

Physics Department Newsletter

January 2012



Provost April Mason visited the Physics Department on Nov. 3, 2011. Here she experiments with angular momentum in one of our innovative teaching studios.

Photo courtesy of Chii-Dong Lin, university distinguished professor

Out of sight: K-State physics grad takes ‘shooting the moon’ literally

Amidst the mountains of Boulder, Colo., Penny Warren admits to missing the open spaces of her native Kansas. But Warren, who received her bachelor's degree in physics from Kansas State University in 1987, develops the tools needed to map the ultimate open area: space.

A principle detector engineer and detector area functional manager at Ball Aerospace & Technologies Corporation, Warren's roots are in Winfield, Kan., where she originally heard about a summer program at Kansas State for high school students. While this initially attracted her to the university, Warren only grew to love Kansas State more as her involvement in the physics department deepened.

“It was a small group; only six people graduated with me,” Warren said. “It had the feel of a small, liberal arts school at a larger university. I loved that physics professors actually taught the advanced classes, as opposed to graduate teaching assistants.”

Looking back at her time at K-State, Warren said she remembers Larry

Weaver, still a physics professor at the university, as one of her favorite educators. Another fond memory includes her time as president of the Society of Physics Students.

“It really helped integrate students into the department,” she said.

After graduating from K-State, Warren went on to receive her master's degree and doctorate in physics from Purdue University. While at Purdue, she and a fellow graduate student established Sciencescape, a science camp for middle school girls, the age when many girls decide science isn't cool.

“We wanted to stem the tide of girls leaving science,” Warren said. “Although I handed off the camp to others, I still remain interested in it. It's been going strong for 20 years.”

After working as a research physicist at the Naval Research Lab for six years, Warren went on to her current position at Ball Aerospace & Technologies Corporation, where she leads a team of 35 engineers and technicians.

Warren said she works with scientific-grade digital cameras for satellites, which are sensitive enough to detect low-level signals down to 100 photons. She has characterized charge-coupled devices for the Kepler Photometer, a NASA spacecraft mapping Earth-sized planets, and charge-couple devices for the OMPS spacecraft that's mapping the ozone in the Earth's atmosphere.

In fall 2011, Warren shared her experiences at Kansas State's Ernest Nichol's Lecture, her second presentation at her alma mater. Living in Boulder with her husband and daughter, Warren makes it back to Manhattan occasionally to visit her sister and brother-in-law, who is the dean of the College of Arts and Sciences.





I am very excited to be selected as the next department head of physics at Kansas State University. During a decade of leadership from outgoing head Dean Zollman, our department has excelled in both teaching and research and stands as a premier department at K-State. With new faculty hires and the retirement of Lew Cocke, we now have 27 full-time faculty members along with more than 60 graduate students, 50 undergraduate physics majors and more than 20 post-doctoral fellows. The remarkable achievements of this group of high quality physicists are presented throughout this newsletter. Much of this is made possible by the support of our alumni and friends, for which I am deeply grateful.

Provost April Mason visited the department in November, giving us the opportunity to highlight our innovative teaching studios and the outstanding research programs in AMO, cosmology, high energy physics, soft matter and biological physics, and physics education. To see some exciting pictures from her visit, please check our Facebook page (www.facebook.com/ksuphys) and our departmental web page (www.phys.ksu.edu). Video profiles of faculty and student achievements are regularly posted. You can follow our achievements on these pages and stay in touch with each other. And please let us know what you are up to! I look forward to communicating with you in the coming year about interesting news events in the department and at K-State.

Warm regards,

Amit Chakrabarti

Amit Chakrabarti

William and Joan Porter Professor and Head

A discovery that gelled

by Greg Tammen

What began as a notion of creating a multipurpose material through a new process has now gelled for two Kansas State University physicists.

