PHYSICS 2006 NEWSLETTER

Kansas State University

Editor's Corner

Mick O'Shea

Greetings from Cardwell Hall. Classes have just finished, the campus is quiet and there is a thick layer of snow on the ground. The day after finals ended we got about nine inches of snow – very fortunate timing!

K-State alumni again have demonstrated why they are regarded to be among the most loyal graduates in the nation with the recent release of information ranking K-State No. 1 in the Big 12 Conference for the percentage of graduates who are members of their respective alumni associations. Compiled for the 2004-05 academic year, this marks the ninth consecutive year K-State has finished in the top position among Big 12 institutions. K-State's percentage of graduates who were Alumni Association members during the last year, 28.13 percent, was the highest ever for the Association and more than three percentage points greater than the second and third place among Big 12 universities.

Changes continue to occur on our campus. In the summer K-State began a 10 year redevelopment of its Jardine housing complex. The project, to exceed $100 million, will offer K-State students a mix of housing options in a community-like setting. No tax dollars are being used for the redevelopment project. Primary funding will come from bonds issued by the Kansas Development Finance Authority and private contributions.

The Marianna Kistler Beach Museum of Art will soon begin a 17,000-square-foot expansion. The current museum has 26,000 square feet. The existing galleries will be devoted to the permanent collection, while the new portion of the building will host temporary exhibitions as well as exhibit storage. An outdoor sculpture gallery is also part of the new design.

The legislature has made no funding cuts in the operating budget this year and has incorporated a pay raise of approximately 2.5% for most employees into the university budget. K-State set another research-funding record. For fiscal year 2005, the university received $110,859,813 in funding for research and creative activities and the Physics Department contributed $7,000,000 of this – a large proportion for just one department.

K-State, with 53 winners, ranks first in the nation among state universities in the number of Goldwater winners since this scholarship began in 1989. The Goldwater provides about $15,000 for two years of study. Among all colleges and universities in the nation, only Princeton, Harvard and Duke have produced more Goldwater scholars.
Muscle & Fitness magazine in its March issue has ranked K-State on its list of Top 20 Fittest Colleges for 2005. Schools are ranked according to six criteria: number of recreation facilities, weight room hours, number of sports clubs, health-related majors, intramural sport opportunities and fitness classes offered.

Most students who leave K-State with bachelor's degrees are successfully moving on in their professional endeavors, according to a report by K-State's Career and Employment Services. The report, Post-Graduation Statistics 2003-04, is based on responses to surveys taken by 80 percent of K-State's 3,503 bachelor's degree recipients who graduated during the 2003-04 academic year. Of the 2,785 graduates surveyed, 69 percent reported they were employed, while 21 percent said they were enrolled in a graduate/professional school or other education program. Sixty percent accepted positions in Kansas.

Legendary Kansas State football coach Bill Snyder retired as the Wildcats' head coach in November and a new head football coach, Ron Prince, has been hired and has begun to build his coaching staff. Bill Snyder will be the featured guest at this year's Little Apple® New Year's Eve Celebration and Ball Drop in Aggieville and has been selected to push the button that brings down the ball. Go to http://www.mediarelations.ksu.edu/ for more information.

Department Head's Corner

Dean Zollman

Writing for our annual newsletter is an opportunity for me to look back at the past year's accomplishments in the KSU Physics Department. At the same time our primary task is education, so we are always looking at how we are preparing ourselves and our students for the future. We think that our accomplishments of this past year will, indeed, be an important contribution to a foundation on which the Department will continue to build. Of course, we are always thankful that we have strong and successful alumni who continue to support our efforts in many ways, including financially, spreading the word about our programs and recommending that students consider K-State Physics for their education.

This year we were able to add two new faculty members. Yurii Maravin is an Assistant Professor who conducts research in high energy physics. He has been working on the D0 experiment at Fermi National Accelerator Lab and has focused much of his work on photon identification. He is an important component in our preparations for future high energy work which will center on a new accelerator at CERN in Geneva, Switzerland. Yurii's Ph.D. is from Southern Methodist. Prior to coming to KSU he was a post doc at Fermi Lab.

Brian Washburn, also an Assistant Professor, joined us following a post doc at the National Institute of Standards and Technology in Boulder, Colorado. His research area is atomic-molecular-optical physics with a specialty in ultrafast and nonlinear physics. Brian uses fiber lasers which emit light pulses with very short time duration to study nonlinear optics. His efforts will lead to a better understanding of phenomena involved in lasers and promise to have many practical applications. He will be collaborating on many efforts with Kristan Corwin who joined our faculty a couple of years ago.

We have two new staff members this year. Russ Reynolds now works in our machine shop. He has significant experience as a machinist and thus is immediately contributing to developing and building instruments for both teaching and research. Robert Sumners has joined our computer support staff as a computer information specialist.

The research staff includes four new post-doctoral research associates and three visiting scholars.

The number of departures has been rather small this year. As I mentioned last year Eckhard von Toerne was awarded the Sophia Kovalevskaja Prize, which is funded by the German Federal Ministry of Education and Research. Eckhard is now on a leave-of-absence from KSU while he conducts high energy physics research at the University in Bonn. I visited Eckhard in July. He is off to a good start and will be learning a lot that will contribute to his research program when he returns to KSU.

Treva Singleton who worked in the main office and then for the Macdonald Lab left when her husband was transferred from Fort Riley to Fort Bragg, North Carolina. She is doing well there and certainly enjoying the warmer weather.

