SPECTRUM

Nanoscience Research Center Opens

FOR THE ALUMNI AND FRIENDS OF THE DEPARTMENT OF PHYSICS & ASTRONOMY
NO. 26 | SPRING 2014 | UNIVERSITY OF NEBRASKA—LINCOLN | ANTHONY F. STARACE, EDITOR

University of Nebraska Lincoln

Transmission electron microscope (TEM) in the Electron Microscopy Central Facility.

Nanoscience Research Center Opens

Nanofabrication Cleanroom Central Facility.

The Nebraska Center for Materials and Nanoscience (NCMN), directed by George Holmes Distinguished University Professor **David J. Sellmyer**, has been at the forefront of its field since its founding in 1988. Now UNL scientists and engineers have state-of-the-art research facilities that will enable new discoveries in one of the nation's highest-priority research areas.

The new 32,000-square-foot Voelte-Keegan Nanoscience Research Center conveniently adjoins Jorgensen Hall, home of the Department of Physics and Astronomy, and is across 16th Street from the College of Engineering complex. It provides centralized research facilities for more than 80 physics, chemistry, engineering, and University of Nebraska Medical Center faculty, as well as several faculty members from other departments, colleges, and campuses. About 20 physics faculty are members of NCMN.

Researchers who work at the nano level — where size and distance are measured in billionths of meters — are exploiting nanotechnology's potential to revolutionize a wide range of products, from medicine and life-saving technologies to energy and electronics. Many say the most significant discoveries are yet to come.

UNL boasts one of the nation's leading nanomagnetics research groups, expertise in laser-assisted nanotechnology and is home to a prestigious Materials Research, Science and Engineering Center, which was established in 2002 with funding from the National Science Foundation.

Researchers previously were spread across several buildings on campus. They will continue to maintain offices in their home departments, but now benefit from a shared research area that enhances collaboration spanning disciplines and departments.

"This collaborative way of doing research now is much, much more powerful," said David Sellmyer, center director and an accomplished nanoscientist. "It will allow us to better confront the grand science and technology challenges facing our country. Collaboration is what's needed for progress in this field."

The new facility offers researchers access to specialized tools like a $2 million high-resolution electron microscope purchased with a grant from the National Science Foundation. Researchers also gain high-tech research space, including a clean room that eliminates dust particles. The center's administrative offices also are part of the new building.

"Having access to such powerful tools and an impeccably controlled research space will provide new insight into nanoscale materials and structures," Sellmyer said. "Our new facility creates an environment that better fosters innovation and will help pave the way to more research breakthroughs."

The building is named for UNL College of Engineering alumnus Don Voelte and his wife, Nancy Keegan, a former chair of the University of Nebraska Foundation's Board of Directors and current board member. They donated $5 million toward the building. They cited UNL's established leadership in nanoscience among factors playing into their decision, along with the field's reach into their own backgrounds and interests.

In addition to the Voelte-Keegan gift, a $7 million competitive federal grant from the National Institute of Standards and Technology (NIST), and a university commitment, funded the $14 million building. The NIST funding came from the American Recovery and Reinvestment Act of 2009. "These are wise investments considering the new facility will position the center to strengthen its role as an economic driver in Nebraska and beyond," Sellmyer said. To date, the center NCMN counts six spin-off companies among its successes.

"This state-of-the-science facility coupled with our faculty's expertise is a powerful combination that strengthens our position as leaders in nanoscience and materials research," said Prem S. Paul, Vice Chancellor for Research and Economic Development. "High-quality facilities are critical to enhancing our capabilities and fostering interdisciplinary research."

Editor's note: This article is adapted from a UNL News Release dated 19 September 2012 by Jean Ortiz Jones.

Positive Report By External Academic Program Review Team

Dan Claes , Chair

The Review Team "found the work being done in undergraduate education inspiring," citing the department "among the best programs nationally."

Strategic planning is an ongoing process revisited annually. We review and revise course offerings, undergraduate and graduate program requirements, and target new hires informed by the goals articulated in these plans. Every six years, as required by the University's Academic Planning Committee (a group responsible for formulating university goals and new initiatives) and the Nebraska Coordinating Commission for Postsecondary Education (a constitutional agency guiding policies for the entire university system) we undergo a much more formal Academic Program Review (APR). The APR includes a self-assessment of our performance in teaching, research, and service, an analysis of our progress since the previous APR review, and a chance to re-examine our long-term aspirations in light of revised College and University goals. An important part of the review is the report prepared by a visiting external team of prominent physicists from peer institutions (which this time meant our colleagues at other Big Ten universities). These physicists had expertise that spanned the research fields of our department and also had administrative experience.

The visiting Review Team lauded the construction of Jorgensen Hall, the "*impressive*" accomplishments of the department, and the strong governance that gives faculty "*input to critical decisions about the program and to the operations of the department.*" They noted the well-funded research program ("*indicating strong recognition of quality by external grant referees*") with many young faculty "*extraordinarily successful in garnering competitive funding such as CAREER grants and DoE early career awards*", and, in particular, commented on the friendly and nurturing environment for new faculty. "*The mentoring support is very well developed.*"

Current Research Program

The Team praised the Department's long-term plan to strengthen the prominent research efforts in Atomic, Molecular, Optical, and Plasma Physics (AMOP), and Condensed Matter and Materials Physics (CMMP) through the targeted hires supported in part by the University's Program of Excellence (PoE) in each of those disciplines. They recognized the major impact of the High Energy Physics (HEP) group, belying its more modest size.

AMOP: The Team praised the "*high-quality expansion to nine faculty*" in AMOP, noting the size and diversity of funding. New efforts in high intensity, high energy density, ultra-fast lasers have brought the group increased international recognition. The Team considers the departmental hiring plan to seek additional faculty with a strong interest in high field laser physics and able to take advantage of the Laser Science Collaboratory to be a wise move. This was the strategy that resulted in our recent hire of Assistant Professor **Matthias Fuchs**.

CMMP: The Team noted "*this area has grown impressively in both research productivity and significance.*" "*The funding acquired… is also very significant, highlighted by a successful NSF-MRSEC.*" Bolstered by the ("*generally expensive*") shared NCMN facilities, the Team acknowledges nanoscience as the ideal direction for the CMMP group to pursue. They point out this could prove a cornerstone for regional economic growth provided physics continues to provide the intellectual motivation and leadership in this highly collaborative area. The successful completion of searches for two new CMMP faculty members (theorist **Alexey Kovalev** and experimentalist **Xiaoshan Xu**) should complement the strengths of the group.

HEP: By attracting two major CMS [Compact Muon Solenoid] projects (a Tier-2 computing center, and the Forward Pixel Upgrade) "*the technical contributions of the UNL HEP group are now well known.*" The APR Team noted the group enjoys a greater impact within the large CMS collaboration than many other U.S. groups. They did feel "*greater engagement with the theoretical community would heighten the intellectual impact of the group*" and suggested hiring a theorist to "*strengthen the international scientific impact of the group.*"

In case you're out of the local news coverage area, Nebraska has entered into a long-term partnership as a University-Affiliated Research Center (UARC) with the United States Strategic Command (USSTRATCOM). This designation offers opportunities for sole-source funding of research in core mission areas critical to USSTRATCOM. The acknowledged expertise in the Department of Physics and Astronomy proved instrumental in securing the UARC. The first of two "task orders" awarded through it was made to Professor **Donald P. Umstadter**'s Diocles Extreme Light Laboratory. We are learning how to take advantage of the opportunities offered by this partnership and understanding the implications and constraints of working within it.

Teaching

The Review Team "*found the work being done in undergraduate education inspiring,*" citing the department as being "*among the best programs nationally.*" They were impressed by "*the modern classroom facilities,*" "*innovative lecture demonstrations,*" and the "*use of a wide range of online and electronic tools.*" This success is due to an established culture of instructional innovation and excellence among the faculty. Institutional support for such initiatives is critical, of course, and is exemplified by UNL's new interdisciplinary DBER (Discipline-Based Education Research) Group and UNL's WIDER-EAGER grant from the National Science Foundation (of which Research Associate Professor **Kevin Lee** is co-PI), both of which aim to improve instruction in STEM disciplines. The Team expressed concern, however, about the level of campus-wide IT support for the development and maintenance of web-based materials. "*Online resources must be highly reliable*" *for students and instructors, even in "an environment where operating systems and commercial software licenses can change rapidly.*"

Undergraduates: The Review Team found "*very engaged and generally happy undergraduate students*" participating in research and outreach activities throughout the department and active in the local chapter of the Society of Physics Students (SPS). Discussion with majors confirmed to the Team that astronomy remains a "*strong motivator for students to study physics*" with some unhappy to have lost the major concentration. Students expressed interest in some additional advanced course offerings, including a mathematical methods course taught by the physics department, though the team realized there were no existing courses that could be eliminated "*without severely harming the competitiveness of the program.*" While we have been previously hampered by a shortage of instructors, as we near the PoE target hiring goals, we have the chance to explore new course offerings. This year we are piloting a theoretical methods course.

Graduate Program: According to the Review Team "*the welcoming and collegial atmosphere in the department and high quality faculty and facilities make UNL attractive*" to potential graduate students. Despite continuously growing enrollments in physics, "*the number of TAs assigned to the Department is woefully mismatched to the number of students taught.*" Additional TA lines, they pointed out, would provide for greater instructional support of undergraduate education. Indeed, a quick survey of the number of GTA- and GRA-supported students (representing 2011-2013 data collected by the Midwest Physics Chairs Association and the listings in the latest edition of the American Institute of Physics' *Graduate Programs in Physics, Astronomy, and Related Fields*) shows more than a third of Big Ten physics graduate students receive GTA support (0.38) through lines funded by their college. At UNL the fraction of GTA-supported lines is just 0.25. An increase in line with the Big Ten average fraction of GTA-supported graduate students would also allow us to admit larger numbers of entering graduate students.

Outreach

The Team found the Department's outreach efforts to be "*exemplary*" (according to one team member "*jaw-droppingly amazing*"), thriving "*on the unusual enthusiasm of the faculty for getting involved.*" The scheduling and logistics of many of our most successful outreach activities (the *Big Red Road Show*, the *Science Café*, the *NanoScience Camp*, *Bright Lights*, and the annual *WoPhyS Conference for Undergraduate Women in Physical Sciences*) are heavily dependent on the help of non-permanent Education and Outreach Staff of NCMN and MRSEC. "*This is an efficient model allowing faculty to do outreach without compromising their research activities.*" As these staff lines are grant-dependent, the Team expressed concern over the lack of "*sustained administrative support for (these) efforts from the college/university.*" They recommended "*departmental staff working with outreach support, possibly coupled with departmental website maintenance.*" The College budget is unlikely to accommodate this.

Facilities

The Review Team described our new building as "truly spectacular." They noted, however, that any increase in faculty size would require additional space. Plans do exist for expanding into a second floor above the new instrument shop (an option in the original design). The Office of Institutional Research and Planning prioritizes all such capital projects, and we're advised that this work awaits identification of an interested major donor. Meanwhile the well-equipped, staffed, and state-supported Instrument and Electronics Shops provide access to precision work at affordable rates, an advantage that our faculty have over competing universities in securing federal grants. These rates have proved important in securing the large projects the department has won and in creating attractive startup packages for new faculty.

We found many things to celebrate in the report, as well as helpful advice we were grateful to receive and will work to implement. In this newsletter, we are happy to share with you many of the accomplishments and changes that so impressed the external committee. As always, we hope you'll consider visiting sometime to see some of these changes first hand.

Daniel R. Claes
Professor and Chair

NEW FACULTY PROFILE

Matthias Fuchs

Matthias Fuchs joined the Atomic, Molecular, Optical, and Plasma (AMOP) physics group in January 2013. He was selected as the top candidate in a search carried out in the 2011-2012 academic year for an experimental physicist with interests in intense laser physics. Part of Fuchs' research will be carried out in the Diocles Extreme Light Laboratory and part will be carried out in new laboratories adjacent to the Diocles Lab.

Fuchs, a German citizen, received his undergraduate degree in physics from the University of Stuttgart and his M.S. degree in physics from the University of Oregon. His doctoral research was carried out at the Max Planck Institute for Quantum Optics outside Munich in the framework of the International Max Planck Research School for Advanced Photon Science. He received his Ph.D. degree summa cum laude from the Ludwig-Maximilian University in Munich. His thesis on "A Laser-driven Soft-X-Ray Undulator Source" was awarded the John Dawson Thesis Prize in 2011 by the American Physical Society's Division of Physics of Beams. Fuchs was also the first author on a 2009 paper with the same title that was published in *Nature Physics*.

In 2010, Fuchs took a postdoctoral position in the group of Professor David Reis at Stanford University and the Stanford PULSE Institute at SLAC National Accelerator Laboratory in Menlo Park, CA, to work on ultrafast and high-field X-ray experiments. A year later he was awarded a $400,000 Peter-Paul-Ewald Fellowship, funded by the Volkswagen Foundation, in support of cutting-edge research with free-electron lasers (FELs) at SLAC's Linac Coherent Light Source (LCLS). At Stanford, Fuchs helped build and characterize the world's brightest laboratory terahertz light source. He also led and collaborated on a series of studies performed at both existing X-ray FELs (at that time), SACLA (in Japan) and LCLS. These studies enabled him to demonstrate for the first time some fundamental coherent nonlinear X-ray effects. He was also a main contributor to an experimental demonstration of a novel technique for investigating ultrafast dynamics in solids.


Matthias Fuchs

At UNL, Fuchs's research is focused on demonstrating the next generation of X-ray light sources and the first applications of their radiation. A novel acceleration technique (laser-wakefield acceleration), employing an ultra-high intensity laser, is planned to serve as a driver for a table-top, electron-beam-based undulator source of ultra-brilliant X-ray pulses with unique properties. A main objective is to use such intense X-rays to carry out pump-probe experiments capable of resolving ultrafast dynamics with much finer temporal resolution than even current free-electron-laser (FEL) sources can reach. In addition, he will continue his work in high-field physics, studying fundamental nonlinear quantum electrodynamics (QED) effects.

by Anthony F. Starace

NEW FACULTY PROFILE

Xiaoshan Xu

Xiaoshan Xu joined the Department's Condensed Matter and Materials Physics (CMMP) group in August 2013. He was the top candidate in a very competitive search carried out in the 2012-2013 academic year that sought to attract a world-class experimental physicist to add strength and new vision to the successful collaborative research activities taking place within the framework of UNL's Materials Science and Engineering Center (MRSEC) and the Nebraska Center for Materials and Nanoscience. Xiaoshan adds to the international competitiveness of UNL's materials science research program through his expertise in pulsed laser deposition methodology. His experience paves the way for UNL to compete successfully in oxide materials research with special emphasis on room temperature multiferroicity. His immediate research goals are to explore the physics of low-dimensional complex oxides on the nanometer scale, at which quantum size effects can change electronic structures and lead to novel physical properties that can be manipulated and thus controlled.

Xu received his B.S. degree in physics in 1997 and his M.S. degree in condensed matter physics from Nanjing University in 2000. His Ph.D. research was carried out and completed in 2007 at Georgia Institute of Technology where he worked in the field of magnetism and ferroelectricity of metal clusters. Following a 2-year postdoctoral appointment at the University of Tennessee, in 2010 he joined the research staff at Oak Ridge National Laboratory, where he was awarded a Eugene P. Wigner Fellowship and was successful in winning several large research grants funded by the Laboratory Director's R&D SEED Fund. In the 2012-13 academic year, he was a research associate at Bryn Mawr College prior to joining our Department.

Xiaoshan Xu's research accomplishments are remarkably broad, ranging from the fields of multiferroics, ionicity in metal oxides, spin liquids in frustrated magnetic oxides, and organic semiconductors, to magnetism and ferroelectricity of metal clusters. He has authored a monograph entitled "The Magnetism of Free Cobalt Clusters: A Study Using Molecular Beam Method" published in 2008 by Akademikerverlag. His research publications include a 2003 paper in *Science* on ferroelectricity in free niobium clusters, eight *Physical Review Letters*, including one in 2013 on room-temperature multiferroic hexagonal LuFeO3 films, and three *Nano Letters*. In addition to these groundbreaking findings he has worked on the spectroscopy of multiferroic materials in high magnetic fields and magneto-chromism of the archetypical multiferroic $BiFeO_3$.


Xiaoshan Xu

At UNL, Xu will construct and set up a world-class pulsed-laser deposition chamber. One of his major objectives is to utilize state-of-the-art growth methodology to fabricate nanostructured epitaxial thin films of multiferroics and half metals following up on his recently discovered new class of room temperature multiferroic hexagonal ferrites. His broad background adds experimental expertise to the CMMP group in the area of oxide thin film growth methods and strengthens its competitiveness in the modern field of electrically-controlled magnetism.

by Christian Binek and Anthony Starace

NEW FACULTY PROFILE


Alexey A. Kovalev

Alexey A. Kovalev

Alexey Kovalev joined the Department's Condensed Matter and Materials Physics (CMMP) group in August 2013, following a highly competitive international faculty search. His interests align with the missions of the CMMP group and with the Nebraska Center for Energy Sciences Research, the Nebraska Center for Materials and Nanoscience, and the NSF-funded Materials Research Science and Engineering Center for Quantum and Spin Phenomena in Nanomagnetic Structures.

Kovalev grew up in Kirov, a Russian industrial and transportation hub 600 miles east-northeast of Moscow. Early on, he developed an interest in mathematics and theoretical physics, which led him to undergraduate study with the group of Nobel Laureate V. L. Ginzburg at the Lebedev Physical Institute of the Russian Academy of Sciences in Moscow. He moved on to graduate study at the Moscow Institute of Physics and Technology, receiving his M.Sc. degree with Highest Honors in 1999 for his thesis on "Spin-charge excitations in two-dimensional Kondo lattice model of high Tc cuprates." In 2002, he entered the doctoral program of the Technical University of Delft, The Netherlands, receiving his Ph.D. degree in 2006. His doctoral dissertation, titled "Electrical and Mechanical Magnetization Torques," included a generalization of the theory of spin transfer torque effects to metallic multilayer systems.

From 2006-2008, he held a post-doctoral position at Texas A&M University where he investigated by means of *ab initio* calculations spin-orbit effects in dilute magnetic semiconductors and the anomalous Hall effect. He did additional post-doctoral work at UCLA during 2008-2010, working on spin-orbit interactions, spin transport, and other theoretical aspects of spintronics. This was followed in 2011 by an appointment as Assistant Project Scientist at the University of California-Riverside, where he worked on magnetic textures and quantum computing.

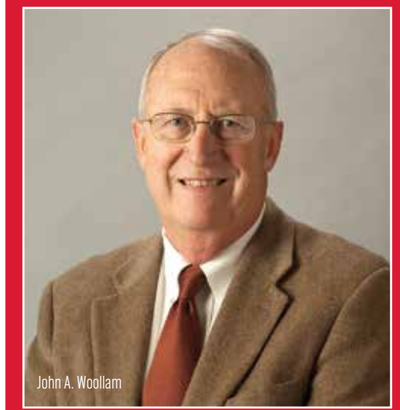
Kovalev's 2011 paper on "Macrospin Tunneling and Magnetopolaritons with Nanomechanical Interference" was selected as an Editor's Selection by the editors of *Physical Review Letters*. It was also the subject of a Physics Viewpoint essay, "Spintronics Meets Nanoelectromechanics," by T. Kontos of the Ecole Normale Supérieure in Paris, who writes: "Coupling a nanoscale object with a resonator is interesting from both a practical and a fundamental point of view. On the practical side, the parametric coupling between a small system and a resonator that acts as a detector can be used to probe very small charges, masses, or magnetic moments. On the fundamental side, a system with microscopic degrees of freedom coupled to a harmonic oscillator is a very important paradigm of quantum mechanics since it allows us to understand deeply the processes of measurement and amplification."

At UNL, Kovalev's research will be focused on theoretical aspects of spintronics, especially those associated with the interplay of the spin, energy and charge transport in systems with topological defects and in which the roles of magneto-electrical and magneto-mechanical interactions are important. His research interests include fundamental aspects of thermalization of magnetic, electronic and lattice degrees of freedom in ferromagnetic structures. In addition, he will explore various aspects of quantum information theory in the context of condensed matter physics and quantum computing. This work has applications to many areas of information technology, data storage, computing, sensors and transducers, cryogenic refrigeration, and energy harvesting. He also has an abiding interest in teaching theoretical physics and in mentoring students in theoretical condensed matter and materials physics research.

by Stephen P. Ducharme and Anthony F. Starace

DEPARTMENT NEWS

Woollam Wins APS Prize for Industrial Applications of Physics


John A. Woollam

John A. Woollam, George Holmes Distinguished Professor of Electrical Engineering and Professor of Physics and Astronomy, was awarded the American Physical Society's 2013 Prize for Industrial Applications of Physics. He was cited *"For sustained contributions to commercialization of spectroscopic ellipsometry, including greatly improved instrumentation and numerous new applications."* Woollam received his Ph.D. in condensed matter physics from Michigan State University in 1967. He joined UNL in 1979 and is a Fellow of both the APS and the American Vacuum Society. In 1987 he founded the J.A. Woollam Company, which has become a worldwide leader in spectroscopic ellipsometry. The company holds over 140 ellipsometry-related patents and employs over 50 people, most of whom are engineers and scientists dedicated to advancing ellipsometry and its applications. The prize includes $10,000 and a certificate. It is awarded in odd-numbered years, beginning in 2009. Woollam is the third recipient.

