PHYSICS ILLINOIS NEWS

THE DEPARTMENT OF PHYSICS AT THE UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN • 2005 NUMBER 2

DeMarco and Kwiat "Amazing Light" Winners

Brian DeMarco and Paul Kwiat were among the 18 young physics researchers selected as finalists in a global competition to participate in *Amazing Light: Visions for Discovery,* an international symposium inspired by and honoring the leadership and vision of Charles Townes, winner of the 1964 Nobel Prize in physics. The young scientists—chosen from a field of 89 applicants and all less than 40 years of age—presented their innovative research at the symposium, which was held October 6–8, 2005, on the campus of the University of California, Berkeley. The symposium brought together renowned scholars and researchers, including 20 Nobel laureates, to explore the extraordinary challenges of 21st century physics and cosmology.

The "Young Scholars" competition focused on exploring and advancing innovative research in physics and astronomy. The 18 finalists presented research papers at the symposium, whose major themes were inspired by and derived from Townes' own ideas and questions. Special emphasis was placed on investigating new, deep discoveries about the nature of reality, as well as for developing powerful new technologies that, like the laser for which Townes shared the Nobel Prize, could open up new domains of scientific research.

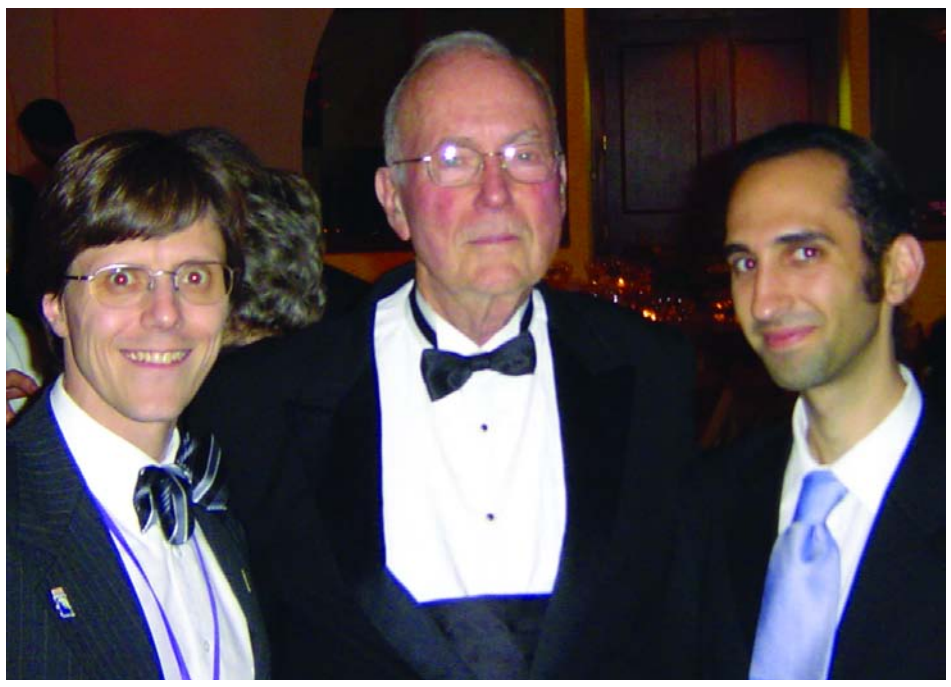


Photo by Paul G. Kwiat

Paul Kwiat, Charles Townes, and Brian DeMarco at the Amazing Light Symposium *in Berkeley, California.*

DeMarco won first place in the "Quantum Physics" category for his presentation on "Quantum Simulation using Ultra-cold Atoms," which described his research aimed at realizing quantum simulation using atoms trapped in an optical lattice. Before coming to Illinois in 2003, DeMarco held a National Research Council Fellowship at NIST, where he worked on quantum information experiments using trapped atomic ions—work that resulted in some of the first experiments demonstrating that scalable quantum computing is possible in the trapped ion system. In 2004, he received the prestigious *Young Investigator Award* from the Office of Naval Research, one of only 26 such awards made in all branches of science and engineering that year. In 2005, he was recognized with a National Science Foundation CAREER Award.

Paul Kwiat's presentation, "The Entanglement Revolution," received third place in the "Innovative Technologies" category. Kwiat described his work on "entanglement," considered to be the quintessential feature of quantum mechanics. By using lasers as a source for photons, his research group systematically studies how quantum systems react to manipulation, interaction with themselves, and measurement. In addition to investigating individual photons, the researchers also create pairs of *entangled* photons, allowing them to study the rudiments of quantum computing, realize perfectly secure encryption via quantum cryptography, and provide extremely convincing evidence that the universe does not obey classical laws.

In January 2001, Kwiat joined the Illinois physics faculty as the second John Bardeen Chair. He has done pioneering research on quantum interrogation, quantum erasure, and optical implementations of quantum information protocols.