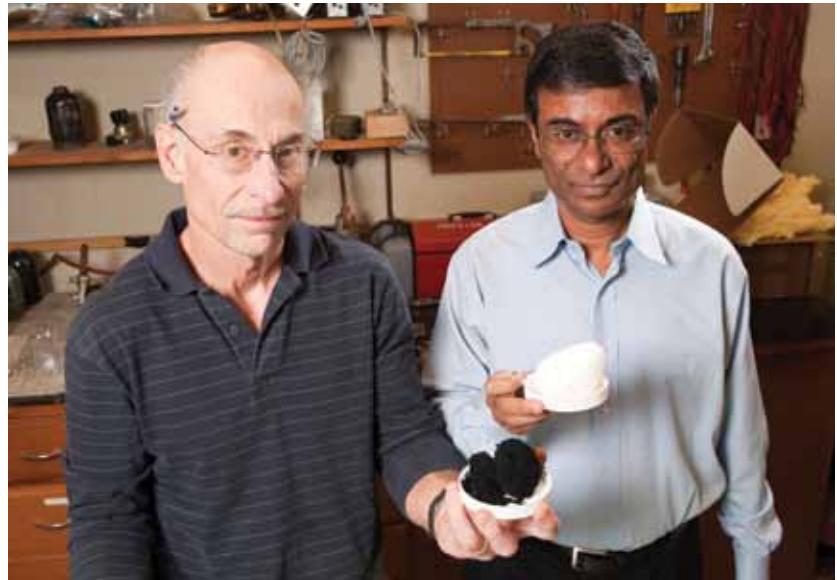
Chris Sorensen, Cortelyou-Rust university distinguished professor and university distinguished teaching scholar, and Amit Chakrabarti, William and Joan Porter chair in physics and head of the department of physics, were recently issued a patent for the discovery and creation of the world's first aerosol gels.

The material — also called gelled smoke or frozen smoke — is a lightweight, porous, high surface area gel formed by gelling clouds of particles in a gas.

"If you take a gaseous mixture of acetylene and oxygen and blow it up in a chamber, you get a cloud of smoke," Sorensen said of the carbon soot aerosol gel, the first aerosol gel made. "If you leave it alone for a couple of minutes the nanoparticles of smoke link together to form a lacy network that spans the chamber. It becomes a sort of fluffy gel that you can just scoop out."

The resulting aerosol gels are one of the lightest weight solid materials on the planet being only twice as dense as air. The material has the consistency of whipped topping but actually jiggles like jelly. As Sorensen puts it, "It wiggles like Santa's belly."

So far two types of aerosol gels have been made, a black one made from carbon soot and a white one made from silica. Just about anything that can combust, though, can be turned into an aerosol gel, Sorensen said. That includes metal powders and metal organic compounds.



Applications include using the aerosol gels as semiconductors, fuel cell catalysts, insulation material, acoustic dampeners and in water filtration systems and cosmetics.

Sorensen was serendipitously introduced to the idea of gelling an aerosol when a graduate student was attempting to scatter light from a flame. He noticed that a continuous network of soot formed across the surface of the flame. Up to that point, similar gels — called aerogels — had only been formed with liquids.

While aerosol gels and aerogels can be used for the same applications, making aerosol gels requires less difficulty than that needed to create aerogels, according to Chakrabarti. Aerogels, which are produced like gelatin, must be carefully drained of liquid before use.

The team recently published an invited (and peer-reviewed) review paper in the journal *Soft Matter* that lays out a theory for why things gel.

Pursuit of attosecond dynamics captures lasting results



For more than 40 years, C. Lewis "Lew" Cocke has been blowing apart atoms at Kansas State University.

Cocke, who added the word emeritus to the title of university distinguished professor in spring 2011, researched destruction on a molecular level in an effort to better understand matter. He spearheaded new directions for physicists around the world, ushering in research on ion-atom collisions, heavy charged ions

and attosecond physics.

Seen by his colleagues as a leader in the field of atomic, molecular and optical (AMO) physics, Cocke helped propel the K-State AMO program and James R. Macdonald Laboratory to an internationally recognized level, and one that is ranked 13th in the nation by U.S. News and World Report.

In April colleagues organized the symposium "Chasing Attosecond Dynamics of Atoms and Molecules with Electrons, Ions and Lasers — the Last Forty Years," which celebrated Cocke's prolific research and included physicists from around the world.

"It's hard to think about my work outside of the context that it was just the science that I thought was interesting and that hadn't been done yet," Cocke said. "I made many friends and worked with many great colleagues."

Though retired, Cocke continues his attosecond research.

New faculty members join physics department



Ellie Sayre

When Ellie Sayre was an undergraduate student, she couldn't decide on her major: theater or physics.

"I reasoned that it was easier to do theater as a physics major than it was to do physics as a theater major," she said. "In grad school, I discovered that I love figuring out how minds work, so I started doing research in physics learning."

Sayre is a new assistant professor of physics at Kansas State University. She earned her bachelor's degree in physics from Grinnell College, and she received her master's of science teaching and doctorate in physics from the University of Maine. Before coming to K-State, Sayre was a visiting assistant professor at Wabash College in Crawfordsville, Ind.

Her research interests include how undergraduates learn physics and how physics students become physicists. Sayre collects data from thousands of introductory students every year to study when and if they learn physics and how quickly they forget what they've learned.

"I'm really curious about how physics students grow to join the professional community of physicists," she said.

