



LIFE IN THE FASP® LANE

Alumna discusses how she created a technology and started a company that has transformed the world of data transfer

Michelle Munson, CEO of Aspera® Inc. and co-inventor of Aspera's fasp® transport technology, presented the 2013 Ernest Fox Nichols Distinguished Alumni Lecture in Physics on Oct. 14 in the Hemisphere Room at Hale Library. The lecture honors distinguished physics alumni from Kansas State University.

The free lecture, "I Was You," was open to the public so that students, faculty and community members could learn about Munson's journey from a physics and engineering student to founder of a successful company.

"Ms. Munson's inspirational talk emphasized the profound influence that a moment's encouragement from a faculty member can have on a student's career," said Kristan Corwin, associate professor of physics who attended the lecture. "She also set a strong example to our students of the power of perseverance, hard work and positive thinking — skills she developed in her physics and engineering courses. She values people as individuals, and shows that to be a basis of excellence in teaching and in starting and growing a company."

Aspera's fasp® transport technology provides breakthrough high performance data transfer and synchronization regardless of Internet distance, data size and network conditions. Thanks to industry adoption, the technology has been awarded a 2014 Engineering Emmy for transforming the digital media industry and is used

today by more than 2,000 companies to transfer large data sets, making Aspera one of the most recognized software startups with more than 100 times growth since its inception.

Munson credits her success to a lifetime education in science, engineering and mathematics. She talked about how her life experiences and relationships have all woven together to make her journey possible as well as the lessons she learned in course.

Munson was born and raised in Junction City and graduated from Chapman High School. At Kansas State University, Munson was a Goldwater scholar and later a Fulbright scholar at Cambridge University where she received a postgraduate diploma in computer science. She graduated from Kansas State University in 1996.

Munson has led Aspera in collaboration with co-founder Serban Simu since its inception in 2004. Before founding Aspera, she was a software engineer in research and startup companies, including the IBM Almaden Research Center. She was the 2006 K-State College of Engineering alumni fellow — the youngest recipient ever. Munson carries multiple patents in high performance transport and bandwidth control and was named a recipient of a 2014 Engineering Emmy from the Academy of Television Arts and Sciences for the Aspera technology.



PHYSICS DEPARTMENT NEWSLETTER



Greetings from K-State Physics! I am excited to report another successful year. Our students and faculty continue to bring distinction to the department. At the same time, our donor support is making a huge difference in our recruitment, retention, and outreach efforts.

Two of our greatest current needs in recruitment and retention are: 1) attracting strong students with departmental scholarships and 2) supporting students involved in undergraduate research. With generous support from our friends and alumni, we now offer an instant \$1,000 scholarship to our outstanding freshmen applicants. The results have been immediate — our incoming class this year has 21 physics majors and at least 10 of them have an ACT score above 32.

Early involvement in research helps retain undergraduates in physics — and it's fun! Our exceptional undergraduate researchers give invited talks at national meetings and win prestigious fellowships. Many of our majors have competed for research funding from the College of Arts and Sciences. Because of the generosity of our friends and alumni, the Department of Physics will expand each student's research experiences by matching the college's funding.

In another important development, our department is building on its exceptional science and scholarship to engage the private sector. The K-State Institute for Commercialization is helping us match research strengths to commercial interests. To help cultivate a culture of "producing products," we invited physics alumna Michelle Munson as our Fox-Nichols lecturer. She is the CEO of Aspera, a company she founded.

Please visit our website (phys.ksu.edu) and Facebook pages (facebook.com/ksuphys) and be in touch with the department. I would love to hear about what is happening in your life (amitc@phys.ksu.edu).