A relatively large number of students completed a physics degree during the past year. Nine students earned B.S. degrees. As is typical of our students they are almost evenly split between continuing their education in graduate school and obtaining employment. Five of the students are now enrolled in graduate studies. Four students finished MS degrees. All but one of them is continuing for a PhD. An additional four students earned PhDs. Three of them now hold post-doctoral research positions while the fourth is conducting research in a government laboratory.

At the input end we have the largest class of freshman physics majors that any of us can remember -- fifteen students. We also have 15 new graduate students. As usual the incoming graduate students come to KSU with very diverse backgrounds. Seven of the students completed undergraduate work in the US while the remaining are from Asia, Europe and the Middle East. This year, seven of the new graduate students are women.

We have received a number of reports about the activities of our alumni. They are included elsewhere in this newsletter. One award from KSU went to Joe Gray who received his Ph.D. under the direction of Jim Legg in 1972. The KSU Alumni Association honored Joe for his work in cancer research by selecting him as one of two Alumni Fellows from the College of Arts & Sciences. More information appears in an article in this newsletter.

Bill Romig who received a BS in physics in 1966 is the Ernest Fox Nichols Lecturer for 2005. Because of scheduling conflicts (primarily mine not Bill's) his visit to campus and lecture will occur early next semester.

Those of you who are members of the Alumni Association may recognize the photo of one of our alumni in the most recent *K-Stater* magazine (see page 23). Jonathan Winkler who received a BS in physics in 1998 was a Rhodes Scholar. He continued to study at Oxford and is now finishing a doctorate in economics and social history.

Our students and faculty continue to bring accolades to themselves and our department. One of our graduate students, Mark Smith, received an award to meet with a group of Nobel Laureates in Lindau, Germany. Mark was one of only 60 science graduate students to receive this expenses-paid trip. A physics minor, David Thompson from Burlingame, is a new Goldwater Fellow. I believe that David is the first physics minor to receive the prestigious national award. Six physics majors have also been recipients.

Young and not-so-young faculty have also garnered national and international honors again this year. Kristan Corwin, Assistant Professor, received an NSF CAREER Award. This five-year grant is "the National Science Foundation's most prestigious award in support of the early career-development activities of those teacher-scholars who most effectively integrate research

and education within the context of the mission of their organization." (NSF Web site) Kristen is the third KSU Physics Assistant Professor to receive this award in recent years.
Also prestigious is the Department of Energy's Outstanding Junior Investigator Award. This award is to "identify exceptionally talented new high energy physicists early in their careers and to assist and facilitate the development of their research programs." (DOE Web site) One of this year's recipients is Glenn Horton-Smith who joined our Department just last year. Glenn is also the third KSU Physics Assistant Professor to receive this award in recent years.

Senior faculty have also been recognized. Bharat Ratra was selected for Fellowship in the American Association for the Advancement of Science. AAAS bestows fellowship on scientists to recognize "meritorious efforts to advance science or its applications." Bharat was recognized for his contributions to cosmology.

Lew Cocke has been selected as the 2006 recipient of the American Physical Society's Davisson-Germer Prize in Atomic or Surface Physics. The award recognizes Lew's "sustained record of novel experimental developments and new insights into interactions of ion and photon beams with atoms and molecules." While this award is awarded by the APS, scientists from all parts of the world are eligible. The Davisson-Germer Prize is the highest international award given specifically for work in atomic physics.

Most recently Talat Rahman's work on "walking molecules" was cited by the American Institute of Physics as one of the 25 top physics stories of 2005.

Our research funding has held steady at slightly more than $7 million from external funds. Thus, the lion's share of the funding for the department comes from sources different from state appropriations.

I am now in the fifth year of a five year appointment as Department Head. While I am accepting a second term, I will also be taking sabbatical beginning in the summer of 2006. I will be spending the 2006-07 academic year in Munich and Kiel, Germany, and hope to thoroughly enjoy being able to concentrate on issues of teaching and learning of physics.

As you can see from this summary of the year's activities, we continue to focus on our teaching and research missions. Our faculty and students are doing very well. Our success has always depended on your help. State financial support for higher education continues to drop in Kansas and throughout the country. KSU, as with most other state universities, has no choice but to significantly increase tuition. At the same time the number of physics students seems to be growing. Thus, we need to provide more scholarships and increase their amounts. We can do so only with your continued support. All of our faculty and students are very grateful for all of the generous support that our alumni have given in the past. We hope that you will continue to think of us and support us in the future.

Faculty

Glenn Horton-Smith Receives DOE Outstanding Junior Investigator Award

Glenn Horton-Smith, a K-State assistant professor of physics, is just one of the recent faculty members in the department to earn

national recognition. Horton-Smith has been named an Outstanding Junior Investigator by the U.S. Department of Energy.

The award is given to recognize exceptionally talented new high energy physicists early in their careers and to assist and facilitate the development of their research programs. Awards made under this program help to maintain the vitality of university research and assure continued excellence in the teaching of physics.

Horton-Smith was recognized for his work with neutrinos, one of the fundamental particles which make up the universe. According to Horton-Smith, neutrinos are the smallest, hardest to detect particle that have ever been proven to exist -- and are also one of the least understood.

"Neutrinos are emitted in the decay of radioactive elements and in the decay of some unstable elementary particles," Horton-Smith said. "Many neutrinos also were made in the 'big bang.' Neutrinos might make up as much of the mass of the universe as all of the atoms heavier than hydrogen put together, but you don't normally notice them because once created neutrinos are hardly ever absorbed again; they rarely interact with matter at all."

Dr. Horton-Smith was honored for research projects that will gather related information needed for future neutrino experiments.