A fellow of the American Physical Society and the Optical Society of America, he is a primary inventor of the world's two principal sources of polarization-entangled photons from down-conversion, which have been used for quantum cryptography, dense-coding, quantum teleportation, entanglement distillation, and most recently, optical quantum gates. ■

Illinois' First Atomic BEC

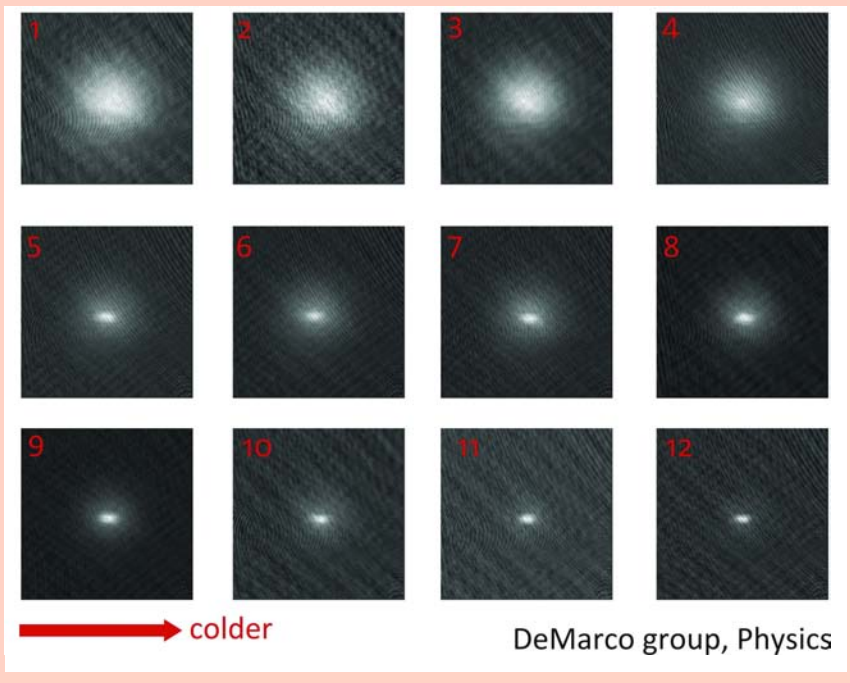


Photo by Brian DeMarco

At 6 p.m. on Tuesday, August 16, 2005, the DeMarco group (graduate students Matt White and Matt Pasienski, post-doc Hong Gao, and Professor Brian DeMarco) took these images of Illinois' first atomic Bose–Einstein condensate. The figure shows a sequence of absorption images; the temperature of the ^{87}Rb gas decreases as the labels increase from "1" to "12." The BEC first emerges at Image "4" (around 150 nK and 300,000 atoms), and the thermal gas disappears in the final two images.

Interview with Nithaya Chetty, President-Elect of the South African Institute of Physics

Editor's Note: It's been 15 years since Nithaya Chetty completed his PhD in physics at the University of Illinois. A physics professor at the University of KwaZulu-Natal in South Africa, Chetty is currently president-elect of the South African Institute of Physics.

Tell us about your childhood, when your interest in physics began, and the individuals who encouraged and influenced that interest.

I grew up in rural Natal province on the east coast of South Africa during the height of the Apartheid system, the country's policy of racial segregation. I am of Indian descent, and my forebears arrived in South Africa as indentured laborers who worked on the sugar cane plantations.

When growing up, I was accustomed to knowing my place in the social order. For example, shop entrances and public amenities—beaches, parks, schools, and transport systems—were separated according to race.

At that time, the choice careers amongst non-whites were medicine, law, and teaching, which enabled graduates in these fields to practice in their own separate communities. Opportunities outside these usual choices were few and, in some

continued on page 15

Letter from the Head

We are well into the new academic year and there is much to report. Generally the news is good, but the future has many uncertainties. The most exciting news is that a stellar cast of six new faculty members joined the department this fall. You can read about them in this issue of the newsletter. Regrettably, we will lose two senior faculty members mid-year, and two retirements at the end of this academic year are certain. Change is normal.

Another piece of good news is that Joe White, who became the 16th president of the University of Illinois on January 31, 2005, is making his mark. He has launched a comprehensive, system-wide strategic planning initiative to identify where we want to be in 2010 and what we must do to get there.

Symbolically, the White administration took flight on September 22 at a gala inauguration ceremony. The Marching Illini led the procession of nearly 500 students, faculty and staff members, alumni, and 90 representatives of other American universities and learned societies, all clad in academic regalia, from the Illini Union to Krannert Center for the Performing Arts. President White's inaugural speech was what we needed—frank about the challenges we face, given decreasing state support and uncertainties in federal funding, and uplifting about the University's great strengths and enormous potential.

Freshman physics major enrollments are up for another year and our new graduate class exceeded our target again this year. Despite our efforts to bring in a slightly smaller-than-normal class, to correct for unexpected increases in acceptance rates in recent years, the reputation of our graduate program brought us another large class.

Lastly, I have decided to step down as department head and retire in August 2006, which will mark my completion of 6 years as head and 39 years as a member of the faculty. A national search for my successor will begin soon, and there is every reason to expect the new head will be identified no later than April 2006 and be in a position to take over in August. I encourage you to send your recommendations for candidates for the next person to lead our remarkable department to Interim Dean Ilesanmi Adesida. ■

Jeremiah D. Sullivan

Whatever happened to…

For one night a year they were stars

BY DAN PETRELLA

For several years at Physical Revue, the annual Physics talent show held each December, a group of graduate students who called themselves *The Conduction Band* stole the show.