[View video profiles of our new faculty at www.phys.k-state.edu!](http://www.phys.k-state.edu/)



Jeremy Schmit

Jeremy Schmit's research is laying the foundation to learn more about diseases like Alzheimer's.

He is a new assistant professor of physics at Kansas State University. Schmit worked in the pharmaceutical chemistry department at the University of California, San Francisco, where he started researching protein aggregation, which might be responsible for some degenerative diseases.

"I am trying to figure out how and why the molecules aggregate: What are the forces that cause them to attract, and how do the aggregates change with time?" he said. "It is up to the biologists to determine how these aggregates result in diseases."

Proteins aggregate in many ways, and Schmit analyzes three types of aggregation: amyloid fibrils, crystals, and amorphous aggregates, all of which have different applications in medicine.

Schmit's research could help in the design of nanoscale devices.

"Nobody really knows what these will be used for, but miniaturization always opens doors and some of the potential applications are straight out of science fiction," he said.

Schmit earned his bachelor's degree from Northwestern University and received his doctorate from the University of California, Santa Barbara.

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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.



Alumni corner

Yujun Wang, who earned his doctorate in 2010, is now a postdoctoral research associate at JILA, a joint institute of the University of Colorado at Boulder and the National Institute of Standards and Technology. He has been there since September 2010.

Kevin Knabe, who earned his doctorate in 2010, was recognized for Outstanding Presentation at the recent Boulder Laboratories Postdoctoral Poster Symposium for his presentation, "Mid-IR Comb Assisted Spectroscopy," with co-authors Paul Williams and Nathan Newbury. He is currently a National Research Council postdoctoral fellow at NIST Boulder Laboratories.

He Wang, who earned his doctorate degree in 2010, wrote and submitted one of eight student papers recognized by the CLEO: QELS-Fundamental Science Program Chairs.

Daniel Moeder, who earned his B.S. in physics in 2010, is working as a process engineer for Romeoville, Ill.-based Advanced Diamond Technologies, a research and development company that grows thin diamond films. Moeder found employment only three weeks after graduating, and uses his physics training regularly in his job.

Kudos to faculty

Matthias Kling, assistant professor, received this year's Röntgen Prize from Germany's Justus-Liebig-University in recognition of his contributions to the development of attosecond nanophotonics. The award is for young scientists who have done excellent work in fundamental radiation physics or fundamental radiation biology. Kling also was featured in a March 2011 Wall Street Journal article that called him one of Germany's "best and brightest."

Three faculty members — Chii-Dong Lin, Chris Sorensen and Kristan Corwin — have been named among the state's top 150 scientists. The recognition comes through the Ad Astra Kansas Initiative, an organization that is spotlighting Kansas researchers, inventors and engineers

from the past to the present who have advanced their field.

Chris Sorensen, university distinguished professor and Cortelyou-Rust professor, won the 2011-2012 Dr. Ron and Rae Iman Outstanding Faculty Award for Teaching from the K-State Alumni Association. The \$5,000 award goes to a full-time K-State faculty member who has distinguished his or herself in their chosen profession and who has contributed significantly to the educational experience of students at Kansas State University.

Kudos to students

Nine students were inducted into the Sigma Pi Sigma ($\Sigma\Pi\Sigma$) physics honor society, joining the 12 current students who were previously inducted. $\Sigma\Pi\Sigma$, part of the Society of Physics Students, recognizes superior scholarship in physics.

More than 33 returning physics students and 25 incoming students were awarded scholarships for the 2011-2012 academic year. These scholarships assist students in funding their physics education and have been established through generous support from alumni, friends and former faculty of the physics department.

Graduate research assistant Adrian Madsen took first place in the 2011 K-State Research Forum poster session for her presentation "Comparing Expert and Novice Eye Movements While Solving Physics Problems."

Graduate research assistant Andrew Jones was awarded the 2011 Kansas State University Research Foundation Doctoral Research Scholarship, worth over \$15,000. The scholarship recognizes the performance of outstanding doctoral students who demonstrate superior academic achievements and scholarly abilities, and whose research has the potential for disclosure of intellectual property and/or commercial application.

More kudos

Several physics department members have been recognized for 40 years of service to the state. They include: **Charles "Lew" Cocke**, university distinguished professors of physics, emeritus; **Robert**

D. Krause, research technician, James R. Macdonald Laboratory; **Peggy Matthews**, administrative officer, physics; **Barbara Steward**, physics and mathematics librarian; **Oliver L. "Larry" Weaver**, professor of physics; and **Dean Zollman**, university distinguished professor of physics.