One experiment that he has been working on since 1998 with 92 of his "best friends" involves building very large detectors deep underground in Japan to observe neutrinos.

"By the late 1990s, we had observed neutrinos from the sun, from nuclear power stations, from cosmic rays and from accelerators," Horton-Smith said. "But there was something strange about the number of neutrinos detected from the sun. There weren't enough of them."

Something interesting was happening, Horton-Smith said. Either the sun worked very differently than previously thought or the neutrinos themselves were changing, "disappearing" by transforming themselves into another type of neutrino through a process called "neutrino oscillation," he said.

“But why did this happen only for solar neutrinos and not to the neutrinos from reactors? Theorists calculated the properties of the oscillating neutrinos and found that all of the observations made at reactors were made too close to the reactor,” Horton-Smith said. Neutrino scientists wanted to make measurements of the neutrinos from reactors more than 100 kilometers away, but even though the most powerful nuclear power station reactor cores make over 500 trillion neutrinos in every millionth of a second, neutrinos interact so rarely that no reactor was powerful enough to make enough neutrinos to be seen that far away, he said. According to Horton-Smith, it would take almost 100 reactor cores to generate even one neutrino interaction event a day in a 1,000-ton detector. Horton-Smith said the KamLAND reactor antineutrino observatory, in the Kamioka mine in Japan, was built to assist in the study of neutrinos. The observatory uses a detector filled with 1,000 tons of scintillating baby oil and benzene and makes use of neutrinos from all the reactors in Japan.

"The major reactors are something like 180 kilometers away," Horton-Smith said. "The scintillator makes a flash of light when a certain kind of radiation deposits energy in it, including the kind created when a neutrino from a reactor, very rarely, interacts with a proton in the scintillator."

Dr. Horton-Smith also plans to build a much smaller detector near K-State's Cardwell Hall that will study cosmic ray signals, which can be confused with neutrinos at shallow and intermediate depths underground.

Since the inception of the junior investigator program in 1978, 185 scientists have received Outstanding Junior Investigator Awards. Of these, 158 have achieved tenured academic positions, 11 hold tenured research appointments and 28 remain on tenure track. Previous winners of this award from K-State include Regina Demina in 2001 and Donna Naples in 1996.

"K-State is very fortunate to have Glenn Horton-Smith on our faculty," said Dean Zollman, head of the department of physics and a university distinguished professor of physics. "His award indicates that he is considered by the high energy physics community, as well as our faculty, as an excellent young physicist. His expertise in neutrino physics provides our students with access to someone who is on the leading edge of a very important and rapidly developing research area."

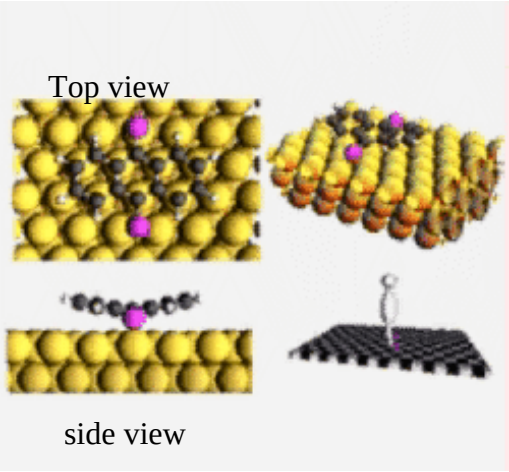
Horton-Smith said he was surprised to get the award in his first year of eligibility. "In most cases where people got it in their first year of eligibility, they come in with a well-developed research program that fit into something that was already going on," Horton-Smith said. "I'm just happy to see that I qualified; that I fit that profile." News release from K-State Media Relations, prepared by Keener A. Tippin, II.

Ratra Selected as 2005 AAAS Fellow

Three K-State professors have been designated Fellows of the American Association for the Advancement of Science. One of those recognized was Professor Bharat Ratra of physics. He was recognized by the association for his contributions in cosmology, including the quantum mechanics of inflation, the dynamical effective cosmological constant and the tissue of cosmological space curvature and cosmic magnetic fields. Dr. Ratra was one of the first physicists to propose the concept of “dark energy,” the still-mysterious entity which opposes gravity and accelerates the expansion of the universe.

Bharat earned a master's in physics in 1982 from the Indian Institute of Technology in New Delhi, India, and a doctorate in physics from Stanford University in 1986. He joined the K-State faculty in 1996 and has received a five-year, $300,000 National Science Foundation grant to study experimental data generated by deep-space experiments to help study the evolution of the universe. He is a Fellow of the American Physical Society. See "K-Statement" faculty & staff newsletter for more information at http://www.mediarelations.ksu.edu/WEB/News/InView/ivmenu.html..

Walking Molecules



The two purple atoms are the feet that do the walking

The work of Professor Talat Rahman was featured as one of the top 21 stories of 2005 by the American Physical Society.

A single molecule has been made to walk on two legs. Ludwig Bartels and his colleagues at the University of California at Riverside, guided by theorist Talat Rahman of Kansas State University, created a molecule -- called 9, 10-dithioanthracene (DTA) -- with two "feet" configured in such a way that only one foot at a time can rest on the substrate.

Activated by heat or the nudge of a scanning tunneling microscope tip, DTA will pull up one foot, put down the other, and thus walk in a straight line across a flat surface. The planted foot not only supplies support but also keeps the body of the molecule from veering or stumbling off course.

In tests on a standard copper surface, such as the kind used to manufacture microchips, the molecule has taken 10,000 steps without faltering. According to Bartels (ludwig.bartels@ucr.edu, 951-827-2041), possible uses of an atomic-sized walker include guidance of molecular motion for molecule-based information storage or even computation.

