

Physics Department Newsletter

February 2013



Robert A. Woodruff in 1964 and today.

An inquiring mind:

Physics alumnus discusses work on the final frontier

Students, faculty and community members learned about a physicist's work designing scientific instruments that study outer space when Robert A. Woodruff presented the 2012 Ernest Fox Nichols Distinguished Alumni Lecture in October.

The Nichols lecture series honors distinguished physics alumni from Kansas State University. Woodruff earned a bachelor's degree in physics from the university in 1964. He was born and raised in Manhattan and was inspired to become a physicist by a first-year Manhattan High School teacher, who attended Woodruff's lecture in October.

Woodruff has spent more than 45 years designing optical systems for U.S. space program missions and has been involved in projects such as Skylab, the Hubble Space Telescope and Kepler.

During Woodruff's lecture, titled "An Inquiring Mind in Search of Phun from Fysics," he discussed two opportunities he received through a physics education: fixing the Hubble Space Telescope spherical

aberration problem and conceiving the optical design for Kepler, which is currently in orbit detecting extra-solar earth-like planets.

"Having been physically separated from Kansas State University since 1964, I am thrilled by the quality of students, facilities and educators at the university," Woodruff said.

**"Because of... my
Kansas State University
education, I was involved in
the outer space frontier."**

"Because of the opportunities afforded to me through my Kansas State University education, I was involved in the outer space frontier presented to my generation. I encourage those beginning their career to find meaning and fun in their adventure, as I did."

Woodruff has served roles in optical design, system engineering, testing and calibration in the development of more than 20 flight hardware instruments. One or more of his designs have been operational in space continuously for nearly 40 years.

Retired from Lockheed Martin Corp., Woodruff is currently an associate of the Center for Astrophysics and Space Astronomy at the University of Colorado in Boulder.



Professor Basil Cunutte supervised Woodruff's undergraduate research.



I am writing to share my excitement about our outstanding department and, at the same time, to thank you for your continued support. Achievements of our faculty and students are presented throughout this newsletter. With federal research grants, university support for infrastructure and private philanthropy, we are striving to reach a much higher level of distinction.

Several new initiatives in outreach, recruitment and recognition have gotten under way in the last year. In collaboration with our K-State Olathe campus, we have started a new seminar series designed to attract Kansas City-area high school students to physics and science in general. In addition, several new awards for graduate students were initiated: graduate teaching awards for outstanding GTAs and graduate research awards for scholarly work.

Our freshman enrollment has shown a substantial increase in the current year. Retention of our physics majors, however, is a critical challenge. We are in the process of setting up a mentoring scholarship where seniors in physics mentor freshmen and sophomores.

I have recently visited the Albuquerque and Santa Fe, N.M., areas and met with several of our alumni. It was great to hear that whether our alumni graduated in the '50s, '60s, '70s, '80s, '90s or as recently as '07, K-State physics has always provided a top-notch education for them and has made a major impact in their careers.

Please visit our website, www.phys.ksu.edu, and Facebook page, www.facebook.com/ksuphys, and stay in touch with the department. I would love to hear about what is happening in your life, so drop me a line at amitc@phys.ksu.edu.

Once again, I want to thank you for what you do for the department.

Warm regards,

Amit Chakrabarti

Amit Chakrabarti

William and Joan Porter Professor and Head

Through the cosmos

Astronomy initiative seeks to increase student interest in physics, science

For many young astronomers, stargazing could also mean looking into an education in physics.

Amit Chakrabarti, head of the department of physics and William and Joan Porter professor, is using astronomy to introduce more students to physics and science.

"Astronomy is especially accessible to the public and to young people because it does not require any advanced degrees or incredibly expensive equipment," said Tracy Tuttle, director of the university's physics laboratories. "The single largest requirement is a healthy curiosity."

Tuttle and his twin brother, Todd, lead the North Central Kansas Astronomical Society, a Manhattan-based amateur astronomy group. A research site roughly 12 miles west of the university is used for observation.

The group's most recent public viewing attracted more than 200 people of varying ages who wanted to learn more about the universe. Similarly, a university-coordinated summer 2012 viewing of the transit of Venus drew several hundred visitors.

"We are in the golden era of amateur astronomy," Tracy said. "In addition, the science of astronomy not only welcomes amateur participation but absolutely relies on it."