DEPARTMENT NEWS

Hong Wins NSF Career Award

Above: Xia Hong
Left: Illustration by Xia Hong
Right: Phis's World: Episode 1

Episode 1: Phis wants to be a physicist 5

Assistant Professor Xia Hong has won a prestigious National Science Foundation (NSF) CAREER award for her proposal entitled "Interface Engineered Multiferroics and Nanoscale Phase Modulation in Complex Oxide Heterostructures." The $600,000 award from NSF's Division of Materials Research started 1 February 2012 for five years. The CAREER award is NSF's most prestigious grant for outstanding pre-tenure faculty to help them develop as teacher-scholars and researchers.

Hong's research program focuses on the novel coupling between electronic and magnetic states and on the local control of phase structures in artificially-designed complex oxide nanostructures and interfaces. Her first goal is to fabricate artificial oxide nanostructures, where an array of ferroelectric pillars is embedded in a magnetic host material with the interface registered with atomic precision, and then to investigate the coupling mechanism between the magnetic and electric states. Her second goal is to create and study nanoscale phase structures in correlated oxide thin films through size confinements or ferroelectric field effect modulation. Her long-term goal is to apply the understanding achieved through this research to produce novel oxide-based electronic and spintronic (solid state) devices that can transcend the performance limits of the devices utilized in current information technology. Students involved in these projects will receive training in advanced experimental techniques and will advance the research frontiers in condensed matter physics.

"My research is very complementary to the existing efforts here," Hong said, particularly the theoretical work of Professor **Evgeny Tsymbal**, director of UNL's NSF-funded Materials Research Science and Engineering Center. "There is a lot of collaboration," she added. "We need a theoretical point of view to understand the new properties we are studying."

The required educational goal of the CAREER award is to engage students, especially women, to be interested and involved in physics studies at an early age. Hong has begun to create a series of cartoon stories ("Phis's World") centered on an easily accessible girl character named Phis. In these cartoon stories, Hong presents a beginner's perspective of basic physics problems and explores how physics can be approached outside the classroom. The stories are disseminated to the public on the Web: http://www.physics.unl.edu/~xhong/hong/Phis/PhisHome.html.

"Many people think physics is very difficult," Hong said. "I thought it was a good idea to use a teenage girl's point of view to illustrate physics principles, not using extensive math equations, but how they operate in real life, to make physics more likable."

by Terese M Janovec

DEPARTMENT NEWS

CMP Faculty Lead New Center for NanoFerroic Devices

The Semiconductor Research Corporation (SRC) and the National Institute of Standards and Technology (NIST) have awarded a UNL physics team a five-year, $7.125 million contract to lead a new Center for NanoFerroic Devices (CNFD) as part of SRC's Nanoelectronics Research Initiative aimed at developing a new generation of electronic devices. George Holmes Distinguished University Professor **Evgeny Tsymbal** is the Center Director and Charles Bessey Professor **Peter A. Dowben** is the Center's Operations Director.

The Center, led by UNL, partners with researchers from UC-Irvine, U. Wisconsin-Madison, SUNY-Buffalo, U. of Delaware, and Oakland U. as well as with the SRC industry consortium. Its stated mission "is to develop non-conventional, low-energy devices based on innovative functional materials systems and conceptually novel approaches for device operation. Research involves exploration of properties, materials, structures, and phenomena non-traditional for existing technologies, such as magnetoelectricity, ferroelectricity, and spin dynamics. CNFD exploits these concepts in novel devices utilizing state variables different from charge and exhibiting significant switching effects that are robust enough to be harnessed as manufacturable technologies."

"Our faculty's leadership of this collaborative research endeavor sponsored by a leading research consortium and the federal government is the latest recognition of UNL's strength in nanotechnology and materials science," Chancellor Harvey Perlman said. The center will harness the significant advances UNL and its NSF-funded Materials Research Science and Engineering Center (MRSEC) have made in exploring nanomaterials with unique properties that may prove the key to surpassing the limitations of current technology. "It's extremely important that we have MRSEC at the University of Nebraska–Lincoln because the new center is a natural continuation of the research that we've been doing," said Tsymbal, who is also MRSEC's director. "Now we're rising to a new level."

Advances in silicon-based technology have made electronics ever smaller, faster and less expensive. But industry experts believe this technology will reach its limit within the next decade. That's because today's electronics use an electric charge to store and process information. Charges leak energy, generating heat and limiting the number of transistors that can be packed onto a chip. They also use energy, reducing battery life.

The new center's research will pursue three promising "themes" for new devices. Each takes advantage of unique, nano-scale properties that require much less energy, which would enable more compact and powerful devices:

Ferroelectric Devices Theme: Professor **Alexei Gruverman** will lead a team based on his and Tsymbal's work focused on nano-thin ferroelectric oxide, a material with both positive and negative polarization directions that can be reversed by switching voltage, which doesn't generate heat. That duality is important because the polarization direction can be read like a binary code to store information. Gruverman and colleagues have shown that reversing the polarization changes the level of resistance as electrons pass between electrodes. Measuring that resistance would allow the

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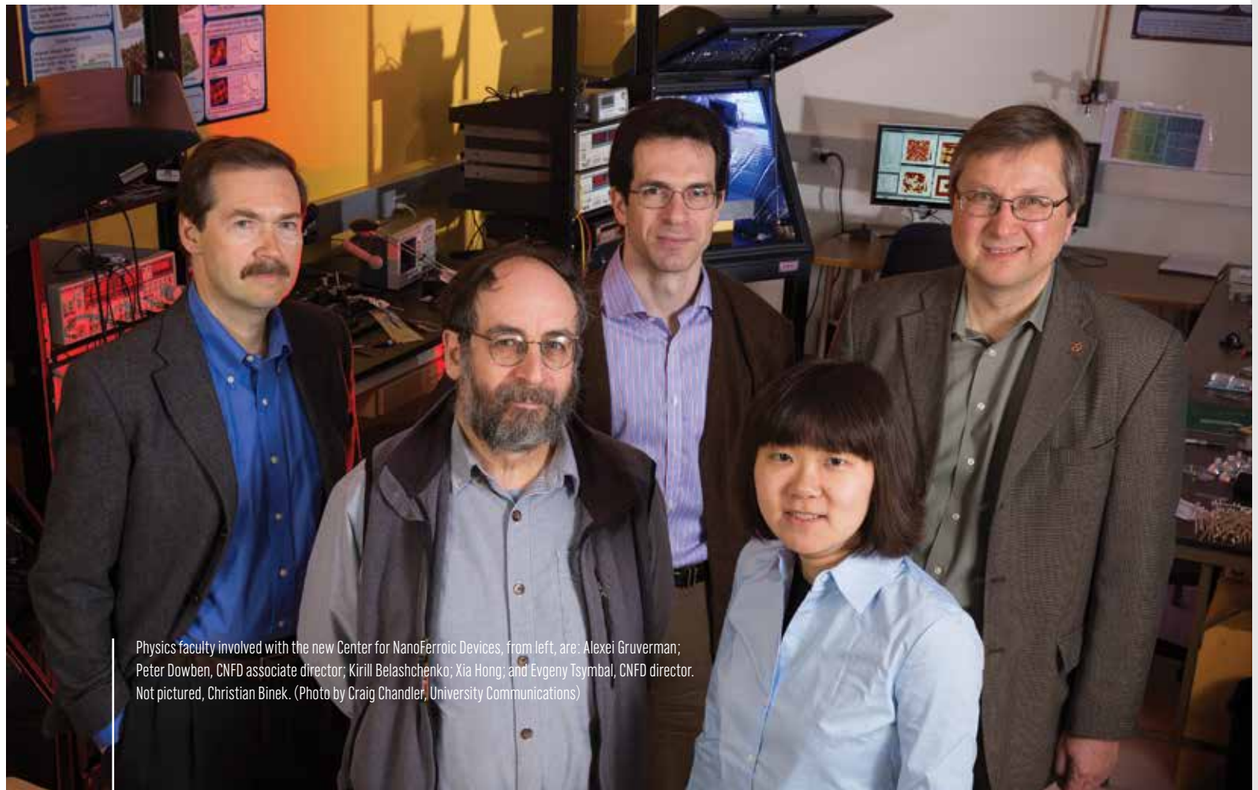


Physics faculty involved with the new Center for NanoFerroic Devices, from left, are: Alexei Gruverman; Peter Dowben, CNFD associate director; Kirill Belashchenko; Xia Hong; and Evgeny Tsymbal, CNFD director. Not pictured, Christian Binek. (Photo by Craig Chandler, University Communications)

DEPARTMENT NEWS

Diocles Lab to Play Role in New University-Affiliated Research Center

The University of Nebraska announced on 11 October 2012 that it has entered into a long-term partnership with the United States Strategic Command (USSTRATCOM) at Offutt Air Force Base to create a University-Affiliated Research Center (UARC). The UARC will serve as a primary research and development center that supports USSTRATCOM's missions to deter and detect strategic attacks against the U.S. and its allies, and to defend the nation as directed.

Through the UARC the university will provide research and development services for USSTRATCOM in areas in which NU faculty have demonstrated significant strength. These areas, which are critical to national security, include: nuclear detection and forensics, detection of chemical and biological weapons, passive defense against weapons of mass destruction, consequence management, and space, cyber and telecommunications law.

The UARC is a university-wide initiative, drawing on a broad range of expertise from all four NU campuses. Faculty will have the opportunity to participate if their research aligns with federal funding opportunities. Their work will be solutions-oriented, geared toward meeting – and ultimately anticipating – USSTRATCOM's needs.

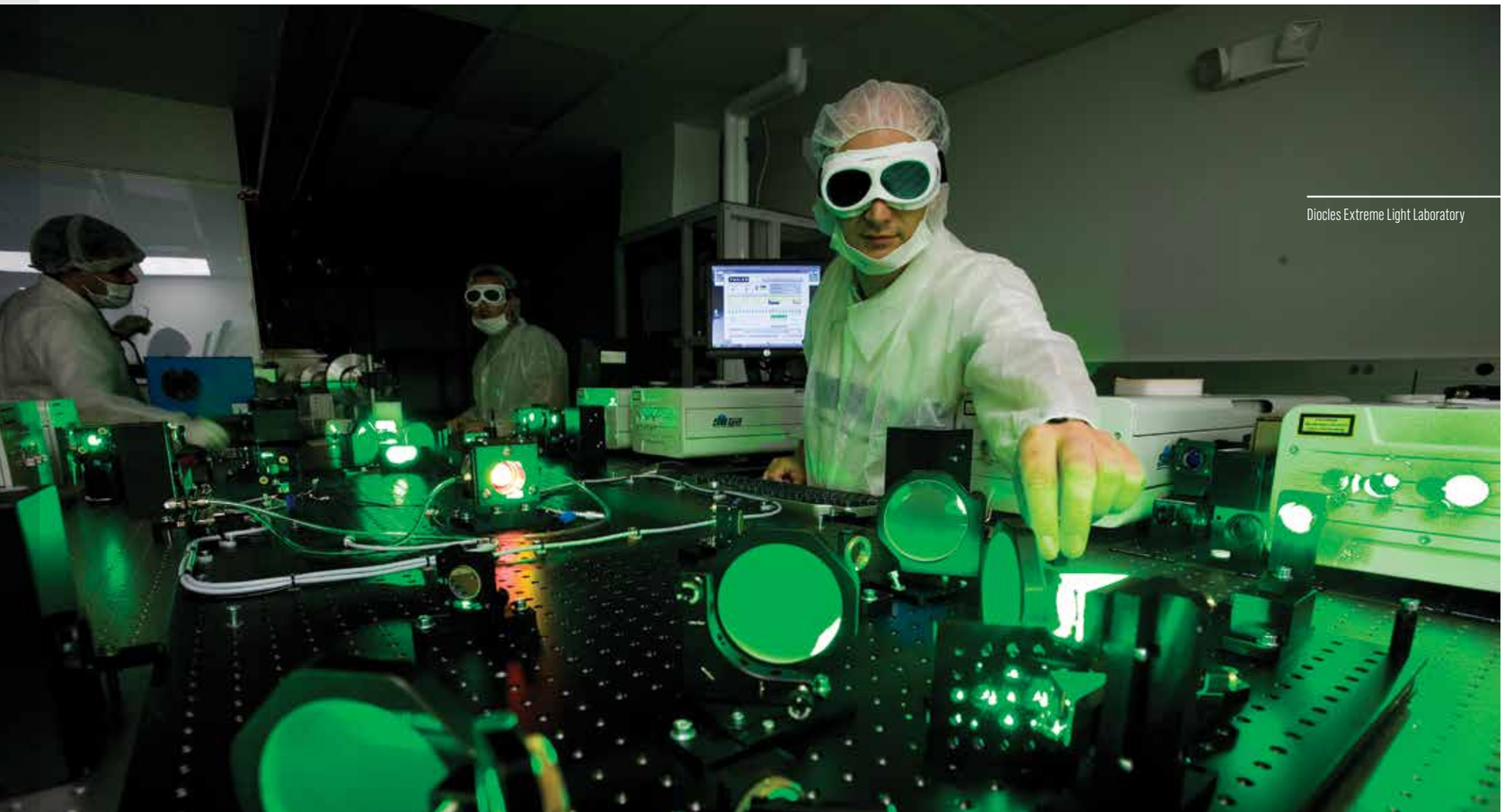
The initial contract award from the Department of Defense to the university provides for up to $84 million over the next five years. Research opportunities through the UARC are expected to grow significantly in the coming years, and the university anticipates additional funding in the future.

Only 14 U.S. institutions, including the University of Nebraska, host a UARC. All UARCs are affiliated with leading research universities, including the Massachusetts Institute of Technology, Johns Hopkins University, Penn State University and others.

The Department's Diocles Extreme Light Laboratory and its research team are expected to play a significant role in some of the UARC's research projects. In particular, it is developing new portable technologies to detect nuclear materials and radiation signatures that are cost-effective, easy to use, and accurate. This research has nuclear security implications and applications in maintaining our nation's nuclear arsenal.

Donald P. Umstadter, Leland J. and Dorothy H. Olson Chair of Physics and director of the Diocles Lab, said, "Research at universities is often considered to be complete at the time of publication of an article in a scientific journal describing the research results. But fundamental research occasionally points toward solutions to pressing national security or defense problems. The UARC will give NU scientists like myself the opportunity to take the next step toward translating their academic research into real-world technologies."

Editor's Note: This article is based on 11 October 2012 press releases by both the University of Nebraska and UNL's Office of Research and Economic Development and on the National Strategic Research Institute's Web page: nsri.nebraska.edu



Diocles Extreme Light Laboratory

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DEPARTMENT NEWS

CMP Faculty Lead New Center for NanoFerroic Devices

device to read the polarization direction, and thus, the information it contains.

Magnetoelectric Devices Theme: This theme relies on Associate Professor **Christian Binek**'s work with spintronics, which manipulates electron spin, in addition to charge, to store information. Traditional magnetic memory devices use a current to generate a magnetic field and change the magnetic direction, which is the binary method of storing information. Binek's team discovered how to switch magnetization using voltage instead. The magic ingredient is chromia, the oxide form of chromium, which can be magnetized with voltage. Bringing a nano-thin film of chromia into contact with a ferromagnetic material and applying voltage switches the material's magnetization direction.

Spin Wave Devices Theme: This theme, led by Associate Professor Ilya Krivorotov at the University of California, Irvine, involves the transport of information not just by switching the spin direction, but also by generating spin waves. Much like a sound wave carries information through time and space, a spin-wave device would be able to interpret information carried on a spin wave, which can also be generated using low-energy voltage.

All of these novel device themes have the potential to go beyond today's semiconducting systems, which would greatly expand computing potential, Tsymbal said. But he emphasized the need for collaboration among researchers and with industry to take these fundamental principles out of the laboratory and into specific devices.

Prem Paul, UNL vice chancellor for research and economic development, agreed: "This university-industry consortium partnership brings together critical funding and expertise to transform the basic research discoveries at universities into a new generation of innovative devices to benefit society."

Associate Professor **Kirill Belashchenko** and Assistant Professor **Xia Hong** are also members of the new center. Industry partners involved in the projects include IBM, Intel, Micron Technology, Texas Instruments, and GlobalFoundries. Semiconductor Research Corp. is the world's leading university-research consortium for semiconductors and related technologies. The Nanoelectronics Research Initiative and the collaboration with the National Institute of Standards and Technology are managed by the Nanoelectronics Research Corp., a special purpose subsidiary of Semiconductor Research Corp

Christian Binek

Editor's note: This article is adapted from a 1 May 2013 UNL News Release by the Office of University Communications and the CNFD Web page: http://www.src.org/program/nri/cnfd/

Kevin Lee Recognized with AAPT 2012 David Halliday and Robert Resnick Award

The American Association of Physics Teachers (AAPT) awarded Research Associate Professor **Kevin M. Lee** (Ph.D. 1997) the 2012 David Halliday and Robert Resnick Award for Excellence in Undergraduate Physics Teaching. This award is given in recognition of contributions to undergraduate physics teaching and awardees are chosen for their extraordinary accomplishments in communicating the excitement of physics to their students. John Wiley & Sons sponsors the award through its donation to the AAPT.

Lee holds appointments in the Department and in the UNL Center for Science, Mathematics, and Computer Education. He earned his B.S. in astronomy at the University of Michigan and his M.S. at Central Michigan University. He did his Ph.D. research in astronomy at UNL in the group of Professor **Edward G. Schmidt** on multiperiodic RR Lyrae stars using observations made with the 30-inch telescope at Behlen Observatory. (RR Lyrae stars are low-mass variable stars, larger in size than our Sun, that are pulsating simultaneously with more than one period.)


Kevin Lee

As stated in AAPT's April 4, 2012 news release, "Lee has dedicated himself to elevating the teaching and learning of astronomy and physics at the college, state, national, and international level. He has distinguished himself as a college instructor and developer of instructional technologies for use in space-science classrooms. The teaching and learning innovations pioneered by the astronomy education group run by Lee at UNL is recognized as being of the highest pedagogical value by those in the astronomy and space science community."

"Beyond this work on the development of instructional strategies and tools that bridge the gap between cutting edge pedagogy and current technologies, Lee has also made significant contributions to AAPT programs leading to increased visibility of and participation in AAPT activities associated with teaching astronomy and the use of technology…."

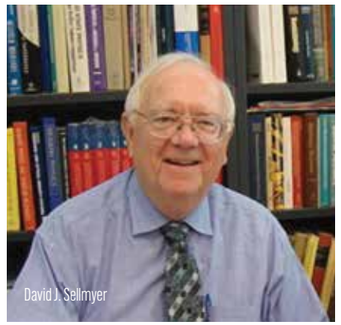
"Lee's work in astronomy education has been remarkable and innovative. His accomplishments include the development of numerous simulations and peer instruction questions, resulting in many workshops. His two seminal works, to date, are The Nebraska Astronomy Applet Project and ClassAction, the clicker question database which is designed to help make large lecture-format astronomy courses more interactive. He freely shares these materials on his website": http://astro.unl.edu.

Editor's Note: This article is adapted from the AAPT news release of 4 April 2012.

Sellmyer Receives Pound-Howard Distinguished Career Award

The Louise Pound-George Howard Distinguished Career Award was established by the Faculty Senate in 1990 to recognize individuals with a long-standing commitment and a distinguished career of service to the University of Nebraska-Lincoln. Perhaps no one exemplifies this commitment better than Professor **David J. Sellmyer**, its 2012 recipient. It has been through his dedication and transformative vision that the University of Nebraska-Lincoln enjoys its national prominence as one of the country's leaders in materials and nanoscience research.

Sellmyer's achievements range from the creative development and fabrication of nanoscale magnetic multilayers, wires and clusters with novel properties, to the development of a wide variety of magnetic-recording and permanent-magnet materials with outstanding properties. He has more than 600 publications including 8 books, and an h-index of 46. He is a Fellow of the American Physical Society (elected in 1976), a Fellow of the American Association for the Advancement of Science (elected in 2013), and holds a George Holmes University Professor chair in Physics (since 1987). He has won an Outstanding Research and Creative Activity (ORCA) award from the University of Nebraska (1996), a Multidisciplinary Research Award from NU's College of Engineering and Technology (2001), and the Outstanding Scientist Award from the UNL Chapter of Sigma Xi (2006). He is also an honorary member of the State Key Magnetism Laboratory of the Chinese Academy of Sciences.