DTA moves along a straight line as if placed onto railroad tracks without the need to fabricate any nano-tracks; the naturally occurring copper surface is sufficient. The researchers now aim at developing a DTA-based molecule that can convert thermal energy into directed motion like a molecular-sized ratchet.

Alumni

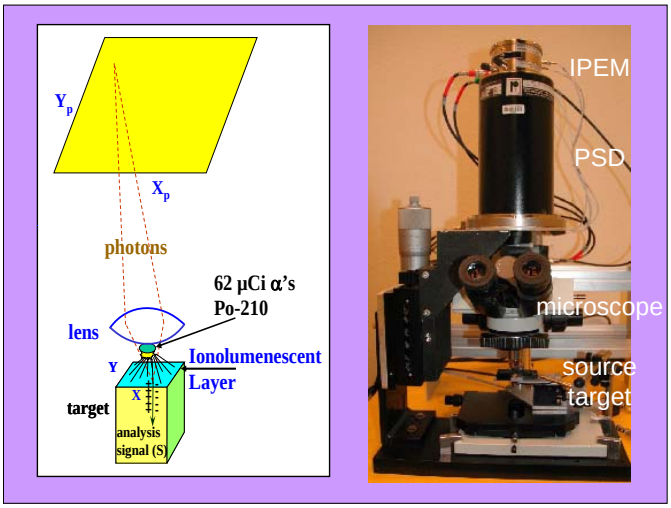
Joe Gray Named Kansas State Alumni Fellow

Joe Gray, associate lab director of Biosciences, was one of 11 named as Kansas State University 2005 Alumni Fellows. He received his Ph.D. in nuclear physics from the school in 1972. The honor recognizes alumni who have "distinguished themselves in their careers." Fellows are chosen by each college (Gray was enrolled in the College of Arts and Sciences) and are invited to return to campus as guests and mentors. A complete list of fellows is available at http://www.k-state.com/Programs/article.aspx?articleId=c9708ecaeb8d4a9199d044563be04960.

KSU Grad Barney Doyle wins his third R&D-100 Award

Barney L. Doyle (Physics - KSU Class of 1971) has been presented his third R&D-100 Award at a ceremony held in Chicago on October 20, 2005. R&D-100 Awards are considered the "Oscars of Invention" and are given out annually by the Chicago-based *R&D Magazine* to the

100 most significant technology-based inventions of the year. Doyle won his first R&D-100 for the eXternal Micro Ion Beam Analysis (X-MIBA) system in 1987 and his second was in 2001 for the Ion Electron Emission Microscope (IEEM). This year's invention was the Ion Photon Emission Microscope (IPEM), and while its name and application is quite similar to the IEEM, it is an entirely new and different device. Doyle is the manager of the Radiation-Solid Interactions Physics Department at Sandia National Laboratories in Albuquerque, NM, and over the years his group has won two additional R&D-100s for a total of five, the most of any department at Sandia.



The IPEM is a new multidimensional high-resolution single-ion nuclear-microscope. Using MeV-energy ions from an accelerator or radioactive source, IPEM is capable of microscopically mapping charge collection and other single-ion induced effects, such as logic upsets, in semiconductor and/or micro-electronic devices. IPEM can also be used to microscopically map the mobility, μ, carrier lifetime, τ, and the important $\mu\tau$-product of semiconductors. As such it has identical capabilities as traditional single-ion nuclear microprobe analysis with the advantage that the ion beam does not have to be focused, which ameliorates the use of costly and complicated nuclear microprobe forming systems. Expensive accelerators can even be avoided by using radioactive sources. Also, because this full-field microscope utilizes light produced by the ions, IPEM can be performed in air or vacuum.

Instead of focusing high-energy ions, the IPEM technique is based on determining the position an individual ion enters the surface of the sample by projection optical microscopy. These position signals are then correlated with the ion-induced signal generated in the sample target or device under test (DUT), such as a malfunction in an integrated circuit or the measurement of charge collection or current transients.

David Penwell

David Penwell graduated from KSU in 1997 with a degree in Physics. After leaving KSU he obtained an MS degree at the University of Missouri at Kansas City and went on to work at Rockwell Collins in Cedar Rapids, Iowa, as a systems engineer. Rockwell Collins is a large corporation and David worked in the Government Systems division which produces among other things GPS receivers for the US government and our allies.

David recently contacted us with some opportunities for students with quantitative degrees (obviously this includes physics) at Rockwell Collins. As you might imagine business in the defense sector has been good and many companies need employees.

We appreciate David contacting us and encourage other alumni who know of opportunities for someone with a physics degree to contact us.

Jon B. Bryan

Jon B. Bryan a 37-year resident of Livermore, CA died Tuesday, Sept. 27, 2005, after a battle with cancer. Dr. Bryan was born November 9, 1940 in Scott City, KS. He graduated from Kansas State University in 1968 with a doctorate in Physics. He worked at Lawrence Livermore National Laboratory and retired in 1993 after 30 years of service.

He is survived by his wife of 31 years, Gail (Voelker) Bryan; his brothers, Joel Bryan of Scott City, KS and Tom Bryan of Ireland; his father, J. Arthur Bryan of Scott City, KS and numerous nieces, nephews and cousins.

Burial was at the Scott City Cemetery in Scott City, KS. Donations may be made to the Livermore Amador Genealogical Society, P.O. Box 901, Livermore, CA 94551, or to Kaiser Hospice, 200 Muir Road, Martinez, CA 94553.

