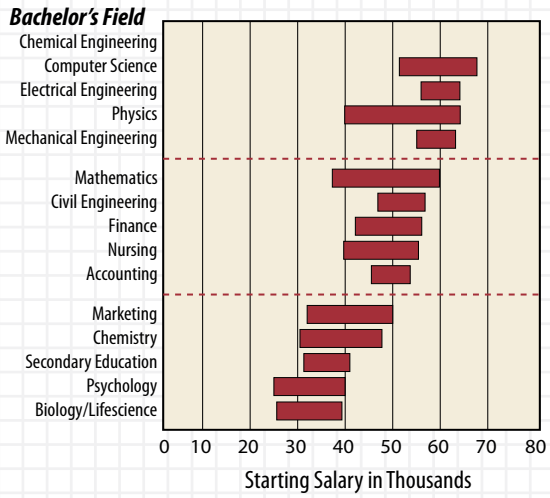
The top panel in Fig. 2 demonstrates that taking Algebra 2 makes a great contribution to making a student college ready; students who continue through trigonometry, pre-calculus, or calculus are even better prepared for college. However, the bottom panel makes it clear that Algebra 2 falls far short of preparing a student for success in a STEM bachelor's degree program—continuing through calculus is clearly a much better strategy for a student with STEM aspirations. In fact, students who complete calculus in high school are almost seven times more likely to earn a bachelor's degree in a STEM field than those whose top math course is Algebra 2.

Figure 3 makes a similar case in science. While chemistry is associated with being college ready (top panel), it takes physics to make a student STEM ready (bottom panel). A student who completes physics is twice as likely to complete a bachelor's degree in a STEM field than one who takes only chemistry; taking a second course in either subject increases the likelihood of earning a STEM degree even more. This likely seems self-evident to most high school physics teachers, but it is generally not appreciated among teachers in other fields—even other science fields—and principals. In fact, staff at the American Physical Society hired a marketing firm to address the issue2 and The Physics Teacher has published an article about how to recruit students into physics classes.3

The degree to which students are well prepared for bachelors' degree programs in science and

What's a Bachelor's Degree Worth?

Typical Salary Offers by Campus Recruiters, AY 2008-09



Typical salaries are the middle 50%, i.e. between the 25th and 75th percentiles.

Fig. 1. Typical salary offer to new bachelor's degree graduates by field for Academic Year 2008-2009. Source: AIP Statistical Research Center, reprinted from the Fall 2009 Salary Survey, with permission of the National Association of Colleges and Employers, copyright holder.

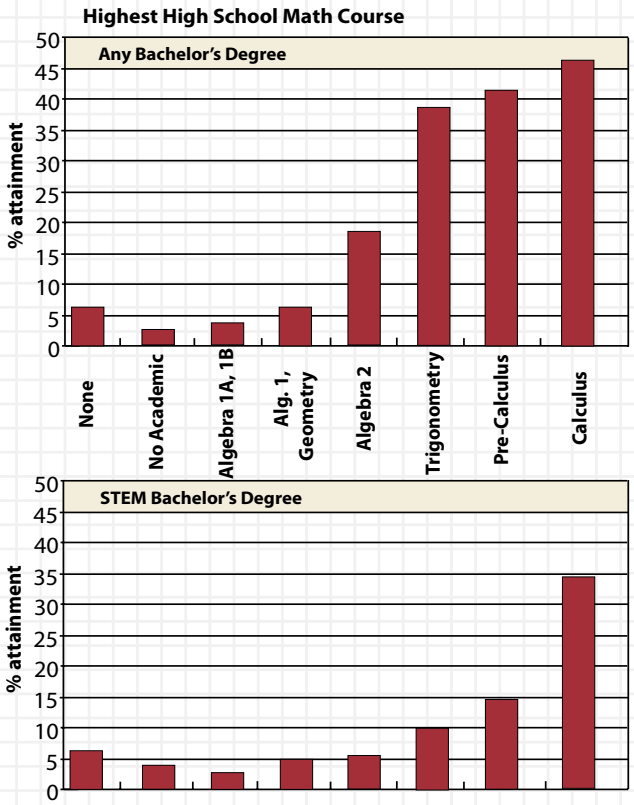


Fig. 2. Bachelor's degree attainment rates for all fields (top panel) and STEM fields (bottom) panel, sorted by the highest level math course taken, from Tyson et al. [1]