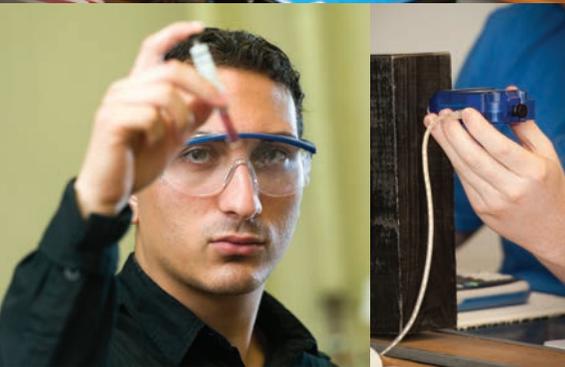
Once again, I want to thank you for what you do for the department.

Warm regards,

Amit Chakrabarti

Amit Chakrabarti
William and Joan Porter Professor and Head

NEW HORIZONS FOUND THROUGH NEW DESIGNS



This fall, newly renovated spaces were put to use by physics students and faculty alike. Cardwell Hall's Room 311, most recently home to a modern physics laboratory and advanced laboratory, was beginning to show its age, said Amit Chakrabarti, head of the department.

"The space was no longer conducive to our modern needs," Chakrabarti said. "These classes, and consequently the space the classes are taught in, are very important to students forming a positive attitude about physics."

Using funds from the College of Arts and Sciences and private donors, the room was freshened from floor to ceiling. In addition, much improved lighting control now facilitates groups of students working together or on separate experiments — even in the dark. Many new whiteboards improve the opportunities for group discussion. A permanent projector and new chairs complete the project.

The Math/Physics Library on the first floor of Cardwell Hall also was remodeled as part of a collaboration between the physics and mathematics departments and the deans of K-State Libraries and the College of Arts and Sciences.

While the library still contains current scientific publications, it also includes a commons space, quiet study locations, a projector screen and a videoconference room.

"We looked at what students and faculty need as a resource center in the modern age," Chakrabarti said. "Much of that meant going beyond printed publications and into spaces that are more interactive and flexible."

Additionally, funding from the provost's office and college and an increased tuition fee are helping upgrade instructional equipment throughout Cardwell Hall.

Chakrabarti links the renovations to the department's other successful recruitment and retention efforts, which include retaining dedicated and award-winning faculty, performing outreach at the K-State Olathe campus and in Wichita, and writing a personalized recruitment letter to every high school physics teacher in the U.S.

"I think providing them with these improved facilities is one aspect to that," he said.

BUILDING LINKS WITH INDUSTRY

K-State physicists are producing more than just great scientific publications recently: They are generating intellectual property and building links with industry. Topics of some recent intellectual property disclosures include Detonation Graphene Nanosheets, Gas-filled Hollow Core Fiber Lasers and Electrochemical Nanowires. Explorations are currently underway for applications in subcellular force sensors, laser-based chemical detection and remote sensing, and optical telecommunications. In addition, companies like Amgen are funding basic research by Jeremy Schmit and co-workers to improve protein-based drug formulation. Our scientists also are meeting with the Kansas Institute for Commercialization to explore new and creative ways to engage the private sector.

NOBEL PRIZE FOR THE HIGGS BOSON

University participated in award-winning discovery

In October 2013, the Nobel Prize in physics was awarded to Peter Higgs and Francois Englert for their 1964 theoretical model on how fundamental particles acquire mass. This model was recently confirmed through the discovery of the predicted fundamental particle, a Higgs boson, through two experiments at the European Organization for Nuclear Research, or CERN, in one of which Kansas State University researchers are heavily involved.

Yurii Maravin, associate professor of physics, is among the university's leaders participating in the ongoing research at CERN. Maravin leads a research group that is responsible for detecting photons and electrons produced in collisions of particles accelerated by the Large Hadron Collider – the world's largest energy particle accelerator. These particles played a crucial role in the discovery of the Higgs boson production in particle collision data.

While the Higgs particle has been observed, Maravin said the work is far from over.

"We found a very important missing piece with the Higgs boson," he said. "However, we still do not know if the newly discovered particle is solely responsible for the mass generation of elementary particles or if it is part of a yet to be discovered phenomenon."