Tony Bonetti and Dylan Smith started the band after playing together in another short-lived group. Bonetti joined the earlier group, in which Smith played bass, when it got a new singer and some of the other members quit. The group didn't last much longer.

Smith and Bonetti decided to put a group together for the Physical Revue in 1997. "Tony and I hadn't played out for a while and we were itching to do that," Smith said.

The group's line-up for the first year included Smith on bass and backing vocals, Bonetti on drums and backing vocals, Dan Sheehy on guitar and backing vocals, and Bill Neils on lead vocals.

"They asked me if I wanted to sing. I told them to keep looking. If they couldn't find anyone else, I would step in," said Neils, who began singing in a church choir and sang in choirs throughout high school and college.

The band, whose name comes from the energy band theory of solids, took popular songs and rewrote the lyrics to relate to physics. Their songs included "Seminar Daze" (based on "Purple Haze"/Jimi Hendrix), "Stayin' Alive" ("Stayin' Alive"/The Bee Gees), and "Take Qual an' Fail" ("Jump, Jive, an' Wail"/Louis Prima).

"We tried to choose songs that both the grad students and the faculty would appreciate," said Smith. They tried to select a mixture of old and new songs and ones that would appeal to a wide audience, like songs by The Beatles and the Brian Setzer Orchestra.

"We would hear a song and think of funny physics lyrics for the chorus," Neils said. "Then we'd sit around and listen to each others' ideas. If we could come up with lyrics for the entire song, it was a go." Neils noted that they wrote a physics version of AC/DC's "You Shook Me All Night Long" but it was never performed because some group members thought it was too racy.

The group was pleased with the response it received from the first performance. "The audience reaction was great," Neils said. Brian Wiemeyer, who joined the group on trumpet, keyboards and backing vocals the second year, recalled being in the audience for the band's first performance. "The first year, when I was actually in the audience, it was electric," he said.

"Goodwin Road"

Sheehy left the group after the first year and Yung Tae Kim took over on guitar and backing vocals.

The group's members agree that the second year was the peak of *Conduction Band's* career. "The second year, we already had a little cult following, and the reaction was even greater," Wiemeyer said. "People remembered us from the previous year and sort of went nuts," said Neils. He said that performing the second year was one of his fondest memories of his time in the band.

Within a few weeks of that performance, the group even recorded an album called "Goodwin Road" in the basement of a band member's house in Urbana. "We sold about 50 copies of it and actually autographed a couple," Wiemeyer said.

Smith said the third year's performance "wasn't quite as magical." The members were busy with working on their theses and didn't have as much time to devote to the group, Neils said. "Honestly, the third year, it went down a bit," said Wiemeyer. "A group similar to ours went on before we did, and stole our thunder a little!"

As members began graduating and leaving the university, the group disbanded.

Smith is still at the university as a postdoctoral research associate for the Materials Research Laboratory. Until this summer, he was playing in a hard rock and funk group called Rodeo Girl Collective that played mostly cover songs at local bars like the Iron Post. Currently his two-year-old daughter keeps him too busy to play in a band.

Bonetti is a research scientist in the Low Temperature Science and Quantum Sensors Group at NASA's Jet Propulsion Laboratory.

Neils is designing cryogenic instruments for Quantum Design in San Diego, California.

Wiemeyer is a research scientist at Technology Service Corporation in Los Angeles and worked as an extra on the made-for-TV movie "18 Wheels of Justice."

In addition to his position as an assistant professor at Lake Forest College in Lake Forest, Illinois, Kim is also the founder, president, and CEO of Palindrome Skateboards.

Sheehy is a research associate in the physics department at University of Colorado at Boulder.

Although they have been apart for several years now, the members still have found memories of their time in the group. Wiemeyer recalled a time when a first-year graduate student approached him in the hallway as though he were some kind of celebrity. Neils' fondest memory is the time they spent hanging out at Smith and Bonetti's house, nicked named "the Dog Pound," writing song lyrics and making fun of each other.

About the possibility of a reunion, Smith said that he wouldn't want to necessarily go on stage but getting back together to play would be fun. "That's Tae's dream, I'm sure," he said. ■

For more information about Conduction Band, *as well as song lyrics and performance videos, visit the group's website at* guava.physics.uiuc.edu/~tae/conductionband.

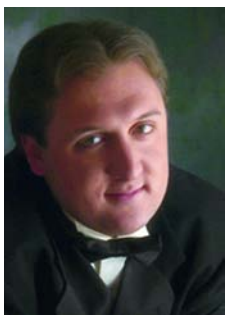
Music of the Spheres, Part 2

BY CYNDI PACELEY

From classical to barbershop to pop, Daniel Bahr, Becky McDuffee, and Matthew Gordon join their fellow Physics colleagues featured in the Spring 2005 issue of *Physics Illinois News* in singing music's praises.