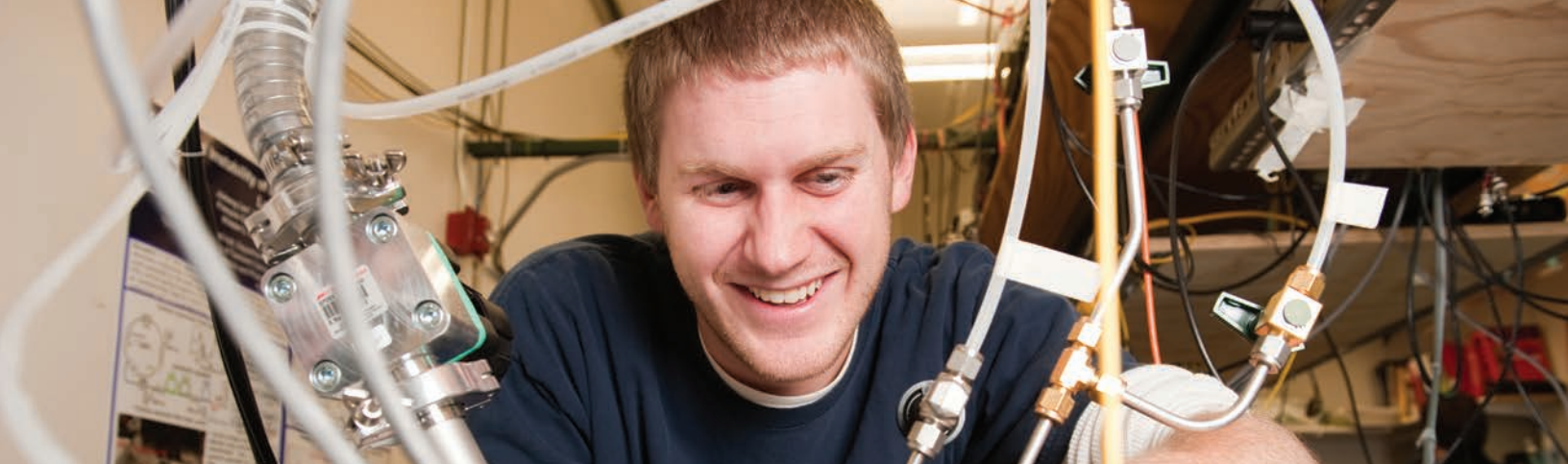
Chakrabarti believes that enthusiasm and amateur participation can be channeled to the department and consequently physics and science.

Astronomy courses open to all majors attract very large enrollment at some universities. To reach more students at K-State, Christopher Sorensen, Cortelyou-Rust university distinguished professor, university distinguished teaching scholar and an avid amateur astronomer, is revamping the department's descriptive astronomy course.

The updated course introduces a two-hour studio component, which will include activities such as observing the moon's patterns, building a spectroscope and recording observations and incorporating the amateur astronomy society.

"I'm excited about this," Sorensen said. "Here we have an opportunity to end up teaching, informing and entertaining the students with astronomy. In the end, the students could learn something and maybe even develop a passion for astronomy that will last their lifetimes."

**"Students could...
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Kudos to Students

Bethany Jochim, doctoral student in physics, received a U.S. Department of Energy Office of Science Graduate Fellowship, or DOE SCGF award.

Adam Summers, senior in physics, was nominated by Kansas State University for the 2012 Rhodes and Marshall scholarships.

Andrew Jones, '12 Ph.D. in physics, received the Graduate Award for Outstanding Academics from the K-State Alumni Association in May.

Dehui Hu, doctoral student in physics, received the Konza and Manhattan Rotary Club Scholarship.

Physics doctoral students **Will Heinson** and **Amy Rouinfar** are National Science Foundation GK-12 EIDRoP fellows for

2012-2013. The fellowship pays the students to do research and to engage underserved students in high school classrooms in Junction City, Kan.

Physics master's student **Shawn Westmoreland** and his work will be featured in the television show "Through the Wormhole," hosted by Morgan Freeman, to air in summer 2013 on the Science Channel.

Scholarship luncheon honors students and alumnus

Doctoral graduate returns as luncheon's first lecturer

At the department's spring 2012 scholarship luncheon, physics students being honored for their scholarships received another surprise: a lecture from Gary Hoover, a former Kansas State University physics student.