Efforts are currently underway to increase the energy at CERN. By 2015, the research

facility is anticipated to achieve almost twice the energy it currently has, making it possible for Maravin and other researchers to pursue more studies of the Higgs boson and search for new physics that could help explain the origin of mass as well as potentially uncover other fundamental mysteries of our universe.

"Currently, we kind of know the Standard Model of particle physics is only a low-energy approximation of a more general theory," Maravin said. "We discovered the Higgs and it was the last puzzle piece to the Standard Model. But we have more puzzles to solve, such as why gravity is so weak and what the origin is of dark matter and dark energy. New discoveries from the energy frontier can help us in defining a more general theory of the universe and help us better understand the world we live in."

The search for evidence about the Higgs boson also included physics faculty members Tim Bolton, professor; Glenn Horton-Smith, associate professor; Andrew Ivanov, assistant professor.

Additionally, the university's Electronics Design Laboratory helped build the inner pixel tracker and several sets of electronic components for one of the accelerator's four particle detectors, named the Compact Muon Solenoid.

EARLY CAREER AWARD RECOGNIZES PHYSICIST'S RESEARCH



Andrew Ivanov, assistant professor of physics, received a five-year \$750,000 Department of Energy Early Career Research

Award for his collaborative research involving the Large Hadron Collider.

Ivanov's proposal, "Quest for a top quark partner and upgrade of the pixel detector readout chain at the CMS," was one of 61 proposals chosen for funding from the 700 submitted in 2013.

Ivanov is searching for a top quark partner by analyzing data

from the Compact Muon Solenoid experiment at the Large Hadron Collider in Switzerland. He also is collaborating with researchers at Fermi National Accelerator Laboratory, or Fermilab, near Chicago. Fermilab's computing center receives data from the Large Hadron Collider and Ivanov is narrowing down this data so he can analyze it at Kansas State University.

"For practical purposes, the knowledge we gain today will be important for future generations," Ivanov said. "We may not be able to see all the benefits of this research in our lifetimes, but this kind of research may lead to new energy sources for future generations."

Ivanov's project also will improve the performance of the Compact Muon Solenoid pixel detector system by upgrading the data acquisition readout for future high energy and high luminosity physics runs at the Large Hadron Collider. Ivanov and engineers in Kansas State University's Electronics Design Laboratory are working on the electronics to improve the detector.

The Department of Energy's Early Career Award supports research in the areas of advanced scientific computing research, biological and environmental research, basic energy sciences, fusion energy sciences, high energy physics and nuclear physics.



UNDERGRADUATE STUDENTS

Heidi Ramzel, junior in physics and geography with a minor in chemistry, Bartlesville, Okla., received a 2013 Ernest F. Hollings Undergraduate Scholarship from the National Oceanic and Atmospheric Administration. The scholarship will help her focus on her dream job of becoming a research meteorologist. Mother of a 6-year old, she has fought hard to earn this opportunity. The scholarship offers a maximum of \$8,000 per year for students with two years left of undergraduate study and a summer internship at a National Oceanic and Atmospheric Administration facility. Ramzel is one of 126 students, out of a pool of more than 900 applicants, who was selected as a 2013 Hollings scholar.

Kevin Robben, junior in physics, chemistry and mathematics, Overland Park, Kan., participated in the inaugural Undergraduate Research Day at the Capitol on April 4, 2013. He presented his research poster, "Study of reprecipitation parameters of conjugated polymer nanoparticles," and had the opportunity to interact with lawmakers. The event, hosted by the Kansas Board of Regents, allowed 80 undergraduates from across the state to present their research in the State Capitol Rotunda.