Daniel Bahr, currently pursuing a PhD in condensed matter physics—specifically in low-temperature superconductivity—recently sang the difficult counter-tenor part of *The Coronation of Poppea* in a University of Illinois School of Music production at Krannert Center for the Performing Arts.

Poppea—written in 1642—was Claudio Monteverdi's last opera and considered his supreme masterpiece, a work that combines tragic and comic elements with deep character development. The earliest opera to be based on historical figures, it relates the story of a beautiful courtesan who schemes to become empress of Rome during Nero's reign.



Daniel Bahr

"It was definitely my most challenging role to date, but I enjoyed it immensely," Bahr said. "There was an amazing amount of music to memorize."

Growing up in Rochester, Minnesota, Bahr was surrounded by music. His parents listened to everything from Anne Murray to Willie Nelson, played the piano, and encouraged their children's musical interests. Singing since the age of 7, Bahr began in a community boys' choir and continued as a member of the Southeastern Minnesota High School Honors Choir. Led and inspired by Rick Kvam, Southeastern's voice teacher, the group won a young artists' contest in Vienna.

"Dr. Kvam was an incredible teacher," Bahr recalled.

"He holds both a medical degree and a master's in music conducting from Harvard," Bahr said. "At that time, he combined the two by working part-time in a hospital emergency room while teaching at Southeastern."

Bahr emulated his instructor beyond music by earning a triple major (physics, music performance, and mathematics) undergraduate degree with honors from Luther College in Decorah, Iowa.

"At the outset, I was a pre-med and music major, but my heart wasn't in medicine," he added. "After switching to physics and getting the triple major, I told my father that he got his tuition's worth from Luther College," Bahr joked.

While pursuing his undergraduate degree, he completed a rigorous 10-week research program in plasma physics, conducted over two summers at Indiana University, Princeton University, and the University of San Diego.

At the U of I, Bahr is in his fourth year and working with Dale Van Harlingen. He recently passed his preliminary exam and will soon begin designing and building a scanning SQUID microscope as part of research to make observations on magnetic fields at near absolute zero temperatures.

"In observing vortices formed by magnetic fields piercing the superconductor, we can gain magnetic topography information of different symmetry structures in unconventional superconductors," Bahr explained.

He hopes to pursue a job in industry or a postdoctoral fellowship following completion of his doctorate in roughly another three years.

Becky McDuffee, a 20-year Physics staff secretary, joined the Champaign-Urbana Sweet Adelines in 1979. She transitioned from a member of the chorus to serving as the group's assistant director for 15 years. Nearly six years ago, she became director of the 24-member chorus in the community of Danville, 35 miles east of C-U.

Though the directorship role prohibits her from singing with the group, she readily cites a performance at the 2004 regional contest as her most exciting show.

"It's the finest compliment a group can receive when the audience starts smiling and clapping before the performance is even over," McDuffee said.

Their final song garnered three ovations (one standing). They have also earned the prestigious "most improved chorus" award, and McDuffee won the novice director award in her first year.

Apart from Sweet Adelines competitions, another cherished honor was leading the singing of "Happy Birthday" at Professor and Nobel Laureate John Bardeen's 80th birthday party.

"That was pretty memorable—leading physicists in vocal tribute to Professor Bardeen," she said.

A native of Champaign who earned an associate's degree in music from Parkland College and a bachelor's degree in rhetoric from the U of I, McDuffee confesses to being "a ham" her entire life. Surrounded by parents and siblings who sang, she joined a high school choir and, later, a church choir. She became hooked for life, however, when she sang in a barbershop quartet as a teenager.

"I realized that in addition to our shared interest in music, these were people I liked to be with," she recalled. "That's why I found Sweet Adelines so appealing—it combined singing, camaraderie, and razzle dazzle."

Now in its 60th year, Sweet Adelines International boasts a membership of nearly 30,000 women in 1,200 registered quartets and 600 choruses in most of the 50 states, as well as in Australia, Canada, England, Finland, Germany, Ireland, Japan, New Zealand, Scotland, Sweden, and the Netherlands.

Chicago and St. Louis are particular hotbeds of barbershop, and this enables McDuffee to easily bring in vocal coaches from around the region for one- or two-day training sessions. As it does for others around the country, this additional tutelage helps her group maintain the high quality standards required before a quartet or chorus is given Sweet Adelines performing rights.

Becky McDuffee anchors her barbershop quartet, Off Senter. *From top, Lu Senter, Anita Edge, Betty Lightfoot, and Becky McDuffee.*

"Being a chorus director is definitely about watching people grow and develop, both personally and vocally," she added.

There is even a physics aspect to barbershop music, McDuffee said.

"Barbershop is sung *a capella* with four voices, ideally matching resonance and vowels, and singing intervals so mathematically exact—Pythagorean tuning—that the frequencies line up and create harmonics," she explained.

These harmonics mean that while four notes are being sung, one or more additional notes above them—and sometimes, one or more notes below—can be easily heard.

"Lining up your voice with three others and 'ringing' a chord hooks many a singer to barbershop," she added.