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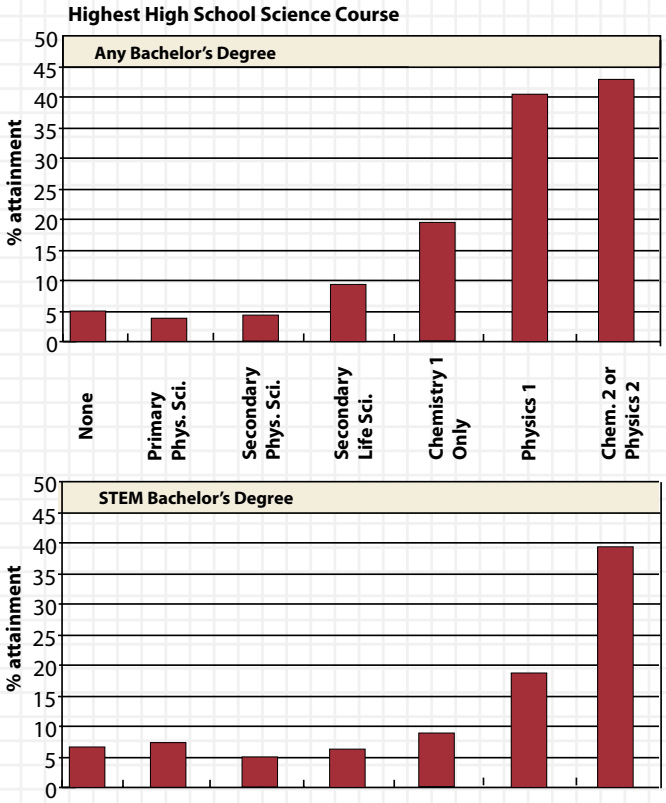

Fig. 3. Bachelor's degree attainment rates for all fields (top panel) and STEM fields (bottom) panel, sorted by the highest level science course taken, from Tyson et al. [1]

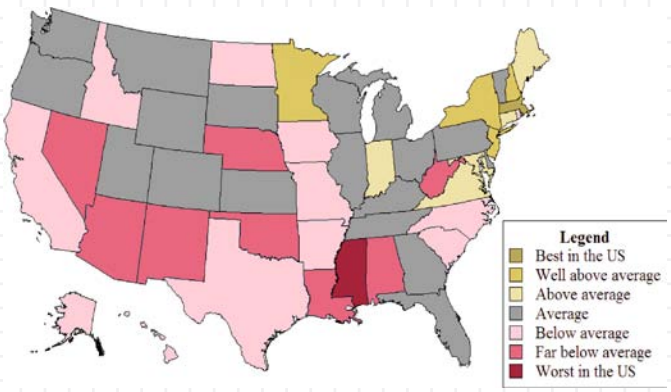

Fig. 4. State ratings using the Science and Engineering Readiness Index. [4]

engineering varies dramatically from state to state. We recently devised a metric, the Science and Engineering Readiness Index (SERI), that demonstrates these striking variations.4 The index incorporates results from the National Assessment of Educational Progress5,6 (NAEP, conducted periodically by the U.S. Department of Education), Advanced Placement examination results in calculus and physics,7 the physics course-taking results from the American Institute of Physics National Survey of High School Physics Teachers,8 and information on teacher certification requirements in science compiled by the National Council on Teacher Quality (NCTQ).9 (More details about each of these data are provided in a technical note at the end of this article.) The information from these sources is gathered into three scores on mathematics performance, science performance, and teacher qualifications. The scores are then used to assign each state a single composite score. The formulation of this index provides an opportunity for examining the strengths and weaknesses of each state's K-12 mathematics and science programs.

The final product of the SERI analysis is a sorting of the states into seven categories—"Best in the U.S." (awarded to Massachusetts), "Well above average," "Above average," "Average," "Below average," "Far below average," and "Worst in the U.S." The states are color coded by categories in Fig. 4.

Given the disappointing (but not surprising) performance of the United States on the PISA assessment of 15-year-olds in science and math,10 it is worth pondering this question: How good does a state have to be to compete successfully at an international level in science education? A hint at an answer is given by a paper published in the journal Science by researchers in Ohio, Maryland, and China.11 They pre-tested freshmen students in their universities before they took physics at college using two well-validated assessment instruments—the Force Concept Inventory 12 and the Brief Electricity and Magnetism Assessment.13 The differences between the score distributions of the American and Chinese students are striking and reflect the high priority given to pre-college physics instruction in Chinese schools. Ohio (rated "average" by the SERI) and Maryland (rated "above average") are clearly not able to compete with the Chinese in physics preparation. Furthermore, it is unlikely that any American state can at present, including Massachusetts. It is likely that Chinese students outperform students from all states.