KUDOS TO STUDENTS

GRADUATE STUDENTS



Maia Magrakvelidze, doctoral student in physics, was awarded the 2013 K-State Physics Outstanding Graduate Student Researcher Award from the physics department in May 2013. She graduated in December 2013 with her Ph.D. Her dissertation, "Dissociation dynamics of diatomic molecules in intense fields," is under the supervision of Professor Uwe Thumm. She has begun a postdoctoral position at Northwest Missouri State University with Himadri Chakraborty. She received her bachelor's degree and master's degree in condensed matter physics from Tbilisi Ivane Javakhishvili State University in Tbilisi, Georgia. She also received a master's degree in atomic and molecular physics from Kansas State University in 2009.



Derrek Wilson, Ph.D. candidate, was awarded the 2013 National Science Foundation Graduate Research Fellowship. He receives more than \$120,000 across three years, which includes a yearly \$30,000 stipend and \$12,000 in lieu of tuition and fees. His research, directed by Carlos Trallero in the J.R. Macdonald Lab, focuses on ultrafast, intense lasers. Said Wilson, "I want to build a company that uses the ultrafast technology my adviser Dr. Carlos Trallero and I develop to create marketable scientific products, and eventually expand to a larger audience of investors." Wilson, of Liberal, Kan., is president and founder of the student chapter of the Optical Society of America, or OSA, at Kansas State University.



Shun Wu, Ph.D. candidate, was selected as a finalist for the 2013 Emil Wolf Outstanding Student Paper Competition by the Optical Society of America for her paper "Direct Stabilization of a Frequency Comb to a $^{12}\text{C}_2\text{H}_2$ -filled Hollow-core Photonic Crystal Fiber." The competition recognizes the innovation, research and presentation excellence of students presenting their work at the Frontiers in Optics, or FIO, meeting.

Seven physics undergraduate majors received the 2013 College of Arts and Sciences Research Award, which is a \$1,000 scholarship to provide 100 hours of undergraduate research. Thanks to your generous donations, the physics department has matched this, providing another \$1,000 to each student to cover an additional 100 hours of research experience!

OUTSTANDING ALUMNI

Fatima Anis (Ph.D., 2009) received a U.S. Department of Defense Postdoctoral Fellowship for Breast Cancer Research from the U.S. Department of Defense. The three-year, \$329K project is titled "Development and Translation of Hybrid Optoacoustic/Ultrasonic Tomography for Early Breast Cancer Detection." The award supports exceptionally talented recent doctoral or medical graduates, the "best and brightest" of their peers. Her Ph.D. was directed by Brett Esry, and she is currently a postdoctoral fellow in biomedical engineering at Washington University in St. Louis.

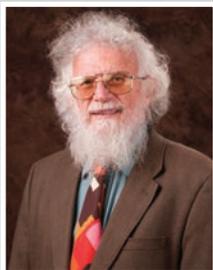
Cheng Jin (Ph.D., 2012) was honored with selection for publication in the Springer Theses series. His Ph.D. thesis, "Theory of Nonlinear Propagation of High Harmonics Generated in a Gaseous Medium," was directed by C.D. Lin, university distinguished professor. The publication offers the opportunity to gain further exposure of his thesis work and prize money.

Jim Chelikowsky (B.S., 1970) won the Rahman Prize from the American Physical Society. He is the director of the Institute for Computational Engineering Sciences Center for Computational Materials, and was cited for his "computational applications of quantum theories to understand and predict

material properties." His research focuses on optical properties, interfacial phenomena, nanoregime systems, microstructure of liquids, simulated imaging and the development of high performance algorithms to predict the properties of materials.

Dyan Jones (PhD., 2009) was named a 2013 research fellow at Mercyhurst University. This award honors faculty for consistently producing a body of scholarship at the highest level within their disciplines. She is currently an assistant professor of physics at Mercyhurst, and received her Ph.D. under the direction of Dean Zollman.

ZOLLMAN HONORED for physics education research



Dean Zollman, university distinguished professor of physics, has been named the 2014 recipient of the prestigious Oersted Medal from the American Association of Physics Teachers. The award honors a person who has had an outstanding, widespread and lasting impact on the teaching of physics.