David J. Sellmyer

For well over 25 years (before "multidisciplinary" became the buzzword we use today) Sellmyer has spearheaded a highly successful effort as director of the Center for Materials Research and Analysis (CMRA), now known as the Nebraska Center for Materials and Nanoscience (NCMN), to establish a nationally-recognized program in materials science research at UNL. Under Sellmyer's leadership, the CMRA and then the NCMN proved to be a driving force for interdisciplinary research across the university. To complement the shared core instrumental facilities built by NCMN, he established, again as director, Nebraska's Materials Research Science and Engineering Center (a $5.4M NSF grant, in 2002, now considered a flagship enterprise for the University), and the Nanoscale Science and Technology Program of Excellence (2002). The NST Program of Excellence itself has resulted in several large-scale collaborative grants, including $3.05M from ONR to study nanoscale magneto-electronic structures and the first W. M. Keck Foundation grant in the State of Nebraska, to study mesospin and quantum phenomena.

Most recently he succeeded in landing a NIST Recovery Act Grant for the Construction of New Research Facilities ($6.9M, 2010). Matched by a $5M donation from two benefactors (UNL College of Engineering alumnus Don Voelte and his wife, Nancy Keegan, a former chair of the University of Nebraska Foundation's Board of Directors and current member of the board), the award allowed for the construction of the Voelte-Keegan Nanoscience Research Center. This new 32,000-square-foot facility adjoins Jorgensen Hall providing NCMN Central Research Facilities for more than 80 physics, chemistry, and engineering faculty; it will certainly be one of Sellmyer's enduring legacies. Complementing this was a multi-investigator Department of Defense award of $6.3M for "Nanoelectronic Memory, Sensor and Energy Devices" (2011), which provided new equipment for the above Nanoscience Research Center. The new center now offers researchers access to nearly $8 million in new equipment, including a $2 million high-resolution electron microscope purchased with a major research instrumentation grant from the National Science Foundation. Researchers also gain high-tech research space, including a Nanofabrication Cleanroom Facility.

In total, counting current grant commitments, David Sellmyer has been responsible for bringing in over $79M in external grants. Including state, university, and Foundation sources, he has managed a portfolio of over $105M in research support. For his four-decades record of dedication, vision, and continuing service to the University of Nebraska–Lincoln, we congratulate him on the receipt of this well-earned career award.

By Daniel Claes

Langan Named "Academic Star"

Laboratory Manager **Shawn T. Langan** (B.S. 2002, M.S. 2013) was named an "Academic Star" by the College of Arts and Sciences in June 2012. The idea behind the designation is to celebrate the achievements of academic personnel in the College with the same kind of attention given to sports stars or rock stars.

Langan manages the introductory teaching laboratories in the Department. The scope of his many activities is wide-ranging. He teaches an introductory lab section, trains teaching assistants, helps program the Department's computers, repairs lab equipment and provides other assistance to students taking introductory labs. He also is involved with outreach events, like Astronomy Day and the Saturday Science program—both of which aim to get young students interested in physics and astronomy. Since 2000, he has worked at the Behlen Observatory near Mead and has helped with the once-a-month public nights held there.

Langan says, "My intention when teaching or talking to students is two-fold. I hope students become interested in the subject matter, but also that every little bit of information will help them someday in the future. It may be years down the line… but hopefully the critical analysis skills that come with studying physics and astronomy can give them an edge in whatever life throws at them." Department Chair **Dan Claes** says Langan is innovative, enormously generous with his time, and an integral player in maintaining a welcoming environment for all of the Department's students. "He is a font of ideas with frequent suggestions for improving the on-campus experience for students, or for reorganizing resources more effectively within the Department," says Claes.

Langan traces his interest in astronomy back to his childhood fascination with *Star Wars* and *Star Trek*. That interest eventually led him to UNL as an undergraduate. He found quickly that his love for astronomy translated into a fascination with physics. "As it turns out, astronomy is purely physics applied to the sky," he said. Since 2002 when Langan joined the group of Professor Edward G. Schmidt, Langan has been a co-author on at least nine research papers concerning Type II Cepheid Variable Stars and an RR Lyrae Star.

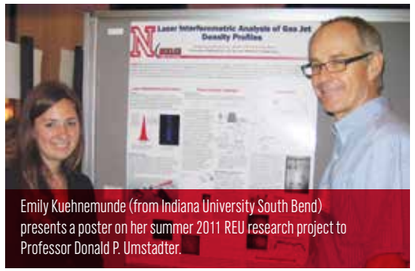
Langan obtained in 2011 a $5,000 NASA Nebraska Space mini-grant that allowed the Department to purchase computer servers and additional desktop computers for the Kositzky Computing Facility, a student resource center located in Jorgensen Hall. The computing facility was established with support from the Kositzky Memorial Equipment Fund, created by James and Jessie Coe to honor Mr. Coe's immigrant parents who encouraged their seven sons to attend the University of Nebraska. Among other winning ideas, Langan instituted a summer orientation for the Department's new graduate students and teaching assistants that culminates in a Department-wide ice cream social. He also initiated classroom observations and mid-term assessments that provide frequent and important feedback to all teaching assistants, Claes said. As of 2013, Langan is vice chair of the Nebraska Chapter of the American Association of Physics Teachers.

Langan strives to stay on top of continually advancing technology and to keep a pulse on students' evolving needs. "They really have high expectations, in a good way, as to what they can ask for in their education," Langan said. And Langan endeavors to meet those expectations.

Editor's Note: This article is adapted from a June 2012 news release and the Fall 2012 issue of the College of Arts and Sciences' Columns magazine.

DEPARTMENT NEWS

Department Hosts Summer REU Site Program on "Lasers and Optics"



Emily Kuehnemunde (from Indiana University South Bend) presents a poster on her summer 2011 REU research project to Professor Donald P. Umstadter.

For three consecutive summers (2010-2012) Professors **Kees Uiterwaal** and **Herman Batelaan** managed a National Science Foundation funded Research Experiences for Undergraduates (REU) site program on "Lasers and Optics" in our Department. Over the three summer programs, a total of 368 students applied to fill the 28 positions that were funded. Applications required transcripts, reference letters, and a letter of application. The GPA of the accepted applicants was 3.75 and 33% of the students were from underrepresented groups. Of the 28 accepted students, four came from Ph.D.-granting institutions, two from an institution having a masters program, and 22 from physics programs in which the highest degree is a bachelor of science/arts. This was consistent with the REU program's goal to help make research available to students having less access to research facilities and activities.

The students spent most of their time working on research projects in the laboratories of Profs. **S. Adenwalla, H. Batelaan, M. Centurion, D. Claes, P. Dowben, M. Fuchs, T. Gay, K. Lee, B. Shadwick, G. Snow, C. Uiterwaal,** and **D. Umstadter**. Six one-hour formal lectures on laser principles, mode-locked lasers, frequency combs and their applications, slow and fast light, non-linear optics, and the orbital angular momentum of light were also given to the students. Additional lectures on laser safety were given by the UNL Environmental Health and Safety Office. Visits were organized to local private research organizations, including KETV's "Super Doppler" weather radar station in Omaha, Advanced Medical Imaging in Lincoln (employing both X-Ray and MRI technology), the J.A. Woollam Co., Inc. in Lincoln (an optical company, founded by UNL Electrical Engineering Professor John A. Woollam, that specializes in ellipsometry), Li-Cor Biosciences in Lincoln (which designs and manufactures equipment for environmental and biotechnology research), and Airlite Plastics Co. in Omaha (which employs machine vision to manufacture plastic food and beverage containers). Social activities during the summer included an outdoor barbeque and a day of sailing at Branched Oak Lake outside of Lincoln.

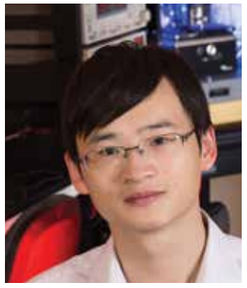
In exit interviews, the REU students reported that they had a great time and learned a lot of physics and much about its applications. Batelaan and Uiterwaal were greatly assisted throughout the summer by **Terese Janovec**, Assistant Director and Education-Outreach Coordinator of the Nebraska Center for Materials and Nanoscience. The UNL Office of Graduate Studies provided much assistance with the administration of the REU site.

BRIEFLY NOTED….

Gruverman and Tsymbal Awarded Endowed Chairs

Alexei Gruverman and **Evgeny Tsymbal** have been awarded endowed chair professorships in recognition of their outstanding research contributions and the impacts of their research on their fields. At the Honors Convocation held on April 13th, 2014, Gruverman was awarded a Charles Bessey Professorship. Gruverman joined UNL in 2007. In 2013 he was named a Fellow of the American Physical Society (APS); the nomination put forward by the APS Division of Materials Physics cited him "for pioneering contributions to the development of piezoresponse force microscopy as a probing and controlling tool of nanoscale phenomena in ferroelectric and piezoelectric heterostructures." A year earlier, at the Honors Convocation on April 14th, 2013, Tsymbal was awarded a George Holmes University Professorship. Tsymbal, director of the NSF-funded Materials Research Science and Engineering Center, joined UNL in 2002 and is renowned for his computational research elucidating fundamental properties of ferromagnetic and ferroelectric nanostructures and materials relevant to nanoelectronics and spintronics. He is also an APS Fellow.

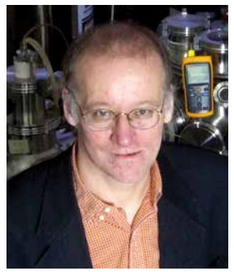
Lu Wins Outstanding GRA Award



Graduate student **Haidong Lu** (M.S. 2011, Ph.D. 2013) received an Outstanding Graduate Research Assistant Award in 2013 from the UNL Office of Graduate Studies. His doctoral thesis research adviser was Professor **Alexei Gruverman**. Lu is currently a postdoctoral research associate in Gruverman's group.

BRIEFLY NOTED….

Skomski Promoted to Research Full Professor



Ralph A. Skomski was promoted to Research Full Professor starting in the 2013-2014 academic year. His high stature in his field is apparent from the comments of his external references, one of whom said he is "unquestionably a world-leading expert in magnetic modeling of intrinsic and extrinsic properties of a variety of magnetic materials and structures." Another asserted that his Topical Review on "Nanomagnetics" [*J. Phys.:* Condens. Matter 15, R841 (2003)] is "one of the most influential theory papers" in nanotechnology. Skomski earned his Ph.D. in 1990 at the Technical University in Dresden. He did postdoctoral research at Trinity College-Dublin (1991-95) and at the Max Planck Institute for Microstructure Physics in Halle (1996-97). He joined our Department as a visiting assistant professor in 1998 and since 2000 has held research faculty appointments.

Sellmyer Named AAAS Fellow

David J. Sellmyer, George Holmes University Professor of Physics, was named a Fellow of the American Association for the Advancement of Science (AAAS) in Fall 2013. His citation reads: "For distinguished contributions to the physics of magnetic materials and nanostructures and for scientific leadership as director of the Nebraska Center for Materials and Nanoscience." Sellmyer was nominated by **Anthony F. Starace**, with supporting letters from Mildred S. Dresselhaus (Institute Professor of Physics, M.I.T.) and Ramamoorthy Ramesh (Professor of Physics and Materials Science, U.C.-Berkeley). The 2013 Fellows were honored at the AAAS Annual Meeting in Chicago in February 2014.

Three Faculty Named Outstanding Referees

The editors of the American Physical Society (APS) have recognized three additional faculty members in the Department as Outstanding Journal Referees. Associate Professor **Kirill Belashchenko** was recognized in 2014, Research Professor **Ralph Skomski** was recognized in 2013, and Research Assistant Professor **Serguei Kalmykov** was recognized in 2011. The APS Outstanding Referees Program was begun in 2008 "to recognize those scientists who have been exceptionally helpful in assessing manuscripts for publication in the APS journals." By means of the program, "APS expresses its appreciation to all referees, whose efforts in peer review not only keep the standards of the journals at a high level, but in many cases also help authors to improve the quality and readability of their articles…." Each year the APS recognizes about 150 of the roughly 60,000 currently active referees for its journals. These three faculty join six others in the Department who have previously been named outstanding referees: **I.I. Fabrikant** (2009), **T.J. Gay** (2009), **R.J. Hardy** (2008), **S. Jaswal** (2010), **A.F. Starace** (2008), and **D. Umstadter** (2008).

Gay Lectures on Football Injuries; Testifies Before Congress

Professor **Timothy Gay** lectured on "Football: Its Physics and Future" to a large audience in Memorial Stadium on April 5th, 2013. His Nebraska Lecture was sponsored by the Office of Research and the Research Council. Gay discussed the physics involved when two opposing players collide in a tackle and addressed the underlying origin of the brain injuries that may result. He covered efforts to improve player protective gear as well as rules designed to reduce injuries. He then speculated on how player injuries and the subsequent litigation against team owners may impact the future of the game. Gay is renowned for his one-minute "Football Physics" lessons that were shown during the 1999 -2004 seasons during breaks in home football games, and a similar series he did for NFL Films. He subsequently wrote a book, *The Physics of Football* (HarperCollins, New York, 2005). Most recently, he testified on March 13th, 2014, at a hearing on sports safety before the U.S. House of Representatives Energy and Commerce Subcommittee on Commerce, Manufacturing and Trade. The hearing focused on what the sports industry is doing to protect players, ranging from youngsters to professionals. Gay spoke on ways to reduce injuries in football, such as by improving equipment and introducing new game rules. Gay's Nebraska Lecture may be viewed online:
http://research.unl.edu/nebraskalectures/spring-2013-nebraska-lecture-football-its-physics-and-future/
His Congressional testimony may be viewed at 30.5 minutes into the following video:
http://www.c-span.org/video/?318281-2/sports-safety-brain-injuries-scientific-panel

Rhynalds Named Instrument Shop Manager

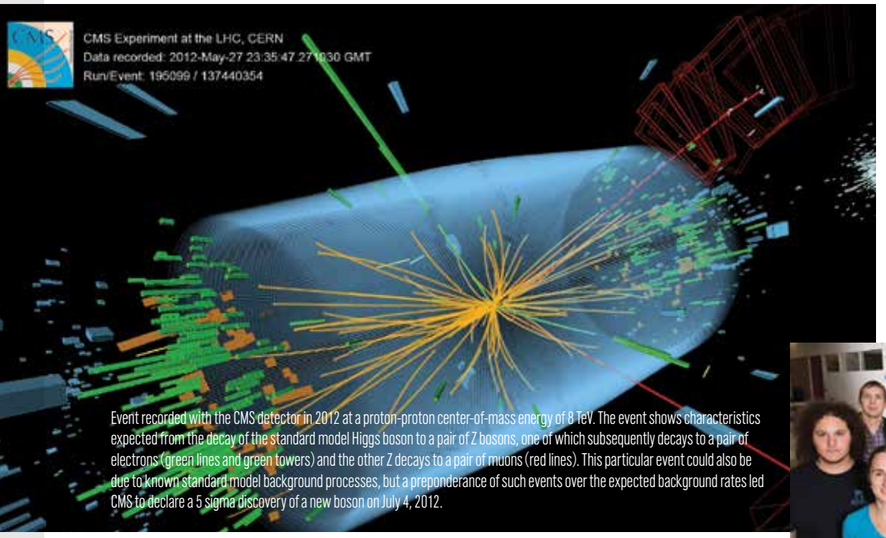
Robert (Bob) Rhynalds, a scientific instrument maker in the Instrument Shop serving the Departments of Chemistry and Physics and Astronomy, has been promoted to manager of the Instrument Shop. He succeeds **Mike Jensen**, who left in 2012 to manage the Physics Department Instrument Shop at the University of Minnesota. Rhynalds joined our Instrument Shop in 2001. In March 2010, he won a College of Arts and Sciences Applause Award in recognition of his high standards of quality and craftsmanship, the pride and genuine interest he takes in his projects, and for his ability to solve difficult problems. More recently, he was recognized at the October 28th, 2011, NU Board of Regents meeting with a University KUDOS Award, which noted, in addition to his superb skills, the valuable guidance and education he provides students concerning their shop projects. Besides Rhynalds, the shop staff includes three other instrument makers: **Keith A. Placek, Patrick Pribil, and Michael Thompson**. Owing to increases in the number of external grant awards and in the number of new faculty hires, demand for shop services has increased significantly. To meet these needs of cutting-edge research, the Shop is continually enhancing its capabilities.

HEP Group Part of Higgs Boson Discovery

UNL's experimental high-energy physics team, along with colleagues from around the world, had good reason to celebrate in 2012. For decades, they've pursued a collaborative hunt for the elusive Higgs boson particle. Finally in July 2012, physicists at the CERN laboratory in Switzerland announced the observation of a new particle whose characteristics matched the long-theorized Higgs boson. Two competing experiments, the ATLAS and the CMS collaborations, independently confirmed the result. The CMS experiment, which UNL's high energy physics (HEP) group is part of, published its definitive result in the 17 September 2012 issue of *Physics Letters B* ["Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC," *Phys. Lett. B* 716, 30 (2012)]. In October 2013, the Royal Swedish Academy of Sciences awarded the Nobel Prize in physics to theorists Peter Higgs and Francois Englert to recognize their work developing the theory of what is now known as the Higgs field. The Higgs boson proves the existence of the Higgs field.

Dubbed by the media as the "God Particle," the Higgs boson explains why some particles have mass and others do not, according to Professor **Gregory Snow**. CERN's atom-smashing Large Hadron Collider has been generating high-energy collisions of protons in its search for this final piece of the theoretical framework known as the Standard Model of particles and forces. Without the Higgs boson, the Standard Model cannot explain how most of these particles acquire their mass, a key ingredient in the formation of the universe.

"We now have firm, statistically significant evidence that we've observed a new particle—a particle that has a mass that is consistent with what we have expected to see with the Higgs boson," said Snow, founding member of UNL's team that has aided in the Higgs search since 1993. UNL's contributions to the CMS experiment included the construction, installation, and monitoring of the silicon tracking detector, which helped identify traces left by the particle's decay. The team also contributed to different aspects of data analysis with CMS as the pursuit of the particle narrowed.



Event recorded with the CMS detector in 2012 at a proton-proton center-of-mass energy of 8 TeV. The event shows characteristics expected from the decay of the standard model Higgs boson to a pair of Z bosons, one of which subsequently decays to a pair of electrons (green lines and green towers) and the other Z decays to a pair of muons (red lines). This particular event could also be due to known standard model background processes, but a preponderance of such events over the expected background rates led CMS to declare a 5 sigma discovery of a new boson on July 4, 2012.

Figure 1: Members of UNL's experimental high-energy physics team. Back row: Ilya Kravchenko, Daniel Knowlton (M.S. 2011), Daniel Claes, Rami Kamalieddin, and Gregory Snow. Middle row: Cameron Bravo (B.S. 2013), Ekaterina Avdeeva, Kenneth Bloom, and Aaron Dominguez. Front, center: Rachel Wilken. Bravo was an undergraduate student and Avdeeva, Kamalieddin, and Knowlton are current graduate students in our HEP program. Wilken was a visiting graduate student from the HEP group at the University of California-Riverside. (Photo by Craig Chandler, University Communications)

Along with Snow, the UNL team includes Associate Professor **Kenneth Bloom**, Professor and Department Chair **Daniel Claes**, Associate Professor **Aaron Dominguez**, and Associate Professor **Ilya Kravchenko**, as well as several other researchers working in Lincoln, at CERN in Switzerland and at the Fermi National Accelerator Laboratory in Batavia, Ill.

The vast majority of U.S. scientists participate in the Large Hadron Collider experiments from their home institutions, remotely accessing and analyzing the data through high-capacity networks and grid computing. UNL is one of seven CMS Tier-2 sites in the United States in the Worldwide LHC Computing Grid, which combines the computing power of more than 140 independent computer centers in 34 countries to analyze results from the Large Hadron Collider's experiments.

Kenneth Bloom is the Tier-2 Project Manager for the United States in the CMS experiment and is co-primary investigator on the UNL part of the project with Aaron Dominguez and computer scientist David Swanson, director of UNL's Research Computing Facility. Bloom is also Deputy Program Manager for U.S. CMS software and computing.

More than 1,700 scientists, engineers and graduate students from the United States collaborate on the experiments at the Large Hadron Collider, most of them on the CMS and ATLAS experiments, through funding by the Department of Energy Office of Science and the National Science Foundation.

In many ways, Claes said, this announcement means the work has just begun. Scientists will need to observe and precisely measure that the particle's behavior is consistent with theoretical predictions. Its discovery represents only a first step into a new realm of understanding the world around us.

"While the discovery of the Higgs may appear to close the list of fundamental particles required by the existing theory, the truth is that the theory still has some mathematically inconsistent pieces that suggest there is actually more to be discovered," Claes said. "There is still a lot to explore."

Editor's Note: This article is an edited and updated version of an article in the Fall 2012 issue of the College of Arts and Sciences magazine, Columns.