Hoover, who graduated with a doctorate in 1968, was the first speaker ever at the annual luncheon. He was invited by Amit Chakrabarti.

According to Chakrabarti, Hoover was the ideal choice to begin the lecture component because of his professional success, his support of the physics department, and his advocacy for introducing middle school and high school-age students to physics and other sciences.

After graduation, Hoover worked as a geophysicist for ConocoPhillips, advancing to branch manager. He was actively involved in a variety of research projects on topics such as acoustic holography, magneto telluric modeling, experimental seismic measurements and rock physics.

"He's worried, and rightly so, that the U.S. is not training enough of our citizens to become scientists and be technology-oriented," Chakrabarti said. "He's very supportive of the physics program at K-State because of our outreach initiatives and also because students can get involved in meaningful research as undergraduates, which is rare at universities."

In addition to speaking at the luncheon, Hoover also met faculty members and toured the laboratory he worked in at K-State while earning his doctorate.

"It was very nice to welcome Gary and his wife, Becky, back to K-State," Chakrabarti said. "The students enjoyed hearing from someone who has graduated from our program, done well in life and truly cares about the future of the sciences."

Scholarships awarded to more students

Thanks in part to increased alumni and donor contributions, the department was able to award 56 undergraduates with scholarships for the 2011-2012 academic year — 14 more than the previous year. The department also introduced scholarships that recognize the accomplishments of graduate students.

The increased scholarships come at the perfect time, said Amit Chakrabarti, department head.

"We're seeing more students interested in physics, more students choosing to major in physics and more joining the physics club," Chakrabarti said. "That's really exciting to see and something we want to continue to encourage. Moreover, undergraduate learning is enhanced when graduate student teaching is valued."

Bachana Lomsadze and Stefan Zigo, doctoral students, received awards for Outstanding Teaching for senior and junior graduate students, respectively.

Finalists for the department's new research awards were then-doctoral students Nora Kling, Cheng Jin and Sean McBride. After competing in a research poster session, McBride received the outstanding research award, while Jin and Kling received meritorious awards.

All student winners and scholarship recipients were recognized at the department's annual scholarship luncheon in May 2012.

Alumna establishes new scholarship

The Terry Suzanne "Speedy" and James King Foster Scholarship in Physics was recently established for undergraduate and graduate students in physics, with a preference given to female students. "Speedy" Foster's trust established this and a similar scholarship in the College of Business Administration.

Kudos to Faculty and Staff



Three faculty members earned fellowship status in the American Physical Society in 2011 and 2012. We now have nine faculty members who are society fellows. Our new fellows are: **Uwe Thumm**, professor, for “outstanding contributions including relativistic calculations for electron-atom collisions and elucidation of interactions of multiple charged ions and photons with atoms, molecules, clusters, surfaces, thin films and nanotubes”; **Bruce Law**, professor, for “fundamental contributions in vapor-liquid interface science of critical binary liquids, including surface-tension, adsorption, wetting and orientational ordering phenomena”; and **Chris Sorensen**, university distinguished professor and Cortelyou–Rust professor, for “original contributions to condensed matter physics, especially to the scientific understanding and technical application of particulate matter.”

Peggy Matthews, administrative officer, was recognized as Classified Employee

of the Year at the 35th annual Classified Employee Recognition ceremony. She also was honored for 40 years of service, serving with physics since 1983. **Deanna Selby**, senior administrative assistant, was honored for 35 years of service, serving with physics since 1992. **Kim Coy**, administrative specialist for the physics education research group, was recognized for 25 years of service, serving with physics since 1985. **Bryan Merritt**, research technologist in the machine shop, was recognized for his five years of service.

Bob Krause, technician in the James R. Macdonald Laboratory for 42 years, retired in November 2012. Many of his responsibilities have been reallocated, but he stands ready to return and help run the tandem accelerator.

Bharat Ratra, professor, has been awarded a 2012-2013 Commerce Bank Distinguished Graduate Faculty Award in recognition of his pioneering work in cosmology, nearly prescient of the discovery that the expansion of the universe is accelerating. He also gave a prestigious S. Goldman Lecture in Mathematical Physics at the University of Central Florida.