Matthew Gordon's newest musical composition is "Finish Your Thesis Oratorio in B-Minor," a self-titled work that explains why he hasn't been singing much lately.

When his schedule allowed music to fill more of his free time, Gordon's interests included performing pop and classical, as well as composing.

Most recently, he sang in the Champaign-Urbana area with a band called "Lost Episodes," covering 1960s and 70s tunes originally made famous by the likes of Elvis Presley, Bob Seger, and Van Morrison, along with those of contemporary artists such as Chris Isaak and Santana. Prior to that, he sang with the U of I Chorale.

"I found performing with the Chorale extremely challenging, since most members of the group are choral conducting majors and I'm strictly an amateur," Gordon said. "During my first semester with them, we performed all 25 movements of Rachmaninoff's *Vespers,* which, above and beyond the technical requirements, is quite a marathon," he added.

His pursuits turned to composition in the past year when he wrote a 10-minute musical, "Uraniborg," about the life of Danish astronomer Tycho Brahe. The piece made its debut as part of the Penny Dreadful Players' 10-minute play festival in 2004.

Originally from the north Chicago suburb of Glenview, Gordon's first exposure to music performance was piano lessons, including a brief foray into the then-popular "Suzuki method," which he abhorred. He abandoned piano for drums in the school band, and began singing in a junior high school choir.

He studied voice with a private teacher while in high school and performed in the concert and jazz choirs, as well as in madrigal and *a capella* groups.

While earning a bachelor's degree in physics at Princeton University, Gordon explored both pop and Jewish liturgical *a capella* groups and continued training with a vocal coach.

Following graduation from Princeton, he worked as a systems integrator for Geodesic Systems in Chicago. He completed a master's in physics at the U of I and is currently pursuing a PhD.

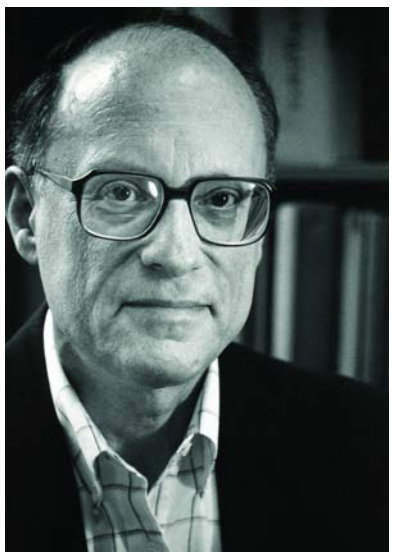
He is now working with Paul Selvin to develop new applications of single-molecule fluorescence to biophysics.

"It's a very fast-moving, exciting field these days, and I've done some interesting work, both in genomics and proteomics," Gordon said.

"We recently filed for a patent on a method for determining generic haplotypes by observing single DNA molecules," he added.

He hopes to graduate within the next year and to pursue a postdoctoral fellowship. ■

Observations on Life in Rhyme and Meter



Oscillations Electromagnetic

Oscillations electromagnetic
I send you with signals of love,
Generated by motions frenetic
Of electrons, by laws from above.
The message flies on as by magic,
At the maximum possible speed.
If my meaning were lost, 'twould be tragic;
Let no one my signals impede.

BY CYNDI PACELEY

Former students of Professor Emeritus Donald M. Ginsberg will be pleased to know the engaging scholar is still writing and publishing.

His current literature, however, doesn't involve the results of condensed matter physics research; the latest work, *At the Edge of a Dream,* features 125 poems composed since Ginsberg's retirement in August 1997. It expands on his earlier book of poetry, *Sunbeams Fall,* published in 2002.

"My poems comment on everyday life, with its rapid changes and its frequently amusing peculiarities and paradoxes," Ginsberg noted.

With titles ranging from "The Voice" to "Speeding Down the Highway" and chapters allocated to both humorous and serious topics, such as physics observations, word games, hobbies, and friends, *At the Edge of a Dream* is enjoyable reading for the physicist and non-physicist alike.

And true to character for a faculty member frequently cited among those University of Illinois teachers ranked as "excellent" by their students, Ginsberg even included homework—partial poems for the reader to finish or to begin.

Ginsberg credits a charismatic high school English teacher with imparting a love of words and poetry.

"She showed genuine enthusiasm for her subject, and that enjoyment was contagious," he recalled.

Excelling in all subjects, Ginsberg attended Chicago's Hyde Park High School for three years before enrolling at the University of Chicago, which accepted students after two, three, or four years of secondary education. He first earned a bachelor's in liberal arts before tackling a second undergraduate degree in physics. A year later, he completed a master's in physics, all at Chicago, and headed to the University of California, Berkeley for his PhD.

Involved in a superconductivity project at Berkeley and with a thesis on the same topic, Ginsberg was well acquainted with the work of Professor and Nobel Laureate John Bardeen at the University of Illinois.

As he finished his doctorate, he was invited to join the U of I faculty. He remained for 38 years and, along the way, served as graduate thesis research adviser to 36 students who earned PhDs. During his career, he was named a Fellow of the American Physical Society, was twice honored as an A.P. Sloan Foundation Research Fellow, and received a Postdoctoral National Science Foundation Fellowship for research in Cambridge, England.