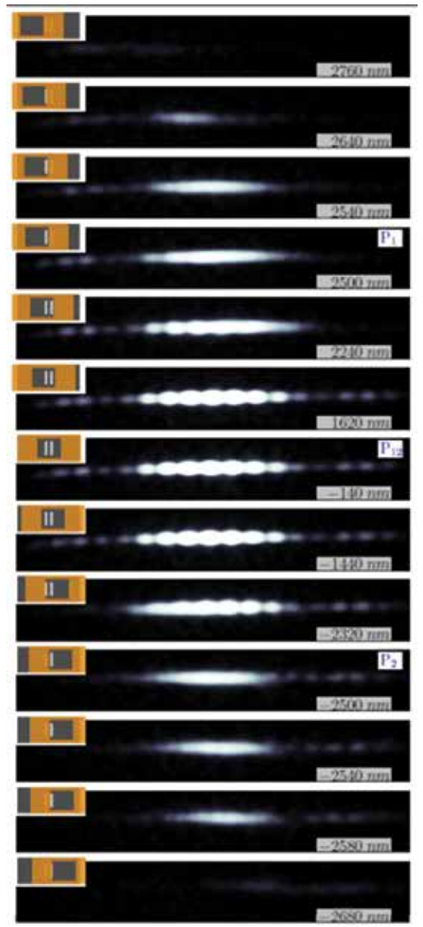
Batelaan Group Demonstrates Controlled Double Slit Electron Diffraction

In 2008, Professor **Herman Batelaan** received a phone call from Damian Pope, the outreach director of the Perimeter Institute for Theoretical Physics in Waterloo, Ontario. The Institute was making educational movies for high school students on topics that would cover exciting physics. Pope wished to cover wave-particle duality to highlight the mystery of quantum mechanics. The Institute had found electron diffraction data taken for a grating by **Roger Bach** (M.S. 2011) when he was an undergraduate student in Batelaan's group. Batelaan looked at the Institute's movie on dark matter, liked it, and agreed to participate. The Institute film staff would need to come for two days, and a date was set. Damian Pope had one small question. Would it be possible to replace the grating with a double slit? Batelaan approached Professor **Sy-Hwang Liou**, and with his help the double slit was made and the experiment was put together. The film crew was enjoyable to work with. They in turn noted that it was great fun to film Batelaan's group at work.

The script called for following Feynman's account of the double slit experiment as given in *The Feynman Lectures on Physics, Vol. III*. In researching the literature, Batelaan and his group found to their surprise that no one had actually done an experiment showing the build-up of the electron diffraction pattern one electron at a time. Akira Tonomura's famous build-up pattern (that one can find in *Wikipedia* and in many books) is actually done for a biprism wire. This may not matter much for a physicist, but for the high-school audience for which the film is targeted it is best to be as close to the original thought experiment as possible. The filming worked out nicely and the Batelaan group's experiments appear in the Perimeter movie "The Challenge of Quantum Reality," which also features Stephen Hawking.

Roger Bach, who continued to work in Batelaan's group as a graduate student, decided that he wanted to make the experimental data better, since the double slit experiment had not yet been published. The group's results were published in the *New Journal of Physics* [R. Bach *et al., New J. Phys.* **15**, 033018 (2013)] with supplementary movies of the build-up of the double slit diffraction pattern, one electron at a time [http://iopscience.iop.org/1367-2630/15/3/033018/media]. Roger added results obtained when one or the other of the two individual slits were closed, as Feynman ordered, for good measure (see figure).

The double-slit story does not end there. In a meeting in Italy in 2010, Batelaan learned of recent work in Paris showing "wave-particle duality" behavior for bouncing oil droplets. The droplets were about 1 mm large and their behavior is in the classical regime. **Eric Jones**, another graduate student in Batelaan's group, has worked on reproducing the oil droplet features reported by the French group. That oil droplets "diffract" is not supposed to be possible, at least if you would believe Feynman. After all, the individual detection clicks and the interference pattern are "the only mystery" of quantum mechanics, and are completely non-classical. What does the oil drop experiment mean for microscopic or quantum-mechanical wave-particle duality? An international group of physicists (labeled the "band of rebels" by Morgan Freeman's televised show "Through the Wormhole," which popularizes science) is searching for a theory of "emergent quantum mechanics." Such a theory would be one that can have hidden variables from which (upon averaging) quantum mechanics emerges. 't Hooft comments on such theories that this may be possible, but you should be careful what you wish for as the theory may be so complex as to not be very useful. Batelaan's group plans to stick with quantum mechanics, at least for the time being.



Double slit electron diffraction patterns as the transmission "window" in the upper left inset figures moves across the double slit.

Gruverman Group Demonstrates Mechanical Writing of Ferroelectric Polarization

An international collaboration led by Professor **Alexei Gruverman** and graduate student **Haidong Lu** (M.S. 2011) reported in the 6 April 2012 issue of *Science* the ability to change the polarization of a nanometer thick ferroelectric film using the sharp needle of an atomic force microscope (AFM). The physical mechanism is flexoelectricity, the coupling between polarization and a strain gradient. Usually the flexoelectric effects are weak, but owing to the small size of the sharp needle tip of the AFM, the strain gradients can be very large over nanoscale lengths. The strain gradients produced by the AFM tip and their associated electric fields were found to be so large that they enabled the voltage-free writing of the polarization of the ferroelectric material by purely mechanical means. The tip-sample contact width is typically less than 10 nanometers (10 billionths of a meter). The authors say that these results "open a way to write ferroelectric memory bits using mechanical force."

The advantage over the usual means to change the polarization of a ferroelectric material using voltage bias is the much smaller area over which data bits can be written and much less energy required for bit writing. For this reason there may be important applications for creating novel energy-efficient data storage devices having much higher data storage capacities.

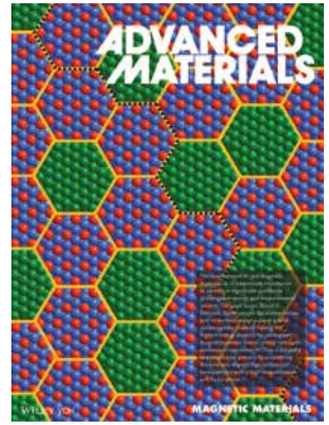
Among other advantages of mechanical switching are: (i) the domain patterns remain stable for days; (ii) the mechanically-written domain patterns are electrically erasable; and (iii) there is no damage to the sample surface. J. Marty Gregg of Queen's University in Belfast wrote a comment on the paper in the same issue of *Science*. He said "…although part of the success in the study by Lu et al. has been to specifically demonstrate that stress field gradients can be large enough to induce ferroelectric switching, [the authors'] breakthrough is actually more general—that nanoscale systems represent the ideal environment in which to capitalize upon field gradient effects."

"There may be important applications for creating novel energy-efficient data storage devices having much higher data storage capacities."

Editor's Note: A Science podcast interview with Alexei Gruverman concerning this paper is available on his Web page: http://physics.unl.edu/gruverman/node/1

Sellmyer Team Develops Novel High-Performance Nanomagnetic Materials

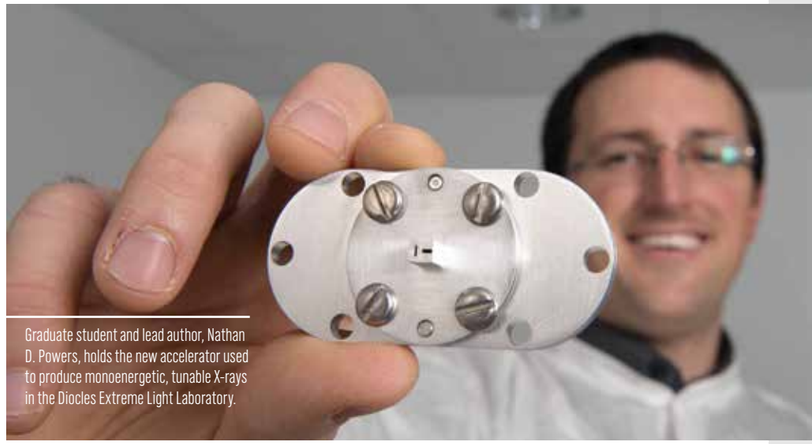
A research team based in the physics department and the Nebraska Center for Materials and Nanoscience led by George Holmes University Professor **David J. Sellmyer** has reported a novel technique for creating permanent magnetic materials that avoid use of expensive platinum or scarce rare-earth elements. The development of more powerful new iron- or cobalt-rich permanent magnetic materials is essential for a host of technologies having applications ranging from more efficient appliances and highly sophisticated microelectronics devices to green energy technologies such as those that underlie hybrid vehicles. The creation of bulk high performance magnetic materials is fraught with difficulties ranging from their often unstable structures and the need for high fabrication temperatures. These problems were avoided by Sellmyer's team by synthesizing magnetic materials as composites of nanoparticles smaller than 10 nanometers in diameter.



The new material demonstrated by the UNL team was comprised of aligned 8 nm Zr_2Co_{11} clusters embedded in a $Fe_{65}Co_{35}$ alloy with high magnetization. This nanocomposite magnetic material was found to have double the energy product of conventional rare-earth-free magnetic materials. (The energy product of a magnetic material is the product of the magnetic field induction B and the internal magnetic field H; it is a figure of merit for magnetic materials.) The team's results [B. Balasubramanian et al., "Novel Nanostructured Rare-Earth-Free Magnetic Materials with High Energy Products," *Advanced Materials* **25**, 6090 (2013)] were featured in the journal *Advanced Materials* (see figure). Co-authors of the work included post-doctoral research associates **Balamurugan Balasubramanian** and **Wenyong Y. Zhang,** graduate student **Bhaskar Das,** Research Professor **Ralph Skomski**, and Sellmyer.

Umstadter Team Develops a New Way to Generate Synchrotron X-rays

X-ray synchrotron light is now the standard tool used in physics, chemistry, biology and materials research. Fifty campus-sized synchrotron facilities exist worldwide. In 2013 researchers in the Diocles Extreme Light Laboratory, led by Professor **Donald P. Umstadter**, developed the first monoenergetic and tunable laser-driven synchrotron x-ray source, which is 1,000 times brighter than the previous state of the art. Because the new x-ray device can be small enough to fit in a hospital or on a truck, it may lead to more widespread applications of advanced x-ray technology. In traditional synchrotron machines, electrons are accelerated to extremely high energy and then made to change direction periodically, leading them to emit energy at x-ray wavelengths. Magnets are used to change the direction of the electrons and thereby produce the x-rays. Umstadter's research team instead drives both the electron accelerator and the magnets with laser light. They first focus their laser beam onto a gas jet, creating a beam of relativistic electrons, and then focus another laser beam onto the accelerated electron beam. This latter beam vibrates the electrons rapidly, which in turn causes them to emit a bright burst of synchrotron x-rays — a process referred to as inverse Compton scattering. The new laser-driven device also produces X-rays over a much larger range of photon energies, extending to the energy of nuclear gamma rays. The results were published in the paper by **N.D. Powers** et al., "Quasi-Monoenergetic and Tunable X-Rays from a Laser-Driven Compton Light Source," *Nature Photonics* **8**, 28 (2014), which is becoming highly cited and downloaded. The results have also been covered in at least 12 news outlets internationally.



Graduate student and lead author, Nathan D. Powers, holds the new accelerator used to produce monoenergetic, tunable X-rays in the Diocles Extreme Light Laboratory.

Tsymbal Group Participates in Discovery of New Class of Materials

An international team of scientists, including George Holmes University Professor **Evgeny Y. Tsymbal**, Research Assistant Professor **J. B. Burton** (B.S. 2003, M.S. 2006, Ph.D. 2008), and former graduate student **Yong Wang** (M.S. 2007, Ph.D. 2011), has discovered a new class of materials that could prove to be very useful in developing new methods of creating computer memory. In the 18 September 2012 issue of *Nature Communications*, the group reported the discovery of high-quality artificial tri-layer superlattices with asymmetric structure composed of non-ferroelectric material layers that nevertheless show distinct ferroelectric behavior that can be tuned by an applied magnetic field. Density functional theory calculations by Tsymbal's group indicated that the broken space inversion symmetry was the origin of the observed behavior. This discovery opens the way for fabrication of a plethora of artificial ferroelectric and magneto-electric low-dimensional devices having the tri-layer superlattice structure and composed of transition metal oxides. These artificial materials may lead to new types of data storage devices.

A ferroelectric material exhibits spontaneous electric polarization, characterized by a positive electric charge on one side of the material and negative on the opposite side. The polarization can be reversed by applying an electric field (from a battery, for example). These two possible polarization orientations make these materials attractive for developing computer memory because each orientation could correspond to zero or one.

Hellas in Greece, Nanyang Technological University in Singapore, and Sungkyunkwan University in South Korea. Using advanced synthesis methods, scientists were able to fabricate heterostructures by depositing atomic layers of different materials, layer-by-layer, in stacks of thickness of a few nanometers (one nanometer is 1 billionth of a meter). Although neither of the constituent materials were ferroelectric, the composed heterostructures showed a pronounced ferroelectric polarization.

The nature of this phenomenon was unclear at first, but Tsymbal's group found the explanation of this behavior. They modeled the atomic structure and electronic properties of these materials by performing computations at UNL's Holland Computing Center, which indicated that interfaces between the constituent materials in the heterostructures were responsible for the observed novel properties.

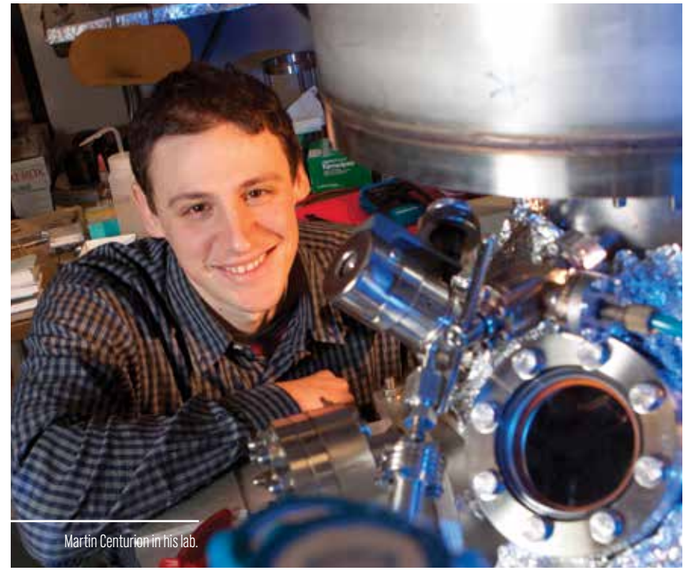
"Crucially, our computations and analysis were decisive for the understanding of the origin of ferroelectricity in the experimentally synthesized heterostructures," Tsymbal said. "We were able to elucidate the microscopic mechanism responsible for their exciting properties." In addition, Tsymbal said, the discovered materials exhibited magnetoelectricity, an important functional property that allows one to affect electric polarization by the application of a magnetic field. "This functionality is especially interesting because of potential application in electrically-controlled data storage with significantly reduced energy consumption," Tsymbal said. "Our MRSEC dedicates strong efforts to study magnetoelectric materials and has international recognition in this field of research."

"Our discovery shows a possibility that researchers could engineer properties at the atomic scale and create new, artificial materials exhibiting novel functional properties not existing in their constituents," said Tsymbal, who is director of UNL's Materials Research Science and Engineering Center (MRSEC). "This significantly broadens the class of known ferroelectric materials and provides possibilities to design new ferroelectrics."

The new materials were fabricated and characterized by researchers from the Foundation for Research and Technology-

Editor's Note: This article is adapted from a 19 September 2012 UNL Newsroom Announcement by Tom Simons.

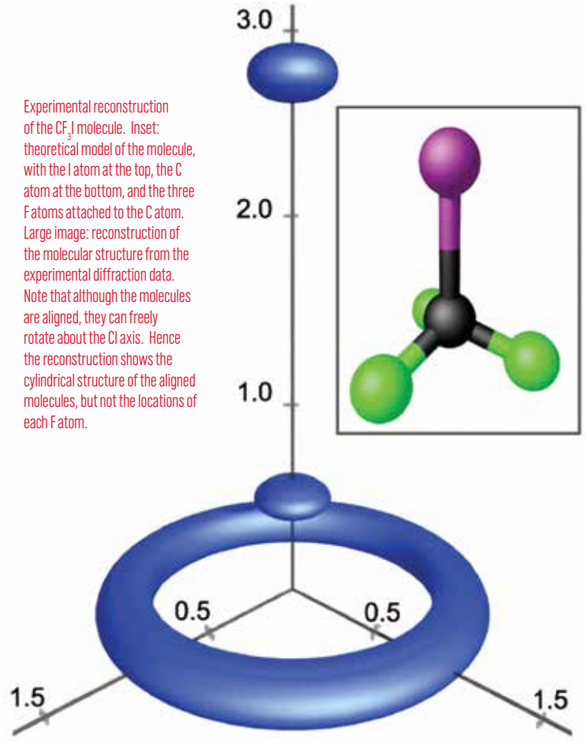
Centurion Group Images Molecules with Electron Pulses



Martin Centurion in his lab.

In a Letter entitled "Imaging of Isolated Molecules with Ultrafast Electron Pulses" published in the 28 September 2012 issue of *Physical Review Letters*, Associate Professor **Martin Centurion**, postdoctoral research associate **Christopher J. Hensley**, and graduate student **Jie Yang** reported the achievement of a long-standing research goal: imaging isolated molecules in three dimensions with atomic resolution. The ability to make such images is essential for elucidating the structure of complex molecules. It is also desirable for determining the intermediate states in molecular transitions.

The group obtained three-dimensional (3-D) structural information of the highly-symmetric CF_3I molecule (trifluoroiodomethane) by the following procedure: They first aligned the randomly-oriented molecules along the central CI axis with an intense, ultrashort (300 fs) laser pulse. When the molecules were maximally aligned, they then diffracted a collimated ultrashort (500 fs) beam of about 2000 electrons, each having an energy of 25 KeV from the molecules. From multiple diffraction patterns obtained in this way, the group used novel numerical algorithms to deduce the molecular structure. The group's results are the first of their kind with temporal resolution better than 1 ps. [Note: One picosecond (ps) is one trillionth of a second; 1 femtosecond (fs) is one thousandth of a picosecond.]



Experimental reconstruction of the CF_3I molecule. Inset: theoretical model of the molecule, with the I atom at the top, the C atom at the bottom, and the three F atoms attached to the C atom. Large image: reconstruction of the molecular structure from the experimental diffraction data. Note that although the molecules are aligned, they can freely rotate about the CI axis. Hence the reconstruction shows the cylindrical structure of the aligned molecules, but not the locations of each F atom.

This new technique provides in principle a means to obtain 3-D images of molecules that cannot be crystalized. However, Centurion's team is focusing on imaging molecular dynamics, i.e., fast structural changes during molecular reactions. "We are now getting to the more exciting part of the project," he says. One of the first molecules that may be investigated is retinal, which is involved in vision. Retinal changes shape rapidly when it absorbs light. "We know what it looks like before and after, but not in between," Centurion says. The team also plans to observe molecules involved in photosynthesis in order to determine how plants convert sunlight to chemical energy. Understanding this process may lead to improved solar energy conversion efficiency. Also, understanding damage to DNA molecules when they absorb UV radiation from the Sun may lead to better understanding of skin cancer and thus of better means to prevent it or treat it.

Editor's Note: This article is adapted from the published paper in Physical Review Letters, the Physics Focus article on that paper by Michael Shirber, and the UNL News Release dated 3 October 2012 by Gillian Klucas.

Richards-Kortum Wins 2013 Lemelson-MIT Award


Rebecca Richards-Kortum

On Valentine's Day in 2013 **Rebecca Richards-Kortum** (B.S. 1985), Stanley C. Moore Professor and Chair of Bioengineering at Rice University, and her colleague, Professor Z. Maria Oden, learned that they had jointly won the $100,000 *Lemelson – MIT Award for Global Innovation.* The award recognizes the co-winners for their life-saving inventions and pioneering efforts to inspire and lead students to invent and deliver low-cost technological innovations to improve health care for people in developing nations. The co-winners donated their award toward the construction of a new neonatal ward at Queen Elizabeth Central Hospital in Blantyre, Malawi. "Each year, more than 3 million babies die within the first month of life," Oden said. "Ninety-nine percent of those deaths happen in the developing world, and many of them could be prevented if hospitals in low-income countries had access to a few low-cost technologies that combat the most common causes of infant mortality." Richards-Kortum said that "Queen Elizabeth Central Hospital … is an extraordinary place that is committed to caring for the world's most vulnerable patients. The physicians there have shown us how simple innovations can dramatically improve neonatal health, and they've inspired us to engage our students in solving the challenges of newborn care in low-resource settings."

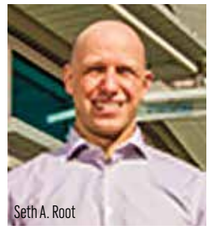
Richards-Kortum is director of *Rice 360°: Institute for Global Health Technologies*, which she founded in 2007. In 2005, with the support of the Howard Hughes Medical Institute, she founded Rice 360°'s undergraduate educational initiative, *Beyond Traditional Borders* (BTB). The BTB curriculum has been institutionalized at Rice as an undergraduate minor in global health technologies. Richards-Kortum's bioengineering research lab develops miniature imaging systems to enable better screening for oral, esophageal, and cervical cancer and their precursors at the point of care in low-resource settings. Her group also works to integrate advances in nanotechnology and microfabrication to develop novel, low-cost sensors to detect infectious diseases, including cryptosporidium, malaria, and tuberculosis. In 2008, she was inducted into the U.S. National Academy of Engineering. She is also a fellow of the Biomedical Engineering Society and the American Association for the Advancement of Science.