Chii-Dong Lin, university distinguished professor, was recognized by ETH-Zurich as a Femtosecond and Attosecond Science

and Technology, or FAST, fellow, and gave multiple invited presentations on strong field and attosecond physics. He also was honored as a Japan Society for Promotion of Science fellow.

Brett Esry, the university's youngest distinguished professor and the Ernest K. and Lillian E. Chapin chair in physics, received the Simons Fellowship in Theoretical Physics, which is providing partial funding for his current sabbatical. Esry is exploring the fundamental theory governing the interaction of ultrashort laser pulses with individual atoms and molecules, as well as the collisions of three atoms at ultracold temperatures. He is visiting four prestigious U.S. institutes in atomic theory. At K-State, he is part of the team awarded \$1 million from the NSF to improve our computer cluster.

The Chapin chair was established in 2000 by Franklin A. and Elizabeth Chapin Burke to honor Ernest K. and Lillian E. Chapin and to recruit and retain the highest quality faculty in physics. Their generosity in creating the Chapin chair helps the university have outstanding physicists like Brett Esry on its faculty.



Gary Wysin fosters international collaborations

Gary Wysin, professor of physics, traveled to Brazil on sabbatical in spring 2012 for his research on vortices in magnetic nanodisks and to complete his book, “Statistical Thermodynamics: understanding the properties of macroscopic systems,” co-authored with L.C. Fai from the University of Dschang in Cameroon.

At Brazil's Federal University of Vicosa, Wysin had stimulating interactions with theorists involved in low-dimensional and low-temperature magnetism, inspiring him to explore new topologies and other twists. At the Federal University of Santa Catarina in Brazil, he worked with Professor Wagner Figueiredo, a well-known scientist in statistical mechanics, and presented the talk “Energy and Dynamics of Vortices in Magnetic Nanodisks.”

Wysin has traveled to Brazil 20 times in the last 23 years, maintaining strong personal and professional connections, and he is working to recruit graduate students from the nation.



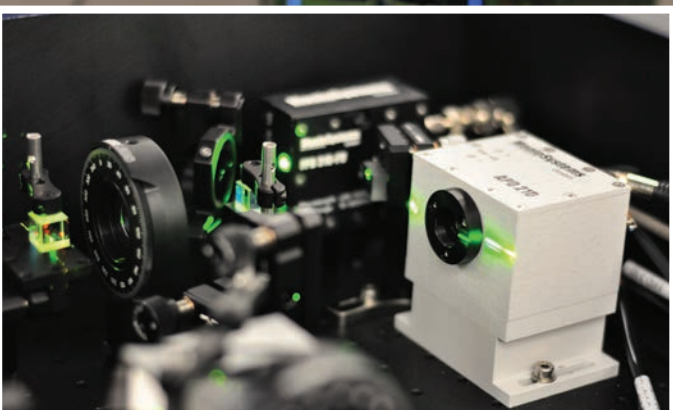
Sanjay Rebello: 2012-2013 Coffman Chair

Once again, the university has recognized a physicist with the Coffman Chair for Distinguished Teaching Scholars, which highlights Kansas State University's commitment to excellence in undergraduate teaching and learning. Sanjay Rebello, associate professor, is the 18th faculty member appointed to the position since it was created in 1995. Other physicists to earn the honor include Chris Sorensen and Dean Zollman, both distinguished professors.

Rebello is leading an interdisciplinary group of faculty to investigate, discuss and implement techniques to foster critical thinking and problem-solving in their classrooms. By implementing active learning tactics in the classroom, Rebello encourages students to become involved and take responsibility for their own education.

“His course has most definitely improved not only my education, but it also helped me to realize that my dream of becoming a physicist is definitely an achievable one,” said Jeff Murray, a junior in physics.

Students also selected Rebello to receive the Schwenk award in 2011-2012 for excellent teaching in the K-State physics department.



*Assistant Professors Matthias Kling and Artem Rudenko tune the new ultrafast laser.
Photo courtesy of Mohammad Zohrabi.*

Poised for the next frontier

The James R. Macdonald Laboratory is accelerating research across the globe

A shiny new laboratory and laser in Cardwell Hall are helping Kansas State University physicists continue a decades-old exploration of the structure and dynamics of atoms, ions, molecules and surfaces. For more than 30 years, this exploration was carried out through the means of ion-atom collisions. Since the start of the new millennium, the focus is on intense, ultrafast lasers.