He was also awarded the Daniel C. Drucker–Tau Beta Pi Eminent Faculty Award in 1992, and joined the elite ranks of those named a University Scholar in 1994–95.

It was his most recent professional honor that was also the most significant. The 1998 Oliver E. Buckley Prize, which Ginsberg shared with U of I colleague Dale Van Harlingen, along with John R. Kirtley and Chang C. Tsuei of IBM, rewarded their seminal work using phase-sensitive experiments in the elucidation of the orbital symmetry of the pairing function in high-T_c superconductors.

Ginsberg and Van Harlingen joined three other distinguished Illinois Physics faculty—two-time Nobel Laureate John Bardeen, National Medal of Science winner Harry Drickamer, and National Academy of Science Comstock Prize winner Charles Slichter—who have also won the prestigious Buckley Prize.

Ginsberg retired nearly a year and a half after first being diagnosed with Parkinson's disease. One of his largest frustrations with the condition is that it ended his ability to play the flute—an avocation he began at age 55.

"I had my first music lesson about 50 years late, but I enjoyed playing and was very happy to perform in the Parkland College Orchestra," Ginsberg said.

His second poem, "Pianissimo Don," made light of his abilities and captured his self-described style of play: "a flutist who never plays forte."

Ginsberg recently began a regimen of physical therapy and has seen improvement in his Parkinson's symptoms. And more good news: he is busy with new poems in preparation for his third book.

Like its two predecessors, the third tome will no doubt express in rhyme and meter the author's philosophy of life—enjoy our beautiful universe, share a laugh, and try not to stub a toe on every chair you pass. ■

Editor's Note: If you would like to order a copy of At the Edge of a Dream, *email Professor Ginsberg at dmgins@uiuc.edu.*

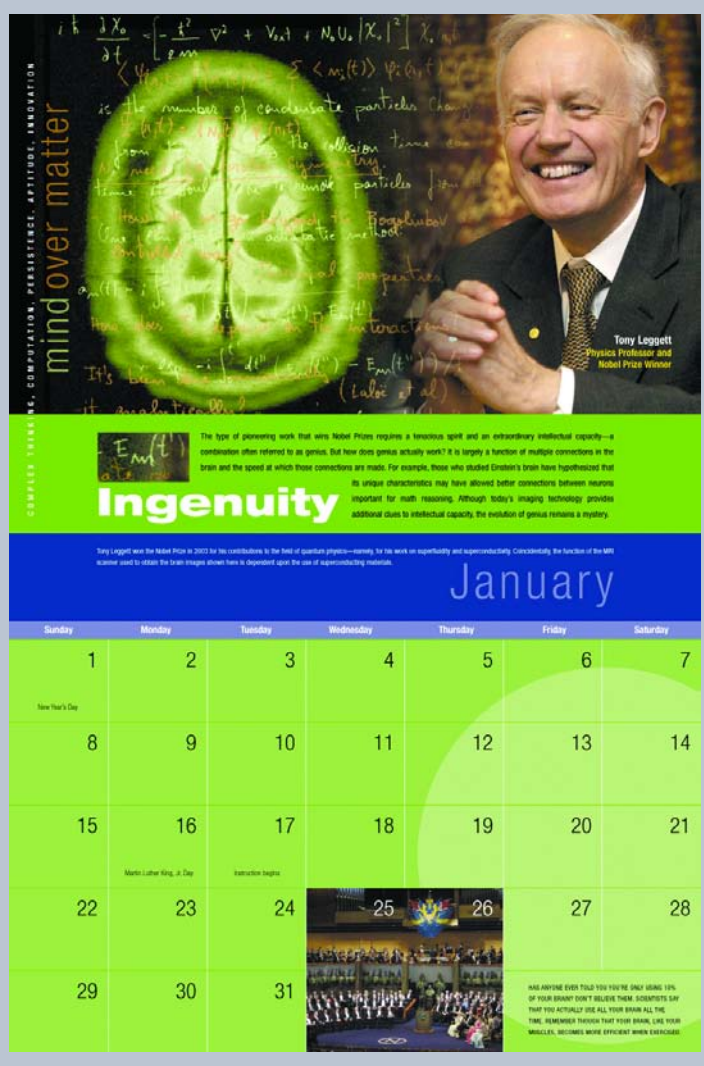
Now That's Using Your Neurons!

In a uniquely U of I product, 2003 Nobel Laureate Anthony Leggett is "January" in the *Big Brains on Campus* 2006 calendar, produced by the Beckman Institute for Advanced Science & Technology. The calendar features artistically enhanced brain scans of 14 campus faculty, students, staff, and administrators, while providing information about various brain regions and functions that each person uses in his or her work. Leggett's brain scan focuses on the regions of the brain that contribute to ingenuity.

"This project allows us to bring together our technology and our people to underscore the incredible brain power we have on this campus and the cutting-edge resources we have at Beckman," said Tracey Wszalek, associate director of the Institute's Biomedical Imaging Center. "It's an opportunity to showcase magnetic resonance imaging research by personalizing the science."