Editors Note: This article is based on material posted on the Web pages of Rice University's Department of Bioengineering. For a video in which the co-winners discuss their plans for the award, see: http://www.youtube.com/watch?v=nE4TePkhHWo&feature=youtu.be

Root Receives PECASE Award

The White House announced on 23 December 2013 that **Seth A. Root** (B.S. 2000, M.S. 2002, Adviser: **Robert Hardy**) was one of 102 researchers to receive a 2014 Presidential Early Career Award for Scientists and Engineers (PECASE), "the highest honor bestowed by the United States Government on science and engineering professionals in the early stages of their independent research careers." The awards were established by President Clinton in 1996. Awardees are either employed or funded by the Federal government. They "are selected for their pursuit of innovative research at the frontiers of science and technology and their commitment to community service as demonstrated through scientific leadership, public education, or community outreach."

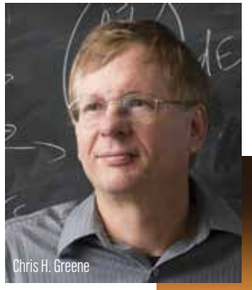
Seth Root is a researcher with Sandia National Laboratory in Albuquerque, NM. As a graduate student at UNL, he worked with Professor Robert J. Hardy on shock wave phenomena. He earned his doctorate in physics from the Institute of Shock Physics at Washington State University. One experiment he did as a graduate student there involved observing how benzene, a highly flammable liquid, reacted under the pressure of a shock wave. In the Summer 2005 issue of *Washington State Magazine*, he was quoted as saying, concerning the project he spent a week preparing and an entire day setting up, "My whole experiment is going to last less than two microseconds….You know, in my three years here, my total experiment time is less than one second."


Seth A. Root

Root joined Sandia in 2008 for the opportunity to work on the Z machine, the world's largest pulsed-power facility. "You are working on a platform that can generate pressure and temperature regimes that are accessible almost nowhere else to understand material behavior at extreme conditions," he said. Root's team combines theoretical and experimental methods to noble gases—which are odorless, colorless, and chemically inert under standard conditions—at extreme pressures and high temperatures. In one experiment, the physicists cryogenically cooled xenon gas to a liquid and then shock-compressed it to 8 million atmospheres of pressure. "We were able to show that density-functional-theory simulations can capture the response of the liquid xenon at very high pressures," Root said. The research helps explain the physics of atoms with relatively high numbers of electrons and has helped verify and improve theoretical methods used in computer simulations.

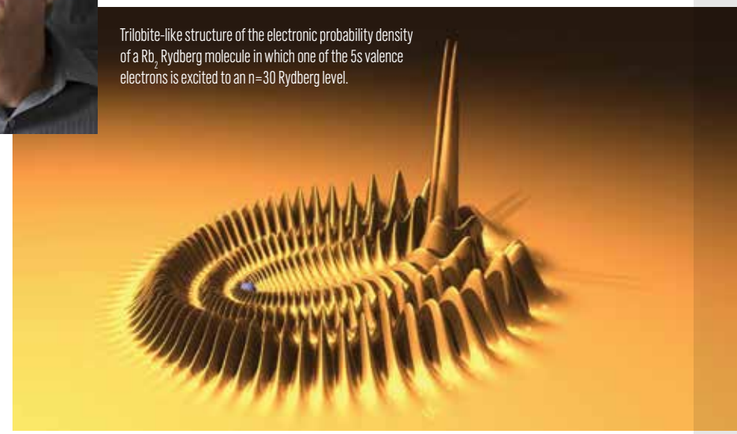
Editor's note: This article is based upon the press releases of the White House (23 December 2013) and Sandia National Laboratory (17 February 2014).

Greene Wins Hamburg Prize for Theoretical Physics


Chris H. Greene

On November 14th, 2013, **Chris H. Greene** (B.S. 1976), Distinguished Professor of Physics at Purdue University, was awarded the Hamburg Prize for Theoretical Physics at the University of Hamburg, Germany for his 2000 prediction of highly-excited Rydberg molecules, which were experimentally observed in cold atomic gases in 2008. The 40,000 Euro prize was established in 2010 by the National Center of Excellence on "Frontiers in Quantum Photon Science" and is funded by the Joachim Herz Foundation. The prizewinner is selected and awarded by the Hamburg Center for Ultrafast Imaging, where the winner presents a lecture at the award ceremony. Greene has previously been awarded the American Physical Society's Davisson-Germer prize (in 2010) and its first I.I. Rabi Prize (in 1991).

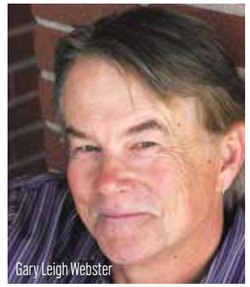
The prizewinning work [C.H. Greene, A.S. Dickinson, and H.R. Sadeghpour, "Creation of Polar and Nonpolar Ultra-Long-Range Rydberg Molecules," *Phys. Rev. Lett.* **85**, 2458 (2000)] predicted that Bose-Einstein-Condensates have the temperature and density sufficient to allow the existence over long times (10-100 msec) of the largest molecules ever produced (of the order of a thousand Bohr radii). Moreover, the highly-excited Rydberg electron (having a principal quantum number n of about 30) would be highly degenerate and might have large orbital angular momentum. Such a molecule is predicted to have a large, permanent dipole moment that could be easily manipulated and controlled with a static electric field. Since the highly-excited electron's wave function would have many oscillations (and consequently many nodes), its structure can appear similar to that of a trilobite fossil. Hence, following the publication of the paper, the term "trilobite molecule" entered the physics lexicon.


Trilobite-like structure of the electronic probability density of a Rb_2 Rydberg molecule in which one of the 5s valence electrons is excited to an n=30 Rydberg level.

Chris Greene moved to Purdue in August 2012 following a highly successful tenure during 1989-2012 at the University of Colorado at Boulder, where he held the positions of Professor of Physics and Fellow of JILA. At Purdue, he is building a program in atomic, molecular and optical physics. His charge is to hire four additional faculty, two theorists and two experimentalists. Last year one of the theory positions was successfully filled. This year a search for an experimentalist is under way.

Webster's Career Takes a Dramatic Turn

Following his retirement in 2009 as a guidance engineer with the United Launch Alliance, a joint venture of Lockheed Martin and Boeing that provides reliable space launch services for the U.S. Government, **Gary L. Webster** (Ph.D. 1981, Adviser: **Anthony Starace**) rearranged his life to pursue his passions and remain as busy as ever. Among those passions is the theatre. Over the past decade, Gary has performed in numerous community theatres in and around the Denver area. In March and April 2013, he played the role of Dad in the play *Leaving Iowa*, performing with the Evergreen Players at Center/Stage in Evergreen, CO. In September 2012, he played the role of Charlie in the play *August: Osage County* at The Dairy Center for the Arts in Boulder, CO. He has also played the roles of Norman in *On Golden Pond*, Serge in *ART*, Chico in *Groucho*, and many more, generally performing in one or two plays per year. Since 2006, Gary has also written ten plays. His most recent play, *A Simple Case*, was performed as a staged reading in November and December 2013 at the John Hand Theater in Denver, CO, by the Firehouse Theater Company. The play concerns a female detective operating in a man's world as she pursues an investigation in Fort Worth, TX in 1963.

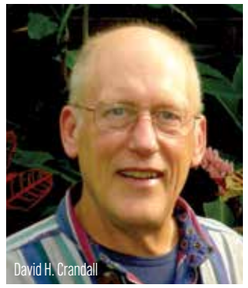

Gary Leigh Webster

Teaching is another of Gary's passions. Together with his wife, Kathy, the Websters operate a tutoring business. While Kathy tutors elementary school students, Gary tutors high school students in math, physics, chemistry, English, etc. Gary also prepares students for the ACT, SAT, and PSAT standardized examinations.

An avid tennis player, Gary is also an assistant tennis coach at Mullen H.S., a Roman Catholic college-preparatory high school in Denver. Gary coaches the junior varsity (JV) men's team in Fall, and the JV women's team in Spring. Besides coaching tennis, he himself competes in U.S. Tennis Association League matches.

Gary and his wife Kathy reside in Littleton, CO. Email: *gleighweb@gmail.com*

Crandall Completes Distinguished Career at DOE


David H. Crandall

David H. Crandall (M.S. 1967, Ph.D. 1970; Adviser: **Duane Jaecks**) retired from the Department of Energy (DOE) on March 8, 2013 as Advisor to the Under Secretary for Science after 30 years of federal government service. David began his DOE career in the Fusion Energy program as Branch Chief for Experimental Plasma Research in 1983. In 1987, he became Director of Applied Plasma Physics and was promoted to the government's Senior Executive Service, its highest career level. He writes that he "enjoyed leading such complex science endeavors as the Tokamak Transport Initiative and the Numerical Tokamak Project." On the other hand, he was the one selected to follow and report on "cold fusion" when that fiasco happened. Among his initiatives, he established an inertial fusion energy component to the fusion energy budget in 1992. In 1995, he joined the Defense Programs part of DOE as the headquarters leader for the National Ignition Facility (NIF), a $3.5 billion facility at Lawrence Livermore National Laboratory (LLNL) that leads inertial confinement fusion research today. In 2000, David became Assistant Deputy Administrator for Research, Development, and Simulation in the newly-established National Nuclear Security Administration (NNSA, part of DOE), overseeing about $2.5 billion/yr of nuclear weapons research at LLNL, Los Alamos National Laboratory (LANL), Sandia National Laboratory (SNL) and the Nevada Test Site (NTS, now NNSS). In 2006, he received a Presidential Rank Award for Meritorious Senior Professionals for his "sustained extraordinary accomplishments" as a member of the career Senior Executive Service.

In 2008, David was named Chief Scientist for the NNSA and enjoyed the latter part of his career advising political appointees at DOE on a broad range of science issues ranging from highly classified topics to energy/climate. In late 2010, he took an assignment as Advisor on Inertial Fusion and National Security to the Under Secretary for Science at DOE, Dr. Steven E. Koonin (former professor of theoretical physics and provost at California Institute of Technology), whom David came to greatly admire. That assignment gave him the opportunity to work again on fusion energy and a wide range of Under Secretary Koonin's other initiatives, a number of which David completed as his final work within DOE. David currently serves as a senior adviser to TechSource, a science and engineering consulting firm in Germantown, MD.

David was the first Ph.D. student of Professor Emeritus **Duane H. Jaecks**. He and **Ronald H. McKnight** (M.S. 1964, Ph.D. 1970) worked with Jaecks on ion-atom atomic collisions starting in 1967. (They have remained good friends ever since and worked together for a time at DOE; they get together regularly in the Rockville, MD area to play golf, talk about science, and watch Big Red football games.) After graduation, David spent a year as a visiting assistant professor of physics at the University of Missouri at Rolla teaching and doing ion-atom collision research while filling in for **John T. Park** (Ph.D. 1963; Adviser: **E. Zimmerman**), who was on sabbatical leave. (John later became Chancellor of the University of Missouri system.) In 1971, David moved to the Joint Institute for Laboratory Astrophysics (JILA) as a postdoc with Gordon Dunn. There he measured electron-ion collision cross sections, wrote his first successful proposal, and made two lifelong friends: his wife Ellen and his lab partner, Ronald A. Phaneuf. David writes that two seminars at JILA stimulated his interest: one on inertial confinement fusion and the other on the first observation of a black hole. In 1974, he and Ellen moved to Oak Ridge National Laboratory (ORNL), where David was a researcher and program manager until he joined DOE in Germantown, MD, in 1983. During that time his friend Ron Phaneuf also came to ORNL from JILA and they collaborated for 9 years researching atomic collisions, including ones important for nuclear fusion. In 1983, that work was recognized by the American Physical Society (APS), which named him a Fellow of the APS "for his major role in establishing the field of study of collisions of multiply-charged ions with electrons and atoms, and for his definitive and revealing measurements in that field."

David writes that he values all aspects of his career. In particular, the science of energy, climate change, nuclear security, materials behavior, and the workings of the cosmos are all topics he has experienced in some depth and they continue to hold his interest. For example, in March 2014 he gave two talks on inertial confinement fusion in China. He asserts that "all fusion research is highly challenging and interesting science and will continue to be so for a number of years before it can be developed for energy."

Dave lives with his wife Ellen in Rockville, Maryland just outside the DC beltway on a 1.4 acre piece of "country in the city." Ellen teaches grade school art and Dave plays plenty of golf. ("Thank you, **Ted Jorgensen**!") He and Ellen have a son, Brian; David also has two daughters, Kathryn and Christine, by a previous marriage.

Eddy, Kumru, Liu, and Yarkosky Speak at Recognition Luncheons

Four alumni returned to the Department over the past three years to speak to our graduating students at our annual Recognition Luncheons. The distinguished alumni are usually chosen from among those who have forged successful careers outside a typical academic physics career (with which students are already quite familiar). The alumni usually reminisce about their student days, describe their career paths, and then advise our students of the lessons they have learned along the way.


Stephan M. Eddy

Stephan M. Eddy (B.S. 1978) was the featured speaker on 2 May 2013. According to the "Executive Summary" of his life, he is "a Military Brat, born in Montgomery, AL and experienced a childhood on the move, going from there to CT, CA, CT, CA, France, England, ND, FL, and MO before moving to NE." He graduated from high school in Nebraska City in 1973. Influenced by his parents and his father's best friend, a physicist/mathematician who flew F-86s during the 1950s, Steve resolved to be a physicist and astronomer by the 7th grade. When accepted by UNL, he declared an astronomy major, which he regards as "the 2nd or 3rd best decision" he ever made.

After graduation, he went briefly into construction, but then joined Schlumberger, a world leader in oil and gas exploration. Over the course of his career there, he moved up from being a *Field Engineer* (performing oil well engineering services) to *Staff Quality Engineer* (implementing testing procedures and managing test personnel) to (offshore) *Field Service Manager* (managing personnel and a budget of $25 million) to *Quality, Health, Safety, and Environment Manager* in Houston (covering 5000 people over three different sites). Upon his retirement from Schlumberger in 2005, he moved to Palm Harbor, Florida. He currently serves as a *Behavioral Analyst and Senior Consultant* with Bovo-Tighe, LLC. In that position, which involves travel to such places as Prudhoe Bay above the arctic circle, various other places in the oil patch, and sometimes even to Washington, DC, he coaches "business folk and engineers regarding their communication and trust-building capabilities and capacities."

Eddy told our students that physicists are needed in the real world for their high capacity to solve ill-defined problems. He remarked that many real world problems have analogies to physics phenomena. As a student at UNL, he recalled how much he enjoyed learning how things really work. He also was impressed by how smart many of his fellow students were. Over his career he learned that life is about making choices. As a manager he learned that "everyone owns a piece of the truth" and he learned to "value what each person brings to the table." He concluded by encouraging students to seek happiness since "life is meant to be good." Contact: *oildog1@gmail.com*


Semih S. Kumru

Semih S. Kumru (B.S. 1987) spoke at the 5 May 2011 Recognition Luncheon. At UNL he worked with **Orhan Yenen** (Ph.D. 1986) in the lab of Professor **Duane H. Jaecks**. After graduation, Semih continued in experimental atomic physics at Creighton University, where he received his M.S. degree in 1988. He then transferred to the physics program at North Dakota State University, where he received his Ph.D. in experimental condensed matter physics (specifically, small-angle X-ray scattering) in 1992. After various temporary jobs, including teaching in the undergraduate medical physics program at Creighton and working as a health physics consultant for the Air Force's Armstrong Laboratory, he joined the Air Force Radiation Assessment Team (AFRAT) in 1996, which provides the manpower and equipment necessary to respond to nuclear and radiological threats, including risk assessment, contingency planning, consequence management, and site recovery. From there he worked in various Air Force capacities dealing with radiation threats up to his current position as *Lead Scientist and Program Manager for Directed Energy Protective Equipment* with the Air Force Research Laboratory (AFRL) at Brooks Air Force Base in San Antonio, TX. His work involves many aspects of the biological effects of radiation, ranging from laser and nuclear radiation safety to development of nonlethal microwave antipersonnel weapons.

Kumru emphasized to our students the value of his studies and degrees in physics. He said they opened doors to a career that he had not anticipated. Recently, Semih retired from active duty in the Air Force, but then joined the Air Force Reserve Officer Corps as a Lt. Colonel. He continues his work as a civilian contractor and health physicist at the AFRL. Contact: *semih.kumru@brooks.af.mil*


Chih-Ray Liu

Chih-Ray Liu (M.S. 1985, Ph.D. 1988, Adviser: **Anthony Starace**) was the Recognition Luncheon speaker on 8 May 2014. Liu did his doctoral thesis in theoretical atomic physics on "Photodetachment of Negative Ions with Two Active Electrons" in the group of Professor **Anthony Starace**. Liu told our students that he found life as a graduate student about the most enjoyable time of his life. He then stayed in the group as a postdoctoral researcher for another two years. It was a very productive period, during which seven papers were published, with Liu the lead author on six of them. However, although Liu enjoyed theoretical physics, he realized that he wanted a career in which his skills could be put to use more immediately.

In June 1990, he became a *Clinical Postdoctoral Fellow* in the Department of Radiation Oncology at Thomas Jefferson University, a private health sciences university in Philadelphia. Upon becoming board-certified in therapeutic radiological physics, in 1992 he became an assistant professor in the Department of Radiology at the University of Tennessee Medical Center in Knoxville. A year later, he joined the faculty in the Department of Radiation Oncology at the University of Florida in Gainesville, where he now holds the position of *Professor and Chief Physicist.*

Chih-Ray described his academic career in medical physics as comprising both teaching and research and development, with about 80% of his time involved with clinical matters and 20% with research and development. He said that the clinical work involves tailoring the particular form of radiation treatment (e.g., photons, electrons, or protons) for each individual patient. The development of a patient's treatment plan takes from several hours to a few days, depending on how close a cancerous tumor is to vital body structures. High energy protons are a relatively recent therapy, with the advantage that damage to healthy tissue can be minimized, as most of the proton energy can be delivered directly to the tumor as the proton comes to rest. However, proton therapy is currently very expensive compared to other radiation therapies. Liu emphasized to our students also how vitally important are good communication skills for a successful medical physics career since one is part of the clinical team treating patients. Also, to be a good medical physicist one must have a passion for quality and safety in order to ensure the best clinical outcome. Finally, as for any faculty member, one must publish one's research and give presentations at disciplinary conferences. Contact: *liucr@shands.ufl.edu*


Mark Yarkosky

Mark Yarkosky (B.S. 1990 Engineering Physics) was featured at the 3 May 2012 Recognition Luncheon. Mark grew up in Scottsbluff, NE and attended UNL. After a few semesters away, he returned to UNL and obtained his bachelors degree in engineering physics (with minors in math and philosophy) in 1990. After graduating, Mark worked for a construction company building energy-efficient houses in the Kansas City area. In 1995, he joined a start-up company, WaveLinQ, that produced field-deployable Opti-

cal Spectrum Analyzers (OSAs). These devices were in increasing demand by telecommunications companies to diagnose transmission problems over fiber optic lines when using wavelength division multiplexing (WDM), in which many signals are transmitted using different wavelengths. WaveLinQ beat such larger companies as HP to market with their OSAs, each of which carried a price tag of $40,000. At WaveLinQ Mark wore many hats, ranging from technical writer, to calibration engineer, to supply chain specialist, etc., as is common in start-ups.

In 1996, Mark entered the fledgling world of wireless communications, joining a forerunner of Sprint. As an engineer in a rapidly changing and dynamic industry, Mark's contributions and responsibilities grew with the company. From 2005-2007 he was the *Director of CDMA* (code division multiple access) *Technology Development*; from 2007-2010 he was the *Director of National RF* (radio frequency) *Engineering*; and since 2010 he has been Sprint's *Director of Product Development, Wireless Services* in Overland Park, KS. He is the sole or co-inventor of 40 awarded patents related to wireless technology innovations. During 2011-2012, Mark was one of 47 leaders nominated by Sprint to participate in Duke Corporate Education's Executive Leadership Program tasked to develop Sprint's future strategy. One result was the introduction of an "innovation culture" at Sprint allowing employees time to pursue novel ideas.