James R. Neff

Dr. James R. Neff died on July 12, 2005. Dr. Neff was an internationally recognized orthopaedic surgeon and Professor at the University of Nebraska Medical Center in Omaha. He was also a former chair of the Department of Orthopaedic Surgery. He died at the age of sixty-five after an extended battle with cancer.

Dr. Neff received his undergraduate degree from KSU in 1962. He then went to KU Medical School and graduated in 1966. He entered the military in 1968 and served as medical officer aboard the nuclear submarine USS George C. Marshall. Following his military service he completed a residency in orthopaedic surgery at the University of Michigan and was a Fellow in Musculosketal Oncology at the University of Florida.

In 1975 he became an Assistant Professor at the University of Kansas Medical Center. During his time at KU Dr. Neff developed a surgical implant which included a titanium intraneduallary nail. The initial use of this device was to reconstruct segmental defects in the lower extremity of cancer patients. Today, this device is know as the “Neff Nail” and is in wide-spread use for many conditions beyond its initial use.

In 1991 Dr, Neff became chair of the Department of Orthopaedic Surgery at the University of Nebraska Medical Center in Omaha. . He was known as an effective and caring teacher as well as an innovator in orthopaedic surgery.

In 1995 Dr. Neff established the *James R. Neff Lectureship in Physics.* This lectureship “shall perpetuate and honor Everett and Florine Neff, parents of James R. Neff, and Janice K. Neff Standish (sister). It is further intended to represent Dr. Neff’s gratitude for the opportunities and education that he received at Kansas State University and to verbally acknowledge Florine and Everett Neff as benefactors of the institution of higher learning.” This lectureship is now funded by an endowment established with a bequest from Dr. Neff.

Dr. Neff was buried in Arlington National Cemetery on October 5, 2005.

More information about James Neff's contribution to research and education in medicine can be found at the University of Nebraska Medical Center Web site. See http://www.umabscsecure.org/ttg-ortho/new/documents/DrJamesNeffTributeFINALforweb.pdf

Information for this article was taken from that web site and from a biography provided to us several years ago by Dr. Neff.

News from the James R. Macdonald Lab (JRML)

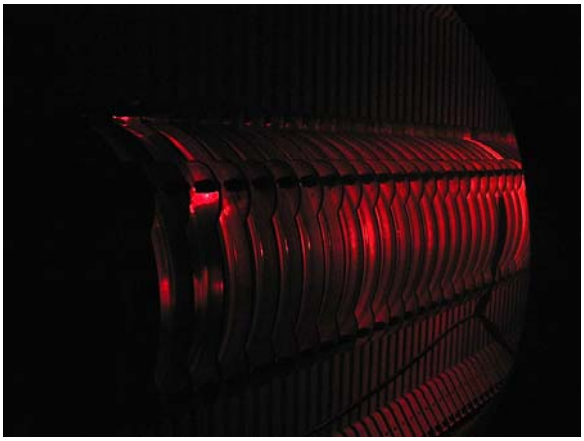
Lew Cocke

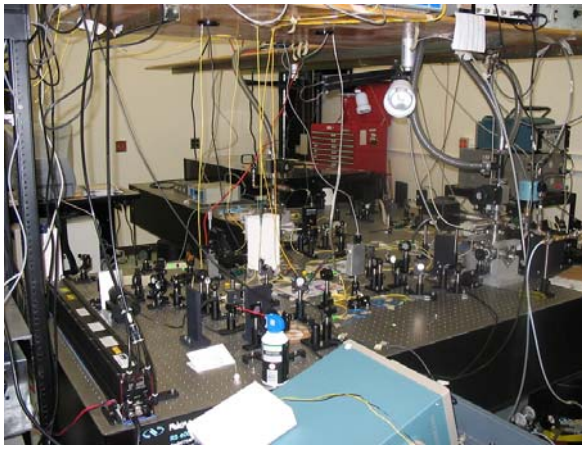
The past year has been a highly productive one in the J.R. Macdonald Laboratory (see http://jrm.phys.ksu.edu/). The change of emphasis from ion-atom collisions to AMO (atomic, molecular and optical) ultrafast physics has become quite mature. Lasers, including both the KLS (Kansas Light Source) and MOT (magneto-optical trap) projects, have become central to the work of all six of the experimental principle investigators. In addition, theoretical work on the interaction of high intensity fields with atoms and clusters is an important part of the work of all three theoretical principle investigators. The ion-beam facilities continue to be used in conjunction with the KLS for both laser-ion and "picopulse" projects. A MOT target is being set up on the EBIS for doing Q value measurements with multiply charged ions. The ion beam facilities also continue to serve visiting users of the facility from Colorado State University (Steve Lundeen), the University of Crete (Theo Zouros), and Augustana College (Eric Wells) as well as in-house users in High Energy Physics (Tim Bolton). We continue to collaborate with users at the ALS at LBNL and the Weizmann Institute of Science.

The physics department has welcomed Brian Washburn as a new Assistant Professor in the area of nonlinear optics and ultrafast fiber lasers. As I write he is moving into his new laboratory space in the JRML, next to the LUMOS laboratory of Kristan Corwin. He and Kristan will form a formidable team. The construction of Brian's laboratory nearly completes the transformation of the "square room," which once housed beamlines from the Tandem Van de Graaff to a laser laboratory. Several new research associates have joined the JRML in the past months. Dr. Goga Veshapidze has joined Brett DePaola's MOTRIMS group, and Dr. Chengquan Li has joined Zenghu Chang's group to work on the KLS. Dr. Zuoliang Duan is also a visitor in Dr. Chang's laboratory from the Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Science. Dr. Ahmer Naweed is a new research associate with Kristan Corwin in the LUMOS laboratory. As we welcome these new research associates, we are sorry to announce the departure of two important Research Assistant Professors. Dr. Bing Shan took a position as Laser Scientist with Quantronix Corporation and Dr. Xiao-Min Tong took a faculty position in the Graduate School of Pure and Applied Sciences at the University of Tsukuba.