Tracy Tuttle has been named director of undergraduate labs. Tuttle manages department teaching assistants, along with administrative duties and curriculum development related to lab classrooms. He earned his bachelor's degree in physics from Fort Hays State University and his master's degree in physics from Wichita State University. Tuttle was the director of the Mabee Observatory and an assistant professor of physics and astronomy at Bethel College in Newton, Kan.

Summer research highlights

Two Kansas high school students spent their summer exploring the fields of natural sciences with the help of the American Chemical Society's Summer Experiences for the Economically Disadvantaged program and Kansas State University. The students worked under the direction of Chris Sorensen, a university distinguished professor of physics who is investigating solubilities of nanoparticle solutions.

The Physics Department hosted 13 students for 10 weeks in an NSF-funded Research Experience for Undergraduates, a program that has run all but 3 years since 1992. Students came from across the country and even Poland, to participate in diverse research projects such as nonlinear optics, neutrino oscillations, and nanoparticle aggregation. Students live in the dorms and receive stipends. They attend lectures on physics and ethics, network and socialize with faculty and other motivated students, and most importantly, do research under the direct mentorship of a faculty member. Through early exposure to scientific research, the program assists students in their career choices. More than 125 college students took part in this and similar programs at Kansas State University this year.

Briefs

by Jennifer Tidball



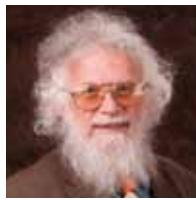
Bethany Jochim, doctoral student in physics from Pierre, S.D., received the LeRoy Apker Award, the top undergraduate honor awarded by the American Physical Society. The award recognizes outstanding achievements in physics and provides \$5,000 to the recipient, a travel allowance to the American Physical Society meeting where the award will be presented and \$5,000 to the recipient's undergraduate institution.

Jochim is a 2011 bachelor's graduate of Augustana College in Sioux Falls, S.D., where she had a successful career as an undergraduate researcher. Some of this research work was conducted at Kansas State University. As a graduate student, Jochim received a research assistantship and the Timothy Donoghue Fellowship. Most recently, she has worked on understanding how ultrashort laser pulses can interact with and control individual molecules. This research, which is funded by the National Science Foundation and the U.S. Department of Energy, might one day lead to new ways of controlling chemical reactions, limiting by-products and creating new materials.



Brett Esry was one of five Kansas State University faculty members named as 2011 university distinguished professors, a lifetime title that is the highest honor the university can bestow its faculty.

Esry, the Ernest K. and Lillian E. Chapin Professor of Physics, is a third-generation Kansas State University alumnus and studies ultracold three-body collisions and intense laser-matter interactions. He performs his intense laser research in the James R. Macdonald Laboratory as a member of the 13th-ranked atomic, molecular and optical physics program in the country. Esry's research has appeared in more than 120 publications and he has given more than 75 talks and seminars. He has been awarded 16 grants to support his research and his funding amounts to more than \$28 million in collaborative projects and \$1.5 million in individual grants.



Dean Zollman, after 10 years as the head of the department of physics, stepped down in June and began phased retirement. He continues to maintain an active presence in the department.

Zollman, a university distinguished professor of physics, came to the university in 1970 and has received multiple awards for his teaching excellence. In 1996, he was recognized by the Carnegie Foundation for the Advancement of Teaching as the Professor of the Year — Research and Doctoral Universities — from the Council for Advancement and Support of Education.

Zollman is a member of many professional organizations including the American Physical Society, the American Association of Physics Teachers and the National Association for Research in Science Teaching.

"His leadership fostered trust and transparency and cultivated excellence," said Kristan Corwin, associate professor of physics.



Robert Katz, former Kansas State University professor of physics, died at his home March 12, 2011, from a brief illness. While at the university, Katz received the

Distinguished Graduate Faculty Award for 1962-63 as an outstanding lecturer and researcher. He developed soft X-ray techniques for assessing insect infestations and researched methods for testing grain density. He co-authored a popular text called "Physics" in 1962 and wrote "An Introduction to the Special Theory of Relativity" in 1964.

While at the university, Katz developed a theoretical model correlating images of cosmic ray tracks with the effects of cancer radiation treatment on human cells. Katz left the university in 1966 to work at the University of Nebraska.

The James R. Macdonald Laboratory is undergoing a significant upgrade to its state-of-the-art ultrafast laser facilities. The laboratory is getting a new laser system which is a high-repetition-rate, high-power,



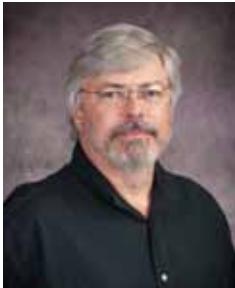
CE phase-locked laser. The \$1 million laser system and attosecond physics laboratory is funded by the U.S. Department of Energy. Kansas State University provided the funds to upgrade the laboratory space so it would meet the stringent environmental conditions for the laser system and related research projects. Construction should be completed in early 2012.