Yarkosky advised our students to develop their self-awareness, explore different occupations, and then vigorously pursue their professional development. He said that his "minimal" competence in physics has been the "core of his career." He also suggested that "putting yourself in uncomfortable positions is the best way to learn." Contact: *Mark.yarkosky@mail.sprint.com*

We Heard That…

Alston, Steven G. (M.S. 1979, Ph.D. 1982, Adviser: **Joseph H. Macek**) is the chair of the Natural Sciences Division, Campbellsville University, 1 University Dr., Campbellsville, KY 42718. Prior to this appointment Steven served as the Dean of Academic Affairs at Northland Community and Technical College in Thief River Falls, Minn., as Dean of the School of Natural and Social Sciences and professor of physics at Wayne State College in Wayne, NE, as Director of Academic Affairs at Penn State University-New Kensington, and as Acting Director of Academic Affairs at Penn State University-Wilkes Barre. Email: *salston@campbellsville.edu*

Anderson, Justin S. (B.A. 1997) is a Portfolio Manager at Cambridge Advisors, Inc., 17330 Wright St., Suite 205, Omaha, NE 68130. Following his physics degree, Justin obtained an MBA degree with a specialization in finance and agribusiness from UNL in 1999. He worked as an Investment Representative with Edward Jones before joining Cambridge Advisors in 2002. Email: *janderson@cambridgeadvisors.net*

Anderson, Terry L (M.S. 1971, Ph.D. 1975, Adviser: **Thomas Morgan**), 605 Peregrine Lane, Oak Harbor, WA 98277, moved recently to Washington from New Jersey. He worked for many years at Bell Laboratories and Lucent Technologies on VoIP and other telephony protocols. Most recently he was Chief Scientist at ITT Exelis, where he developed software for military communication radios. Email: *terry@terryandjan.net*

Andrianarijaona, Vola (Jorgensen Postdoctoral Fellow, 2005-2006, Adviser: **Timothy Gay**), Pacific Union College, One Angwin Ave., Angwin, CA 94508, is a professor of physics. On his recent visit to the Department, he said that in 2012 he spent a sabbatical doing research on charge transfer collisions (such as proton–hydrogen molecule collisions) in the laboratories of Xavier Urbain at the Université catholique de Louvain, Belgium, and Charles Havener in the Physics Division at Oak Ridge National Laboratory. These have resulted in a number of publications in 2013 in *Physical Review Letters* and *Physical Review A*. Email: *vola@puc.edu*

Annin, Scott (B.S. 1995) is a full professor and vice chair of the mathematics department at California State University-Fullerton. He obtained his Ph.D. in mathematics from the University of California, Berkeley specializing in finite group theory and semi-group theory. Email: *sannin@fullerton.edu*

Aylesworth, Kevin D. (M.S. 1986, Ph.D. 1989, Adviser: **David J. Sellmyer**) recently started a consulting firm, Katibrian Consulting LLC, 508 Queen Anne Rd., Cherry Hill, NJ 08003. His firm specializes in custom business process automation and application development. Kevin was previously a Special Projects Manager for GE Trailer Fleet Services.

Backhaus, Scott (B.S. 1990), Los Alamos National Laboratory (LANL), co-authored an article "Getting a Grip on the Electrical Grid" in the May 2013 issue of *Physics Today*. The abstract states: "As our electrical grid systems become smarter and more autonomous, they require greater control technologies to protect them from failing." In an email message, Scott wrote: "It's an area that desperately needs help from physics. Power engineers have [typically] only seen one physical system …. Physicists can draw on many. As an example, we've recently developed analytical solutions for the propagation [of electrical power] using boundary layer theory from fluid mechanics. To continue the analogy, I'm going to attempt to build a … scale model of the real system in my lab and see if we can validate these solutions." Scott obtained his Ph.D. at the University of California-Berkeley. In 2003, he was named one of the Innovators Under 35 by the MIT *Technology Review*. He and **Gregory W. Swift** (B.S. 1974), also at LANL, are well known for their research in thermoacoustics. Email: *backhaus@lanl.gov*

We Heard That…

Bruegman, Otto (B.S. 1984, M.S. 1987) is the Instrument Manager for the Joint Polar Satellite System (JPSS) at the National Oceanic and Atmospheric Administration (NOAA). He is responsible for developing a series of microwave sounders used for weather forecasts around the world. He works with a contract officer to manage contracts and provide leadership and technical direction over requirements, schedules and budgets to meet NOAA's requirements.

Caruso, Anthony N. (M.S. 2003, Ph.D. 2004, Adviser: **Peter Dowben**) was promoted with tenure to associate professor of physics in 2011 at the University of Missouri–Kansas City, 5110 Rockhill Rd, K.C., MO 64110. He is the secretary of the American Vacuum Society Division of Magnetic Materials, Interfaces, and Nanostructures. Email: *carusoan@umkc.edu*

Choi, Jaewu (Ph.D., 1998, Adviser: **Peter Dowben**) has been promoted to professor in the Department of Information Display at Kyung Hee University, South Korea. He leads a research team focused on developing flexible displays based on thin film transistors as well as on creating glass-less 3D displays. Email: *JaewuChoi@khu.ac.kr*

Cornelison, Steven G. (Ph.D. 1982, Adviser: **David Sellmyer**) continues to work as a civilian employee at the U.S. Army Research Laboratory, Aberdeen Proving Ground, MD 21005-5066. In his spare time, he is head coach (certified at the "elite" level) for ACPR Gymnastics.

Dokter, Jon J. (B.S. 1993) teaches astronomy at Pima Community College in Tucson, AZ. He has also developed a college football computer ranking system called the Entropy System, which he has applied to every college football season back to 1869. He started the Entropy System in 1993 and "put a huge amount of time into collecting scores for every season." Unlike most other sports, he notes, college football teams "can only play about 10 percent of all other teams in a given year [which] necessitates [a] power ranking" to determine the best teams. Despite the voluminous data he has collected, he says "predicting sports is one of the hardest things there is."

Francis, Oceana P. (B.S. 1995) has accepted the position of assistant professor of civil and environmental Engineering at the University of Hawai'i at Manoa. Following her B.S. degree in physics and astronomy at UNL, she obtained B.S. (2002) and M.S. (2004) degrees in civil engineering from the University of Alaska-Anchorage. In 2012, she obtained a Ph.D. in Atmospheric Sciences from the University of Alaska-Fairbanks. Her research interests at present concern the effects of meteorological and ocean processes on coastal infrastructure. She is a certified civil engineer in both Alaska and Hawai'i. Email: *oceanaf@hawaii.edu*

Fukutani, Keisuke (M.S. 2010, Ph.D. 2012, Adviser: **Peter Dowben**) has accepted a position as assistant professor in the physics department at Tohoku University in Sendai, Japan.

Huang, Cheng-Wei ("Wayne") (M.S. 2010, Ph.D. 2013, Adviser: **Herman Batelaan**) has taken a postdoctoral research position in experimental quantum optics at Texas A&M University in College Station. He writes, "Greetings! I just want to give you a quick update of my 'new life' in Aggieland (Texas A&M)….Ever since I stepped into Aggieland, the sense of Husker pride quickly took over me. Thankfully I found another fellow Husker, **James (Jimmy") Strohaber** (B.S. 2001, Ph.D. 2008, Adviser: **Cornelis Uiterwaal**), who … has been a postdoc at Texas A&M since 2009. We spend a lot of time talking about physics, but even more time chatting about the …UNL physics department. Jimmy shared with me many classic (and unknown to me) stories. I am enlightened to realize that I was actually very lucky to be part of the Husker pack! Anyway, what I am trying to say is that I miss you guys and I miss UNL. In the meantime, I am trying to work as hard as I can. Every morning when I come to work, I would repeat Herman's classic saying to myself: '80 hours a week!' Hopefully I will make myself a worthy Husker in Aggieland!" Emails: *wayneh@huskers.unl.edu* or *whuang1@physics.tamu.edu*

Ilie, Carolina C. (Ph.D. 2008, Adviser: **Peter Dowben**) was promoted in 2012 to associate professor of physics at the State University of New York at Oswego. Email: *carolina.ilie@oswego.edu*

Jeong, Hae-Kyung (M.S. 2000, Ph.D. 2003, Adviser: **Peter Dowben**) is a professor in the physics department of Daegu University, Gyeongsan, 712-714 Republic of Korea. Email: *outron@gmail.com*

Keller, Jason D. (B.S. 2006, M.S. 2009, Ph.D. 2013, Adviser: **Daniel Claes**) has joined the National Opinion Research Corp. (NORC) at the University of Chicago as a Data Technology Developer. NORC conducts high-quality social science research in the public interest. Keller writes that he extracts information from social media and other online resources to evaluate public opinion and determine the sources of social networking structure. He also performs statistical analyses and uses machine learning algorithms to determine important patterns and structures. Email: *keller-jason@norc.org*

We Heard That…

Krane, John (M.S. 1994, Ph.D. 1998, Adviser: **Gregory Snow**) earned his Ph.D. in experimental high energy physics (HEP) and worked for eight years at Fermi National Accelerator Laboratory as an internationally-recognized HEP scientist. Since 2003, he has been a Quantitative Financial Analyst at Third Millennium Trading Investments, LLC, in Chicago using his HEP skills of statistical analysis, pattern recognition, data mining, and Monte Carlo simulation techniques. The American Physical Society's Forum on Graduate Student Affairs has posted a lengthy 2014 article about John that discusses his physics and financial careers and how he transitioned from one to the other: http://www.aps.org/units/fgsa/careers/non-traditional/krane.cfm
Email: *jkrane1@hotmail.com*

Machacek, Joshua (M.S. 2009, Adviser: **Timothy Gay**), Jet Propulsion Laboratory, M/S 121-104, 4800 Oak Grove Drive, Pasadena, CA 91109, received his Ph.D. in 2013 from The Australian National University, where he worked in the Centre for Antimatter-Matter Studies, an Australian Research Council Centre of Excellence. While there, he and a fellow graduate student co-founded Positron Dynamics LLC, of which Josh is now Chief Scientist. The company develops positron beam technologies for use in non-destructive testing (NDT) of critical components in the aerospace and defense markets. At the heart of these technologies is a novel method of producing and moderating positrons, for which several patents were awarded in 2011. Upon receiving his Ph.D., Joshua joined the Jet Propulsion Laboratory in Pasadena as a Caltech Postdoctoral Scholar in atomic and molecular physics.
Email: *josh.machacek@positrondynamics.com*

Males, Jared R. (B.S. 1998), 933 N. Cherry Ave., Tucson, AZ 85721, holds a NASA Carl Sagan Postdoctoral Fellowship at the University of Arizona, which was awarded in 2013, the year Jared completed his doctoral work there. The primary goal of the Carl Sagan Fellowship program is to support outstanding recent postdoctoral scientists in conducting independent research related to the science goals of NASA's Exoplanet Exploration Program. In addition to a generous salary stipend, the fellows also receive an annual research budget of $16,000. Jared aims to investigate exoplanetary habitability by perfecting instrumentation to image Jupiter- and Saturn-sized planets in the liquid-water habitable zone of nearby stars. Jared says "I study adaptive optics and extrasolar planets in the Center for Astronomical Adaptive Optics (CAAO). I work on the Magellan AO project (MagAO) and I am the instrument scientist for the VisAO camera, the world's first diffraction-limited visible-wavelength camera on a large telescope. The goal of my research is to, one day, take a picture of a habitable planet around a star like our sun—a place where humans could live. We have some work to do, and some problems to solve, but we will take that picture in my lifetime." Email: *jrmales@email.arizona.edu*

Park, Chang-Hwan (Ph.D. 1984, Adviser: **Anthony Starace**), 1429 12th Ave., Los Angeles, CA90019, writes that he has retired from his medical physics practice.

Peterson, Bradley W. (B.S. 2004) joined the University of Wisconsin-Barron County as an assistant professor in Fall 2012. Brad earned his B.S. degree at UNL in physics under the Astronomy Option in 2004 and then obtained his Ph.D. in Astrophysics from Iowa State University in 2011. His research focuses on collisions between galaxies and how these collisions affect star formation.
Email: *Bradley.peterson@uwc.edu*

Plano Clark, Vicki (Physics Laboratory Manager, 1993-2005) left UNL in summer 2012 to become an assistant professor of education at the University of Cincinnati. During her 12-year tenure as Physics Laboratory Manager, Plano Clark was instrumental in revitalizing all aspects of the Department's laboratory instructional programs. She initiated weekly meetings with graduate teaching assistants and together with Professor **Robert Fuller** applied for and obtained numerous federal and private foundation equipment grants for our instructional laboratories. In 2005, she took a position as a Research Assistant Professor in the UNL College of Education and Human Sciences, serving also as co-director of the Office of Qualitative and Mixed Methods Research and as Managing Editor of the *Journal of Mixed Methods Research.*
Email: *vicki.planoclark@uc.edu*

Schneider, Donald P. (B.S. 1976), department head and Distinguished Professor in the Department of Astronomy and Astrophysics at Penn State wrote us recently to say, "I have many fond memories of my time at Nebraska. I'm thrilled that [UNL is] now in the Big Ten; I arrived at PSU the year after Penn State joined, and I've been amazed at what the peer pressure has done to raise research expectations." Don is the Survey and Scientific Publication Coordinator for the Sloan Digital Sky Survey III, which recently released to the public an online data set featuring 60,000 stars that, according to a 2 August 2013 press release, "are helping to reveal how our Milky Way galaxy formed." Don's scientific activities have been highly cited for the impact they have made on his field.

We Heard That…

Scheer, Adam (M.S. 2006, Adviser: **Paul Burrow**) is a postdoctoral research associate at Sandia National Laboratory's Combustion Research Facility, 7011 East Ave., Livermore, CA 94550. He received his Ph.D. in physics from the University of Colorado-Boulder doing research on the breakdown of biomass molecules at the National Renewable Energy Laboratory in Golden, CO.

Sorensen, Paul R. (B.S. 1996), a tenured member of the physics department at Brookhaven National Laboratory (BNL) has narrated a compelling video entitled, "Breakthrough: RHIC Explores Matter at the Dawn of Time." The video may be viewed here: http://www.bnl.gov/rhic/video.php?v=270 RHIC is the Relativistic Heavy Ion Collider at BNL. Paul's research has yielded some of the most powerful evidence that the matter produced by RHIC is quark gluon plasma, the liquid-like, flowing mix of elementary particles left in the Big Bang's wake. For his important early measurements, Sorensen won the 2008 George E. Valley Jr. Prize of the American Physical Society. In 2009, he also received the Presidential Early Career Award for Scientists and Engineers. Sorensen received his Ph.D. from the University of California, Los Angeles, in 2003. He came to BNL in 2005 as a Goldhaber Fellow. Email: *prsorensen@bnl.gov*

Thomas, Jeff (B.S. 2010) received his M.S. in physics in 2013 from the University of Massachusetts at Lowell. Currently he teaches physical science at Newton Country Day School, a Roman Catholic college preparatory school for girls in the greater Boston area. As an undergraduate, Jeff did research in the Diocles Extreme Light Laboratory under the supervision of Dr. **Sudeep Banerjee**. Email: *jeff.thomas137@gmail.com*

Wang, Yong (M.S. 2007, Ph.D. 2011, Adviser: **Evgeny Tsymbal**) is completing an M.S. degree in the Financial Mathematics Program of the Mathematics Department, University of Chicago, 5727 S. University Ave., Chicago, IL 60637. From 2012-2013, he held a postdoctoral position at the Pacific Northwest National Laboratory, performing numerical simulations of novel materials.

Xiao, Jie (M.S. 2006, Ph.D. 2009, Adviser: **Peter Dowben**) has joined the Young Investigator Group for Functional Materials in Solution at the Helmholtz-Zentrum Berlin für Materialien und Energie (HZB), which operates the synchrotron source, BESSY II. Email: *jie.xiao@helmholtz-berlin.de*

Contact Us

Dan Claes, Chair, and Anthony Starace, Editor, encourage you to contact us with your news and comments. We have established a new email address where our alumni can easily email to us their news, address changes, contact information, etc.: **physicsalumni@unl.edu** To contact us individually, our emails are **dclaes@unl.edu** and **astarace1@unl.edu** Finally, news about the Department is also posted on our Web page: **http://physics.unl.edu/**

Kirbys Establish Outstanding Physics Major Award

Professor Emeritus **Roger D. Kirby** and his wife Suzanne have established the Roger and Suzanne Kirby Outstanding Physics Major Award in order to honor outstanding UNL undergraduate students majoring in physics. Funding for the award is provided by the Roger and Suzanne Kirby Fund for Physics, which they established at the University of Nebraska Foundation on December 28, 2011. The Award targets physics majors with outstanding academic performance who have also "been broadly and successfully engaged in the activities of the Department." Examples of such activities include successful participation in research, extensive interactions with faculty, participation in the Society of Physics Students, use of the Department's various facilities (such as the Student Instrument Shop), involvement in teaching (as a Teaching Fellow), regular attendance at colloquia and seminars, and other related activities that are or may become available within the Department. A Departmental committee selects the award recipient annually.

Roger Kirby has had a deep, long, and formative relationship with UNL and the Department, which he joined in the fall of 1971. Ever an enthusiastic member of the Department, in 1995 Roger became Department Chair. For the dozen years until 2007 he devotedly shaped and nurtured the development of the Department, establishing and maintaining the necessary confidence and support of UNL's senior administrators. The milestones of his long term as Chair include the hiring of 14 new faculty members, the establishment of the Diocles Extreme Light Laboratory, and the construction of the state-of-the-art Jorgensen Hall, the Department's home since Fall semester 2010. Reflecting on these accomplishments, Roger decided in May 2011 to retire, as his last Ph.D. student was near graduation. Roger's recent research concerned femtosecond time-resolved magneto-optical measurements, which he and his group brought to experimental perfection during 2003-2007 with support of a W. M. Keck Foundation grant. This challenging experimental work in the time domain is a logical extension of such frequency domain techniques as Raman scattering and far-infrared absorption, which he and his group used to investigate the precessional behavior of exchange-coupled magnetic moments in complex thin films such as Co/Ru/Co trilayers. Knowledge of this behavior is essential for the continued development of magnetic storage media. [*For a more detailed description of Kirby's career, see p. 12 of the Fall 2011 issue of Spectrum.*]

Both Roger and his wife Sue share a deep passion for science and science education. Sue, as an elementary school teacher in Lincoln Public Schools for more than 25 years, has a history of fostering science education that even rivals Roger's. During her quarter century of service as a teacher she was "on-loan" to UNL for four years (1991-1995), during which she served as director of the Peers (**P**romoting **E**xcellence in **E**ducation **R**egionally and **S**tate-Wide) Academy, part of the NSF-funded Nebraska State Systemic Initiative aimed at improving science and math instruction throughout the state. As director, she traveled to all parts of the state to help train teachers in science instruction. For her diligent work, Sue has won many awards. For developing Playground Paleontology, in which children find and identify fossils on school playgrounds, she was recognized with a Cooper Foundation Award. In 1991, Sue won the Presidential Award for Science Teaching. For this she was invited to a week-long trip to Washington DC, during which her teaching successes were celebrated by President George H. W. Bush in the White House Rose Garden. Sue also won the Distinguished Teacher of the Year Award of the Lincoln Scottish Rite Preservation Foundation, given to an outstanding teacher in the Lincoln Public Schools (LPS). In addition, Sue has been active in some of the Department's science education activities. In particular, she served as the LPS Liaison to our Saturday Science program for elementary school students for nearly two decades. She was also a Co-PI on two of the Department's NSF-funded Project Fulcrum grants (totaling $3.4 M), which placed science graduate students into elementary school classrooms in Lincoln.

As a couple so deeply immersed in science, so sincerely dedicated to helping the next generation of students to succeed in science, and so passionate in advancing effective means of teaching science, it is not surprising that the Kirbys decided to establish an award for our outstanding physics majors. The Department is deeply grateful to the Kirbys for their generosity and for their support and recognition of excellence in our students.

By Christian Binek

Acknowledgments

The Department is very grateful to the following individuals and corporations for their new and continuing financial contributions during the period 1 August 2011–27 May 2014. These contributions have been made in support of major items of capital equipment, an endowed professorship, graduate fellowships, undergraduate scholarships, and invited lectures as well as for unrestricted purposes. Those who have not been contacted by one of the University of Nebraska Foundation's telephone campaigns or who might be considering an additional tax-deductible gift to us should note that we have the following general accounts at the UN Foundation:

1) ***Physics & Astronomy Development Fund*** [for unrestricted gifts] (Account No. 2557.0)

2) ***Physics & Astronomy Lecture Endowment Fund*** (Account No. 3321.0)

3) ***Physics & Astronomy Alumni Scholarship Endowment Fund*** (Account No. 3303.0)

Alternatively, former students, friends, and/or colleagues of Professors Sitaram Jaswal, Ted Jorgensen, Roger Kirby, and David J. Sellmyer as well as of Lecture Demonstrations Manager Menno Fast may wish to contribute to the following endowment funds:

4) ***Banti & Mela Ram Jaswal Fund*** [for undergraduate scholarships] (Account No. 6843.0)

5) ***Ted Jorgensen Fund for Physics*** [for undergraduate scholarships] (Account No. 8846.0)

6) ***David J. & Catherine J. Sellmyer Fund*** [for support of condensed matter and materials science] (Account No. 6781.0)

7) ***Menno Fast Memorial Fund*** [for lecture demonstration equipment] (Account No. 10681.0)

8) ***Roger and Suzanne Kirby Fund*** [for Outstanding Physics Major] (Account No. 112318.0)

Contributions to any of these may be made conveniently using the contribution card and return envelope enclosed with the mailing of this newsletter, or through the NU Foundation website at: http://nufoundation.org.