During the past year we have published 53 papers in refereed journals, including five in Physical Review Letters. The research findings in these are many: we summarize a few here. Richard and colleagues reported the first experimental evidence for the existence of image-potential states in carbon nanotubes. A theoretical analysis of image-potential states of single- and multi-walled carbon nanotubes was carried out by a collaboration between the groups of Richard and Thumm. Chang and colleagues have demonstrated the production of the "supercontinuum," implying the production of a single attosecond pulse in argon. Ben-Itzhak and colleagues reported a comprehensive study of the dissociation and ionization by short laser pulses of the simplest of all molecules, the H_2^+ ion. Lin and Tong have developed a quantum theory for analysis of the decay of an autoionizing state created by an attosecond xuv pump pulse and

probed by an intense infrared pulse. Cocke, Litvinyuk and colleagues have found that a very simple COLTRIMS experimental approach can be used to map out the spatial profiles of the outermost orbitals in small molecules. DePaola and colleagues have used their MOTRIMS approach to follow the temporal evolution of state populations in Rb during coherent excitation. Esry and colleagues reported a theoretical study of the dissociation of HD^+ and H_2^+ by ultrashort laser pulses.





High Energy Physics

Tim Bolton

The KSU high energy physics group enjoyed another busy and productive 12 months in the World Year of Physics. Several of our group's notable accomplishments are described elsewhere in this newsletter, so I will mostly give an update of activities of our people and give some web links to learn more about our work.

On the research front, K-State's D-Zero experiment (see http://www-d0.fnal.gov/) at Fermilab passed the one inverse femto-barn mark in integrated luminosity. A fantastic program of study continues on top quark physics, CP violation, electroweak gauge bosons, and searches for signs in the property of the Fermilab Tevatron's most violent collisions of the new physics that governs Nature at the TeV energy scale. Some of the exotic possibilities include "supersymmetry," the idea that all spin ½ particles have spin 0 partners, and, to really stretch your mind, that the four dimensional world we see is really just a local patch of the true eleven dimensions of space and time that make up the Universe.

New assistant professor Yurii Marvin has created a dynamic group with Post-doc Dima Bandurin and graduates student Alexei Ferapontov and Keti Kaadze that specializes in studying collisions with high energy photons. Graduate students Mansoora Shamim and Mahsana Ahsan are making great progress in completing their theses with Tim Bolton. Post-doc Kristian Harder completed an outstanding year managing a crucial detector sub-system of D-Zero called the silicon microstrip tracker and is switching his efforts into studies of the production properties of top quarks. KSU has also finished its part of an important instrumentation improvement of the silicon tracker called "the layer zero upgrade." This involved design and production of custom electronics in collaboration with KSU Electronics Design Lab engineer Russell Taylor.

Post-doc Dima Onoprienko wrote major sections of the crucial control software for this new project.

In two short years, Fermilab will cede its title of world's highest energy accelerator to the Large Hadron Collider (LHC) located at the European particle physics lab CERN in Geneva, Switzerland. K-State is deeply involved in building one of the experiments to run at the LHC called CMS (see http://cmsinfo.cern.ch/Welcome.html/). As usual we specialize in silicon charged particle detectors, in this case the forward pixel system. Bolton and Taylor will spend the next six months checking out hundreds of specialized circuits for the forward pixels in the KSU high bay lab; and Onoprienko and Bolton have implemented a complex software simulation package that is needed to optimize the use of the detector. Maravin and Bandurin are working with Fermilab colleagues to set up an operations center in Illinois that will allow US physicists to operate the CMS experiment completely by remote control from Illinois, or even from desktop computers in Manhattan!

Meanwhile, Glenn Horton-Smith, Noel Stanton, and Bolton are leading KSU's program in neutrino oscillation physics, the topic of which is nicely described elsewhere in this newsletter. Post-doc Alfred Tang and graduate students Mark Smith and Jasmine Foster are working with this team on the KAMLAND (see http://www.awa.tohoku.ac.jp/html/KamLAND/), Double-Chooz (see http://doublechooz.in2p3.fr/), and Braidwood (see http://braidwood.uchicago.edu/) experiments located in Japan, France, and Illinois, respectively! Mark and Jasmine are also involved with "table-top" projects that will provide important data for the larger experiments. Jasmine is building a liquid scintillator test module that she will expose to a low energy proton beam with the help of our friends in the Macdonald Lab; and Mark is building a specialized detector for rare cosmic ray interactions that will operate in an undergraduate enclosure. You could help Mark out a lot in fact if you happen to know where a nearby room is that sits about 50 feet underground and hopefully has some heat and lights!

While Eckard von Toerne is enjoying a long-term leave in Bonn, Germany supported by his Sofja Kovaleskaja Prize of last year, he is still managing to keep his hand in KSU-HEP. He and the resourceful Onoprienko have completed a highly regarded set of studies on charged particle tracking in yet another future accelerator project, this time the International Linear Collider (see http://www.linearcollider.org/cms/), a proposed futuristic complex of 30 kilometer long linear accelerators that will shoot high energy beams of electron and positrons at each other.