The James R. Macdonald Laboratory — which focuses on atomic, molecular and optical physics — now houses a \$1.3 million laser system funded by the U.S. Department of Energy. Kansas State University provided more than \$500,000 for a laboratory upgrade, which was completed in summer 2012.

“The new lab space is a state-of-the-art ultrafast laser lab,” said Itzik Ben-Itzhak, the director of the Macdonald Laboratory and who was named a university distinguished professor in 2012. “It accommodates a high repetition rate, intense laser system that serves a multitude of experiments mainly focused on attosecond physics. These experiments and the laser system require a high level of environmental control, which the new lab space provides.”

Even though the new laser system was only installed in July 2012, researchers have already taken important data and are preparing publications. This rapid turnaround is the result of hard work by both the researchers and the laboratory technical staff.

It is because of these advanced facilities and high-profile research projects that U.S. News and World Report has ranked the university’s atomic, molecular and optical physics graduate program, which includes the Macdonald Laboratory, as the 13th best in the nation. The program is also one of the largest in the country.

Each year, the Macdonald Laboratory is supported by multiple agencies, including a \$2.5 million grant from the Department of Energy. The laboratory includes eight experimental and three

theory faculty who all continue to receive international and national recognition for their work. Three research faculty, numerous postdoctoral fellows, graduate students and undergraduates round out the laboratory’s workforce.

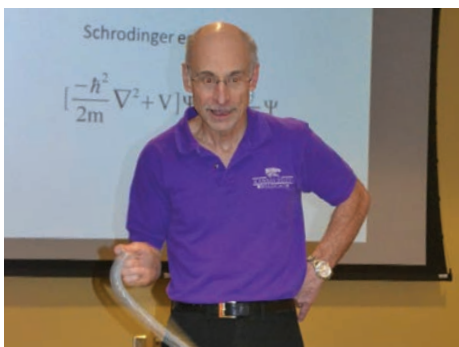
Carlos Trallero, assistant professor of physics, recently was awarded two instrumentation grants: a nearly \$1 million National Science Foundation Major Research Instrumentation grant and nearly \$200,000 from an Air Force Office of Scientific Research Defense University Instrumentation Program grant. The resulting acquisition of a high intensity tunable long-wavelength femtosecond laser will facilitate his exploration of high harmonic generation, attosecond and strong-field physics.

Matthias Kling, assistant professor of physics, recently received a \$750,000 Early Career Research Program Award to explore controlling and tracing of electrons in nanosystems — the first step to improving electronics and communication technology. This research was enabled by his work on steering electrons in molecules, for which he was awarded the Nernst-Haber-Bodenstein Prize of the German Bunsen Society in 2012.

Artem Rudenko, assistant professor of physics, recently joined the program and was one of the principal investigators in the international collaboration that used the Linac Coherent Light Source to create unprecedented high-charge states of atoms and molecules. The work recently appeared in *Nature Photonics*.

The year 2012 has also been a successful one for the theory group, highlighted by a *Nature* publication co-authored by Chii-Dong Lin, university distinguished professor of physics.

As faculty members continue high-profile research, the atomic, molecular and optical physics program is poised to achieve even greater success as an international research leader for the foreseeable future.



Photos contributed by Kristi Northcutt and Mike Strohschein

Expanding our community outreach

Our department consistently reaches out to our surrounding community through public lectures, tours of our laboratories, physics shows in area schools, science workshops on campus and our very popular physics show at the university's All-University Open House.

Recently we began a new seminar series at the Kansas State University Olathe campus targeting high school students in the Greater Kansas City area. In December, Chris Sorensen, university distinguished professor and Cortelyou-Rust professor (pictured above), demonstrated the properties of nanoparticles to some excited high school students. Previously, Vinod Kumarappan, assistant professor, presented the physics of aligning molecules in laser fields, and Sarah Golin, coordinator of the new series and instructor, presented the strong career opportunities for those with physics degrees. The lecture series is an excellent opportunity to recruit physics students and communicate the importance of physics to the public.

Other highlights in our outreach activities include Bharat Ratra's participation in the Science Café movement. Ratra, professor, has presented the accelerating expansion of the cosmos to interested audiences across the state and beyond. Dean Zollman, university distinguished professor, has given public lectures in Mumbai, India, and presented a two-week workshop in Delhi, India, for physics teachers from developing nations.