Zollman received the award for his

significant contributions to physics education research and mentoring of a generation of researchers. It is his second medal from the association — he also received the 1995 Robert A. Millikan Medal.

Zollman has contributed much to the world of physics, such as using advanced technology to bring physics to all learners, mentoring students even after they graduate and his physics education research. He has devoted his career to studying how students learn physics and searching for new and exciting ways to teach physics in the classroom.

COFFEE AND THE COSMOS

How science cafés are blending specialized knowledge with casual conversation



Bharat Ratra is helping turn science into the hottest thing at coffeehouses since cappuccinos.

Ratra, professor of physics, is part of the national science café movement — an effort to advocate science and its benefits through informal public education. Science cafés are designated coffeehouses or microbreweries where people meet to casually discuss science and technology. The informal setting is intended to create a welcoming and inclusive atmosphere for people with no science background.

Ratra has spoken about cosmology at the Manhattan Science Café, which is one of six science cafés in Kansas. The café meets at 7 p.m. on the second Tuesday of every month at Radina's Coffeehouse and Roastery on North Manhattan Avenue.

Each session opens with a guest speaker giving a brief presentation to kick off questions and a discussion about the topic, Ratra said. Topics have included sustainability, DNA sequencing and the science of making beer.

In addition to speaking at the Manhattan Science Café, Ratra has been a guest speaker at the other five Kansas science cafés, including the one he helped bring to Topeka. In July 2013, he spoke about dark matter, dark energy and the accelerating universe at the Topeka location.

A list of science cafés is available at <http://www.sciencecafes.org/find/>.

ENDOWED LECTURES

Neff Lecture: David Weitz, Mallinckrodt professor of physics and applied physics at Harvard University, presented “Dripping, jetting, drops and wetting: The magic of microfluidics,” on April 1, 2013. The lectureship is funded by an endowment established with a bequest from alumnus James R. Neff, an internationally recognized orthopedic surgeon, in honor of his parents.

Peterson Lecture: Alan Guth, Victor F. Weisskopf professor of physics at the Massachusetts Institute of Technology, or MIT, presented “Inflationary Cosmology: Is Our Universe Part of a Multiverse?” Alumnus Chester Peterson Jr. of Lindsborg, Kan., endowed the lecture series in 2006 to interest everyone in the fascinating world of modern physics.

MORE KUDOS TO FACULTY



Artem Rudenko, assistant professor, was recognized with the VUVX Conference Award in Atomic Physics, which recognized “his exceptional contributions to laser and X-ray science in atomic and

molecular physics. Using ultra-short and phase stabilized laser pulses and Free-Electron Lasers, he has been the driving force for benchmark experiments from the VUV to the X-ray regime.” The 38th international conference on Vacuum Ultraviolet and X-ray Physics, or VUVX, was July 12-19, 2013, in Hefei, Anhui Province, China.



Brett DePaola, professor, received the 2013 Presidential Award for Excellence in Undergraduate Teaching. DePaola recently converted the department's Physical World II course into Science for Policy

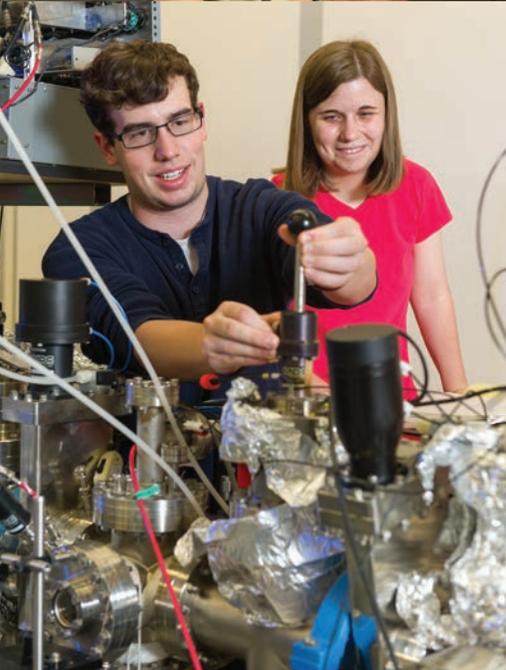
Makers, a new course based on his experiences as a Jefferson science fellow. DePaola served as a fellow with the U.S. Department of State from 2010 to 2011, and continues to be an intelligence community associate who helps the U.S. intelligence community with science- and technology-related issues.