As with other groups in the physics department, we continue to enjoy working with fantastic KSU undergraduates. Our crew this year included our accounting intern, Aubrie Koester, and undergraduate researchers Jon Kalodimos, Wesley Cameron, Dan Wright, Arthur Thompson, Tom Vehlewald, and Dave Thompson. We are delighted that Dave received a Goldwater scholarship in part for his work with our group.

We also remain proud of our HEP outreach activities (see http://www.phys.ksu.edu/hep/). Our 22-teacher Quarknet project continues under the able guidance of lead-teachers Fred Nelson and Laurie Cleavinger of Manhattan and McLouth High Schools, respectively, and with the continuing collaboration of Sanjay Rebello and the KSU PERG. And we continued to take a lead in the scientific literacy projects at the KSU Center for Understanding of Origins (see http://www.phys.ksu.edu/origins/), with program assistant Nidhi Mungali making critical contributions to all facets of Center activities.

I'll close with some more news about people. As mentioned elsewhere, Glenn Hortom-Smith received a DOE Outstanding Junior Investigator Award this past summer. This is KSU-HEP's

third since 1996, which ties us with Boston University for the most awards given for experimental physics to one institution over the past ten years. Our former post-doc Flera Rizatdinova started an assistant professor position at Oklahoma State this past fall; she joins Todd Adams as K-State HEP folks who have moved onto faculty ranks. Mark Smith received a DOE award to attend the 55th annual Nobel Laureate's symposium in Lindau, Germany. Kristian Harder and his wife Katrin are enjoying their baby daughter Ana. Ron Sidwell ended a brilliant 35 year career as one of the field's foremost experts on silicon tracking detectors and is now enjoying life as an independent consultant with his wife Robin on Washington's Olympic peninsula. A highlight of Ron's retirement dinner was a visit from Bill Reay, who seems suspiciously busy for a twice-retired professor up in Columbus, Ohio. Bill is flying again too with a new airplane (see http://www.physics.ohio-state.edu/~reay/). Our research administrator Pamela Schremmer is now Pamela Anderson after her beautiful October wedding in Paxico. Finally, to close on some great news, some of you may be aware of former student Drew Alton and his wife Julie's *very* early birth last year of a new son. I'm glad to say that Chance is thriving these days with big sister Kaylyn.

Physics Students in the Spotlight

Physics Student Selected as 2005 Goldwater Scholar

A KSU physics student, David Thompson of **Burlingame**, was one of four Kansas State University students who have been awarded $7,500 Barry M. Goldwater Scholarships. The other KSU students include Mike Higgins, **Manhattan**; Meg Fasulo, **Olathe**; and Matt Basel, **Overland Park**.

K-State students have now won 53 Goldwater Scholarships since the program began in 1989. K-State is ranked first in the nation among all 500 four-year state universities in the number of Goldwater winners. Including both the 500 public schools and 1,500 private colleges and universities in the nation, only Princeton, Harvard and Duke have produced more Goldwater scholars.

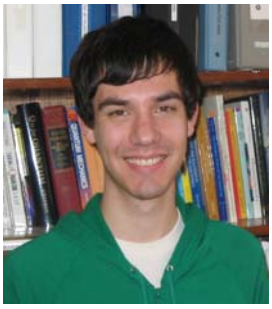
"This is the ninth year in the 17-year history of the Goldwater Scholarship competition that K-State has had four winners in one year. It's also the 15th time K-State has had multiple winners of this national honor," said K-State president Jon Wefald. "Our congratulations to these four students on this outstanding accomplishment."

Thompson is a senior in electrical engineering with an emphasis in biomedical engineering and minors in physics and Japanese. He was a teaching assistant for several years and was a coordinator of Physical World labs. He plans to earn a doctorate in biomedical engineering and conduct research and teach in a university setting, focusing on biomedical engineering and the new opportunities emerging in the field. A K-State honors list student, he is a member of the College of Engineering honors program and has received the James A. Branson Memorial Scholarship. He has been active with Powercat Masters Toastmasters, where he served as secretary. Thompson is currently conducting research under the supervision of Tim Bolton, professor of physics. His project is a simulation program to help measure neutrino oscillations. He is a 2001 graduate of Burlingame High School and Allen County Community College, which he attended concurrently. Thompson is married to Amity I. Smith Thompson and is the son of David W. and Judith B. Thompson.

The other three students are Higgins who is a senior in mathematics and statistics, Fasulo who is a senior in chemistry, biochemistry and microbiology, and Basel who is a sophomore in chemistry.

The Goldwater Scholarship competition is for students who major in science, math or engineering and plan a career in research. The scholarship provides up to $7,500 annually for a student's final one or two years of undergraduate studies. To be eligible, students must have at least a 3.0 grade point average. They also must complete four mini-essays and write a longer essay about a significant area of research in their field of study. Go to http://www.mediarelations.ksu.edu/ for more information.

Physics Major Invited to Present Research to DAMOP Session at APS



Mat Leonard, a senior physics major, was invited to present his research on "Isotopic Effect in Bond Rearrangement Caused by Sudden Single and Multiple Ionization of Water Molecules" in the special session of the Division of Atomic, Molecular, Optical Physics (DAMOP) APS conference featuring research performed by undergraduate students. From all of the outstanding applications received, five students were selected to share their work. *Mat* is conducting his experimental work in the *J.R. Macdonald Laboratory* under the guidance of Dr. *Itzik Ben Itzhak* and Dr. *Kevin Carnes*. In addition, Mat is one of the K-State McNair scholars and was awarded the Macdonald Memorial scholarship for the 2005-2006 academic year, during which he is conducting imaging measurements of molecular dissociation.