View our videos at
www.phys.k-state.edu/video/

Outstanding Alumni

Amit Chakrabarti met with more than 10 alumni in a whirlwind two-day visit to Albuquerque, Santa Fe and Los Alamos, N.M., in September. Among the alums he visited with included **Shanalyn (Kiger) Kemme**, '84 B.S. in math and physics and '85 M.S. in physics, and **J. David Schneider**, '70 M.S. in physics. Chakrabarti plans trips to meet more alumni over the coming years.



Dr. Clarence S. Clay, '47 B.S. in physics and '48 M.S. in physics, a renowned geophysicist who shaped the science of oceanography, was honored in a dedicated

session at the 164th meeting of the Acoustical Society of America in Kansas City, Mo. Amit Chakrabarti attended to honor one of our most distinguished alums. He also thanked **Jane Clay** for the scholarship she and Dr. Clay established in 1996 and for her continued support of our students.

Michelle Munson, '96 B.S. in physics and electrical engineering, is co-inventor of Aspera's award-winning fasp™ transport technology, involving protocols designed to move large quantities of data quickly through the Internet. Munson co-founded Aspera, a company recognized as a Top 50 Cloud Innovator by GigaOM, to promote this technology.

Jacqueline Spears, '69 B.S. physics, '72 M.S. in physics and '88 Ph.D. in educational administration, has been appointed interim associate dean of Kansas State University Olathe.

Lawrence Ramsey, '72 M.S. in physics, has been named a Penn State distinguished scholar for a sustained record of extraordinary achievement in research and education. In particular, Ramsey has developed several new astronomical observatories and done pioneering research in fiber optic astronomical instrumentation. He also has shown significant leadership in the astronomical community.

Salomón Itzá, associate professor of physics at the University of the Ozarks, has been named the Western Arkansas Outstanding Professor for 2012 by the Western Arkansas Education Service Cooperative. Itzá credits his postdoctoral training in physics education research at Kansas State for facilitating his work with area teachers.

Peterson lecturer inspires future physicists

Boris Kayser, distinguished scientist at the U.S. Department of Energy's Fermi National Accelerator Laboratory, presented the 2012 Peterson Public Lecture in Physics, "Neutrinos Get Under Your Skin."

The lecture series is named after Chester Peterson Jr., Lindsborg, Kan., who generously established the lecture endowment to host enthusiastic speakers — such as Kayser — to spotlight modern physics.

Kayser is the author of more than 100 scientific papers, has degrees from Princeton University and the California Institute of Technology, and has more than 40 years of experience at the National Science Foundation and Fermi Laboratory.



*Large Hadron Collider
Photo courtesy of CERN*

Higgs boson discovered, teaching rewarded

For Tim Bolton, 2012 was a good year.

In April 2012, Bolton, professor of physics, received Kansas State University's Commerce Bank Outstanding Undergraduate Teaching Award. The award recognizes educators who have a superior influence on student success.

For Bolton, that success comes in helping students understand a field that is frequently seen as intimidating.

"Students find they usually like physics once they get over their fear of the mathematical parts," he said. "I find physics very enjoyable to teach as I get to have a lot of fun with my classroom demonstrations. I also get satisfaction in that I am contributing directly in helping train more scientists, engineers and mathematicians for the country and the world — something we need."

Bolton also helps others understand physics beyond the classroom. As a member of Quarknet, a high energy physics outreach program, Bolton meets with Kansas high school teachers to discuss how they incorporate high energy physics in the classroom.

But it's not just teaching in which Bolton excels. His research also is drawing attention.

In July 2012, scientists at the European Organization for Nuclear Research, or CERN, announced that they found evidence for a subatomic particle known as the Higgs boson, named after its inventor, Peter Higgs.

According to Bolton, the Higgs boson is the quantum of a new type of force field in nature that solves a very tricky problem in

relating the theory of electromagnetic and weak nuclear interactions with experimental observations.

Bolton and fellow physics faculty members Andrew Ivanov, assistant professor, and Yuri Maravin, associate professor, were part of an international collaboration that made this discovery possible.

"This is a very important scientific discovery, possibly one of the 10 most important of this century," Bolton said. "As a scientist it's very exciting that humanity knows a little bit more about nature than we did yesterday."