Checks should be made payable to the University of Nebraska Foundation and should indicate for which account the money is intended. Those contributors whose employers have a matching gift program should indicate this.

AYLESWORTH, KEVIN DONALD (M.S. 1986, Ph.D. 1989)
BAO, MINQI (M.S. 1992, Ph.D. 1995)
BARRETT, WILLIAM AVON (B.S. 1952, M.S. 1953)
BOYER, LARRY LEE (M.S. 1968, Ph.D. 1970)
BRYAN, BLAINE D. (B.S. 1960)
BULLIS, JONATHAN (M.S. 2004)
BURROW, PAUL D. & MARY
CAPLAN, LOUIS JAMES (M.S. 1964, Ph.D. 1975)
EDDY, STEPHAN MCCHESNEY (B.S. 1978)
FINKLER, PAUL
FMC CORPORATION
GALLIARDT, DONALD (M.S. 1975, Ph.D. 1983)
GENERAL ELECTRIC FOUNDATION
GRAY, DAVID MICHAEL (B.S. 1977)
HAWTHORNE, MAURICE RAY (B.S. 1964)
HEEGER, ALAN (B.S. 1957)
IBM CORPORATION
JACOBS, LOYD DONALD (M.S. 1958)
JASWAL, SITARAM S. & ALICE
JOUTRAS, DAVID (B.S. 1979)
KEIFER, DAVID WARREN (B.S. 1968)
KIRBY, ROGER D. & SUZANNE K.
LEWIS, MICHAEL KEVIN (B.S. 1992)
MACEK, JOSEPH H. AND ELLEN A. (Ph.D. 1980)
MAHER, ROBERT (M.S. 1975 Ph.D. 1980)
NIVA, GORDON DAVID (M.S. 1975, Ph.D. 1979)
PILALIS, LABROS EVAGGELOS (B.S. 1978)
RAYTHEON MATCHING GIFTS
RUCKMAN, JERRY E. (B.S. 1962)
RUDD, M. EUGENE & EILEEN (Ph.D. 1962)
SCHLITT, DAN
SCHULDT, THEODORE (B.S. 1961)
SELLMYER, DAVID J. & CATHERINE J.
SPENCER, CARY RAY (B.S. 1971)
STARACE, ANTHONY F. & KATHERINE F.
TEAYS, TERRY JOHN (Ph.D. 1986)
THE BOEING COMPANY
TVETEN, ALAN BRIAN (M.S. 1959)

Robert G. Fuller (1936-2012)

Professor Emeritus **Robert G. Fuller** died on Monday, April 9, 2012. He had suffered a brain aneurism the morning of the previous Thanksgiving from which he never fully recovered. Fuller was a faculty member in the Department from 1969 to 2005, when he became an emeritus professor. He was known for his teaching. He twice earned College of Arts and Sciences awards for distinguished teaching (1973 and 1986) and was recognized nationally for his teaching excellence. Among other accolades, he was named by *Insight* magazine as "One of the 10 best college professors in America" in 1987. In 1992, he was awarded the Robert A. Millikan Medal for outstanding contributions to the teaching of physics by the American Association of Physics Teachers. In 1993 he received the University of Nebraska's highest recognition for teaching, the Outstanding Teaching and Instructional Creativity Award. He was named a member of UNL's Academy of Distinguished Teachers in 1995, and he received the "Doc Elliott" Award from the UNL Alumni Association in 2011. He was an active member of the American Association of Physics Teachers and was its national president in 1980.

A native of Indiana, Fuller obtained his B.S. degree in physics from the University of Missouri-Rolla in 1957. Following a year as an NSF Fellow at the University of Illinois, where he obtained his M.S. degree in physics in 1958, Fuller traveled to Rangoon, Burma, where he taught science courses at the Methodist English High School from 1958-61. One of his students there was Aung San Suu Kyi, who eventually became a human rights activist and winner of the Nobel Prize for Peace. Returning to the U.S.A., Fuller earned his Ph.D. in experimental condensed matter physics at the University of Illinois in 1965, whereupon he worked from 1965-1969 as a physicist at the Naval Research Laboratory in Washington, D.C. He joined the Department as an associate professor in 1969, becoming a professor in 1976. He was a visiting professor at the University of California-Berkeley from 1976-77, at the Open University in the U.K. from 1982-83, at the U.S. Air Force Academy in Colorado Springs from 1986-1988 and again from 1995-96, and at the U.S. Military Academy in West Point from 1999-2000.

An innovative educator, he eagerly embraced new technologies and developed learning activities to include students as partners in learning. His *Topics in Environmental Science* course was team taught from 1971-74. He implemented the *Personalized System of Instruction*, also known as the Keller Plan, in the Department's teaching of physics. From 1975-1997 he directed the ADAPT program of instruction at UNL, a multidisciplinary, Piagetian-based program for college freshmen. From 1978-1994 he created many interactive videodisc lessons, beginning with *The Puzzle of the Tacoma Narrows Bridge Collapse*. He organized many *Workshops on College Teaching and the Development of Reasoning*. Many of his courses, such as *Energy in Perspective* and *Problem Solving Using Computers* were developed for non-science majors.

Notable among Fuller's books is *A Love of Discovery: Science Education – The Second Career of Robert Karplus* (2002), which has been acclaimed by those who knew Robert Karplus as providing a sense of his interest in the process of discovery.

An oral history interview with Fuller is available here:
http://real.unl.edu/programs/emeriti_lib/Fuller_Robert_G.php

Gordon A. Gallup (1927-2014)

Professor Emeritus **Gordon A. Gallup** died on March 26, 2014. He was born March 9, 1927 in St. Louis, Mo. During WWII he served in the Navy as a radar technician. Under the G.I. bill, Gordon then obtained his college degree in chemistry at Washington University in St. Louis. He received his Ph.D. in physical chemistry from the University of Kansas in 1963 and did postdoctoral research at Purdue University. In 1955 he came to UNL, becoming a full professor in the Chemistry Department in 1964. In 1993 he retired from teaching and since then has held a courtesy appointment in the Department of Physics and Astronomy, collaborating with Professors **Paul Burrow**, **Ilya Fabrikant,** and **Timothy Gay** on research involving molecular processes.

Gallup's research interests over the years included infrared spectroscopy of molecular vibrations, the theory of molecular electronic structure, valence bond theory, electron scattering from atoms and molecules, and dissociative electron attachment. He published over 130 articles in the leading chemistry and physics journals as well as a book, *Valence Bond Methods: Theory and Applications* (Cambridge University Press, 2002). Together with his students, most recently J.D. Mills, he also created a quantum chemistry program, *Molcrunch: An atomic or molecular electronic properties computational package*, which is available at this URL:

http://sourceforge.net/projects/molcrunch/

At the Memorial Service for Gallup on March 29, 2014, Paul Burrow said that when Gallup retired from the chemistry department, "physics grabbed him" and provided him an office. Burrow noted that they published 24 papers together, including Gallup's most cited paper on "Electron Attachment Energies of the DNA Bases" [K. Aflatooni, G.A. Gallup, and P.D. Burrow, *J. Phys. Chem.* A **102**, 6205 (1998)], which has been cited 240 times to date. Burrow stated that scientifically, Gallup "never peaked—he was doing his best work until the day he died." Indeed, Ilya Fabrikant, with whom Gallup published 10 papers, stated that "Gordon worked until the last moment—we talked by phone about our next paper one week before his death." Ilya said Gallup coached him on the proper style for writing scientific papers in English. He said they shared an interest in music and that he was impressed by Gallup's ironical attitude toward politics in science. Tim Gay said that "Gordon brought out the best scientist in me." He noted that Gordon and Paul organized a weekly "electron lover's lunch" on Fridays that was a scientific and social highlight of the week. Lawrence Parkhurst, a chemistry colleague of Gallup, noted that Gordon was "unflappable." He recalled that in a lecture demonstration gone awry Gallup was using liquid oxygen and there was a big, loud explosion that sent shock waves throughout the chemistry building. Gordon's comment to the stunned students was, "Well, that shows the power of unpaired electrons!"

Among his hobbies, Gallup played the piano, was an avid reader, and loved to sail on the lake outside his home at Capitol Beach. He is survived by his wife, Grace (Gay), his daughter Stephanie, his daughter-in-law Linda, and six step-children: Douglas, Craig, Martin, Terry, Jane, and Joy.

John W. Weymouth (1922-2012)

John Walter Weymouth died December 20, 2012 from complications of Parkinson's disease. John was born on the Stanford University campus in Palo Alto, Calif., where his father and grandfather were professors. He attended Stanford and earned a Ph.D. in physics in 1951 from the University of California at Berkeley. He taught and did research in physics at the University of California, Vassar College, Clarkson University, and the University of Nebraska, where he retired in 1989.

In mid-career Weymouth became interested in the application of geophysical sensing techniques in archaeology. At that time, John was part of a small number of international scientists with training in physics who were working to develop instruments and methods that would help archaeologists locate subsurface features at archaeological sites.

John's pioneering work (to use magnetometers as a survey tool for subsurface mapping of archaeological features) was conducted throughout the United States and Europe and demonstrated the essential need for geophysical surveys in advance of archaeological excavations. His most notable early contributions were magnetometer surveys at the Sakakawea Village at Knife River Indian Villages in North Dakota, and at the Walth Bay site at Oahe Reservoir near Mobridge, South Dakota. These important studies introduced North American archaeologists to the potential of geophysics for improving archaeological research.

Much of John Weymouth's work was in assistance to the National Park Service. He conducted geophysical investigations on more than a dozen units of the National Park Service ranging from Fort Clatsop and Chaco Canyon to Abraham Lincoln's Home and Hopewell Culture National Historical Park. Dr. Weymouth did important work on historic sites ranging from Fort William in North Dakota, Fort Atkinson in Nebraska, to Fort Davidson in Missouri and Fort Larned in Kansas. He worked on historic Indian village sites, pioneer farmsteads, and the Rock Creek Station on the Oregon Trail. Although Dr. Weymouth began his research with a focus on magnetic surveys, he also incorporated resistivity and ground penetrating radar into his arsenal of skills and continually refined these techniques, pioneering their use in wide range of prehistoric and historic contexts in North America, Europe and Japan.

In 2012, John Weymouth was awarded the Rip Rapp Archaeological Geology Award of the Geological Society of America. The award citation noted that his "*ground-breaking work paved the road for geophysical applications in archaeology. His meticulous and prolific studies demonstrated the usefulness of these techniques for a wide range of prehistoric and historic sites and inspired others to follow in his wake. He served as a bridge between the geophysical community and archaeologists, establishing and encouraging connections with archaeological practitioners on a national, but also on an international, level.*" In his response, Weymouth said, "*Being honored with the Rip Rapp Award by the GSA is like being given the cherry on top of the confection since I have so thoroughly enjoyed working with archaeologists on interesting sites. Back in the early 70's I was contentedly teaching Physics and doing research in materials science when archaeologists of my acquaintance at the University of Nebraska challenged me with some science problems in their discipline. Out of my reading, talking and thinking on these problems I developed a seminar course in "Science in Archaeology". With such a broad title we could study a wide range of applications. I did some research in x-ray diffraction of ceramics but it became clear that there was a need to develop tools and field expertise in evaluating sites being considered for excavation. The literature showed me that magnetic surveying of sites had been pioneered in Europe and should be able to be used in this country. There followed years of development of instruments and field work at various sites in this country and in Japan and Greece. Working with a wide variety of archaeologists and students has been very satisfying. It is especially gratifying that one of my PhD students is now a professor of Physics teaching and working in magnetic prospection in Greece on Crete.*"

Nasser Maleki (1953-2012)

Nasser Maleki (M.S. 1977, Ph.D. 1981; Adviser: **Joseph Macek**) died at his home in Savannah, GA, with his family at his side, after a three-year battle with glioblastoma. Born in Tehran, Maleki received his B.S. in physics at Shiraz University in Shiraz, Iran in 1976. His graduate studies at UNL in theoretical atomic physics were supervised by **Joseph H. Macek**. His doctoral thesis was on "Schwinger's Variational Principle for Electron-Ion Scattering." Following a brief postdoctoral appointment in Macek's group, Nasser entered an NIH-sponsored fellowship program in Medical Physics at the Joint Center for Radiation Therapy at Harvard Medical School that led to his becoming a board-certified radiologist in 1984. He was then appointed assistant professor of radiotherapy at Mount Sinai Medical Center in New York, NY. In 1989, he became Director of Medical Radiation Physics at the Anderson Cancer Center of Memorial Health University Medical Center in Savannah, GA. When Georgia Institute of Technology began a graduate program in medical physics in 2007, Nasser was named its Director. The clinical parts of the program were done at the Memorial Health University Medical Center; Ph.D. students did their doctoral research under Maleki's supervision. Maleki's main research interest was in the area of Internal Organ Motion during Radiation Treatment. The field of Image-Guided Radiation Therapy (IGRT) is relatively new. It addresses the issue of organ motion during radiation treatment, one of the most challenging problems in treatment optimization. Maleki's research explored the application of implantable passive and active markers, RF transmitter or magnetic, for organ motion detection. He was also active in the use of linear accelerators for Stereotactic Radiosurgery, a form of radiation therapy that focuses high-power energy on a small area of the body (and which, despite its name, is a treatment, not a surgical procedure).

Maleki is survived by his wife of 25 years, Johanna (Hynes), and four sons: Gian, Aria, Cyrus, and Sia.

OBITUARIES

Jean M. Rolofson (1930-2012)

Former Department Office Manager, **Jean M. (Jeambey) Rolofson**, died on Wednesday, February 29, 2012. She was born February 29th, 1930 in Red Oak, Iowa. Her father was a Methodist Episcopal minister. Rolofson joined the Department in 1979 and managed the main office for 19 years, during which she served as administrative assistant to three Department Chairs: **David J. Sellmyer** (1979-84), **Anthony F Starace** (1984-95), and **Roger Kirby** (1995-98). During Jean's tenure the role of the office staff changed markedly from that of typing handwritten drafts to functioning as part of the administrative team managing and running the Department. Jean had an excellent aesthetic sense. When she retired in 1998, Starace noted that she always made his correspondence and reports "look beautiful." Her daughter and three sons said she enjoyed reading, playing the organ, and interacting with her children, 12 grandchildren, and 4 great-grandchildren.

In Memoriam

Byrne, Eric J. (B.S. 1983) of Ocean, N.J., died May 9, 2005 from complications of high-altitude sickness. He was on a trekking expedition in Bhutan at 13,000 feet when he became ill May 5th. He was buried May 23 in Omaha, Neb. Byre, 44 years old, was working as a consultant at the time of his death. He earned his masters and doctoral degrees in computer science from Kansas State University and an MBA from Wharton Business School at the University of Pennsylvania.

Cahn, Julius H. (Former faculty member, 1948-1950) died July 29, 2009 in Santa Fe. He was 89 years old. Cahn taught physics at UNL, but left to join the Battelle Memorial Institute in Columbus, OH for eight years. He then spent twenty-six years at the University of Illinois, Urbana-Champaign, working mostly in the astronomy department, but also in the electrical engineering and physics departments. He retired in 1985, and he and his wife moved to Santa Fe. There he became interested in weightlifting and was one of the oldest participants in weightlifting meets.

Cerbus, Gregory Eugene (M.S. 1985, Adviser: **David Sellmyer**) succumbed to pancreatic cancer on April 3, 2012. He had worked for Raytheon Corporation for 27 years as a project manager and systems engineer. He is survived by his wife Elaine and six children.

Epstein, Saul T. (Former faculty member, 1954-1963) died of cancer at the age of 85 on February 27, 2010 in Madison, WI. Born June 14, 1924, in Southampton, NY, he earned a Ph.D. in physics from the Massachusetts Institute of Technology in 1948. Following an appointment at the Institute for Advanced Study (Princeton) in 1947-1948, he was an instructor in physics at Columbia University from 1948 to 1951. After two one-year appointments at Stevens Institute and Boston University, he became an assistant professor at UNL in 1954 and was promoted to professor by 1963. In 1963 he was recruited to the University of Wisconsin-Madison with a joint appointment as professor of physics and a member of the Theoretical Chemistry Institute; after 1970 his appointment was completely in physics. He retired in 1988. Saul was an accomplished theoretical physicist whose early work focused on quantum field theory and whose later work evolved toward atomic physics and quantum chemistry. He was a Fellow of the American Physical Society.

McConnell, Gordon B. (Former Instrument Maker III and student shop supervisor, 1981-1997) passed away on May 13, 2013 at his home at the age of 68.

The Record

Editor: Jennifer Barnason

2010-2011 DEGREE RECIPIENTS

Bachelor of Science

- **Maria Gabriel Becker** (August 2010) enrolled in the graduate physics program at UNL working with Professor Batelaan.
- **Anas Bouzid** (August 2010) enrolled in the graduate physics program at UNL working with Professor Shadwick.
- **Cory Michael Baumgarten** (May 2011) enrolled in the graduate physics program at Colorado State University-Fort Collins.
- **Samuel Kenneth Davis** (May 2011) enrolled in the graduate physics program at Northwestern University.
- **Thomas Van Horn Kelley** (May 2011) took a position as a Department Director at General Fire and Safety in Lincoln, NE.
- **Benjamin Patrick McGill** (May 2011) took a position at Gallup in Lincoln, NE.
- **Justin Tyler Nitz** (May 2011) enrolled in the graduate geology and geophysics program at Texas A&M University.
- **Bradley J. Nordell** (August 2011) enrolled in the graduate physics program at the University of Missouri-Kansas City.
- **Shawn Ryan Roberts** (May 2011) enrolled in the graduate astronomy program at the University of Massachusetts-Amherst.
- **Neil Christopher Stein** (May 2011) took a position as an intern at UNL's Holland Computing Center.

Master of Science

- **Roger Anthony Bach** (May 2011) entered the doctoral program in physics at UNL working with Professor Batelaan.
- **Paramita Dasgupta** (May 2011) is studying theoretical physics at IIT in Kanpur, India.
- **Benjamin David Hage** (May 2011) entered the doctoral program in physics at UNL working with Professor Ducharme.
- **Cheng-Wei Huang** (August 2010) entered the doctoral program in physics at UNL working with Professor Batelaan.
- **Eric Thomas Litaker** (May 2011) entered the doctoral program in physics at UNL working with Professor Gay.
- **Haidong Lu** (May 2011) entered the doctoral program in physics at UNL working with Professor Gruverman.
- **Scot Cameron McGregor** (August 2010) entered the doctoral program in physics at UNL working with Professor Batelaan.
- **Junlei Wang** (December 2010) entered the doctoral program in physics at UNL working with Professor Binek.

Doctor of Philosophy

- **Xi He** (May 2011) took a Research Associate position at Brookhaven National Laboratory.
- **Jing Liu** (May 2011) took a position at the National Synchrotron Light Source at Brookhaven National Laboratory working on the U4B beamline for Northeastern University.
- **Zhengzheng Zhang** (May 2011) took a position as a Science Writing Intern at the University of Wisconsin, Madison.

2011-2012 DEGREE RECIPIENTS

Bachelor of Science

- **Kyle John Bunkers** (May 2012) enrolled in the graduate physics program at the University of Wisconsin.
- **William Austin Deck** (December 2011)
- **David Foote** (May 2012) enrolled in the graduate chemical physics program at the University of Maryland.
- **Maxwell David Gregoire** (May 2012, with Distinction) enrolled in the graduate physics program at the University of Arizona.
- **Peter Donald Hansen** (May 2012) enrolled in the graduate physics program at the University of Minnesota.
- **Benjamin Carl Hoffman** (December 2011) – enrolled in the graduate physics program at North Carolina State University.
- **Collin James McAcy** (May 2012) enrolled in the graduate physics program at UNL working with Professor Uiterwaal.
- **Kyle Anthony Tobin** (May 2012) enrolled in the graduate physics program at the University of California, San Diego.

Master of Science

- **Daniel P. Knowlton** (December 2011) enrolled in the graduate physics program at UNL working with Professor Bloom.
- **Abhijit Mardana** (August 2011) took a position at Intel in Oregon.
- **Shashi Poddar** (December 2011) enrolled in the graduate physics program at UNL working with Professor Ducharme.
- **Anil Kumar Rajapitamahuni** (August 2011) enrolled in the graduate physics program at UNL working with Professor Hong.
- **Jingfeng Song** (May 2012) enrolled in the graduate physics program at UNL working with Professor Ducharme.
- **Alexander Stamm** (May 2012) enrolled in the graduate physics program at UNL working with Professor Shadwick.
- **Lei Yu** (December 2011) enrolled in the graduate physics program at UNL working with Professor Shadwick.