Physics Major Nominated for 2006-07 Goldwater Scholarship

Eli Parke, a junior physics and engineering dual major, was selected to be one of the four *K-State* Nominees for 2006 for the *Barry M. Goldwater* scholarship. A decision on who will receive this scholarship will be made in a national competition later this year. He has already received the Giese Memorial scholarship. He proposed to perform experimental studies in the *J.R. Macdonald Laboratory* under the guidance of Dr. *Itzik Ben Itzhak* on "the interaction of slow highly-charged ions with CO molecules." Of particular interest in his proposed research is the correlation between the post collision behavior of the target and projectile.

K-State Physics Grad Student Invited to Meeting of Nobel Laureates

Mark Smith, a Kansas State University doctoral student in high-energy physics, was selected to attend the 55th Lindau Meeting of Nobel Laureates and Students June 26-July 1 in Lindau, Germany.

Smith, Topeka, was one of 60 outstanding graduate students in the United States selected by the Department of Energy, the National Science Foundation and the Oak Ridge Associated Universities to attend. His sponsor is the Department of Energy's Office of Science, which covered all costs of his attending the meeting.

The winners of the Nobel Prize have met each year since 1951 in Lindau, and in recent years, the three U.S. agencies have sponsored a group of top young U.S. scientists to join the laureates for weeklong discussions of sciences and medicine.

The structure of the meeting is such that the Nobel Laureates present lectures on a topic of their choice related to chemistry, physics or medicine during morning sessions, and laureates and students mix in the less formal small-group discussions during afternoon and evening sessions. Smith is in his third year of high-energy physics graduate education. "Attending this meeting was a wonderful honor for me," he said. "We heard Nobel Prize winners make presentations, and were able to talk informally with them. It was a week of wide-ranging science discussions in an international group. It was very exciting."

For six weeks in the summer 2005, Smith's research project took data at the Fermi National Accelerator Laboratory near Chicago as part of the large experiment called D Zero. Kansas State University is a member of the consortium of 90 leading research-oriented universities, the Universities Research Association Inc., that oversees Fermilab as a national research facility.

Fermilab houses the most powerful physics research tool in the world, the Tevatron proton/antiproton particle accelerator. Within its four-mile underground ring of the accelerator, subatomic particles are hurled from opposite directions at nearly the speed of light. The collisions reproduce the energy environment that was present at the beginning of the universe. Researchers collect immense amounts of data from collisions and examine the data for indications of new building blocks of matter or new forces at work.

A major physics problem that can be studied at Fermilab is symmetry breaking and Smith's research is a symmetry-breaking study. He studies the B meson particle, specifically, a B_S meson.

K-State high-energy physics professor Tim Bolton said the B_S meson is one of only three or four systems known in nature that displays a rare symmetry-breaking property known as "CP violation." Studying B_S meson gives scientists a little laboratory in which to consider the matter-antimatter symmetry-breaking event that occurred after the Big Bang.

The Bs meson could hold a clue to understanding why we now live in a universe made of matter instead of an antimatter universe. The antimatter has disappeared, says Bolton. "It's gone, and it's been gone for a long, long time."

At Fermilab, Smith helped lead a large data collection team, an international group of postdoctoral researchers, physicists and other graduate students.

The B meson studies are an aspect of a huge and enduring experiment at Fermilab called the "D Zero experiment" - more than 500 scientists from institutions on four continents participate in this multi-hundred million dollar experiment. In 1995, D Zero scientists found first evidence of the existence of the top quark, a key particle.

In April, Smith presented 'Heavy Quark Studies Using B+ - >J/Psi K*' at the American Physical Society's meeting in Tampa, Fla. "Being selected to present at APS was a tribute to Mark's research," said Bolton. "It means that his colleagues on D Zero think he's doing something very interesting."

Smith's K-State major professor is Eckhard von Toerne, who has been doing research at a laboratory in Bonn, Germany. Smith toured the lab following the Lindau meeting.

Smith is a graduate of Seaman High School. He is a U.S. Marine Corps veteran. He earned an undergraduate degree in mathematics with honors from Washburn University. His wife, Christina, is a K-State doctoral student in statistics, also from Topeka.

Mark Smith is the son of Darlene Smith and the late Walter Smith Jr., Topeka. Christina Smith is the daughter of Thomas and Doris Hobbs, Topeka. News release prepared by: Kay Garrett, 785-532-3237, e-mail anuenue@k-state.edu.

This Year's Graduates

Bachelor of Science Degrees

Drew Bures - Employment
Steve Gilbertson - Graduate School, KSU Physics
Brendon Lohman - Graduate School, KSU Physics
Carina Poltera - Graduate School (Master's program), Ball State, Physics
Adam Smith - Employment
Justin Tiemann - Employment
Aaron Wech - Graduate School, University of Washington, Geophysics
Jonathan Whitmer - Graduate School, University of Illinois, Physics

Masters of Science Degrees

Bijaya Aryal - Graduate School (Ph.D. program), KSU, Physics
Charles Mamolo - Graduate School (Ph.D. program) KSU, Education
Opress Makhafula - Instructor, KSU, Physics
Mohammad Faheem - Graduate School (Ph.D. program) Idaho
Rajesh Thapa - Graduate School (Ph.D. program), KSU, Physics

Doctorate Degrees

Howard Camp - employed by IDA (Institute for Defense Analyses), Alexandria, VA
Sampyo Hong - Postdoc, KSU Physics
Mim Nakarmi - Postdoc, KSU Physics
Zengxiu Zhao - Postdoc, Univ. of Ottawa, Canada, Physics

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