The Beckman Institute cultivates groundbreaking, interdisciplinary research in three scientific and technologically relevant areas: biological intelligence, human-computer intelligent interaction, and molecular and electronic nanostructures.

Calendars are available for purchase online at www.beckman.uiuc.edu/bigbrains.html. The Department of Physics also has a limited supply of calendars; write to Celia Elliott (cmelliot@uiuc.edu) if you'd like to purchase one. The cost is $14.95 plus mailing. Recently featured on Paul Harvey and in the Chicago Sun-Times, Boston Globe, St. Louis Post-Dispatch, Washington Post, and Miami Herald, as well as on ABC, CBS, and Yahoo News, the calendar has also been publicized in Canada and Australia. With this much attention, they're sure to sell out quickly, so don't delay in placing your order. ■



Protein Movements Re-evaluated

Researchers Look at Channels With New Technique

By Greg Kline, News-Gazette Staff Writer

Protein molecules form minute, gated pores in cell membranes to let things pass through—water and ions like salt and potassium, for example.

The proteins open and close the channels they form in a way that lets enough through to do the job, but not too much, which would damage the integrity of the cell.

It is a basic biological process going on in cells inside us all the time and in every other type of cell, so vital that its breakdown can contribute to many diseases, and many drugs to treat diseases target it.

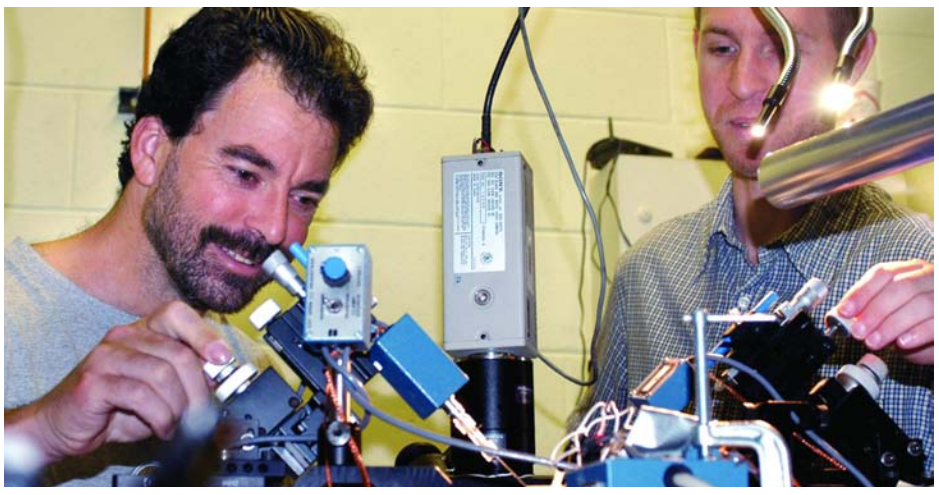


Photo by Vanda Bidwell/The News Gazette

Prof. Paul Selvin, left, and graduate student David Posson work with an electro-physiology microscope they use to look at frog egg cells injected with proteins they study, in a laboratory at the University of Illinois' Loomis Lab.

"The way you think and feel and see are all nerves firing and nerves firing are based on these ion channels," University of Illinois Professor Paul Selvin said recently.

He also pointed to research done elsewhere where slight modifications in ion channels of fruit flies left them needing very little sleep, and caused them to die much earlier.

The protein channels "are of tremendous physiological and clinical significance," he said.

Now, Selvin, a biophysicist, and UI researcher David Posson are shedding light on the way the proteins open and close their channel gates and may settle something of a scientific controversy.

Proteins work by moving and taking shapes, and some scientists have proposed that they make a major shift, for a protein, in acting like a switch or plunger to regulate the gates.

But in an article in the journal Nature, released today [August 11, 2005], Posson, Selvin and colleagues say the proteins appear to move very little and change shape even less.

Selvin said scientists who have examined the process previously used a technique called X-ray crystallography, which basically freezes the proteins in order to study them.

But that technique may affect a protein's state itself and influence the results, the UI researchers contend. In contrast, they've developed a method of looking at the molecules in action.

"That's a big advantage of our technique," Selvin said.

Posson, who finished his doctoral work at the UI this year and is now a post-doctoral researcher in Selvin's lab, used a specially modified scorpion toxin that naturally binds to so-called Shaker potassium ion channels. The toxin molecule includes a tiny dye marker that fluoresces, or glows, green when excited by a laser.

Since the researchers know the toxin attaches outside the top of the protein channel, the marker gives them a baseline from which to measure the changes in the part of the protein that serves as a gate. That part is marked with a different colored dye.

The UI researchers manipulate the electrical voltage across the cell, in this case a frog egg, where they've injected the proteins, which causes the gate to open and close.

They excite the dye markers and use their fluorescence to track the distance the protein gate moves from the scorpion toxin and the degree to which it changes shape.

"The change in distance was much, much less ... than expected" based on previous research using X-ray crystallography, Posson said. They also saw no evidence of a sizeable change in the protein's shape or position.