Several undergraduates, graduate students and postdoctoral research assistants — including some who became interested in the Higgs boson through one of Bolton's classes — also participated in the search throughout the years.

Bolton led them in testing thousands of parts of the inner pixel tracker detector for the Large Hadron Collider's Compact Muon Solenoid, or CMS — one of two particle detectors devoted to hunting the Higgs boson and dark matter. The young researchers helped interpret results from the data collected by the Compact Muon Solenoid, lay the cable necessary for experiments at the CERN facility, and write the computer software used in the experiments.

In the fall, Bolton began a two-year appointment with the U.S. Department of Energy's Office of Science in Washington, D.C., as a program manager for the High Energy Physics Intensity Frontier — one of three broad thrusts in particle physics designed to help scientists, like Bolton, understand the world better.

Bolton joined K-State in 1994.

Notice of Nondiscrimination

Kansas State University is committed to nondiscrimination on the basis of race, color, ethnic or national origin, sex, sexual orientation, gender identity, religion, age, ancestry, disability, military status, veteran status, or other non-merit reasons, in admissions, educational programs or activities and employment, including employment of disabled veterans and veterans of the Vietnam Era, as required by applicable laws and regulations. Responsibility for coordination of compliance efforts and receipt of inquiries concerning Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Section 504 of the Rehabilitation Act of 1973, the Age Discrimination Act of 1975, and the Americans With Disabilities Act of 1990, has been delegated to the Director of Affirmative Action, Kansas State University, 214 Anderson Hall, Manhattan, KS 66506-0124, (Phone) 785-532-6220; (TTY) 785-532-4807.

Thank You

for all your help to improve our department's impact on science, students and the community! There are many ways your support makes a difference.

- As tuition costs increase and state funding of higher education dwindles, your support is critical for our physics majors.
- Donor support of undergraduate research promotes student retention and successful careers.

- New donor-funded graduate student teaching and research awards enhance the undergraduate learning environment.
- Our recruitment, outreach and mentoring programs need critical support from donors like you!

To contribute, please visit our website at www.phys.k-state.edu/giving

For more information about establishing your own named scholarship at the university, please call the KSU Foundation development team at 800-432-1578. Again, thank you!

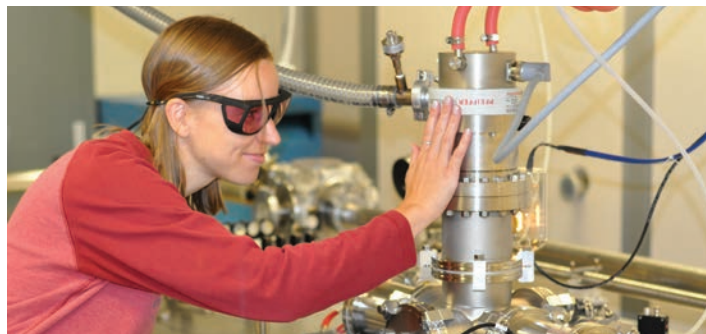
Doctoral student meets Nobel Laureates

Nora Kling, a doctoral student in physics from Dell Rapids, S.D., works with the team of Itzik Ben-Itzhak, university distinguished professor of physics. Kling specifically studies the reaction dynamics of intense laser light interacting with atoms and molecules.

She conducted similar research at the Max Planck Institute of Quantum Optics in Garching, Germany as a research assistant for two and one-half years, beginning with a Fulbright Scholarship in 2009.

In summer 2012, Kling participated in the 62nd Lindau Meeting of Nobel Laureates in Lindau, Germany. Kling was selected by the U.S. Department of Energy's Office of Science to attend the meeting, July 1-6, that was dedicated to physics.

"Meeting the Nobel Laureates was incredibly inspiring, and the discovery of the new [Higgs] boson was announced while I was in Lindau, in a room with about 1,000 physicists from all over the world, which was indescribable," Kling said.



Kling's many awards include the Yong-Ki Kim Graduate Award for Research Excellence in 2009 and the Golden Key Award for Outstanding Graduate Research Assistant. Kling has co-authored numerous publications that have appeared in prestigious journals. Recently she was part of an international team to study double ionization of atoms, which has proven to be a key factor to improving knowledge of correlated electron dynamics. The work appeared in Nature Communications.