At present Massachusetts defines the level of excellence for American states. Other states should examine the Massachusetts model to see how to improve the preparation of K-12 students for success in college and beyond.

Technical note

The data for the Advanced Placement exams come from the College Board and represent every student who took the respective AP® exam.

For the physics-taking data, AIP surveyed a nationally representative sample of 1/6 of all the schools, both public and private, in the U.S. and extrapolated up to population estimates controlling for state, type of school (public/private), and size of school (number of seniors). So the physics-taking numbers, while they come from a sample of students, are calculated and intended to represent all students.

Likewise, the NAEP data are also derived from statewide representative samples. The "About State NAEP" web page (nces.ed.gov/nationsreportcard/about/state.asp) states: "NAEP provides results about subject-matter achievement, instructional experiences, and school environment, and reports these results for populations of students (e.g., fourth-graders) and subgroups of those populations (e.g., male students or Hispanic students)."

In both cases where a sample was used, statistical sampling procedures were used to

continues on page 14

Physics Department participates in FSU Day at the Capitol

The "FSU Day at the Capitol" has become a popular tradition during the legislative session. It is a wonderful opportunity to bring the Florida State University community to legislators and staff, emphasize the University's proud heritage, and bring attention to the extraordinary accomplishments of our faculty and students.

The FSU Physics Department was represented by Prof. Vladimir Dobrosavljevic and his four graduate students: Hanna Terletska, Yohanes Pramudya, Samiyeh Mahmoudian, and Hossein Javan Mard. They illustrated the multicultural and multilingual community that flourishes at FSU, bringing the best and brightest young scholars from all over the world to enrich our outstanding academic programs. They presented science demonstrations and explained the simple but conceptually deep science ideas to legislators, emphasizing the profound impact of science on society. The FSU Physics display was also enjoyed by President Barron and his wife, Molly, who engaged in conversation with the young scientists and their mentor.

FSU Day at the Capitol activities

'Preparing students'

—continued from page 13

insure that the sample data are representative of the entire population.

Finally, the National Council for Teacher Quality data are based on NCTQ's analysis of state policies regarding state high school science licensure requirements.

The authors used the data as reported.

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the PHYSICS AWARDS CEREMONY

See the back page for more awards photos! ☛

2011 Sigma Pi Sigma inductees (left to right) Andrew Zarrella, Andrea Morland, Brett Israels, Stephen Hastings, Sponsor Dr.Winston Roberts, Daniel Davis, Andrew Ackert, and Pradiip Alvarez.

2011 Novotny Award recipient Ben Eakins (center) with Maggi Vanos-Wilson (left) and Dr. Simon Capstick.

This column, above: Dr. Jeff Owens presents the 2011 Lannutti Award to three winners. Top: Morgan Askins. Center: Kristen Collar. Bottom: Julia Bourg.

Drs. Sharon Hagopian and Vasken Hagopian flank the two winners of the 2011 Hagopian Family Endowment Award: Venkatesh Veeraraghavan (left) and Heribertus Bayu Hartanto.

the PHYSICS AWARDS CEREMONY

See page 15 for more awards photos!

Kristen Collar, left, accepts the Lynn Shannon Proctor Award for 2011 from Dr. Susan Blessing.

Kan-Sheng Chen, at left, receives the Yung Li Wang Award for 2011 from Dr. Sam Tabor.

Vladimir Dobrosavljevic, left, also received the PAI award for 2011 from Dr. Plendl.

The 2011 Dirac-Hellman Award went to Hanna Terletska, presented by Dr. Nicholas Bonesteel.

Dr. Sam Tabor, at right, presents the 2011 John D. Fox Award to Damiel Santiago.

Dr. Mark Riley recognized Administrative Support Assistant Kathy Mork for her 25 years of service.

Bret Gardner, at left, accepts the 2011 Schwarz Award from Dr. David Van Winkle.

Professor Jeff Owens (left) received one of two PAI awards for excellence in teaching and research, presented by Emeritus Professor Hans Plendl.

Teaching Lab Specialist Mark Cartagine got the Atom Award, the department's top staff award.