Sanjay Rebello, professor, was honored as an Outstanding

Faculty Member by Mortar Board. Faculty members are selected based on their dedication to student success and their contributions to the university.

Brendan Heffernan (First photo below), junior in physics, Olathe, Kan., works in the lab with Chris Sorensen, university distinguished professor of physics. Heffernan is one of K-State's nominees for the Barry M. Goldwater Scholarship, a national award given to outstanding students.



EXPLORING THE WORLD THROUGH RESEARCH

Undergraduate research is a staple of the physics department. From projects to creative endeavors, the department offers undergraduates numerous opportunities to work alongside faculty mentors.

Here's a closer look at four undergraduate researchers:

Justin Raybern, senior from Hudson

Major: physics

Faculty mentor: Andrew Ivanov, assistant professor of physics

Raybern is a former high school chemistry and physics teacher who is now pursuing physics research. Raybern is working with Ivanov on developing a testing protocol for the Token Bit Manager chip that will be used in the upgrade of the Compact Muon Solenoid experiment at CERN. The new chips need to be tested and optimized before the scheduled 2018 upgrade.

"My plan is to begin graduate studies in physics in fall 2014. I would like to do research in high energy or nuclear physics. The project that Professor Ivanov and I are working on is exactly the kind of research that I want to do."

Mattithyah Tillotson, senior from Whitewater

Major: physics

Faculty mentor: Kristan Corwin, associate professor of physics

Tillotson is working with Corwin on constructing a fiber cell that contains acetylene to use for saturated absorption spectroscopy. Tillotson also has studied the effects collapsing the core of the optical fiber has on the way the light transmits through it. Tillotson is studying two other subjects — secondary education and chemistry — and someday would like to teach chemistry or physics at a middle or high school.

"I've learned a lot more through my research experience than just my results. I've learned a lot about the nature of science and how research works. I've learned the importance of problem solving and critical thinking skills. Finally, I've seen how sometimes you just have to tenaciously attack a problem and eventually you'll get an answer."

Jeffrey Murray, junior from Topeka

Major: physics

Faculty mentor: Sanjay Rebello, professor of physics

Murray has been involved in several undergraduate research programs, including the physics Research Experience for Undergraduates program, Developing Scholars Program and McNair Scholars Program. He has studied topics such as carbon nanotube fiber lasers and the effectiveness of visual cueing in introductory physics problem solving. Murray used to live in Nashville, where he was a professional drummer and worked with country artist Sara Evans and bands like Midnite Run and Matrix.

"I chose Kansas State University because of the opportunities to be involved with undergraduate research. I love research because it is the application of a large portion of the physics that you learn in your undergraduate classes. Also, it is really exciting to work on a problem that has not been solved before."

Sara Crandall, graduate from Cheney

Earned physics degree in December 2012

Faculty mentor: Bharat Ratra, professor of physics

As a student, Crandall worked with Ratra and published research in statistical analyses of cosmological parameters. One of their projects involved Hubble parameter versus redshift data, and another project was a collection of 20 years of 12 cosmological parameter data. Crandall also researched high energy physics, built a small muon detector and helped the physics education research group. She someday would like to venture into space.

"Through undergraduate research, I've learned vital programming and academic paper-writing skills, how to take constructive criticism and most importantly, patience."



FANTASTIC VOYAGE

Sorensen lectures on South American cruise

Christopher Sorensen, Cortelyou-Rust university distinguished professor of physics and university distinguished teaching scholar, recently said “bon voyage” to the traditional classroom environment in favor of one on the high seas.