Doctor of Philosophy

- **Nina Hong** (May 2012) took an Applications Physicist position at J. A. Woollam Company in Lincoln, NE.
- **Karolina Janicka** (December 2011) is focused at present on child rearing.
- **Zhen Li** (December 2011) took a position as a HAMR Electrical Test Integration Engineer at Seagate Technology in Bloomington, MN.
- **Abhijit Mardana** (May 2012) took a position as a Research Scientist at Intel in Oregon.
- **Tathagata Mukherjee** (December 2011) took a position as a Senior Engineer at Seagate Technology in Minnesota.
- **Geoffrey Rojas** (December 2011) took a position as a Postdoctoral Fellow at Oak Ridge National Laboratory.
- **Timothy Scarborough** (May 2012) took a position as a Postdoctoral Research Scholar at the California Institute of Technology.
- **Yong Wang** (August 2011) took a position as a Postdoctoral Research Associate at Pacific Northwest National Laboratory.
- **Xiao Hui Wei** (May 2012) took a position at Western Digital in Fremont, California.
- **Menghao Wu** (December 2011) took a position as a Postdoctoral Research Associate at Virginia Commonwealth University.

The Record

2012-2013 DEGREE RECIPIENTS

Bachelor of Science

- **Cameron Bravo** (May 2013) enrolled in the graduate physics program at the University of California, Los Angeles.
- **Susan Cooper** (May 2013) enrolled in the graduate physics program at Pennsylvania State University.
- **Caleb Fangmeier** (May 2013) entered the graduate program in physics at UNL working with Professor Uiterwaal.
- **William Stewart** (May 2013) plans to become a high school physics teacher in Texas.
- **Stephen Szalewski** (May 2013) took a position as a Process Engineer at Garmin International.
- **Hao Wu** (August 2013) is studying at the London School of Economics and Political Science.

Master of Science

- **Evan Brunkow** (August 2013) entered the doctoral program in physics at UNL working with Professor Gay.
- **Shi Cao** (May 2013) entered the doctoral program in physics at UNL working with Professor Dowben.
- **Nathan Clayburn** (August 2013) entered the doctoral program in physics at UNL working with Professor Gay.
- **Bhaskar Das** (August 2013) entered the doctoral program in physics at UNL working with Professor Sellmyer.
- **Kayle Otis DeVaughan** (August 2013) took a position with Bank of America in Chicago, IL.
- **Keith Foreman** (August 2013) entered the doctoral program in physics at UNL working with Professor Adenwalla.
- **Qianqian Jiao** (August 2013) entered the doctoral program in physics at UNL working with Professor Liou.
- **Shawn Thomas Langan** (August 2013) took a position as Introductory Teaching Lab Manager in physics at UNL.
- **Shijie Li** (August 2013) entered the doctoral program in physics at UNL working with Professor Tsymbal.
- **Thomas Scott** (August 2013) entered the doctoral program in physics at UNL working with Professor Dowben.
- **Tao Wang** (May 2013) entered the doctoral program in physics at UNL working with Professor Ducharme.
- **Xin Zhang** (August 2013) entered the doctoral program in physics at UNL working with Professor Dowben.

Doctor of Philosophy

- **Xumin Chen** (May 2013) took a position as a Postdoctoral Research Fellow at Lawrence Berkeley National Laboratory.
- **Keisuke Fukutani** (December 2012) took a position as an Assistant Professor in the Department of Physics at Tohoku University.
- **James Glasbrenner** (May 2013) took a position as a National Research Council Postdoctoral Researcher at the Naval Research Laboratory.
- **Cheng-Wei "Wayne" Huang** (August 2013) took a position as a Postdoctoral Researcher in the Department of Physics at Texas A&M.
- **Jason Keller** (August 2013) took a Postdoctoral Research Associate position at UNL working with Professor Claes.
- **Lingmei Kong** (December 2012) took a position as a Postdoctoral Researcher at Pacific Northwest National Laboratory.
- **Scot Cameron McGregor** (August 2013) took a position as a Postdoctoral Researcher at the University of Toulouse, France.
- **Pankaj Kumar Sharma** (August 2013) took a Postdoctoral Research Associate position at UNL working with Professor Gruverman.
- **Rui Zhang** (August 2013) took a position as a Principal Engineer at Western Digital in San Jose, California.

FELLOWSHIPS & TRAINEESHIPS

2010-2011 FELLOWSHIPS & TRAINEESHIPS

Bridging Program Fellowship
Maria Becker
Evan Brunkow
Nathan Clayburn
William Echtenkamp
Keith Foreman
Wayne Frederick
Eric Jones
Thomas Scott

GAANN Fellowship
Nathan Clayburn
William Echtenkamp
Keith Foreman
Donna Kunkel

Undergraduate Research Fellowship
Justin Nitz

Undergraduate Teaching Assistant Fellowship
Marina Bradaric
Cassandra Etmund
Matthew Hesse
Matthew Molinelli
Lauren Wolterman

Undergraduate Distance Education and Outreach Assistant Fellowship
Justin Nitz
Christina Riley
Melissa Test

2011-2012 FELLOWSHIPS AND TRAINEESHIPS

Bridging Program Fellowship
Joshua Beck
Peter Beierle
Om Goit
David Korn
Talitha Muehlbrad
Iori Tanabe
Matthew Wahila

GAANN Fellowship
Evan Brunkow
Nathan Clayburn
William Echtenkamp
Keith Foreman
Wayne Frederick
Eric Jones
Dan Knowlton
Donna Kunkel

The Record

Talitha Muehlbrad
Matthew Wahila

NASA Nebraska Space Grant Fellowship
Joan Dreiling

Undergraduate Research Fellowship
Susan Cooper
Mitchell Schmidt
Ben Wotruba

Undergraduate Teaching Assistant Fellowship
Marina Bradaric
Matthew Hesse
Matthew Mollinelli
Christina Riley
Alexandra Shomshor
Ethan van Winkle
Lauren Wolterman

2012-2013 FELLOWSHIPS AND TRAINEESHIPS

Bridging Program
Prakash Giri
Collin McAcy
Amanda Steck
Michael Street
Semere Woldemariam
Omid Zandi

Fling Fellowship
Joan Dreiling

GAANN Fellowship
Joshua Beck
Maria Becker
Peter Beierle
Evan Brunkow
Eric Jones
Dan Knowlton
Thomas Scott
Alexander Stamm
Amanda Steck

NASA Nebraska Space Grant
Joan Dreiling

Undergraduate Teaching Assistant Fellowship
Lauren Geiger
Matthew Hesse
David Olney
Dominic Ryan
Alexandra Shomshor
Nicholas Spencer
Ethan van Winkle
Patrick Wilcox

Undergraduate Distance Education and Outreach Assistant Fellowships
Marina Bradaric
Cristina Riley
Lauren Wolterman

SCHOLARSHIPS

2011-2012 SCHOLARSHIPS

Robert M., Stephan M., and Elizabeth Anne Eddy Scholarship
Kyle Tobin

Edward J. Hirsch Scholarship
Peter Hansen
Derek Ruffner

Banti and Mela Ram Jaswal Scholarship
Caleb Fangmeier
Hao Wu

Cheunjit Katkanant Memorial Scholarship
Mitchell Schmidt

Henry H. Marvin Scholarship
Susan Cooper
Maxwell Gregoire
Logan Hepp
Cristina Riley
Derek Ruffner

Kurt Meyer Physics Scholarship
Stephen Szalewski

Physics & Astronomy Alumni Scholarship
Yaroslav Ketsman
Anton Lintel
Collin McAcy

Stowell Fund Scholarship
Kyle Bunkers
Samantha Burtwistle
Caleb Fangmeier
David Foote
Adam Lif
Caleb Mayfield
Travis Ray
Derek Ruffner
Dominic Ryan
Mitchell Schmidt
Stephen Szalewski
Kyle Tobin

2012-2013 SCHOLARSHIPS

John E. Almy Scholarship
Susan Cooper
Jordan Fountain
Hao Wu

Dr. William L. Bade Scholarship
Samantha Burtwistle
Ivan Moreno-Hernandez
Derek Ruffner
Mitchell Schmidt

The Record

William Barrett Scholarship
Jesse Epperson
Caleb Fangmeier
Logan Hepp
Anton Lintel
Travis Ray
Stephen Szalewski

Robert M., Stephan M., and Elizabeth Anne Eddy Scholarship
Yu Hang Ng
Dominic Ryan

Banti and Mela Ram Jaswal Scholarship
Dominic Ryan

Cheunjit Katkanant Memorial Scholarship
Anton Lintel

Kirby Fund for Physics
Stephen Szalewski

Henry H. Marvin Scholarship
Steven Emmel
Adam Lif
Cristina Riley

Kurt Meyer Physics Scholarship
Anton Lintel

Physics & Astronomy Alumni Scholarship
Steven Emmel
Karly Williams

Joel Stebbins Fund Scholarship
Caleb Mayfield
Yu Hang Ng
Derek Ruffner

HONORS

2010-2011 HONORS

College of Arts & Sciences' Applause Award
Angie Okelberry
Bob Rhynalds

Doc Elliot Award Honoring Retired Faculty
Robert G. Fuller

Academy Award from the Academy of National Hispanic Scholars
Roger Kirby

Chinese National Award for Outstanding Students Studying Abroad
Jing Liu

Materials Research Society Graduate Student Silver Award for Particularly Significant & Timely Research
Xi He

Distinguished Graduate Teaching Assistant Award
Nathan Clayburn

2011 UNL Outstanding Graduate Assistant Award
Xi He

University of Nebraska Outstanding Graduate Student Award - Honorable Mention
Zhengzheng Zhang

Distinguished Undergraduate Teaching Assistant Award
Marina Bradaric

Outstanding Referee of the American Physical Society
Serguei Kalmykov

2010-2011 Society of Physics Students Officers
Cameron Bravo
David Foote
Maxwell Gregoire
Kyle Bunkers

2011-2012 HONORS

NSF Faculty Early Career Development Program Award
Xia Hong

Louis Pound - George Howard Distinguished Career Award
David J. Sellmyer

Certificate of Recognition for Contributions to Students
Axel Enders
Tim Gay

Research Leadership Award, UNL Office of Research and Economic Development
David Sellmyer

2012 David Halliday & Robert Resnick Award for Excellence in Undergraduate Physics Teaching
Kevin Lee

2011-2012 Society of Physics Students Officers
David Foote
Peter Hansen
Maxwell Gregoire
Kyle Bunkers

Physics & Astronomy Distinguished Graduate Teaching Assistant Award
Om Goit

Physics & Astronomy Distinguished Undergraduate Teaching Assistant Award
Alexandra Shomshor

Physics & Astronomy Undergraduate Award for Excellence in Research
David Foote

Physics & Astronomy Undergraduate Academic Merit Award
Dominic Ryan

Roger & Suzanne Kirby Outstanding Physics Major Award
Kyle Bunkers

The Record

2011-2012 University Teaching Assistance Corps Mentor
Wai Kuan See Tho

2011-2012 UCARE Award Recipients
Kyle Bunkers
Susan Cooper
Benjamin Hoffman
Yaroslav Ketsman
Ethan van Winkle

2012-2013 HONORS

Distinguished Achievement Award: Iketani Science and Technology Foundation
David J. Sellmyer

George W. Holmes University Professor of Physics & Astronomy
Evgeny Tsymbal

Promoted to Associate Professor with Tenure
Bradley A. Shadwick

Elected to the Fermilab Users Executive Committee, 2012-2014
Gregory Snow

Distinguished Graduate Teaching Assistant Award
Elena Echeverria Mora

Distinguished Undergraduate Teaching Assistant
Ethan Van Winkle

Undergraduate Award for Excellence in Research
Caleb Fangmeier
Dominic Ryan

Undergraduate Academic Merit Award
Dominic Ryan

Roger & Suzanne Kirby Outstanding Physics Major Award
Cameron Bravo

UCARE Award Recipients
Marina Bradaric
Anton Lintel
Yu Hang Ng
George Peterson
Mitchell Schmidt

2012-2013 Society of Physics Students Officers
Cameron Bravo
Ethan Van Winkle
Matthew Hormandl
Steven Emmel

COLLOQUIA

2011 SPRING SEMESTER COLLOQUIA

January 13
Zenghu Chang, University of Central Florida
"The Attosecond Laser: A Solution Seeking Problems"

January 20
Ralph Skomski, UNL
"Like Sardines in a Can"

January 27
Peter Fischer, Lawrence Berkeley National Laboratory
"Magnetic Soft X-Ray Microscopy: A Path Towards Imaging Magnetism Down to Fundamental Length and Time Scales"

February 3
Jennifer Docktor, University of Illinois, Urbana-Champaign
"Conceptual Problem Solving in Physics"

February 10
Marc Warburton, Great Plains National Security Education Consortium
"Physics and Physicists in the Intelligence Community"

February 17
Kevin Lee, UNL
"The Evolution of Peer Instruction in Introductory Astronomy"

February 24
Anthony F. Starace, UNL
"Attosecond Physics: A 'Spin-off' of Strong Field (Intense Laser) Physics"

March 3
Martin Johnston, University of St. Thomas
"Rethinking the Advanced Lab"

March 4
Herman Batelaan, UNL
"A Strong Future for a Weak Quantum Effect"

March 17
Sacha Kopp, University of Texas, Austin
"How to Double the Number of Undergraduate Physics Majors"

March 31
Edward Wishnow, University of California, Berkeley
"Stellar Interferometry"

April 14
Mike Downer, University of Texas, Austin
"Plasma-Based Particle Accelerators: There's Plenty of Room at the Bottom"

April 21
Dale Tupa, Los Alamos National Laboratory
"Proton Radiography Capabilities at Los Alamos National Lab"

April 28
Michael Schmitt, Northwestern University
"Electroweak Physics from the LHC"

May 5
John Bush, Massachusetts Institute of Technology
"Bouncing Droplets (& the Nature of Reality)"

The Record

2011 FALL SEMESTER COLLOQUIA

August 5th
Dan Liu, Auburn University
"Investigation into the Effect of Substrate on $Pb(Zr_{0.52}Ti_{0.48})O_2$ Films"

September 29
Paul S. Bagus, University of North Texas
"New Developments for the Analysis of XPS"

October 9
Kam-Ching Leung, UNL
"Chemical Evolution of the Early Universe"

October 13
Charles I. Sukenik, Old Dominion University
"Spectroscopy and Other Studies with Ultracold Atoms"

November 17
Tamar Seideman, Northwestern University
"Driven Electrons in Strong Laser Fields"

2012 SPRING SEMESTER COLLOQUIA

January 26
Axel Enders, UNL
"From Simple Interfaces to Designed Hybrid Materials"

February 16
Byoung-ick Cho, Lawrence Berkeley National Laboratory
"High Energy Density Matter Studied Using Ultrafast X-Rays and Lasers"

February 23
Xibin Zhou, Massachusetts Institute of Technology
"Ultrafast Optics and Spectroscopy: From THz to Extreme Ultraviolet"

February 28
Yunpei Deng, Max Plank Institute of Quantum Optics
"Advancing Ultrashort Laser Pulse Technology"

March 1
Guillaume Laurent, Kansas State University
"Generation & Application of Attosecond Pulses for Real-Time Observation of Atomic Processes"

March 6
Matthias Fuchs, Stanford University & PULSE Institute, SLAC National Accelerator Laboratory
"The Next Generation Lightsource and Its Applications"

March 15
Marcos Dantus, Michigan State University
"Understanding & Controlling Strong-Field Laser Molecule Interactions"

March 29
Mandy Rominsky, FERMILAB
"The New Muon g-2 Experiment at Fermilab"

April 5
Matt Dawber, Stony Brook University
"Artificially Layered Ferroelectric Superlattices with Exceptional Properties"

April 12
Benjamin McMorran, University of Oregon
"Electron Beams with Angular Momentum & Their Application to Magnetic Imaging"

April 19
Suzanne G.E. te Velthuis, Argonne National Laboratory
"Magnetism in Complex Oxide Heterostructures"

April 26
Brad Shadwick, UNL
"The Role of Computation in Plasma Physics"

2012 FALL SEMESTER COLLOQUIA

August 30
Ilya Kravchenko, UNL
"Discovery of the Higgs-like Boson at the Large Hadron Collider at CERN"

September 6
Ron Synowicki, J.A. Woollam Co., Inc.
"Polarization on the Prairie: The History of Early Polarimetry and Ellipsometry in Nebraska, 1900-1920"

September 13
Matthias Kling, Kansas State University
"Controlled Electron Acceleration from Nanoparticles and Clusters"

September 20
Nick Martin, University of Kentucky
"Electron and Photon Impact Autoionization of Helium"

September 27
Micky Holcomb, West Virginia University
"Magnetoelectric Interfaces, Synchrotrons and Lasers"

October 11
Zhigang Jiang, Georgia Institute of Technology
"Landau Level Spectroscopy of Graphene and Graphite"

October 25
David Gerdes, University of Michigan
"Exploring Nature's Dark Secrets: Cosmology with the Dark Energy Survey"

November 8
Mike Bogan, SLAC National Accelerator Laboratory
"The Next Decade of Single Particle Diffraction with X-Ray Lasers: Opportunities in Structural Biology and Climate Science"

November 15
Michael Schulz, Missouri University of Science and Technology
"The Overlooked Role of Projectile Coherence in Atomic Fragmentation Processes"

The Record

November 29
Donald P. Umstadter, UNL
"Probing Matter with Extreme Light"

December 6
Luat Vuong, Queens College of CUNY
"Demonstrations of Photo-Induced Magnetism in Metallic Nanocolloids Using Sunlight and Fridge Magnets"

2013 SPRING SEMESTER COLLOQUIA

January 25
James F. Scott, Cambridge University
"The Renaissance of Ferroelectric Memories"

January 31
Bharat Ratra, Kansas State University
"'Standard' Model of Cosmology… and Open Questions"

February 21 (Cancelled due to weather)
Richard Mabbs, Washington University
"Anion Photodetachment Imaging: Probing Parent Orbitals and Electron-Molecule Interactions"

February 25
Jason Haraldsen, Los Alamos National Laboratory
"Understanding the Magnetic Ground States for Improper Multiferroic Materials"

February 28
Pouyan Ghaemi, Institute for Condensed Matter Theory, University of Illinois, Urbana-Champaign
"Graphene: The Elastic Playground of Novel Electronic Phases"

March 7
Tanmoy Das, Los Alamos National Laboratory
"Intermediate Coupling Model of Correlated Systems"

March 8 (Big Red Experience)
Daniel R. Claes, UNL
"Just What the Heck Is a Higgs Boson?!"

March 11
A.K.M. Newaz, Vanderbilt University
"Tuning Electrical and Optical Properties of 2D Atomic Crystals"

March 14
Alexey Kovalev, University of California, Riverside
"Spin Mechanics: From Single Molecule Magnets to Majorana Fermions"

March 25
Xiaohang Zhang, Magnetic Materials Group, NIST
"One to Two, or to Nothing: Superconducting Spectroscopy for the Study of Electronic States"

March 28
Hari Srikanth, University of South Florida
"Tunable Microwave Response and Other Emergent Magnetic Properties in Hybrid Nanostructures"

March 29
Xiaoshan Xu, Bryn Mawr
"Single Phase Magnetoelectric Multi-Ferroics: From Mechanism to Applications"

April 1
Eundeok Mun, National High Magnetic Field Laboratory, Los Alamos National Laboratory
"Magnetic Field Tuned Quantum Criticality of Heavy Fermion System YbPtBi"

April 11
John Hall, JILA
"Five Decades of Lasers, Six Decades of Progress, and a Proposed Space Experiment to Test Einstein's Assumptions"

April 19
Susan Benecchi, Carnegie Institution
"Solar System Archaeology: What we Learn from Small Bodies in our Solar System"
"The New Horizons Mission: Pluto and Beyond" (Public talk)

April 19
Seungbum Hong, Argonne National Laboratory
"Visualization and Manipulation of Polarization and Screen Charges"

April 25
Jiandi Zhang, Louisiana State University
"Why are Ultrathin Films of Metallic Oxides Nonmetallic?"

2013 FALL SEMESTER COLLOQUIA

September 13
Ralph Ernstorfer, Fritz Haber Institute, Berlin
"Non-equilibrium Structural Dynamics and Phase Transitions in Solids"

September 26
Richard Mabbs, Washington University, St. Louis
"Anion Photodetachment Imaging: Electron-Neutral Molecule Interactions from Anion Precursors"

October 3
John Goree, University of Iowa
"The First Measurement of Spatially-Localized Viscous Heating"

October 10
Lane Martin, University of Illinois, Urbana-Champaign
"The Science and Engineering of Functional Complex Oxide Thin Films"

October 17
Martin Centurion, UNL
"Ultrafast Imaging of Molecules"

November 1
Lars Bojer Madsen, Aarhus University, Denmark
"Elements of Theoretical Strong-Field and Attosecond Physics"

The Record

November 7
Qing-Bin Lu, University of Waterloo, ON
"Global Climate Change and Atmospheric Ozone Depletion: Understanding and Perspective from a Physicist"

November 11
Masashi Sahashi, Tohoku University
"Study on Magnetoelectric Effect in Thin Film Cr2O3 Sesquioxide and Electrical Switching of HEX and Residual Magnetization"

November 21
Carlos Trallero, Kansas State University
"From Atoms to Solids: Mapping Structure with Electrons"

December 5
Joao Guimaraes da Costa, Harvard
"The Standard Model and the Higgs Boson at the LHC"

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