Yuri Maravin, associate professor of physics, has received a two-year appointment to the physics leadership team of the CMS experiment at the CERN Large Hadron Collider, or the LHC, near Geneva, Switzerland. A large international team of scientists, including a strong Kansas State University contingent, studies the products of collisions at the LHC to search for clues about the nature of forces under the conditions present after the Big Bang.

Maravin co-leads a diverse team of international physicists charged with ensuring that the CMS detector and its complex reconstruction software programs provide the best possible measurements of photons, electrons and positrons. The CMS experiment engages more than 3,000 scientists from 183 institutions in 38 countries. Other university faculty involved include Tim Bolton, professor of physics, and Andrew Ivanov, assistant professor of physics.

Brett DePaola: Answering the call to serve



Professor Brett DePaola got his inspiration to apply for a Jefferson Science Fellowship from the top: President Obama.

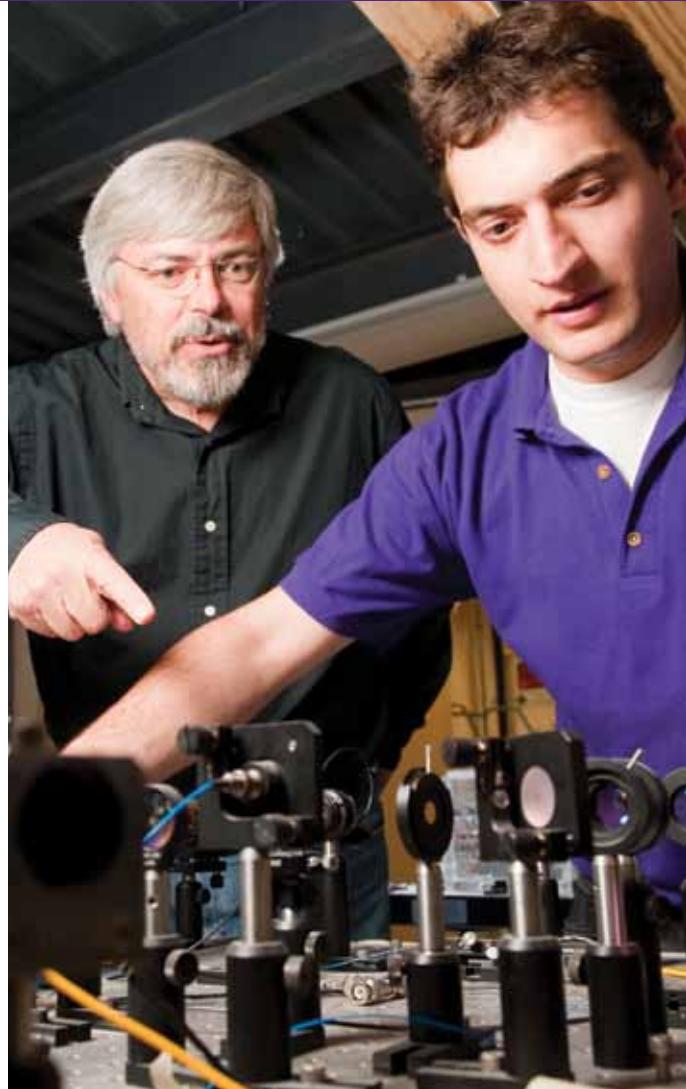
"I applied for this program because I was inspired by President Obama's call for all of us to volunteer whatever we had to offer for the good of the country," DePaola said. "As a teacher, I feel I'm already making a contribution. However, as a science adviser to the U.S. Department of State, I had the opportunity to contribute even more."

DePaola is the first K-State faculty member to be selected for the elite fellowship, which is available to tenured academic scientists and engineers from U.S. institutions of higher learning. Fellows spend a year at the State Department or the U.S. Agency for International Development for an on-site assignment in Washington, D.C., that may also involve extended stays at U.S. foreign embassies and/or missions.

DePaola served his fellowship during the 2010-2011 school year, during which time he was supported by Kansas State University. He was assigned to the State Department's Office of Economic Analysis in the Bureau of Intelligence and Research.

Although he is back teaching at K-State now, DePaola remains available to the State Department for short-term projects through 2016.

A K-State faculty member since 1986, DePaola earned bachelor's and master's degrees in physics from Miami University in Ohio and a doctorate in physics from the University of Texas at Dallas.



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344