Sorensen spent Feb. 20-March 5 as a guest lecturer on board a cruise ship in South America. Scientific American

magazine sponsored the cruise, called the Bright Horizons 16.

Sorensen was one of five speakers invited by Scientific American to give lectures to 150 people. Audience members included medical doctors, inventors, retired engineers and professors — all of whom enrolled in the exotic lecture series after learning about the 2013 speaker lineup and destinations from an advertisement in the magazine.

“It was a nerd holiday,” Sorensen said. “We all came from different walks of life, but our common tie was that we were all intellectually interested in science. It was a great group. I had a wonderful time and had a great response from the crowd.”

Throughout the voyage, Sorensen presented five 55-75 minute lectures that focused on physics and humanity’s understanding of science. His topics

included light scattering, nanoparticles and how scientists have discovered what they know about the universe.

For Sorensen, the cruise was more than the opportunity to talk science.

Growing up, he subscribed to Scientific American, which appealed to his curiosity for science. Similarly, the ship’s path through Cape Horn, the Strait of Magellan and several Patagonian channels on its voyage from Santiago, Chile, to Buenos Aires, Argentina, appealed to his imagination.

“From my point of view, the route was fantastic,” Sorensen said. “I grew up reading all of these great sea and sailing stories, like ‘Moby-Dick’ and ‘Two Years Before the Mast.’ So, to go around Cape Horn and visit lots of those areas where many of those stories took place was a high adventure for me.”



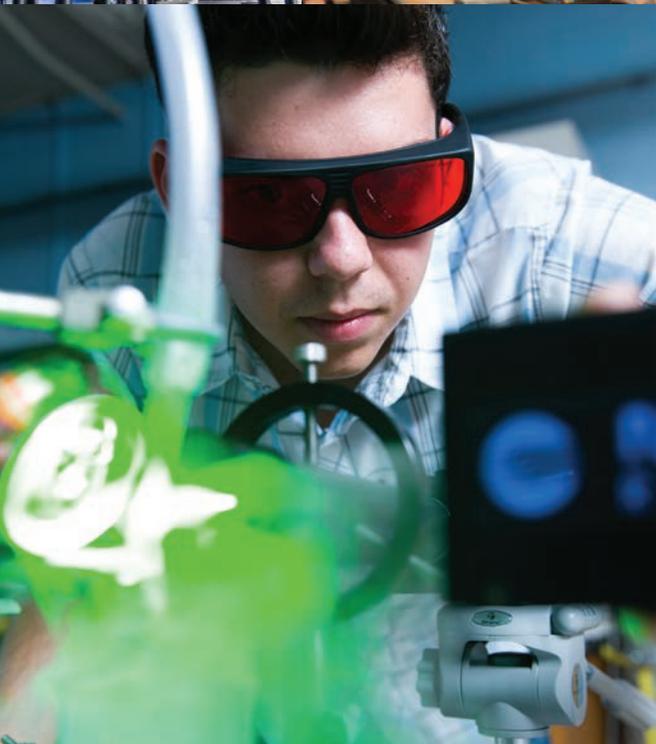
OUTREACH EFFORTS

Our physics lecture series in Olathe, Kan., had 147 attendees and 115 students last year. A similar lecture series will soon begin at Wichita East High School, co-organized by alumnus Chris Wyant.

Many groups of high school students have visited the department this year. Students toured research labs and interacted with demos to learn about concepts such as torques, thermodynamics, optics and electromagnetism. Some groups come through a BNSF Railway grant to both physics and the College of Engineering. Seaman High School in Topeka, the online high school the IQ Academy and Wichita East High School all sent students, as did Fort Hays State University.

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.



THANKS FOR YOUR SUPPORT

Thank you for all you do to help us 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.
- Donor-funded renovations and equipment have enhanced the hands-on learning opportunities for our undergraduates.
- Donor-funded graduate student teaching and research awards enhance the undergraduate learning experience.
- Our newly enhanced 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!