The results are similar to another s tudy, also published in Nature, that Selvin and colleagues released in 1999. But the addition of the scorpion toxin, which wasn't available then, improves the experiment and enhances the findings. Selvin said it's possible the fluorescent markers could affect the results as well. But he said UI researchers tested different chemical compositions and checked the electrical properties of the proteins before and after looking for any effects and found none.

UI scientist Pinghua Ge, Christopher Miller at Brandeis University and Pancho Bezanilla at UCLA contributed to the study. The research was funded by the Carver Foundation, the National Science Foundation and the National Institutes of Health.

The study gets at the nature of the protein's movement, but how the whole process works is still an open question on which Posson plans to focus next. Selvin also wants to look at mechano-sensitive channels, which are channels that appear to open and close based on pressure on the cell membrane as opposed to electrical voltage. ■

Alfred O. Hanson, 1914–2005

Alfred Olaf Hanson, 90, an emeritus professor of physics, died July 2 in Urbana.

Born September 26, 1914, on his father's homestead farm near Braddock, North Dakota, he was the son of Norwegian immigrants. He recalled that, as a boy, he collected buffalo bones on the farm and observed circles of stones which secured Sioux teepees.

He married Elizabeth Marie Miller on May 16, 1942, in Columbia, Missouri. He is survived by his wife and their four children: Andrew Jorgen Hanson of Bloomington, Indiana; Donald Farness Hanson of Minneapolis, Minnesota; Ardith Hanson Field of Colorado Springs, Colorado; and Craig Demorest Hanson of Rochester, New York; and by four grandchildren.

Professor Hanson received his elementary education in a one-room country school in Emmons County, North Dakota. After his family moved to Grand Forks, North Dakota, in the mid-1920s, he attended high school and college there, earning a BS in education at the University of North Dakota in 1936. He was a high school science teacher in Pine River, Minnesota, in 1936–37, but returned to the University of North Dakota as a teaching assistant in mathematics, obtaining an MA in science in 1938. He then enrolled at the University of Wisconsin-Madison as a graduate student in physics. In 1942, he received his PhD in physics under the direction of R.G. Herb and remained at the University of Wisconsin van de Graaff generator laboratory as an employee of the secret, wartime, atomic-bomb Manhattan Project until April 1943, when the two Wisconsin van de Graaff generators—and most of the staff working with them—were moved to Los Alamos, New Mexico, to continue the neutron measurements needed in design of the atomic bomb. On July 16, 1945, Hanson was in charge of a small ground experiment at the New Mexico Trinity-North site, 10,000 yards from ground zero, when the first atomic bomb test shot was detonated.

In January 1946, with his wife and young son, Andrew, he moved from Los Alamos to the University of Illinois as an assistant professor of physics to begin his long and distinguished career in academic experimental nuclear physics. At that time, Donald Kerst's 20-MeV betatron at the University of Illinois produced the highest energy x-rays in the world, and Professor Hanson, with colleagues, used them to investigate the structure of, and especially the size of, atomic nuclei.

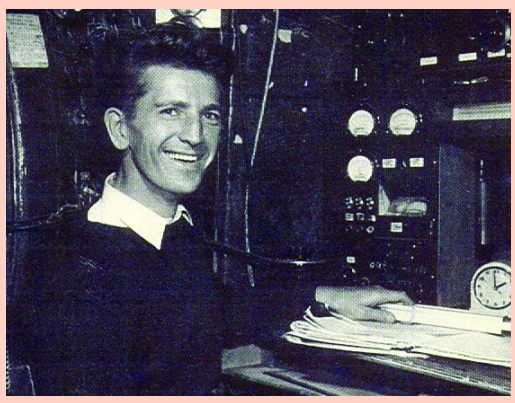
In 1948, Professor Hanson was joined by E.M. Lyman and M.B. Scott in a seminal electron scattering experiment, which was celebrated 35 years later by a commemorative conference held in Urbana.

By 1950, a much larger betatron, capable of producing 300-MeV electrons and x-rays, had been constructed at Illinois. In a sense, the earlier betatron was used to investigate how atomic nuclei are constructed from protons and neutrons, while the larger machine was used to study the structure of the protons and neutrons themselves. Using this new capability, Professor Hanson's group performed a series of elegant experiments that laid the path for others to follow.

In 1967, when support for the 300-MeV betatron was being terminated, he began experimental work with a new kind of electron accelerator, a microtron, which, using a superconducting linear accelerator, produced much more intense electron beams.

In his career at Illinois, Professor Hanson directed 18 students to their doctoral degrees in physics.

In 1955–56, Professor Hanson was a Fulbright Scholar in Turin, Italy, where he assisted in setting up a betatron laboratory there. On July 27, 1956, having preceded his family back to the United States, Hanson met them on the docks in New York City as they disembarked from the ship that had rescued them from the ill-fated voyage of the Andrea Doria. Again, in 1960, he served as a Fulbright lecturer—with the betatron group in Sao Paulo, Brazil.



Al Hanson at the controls of the U of Wisconsin van de Graff ("long tank") generator, imported to wartime Los Alamos.

Professor Hanson spent a sabbatical at the Brookhaven National Laboratory in 1961–62 and, in 1965, managed a high-energy experiment there.

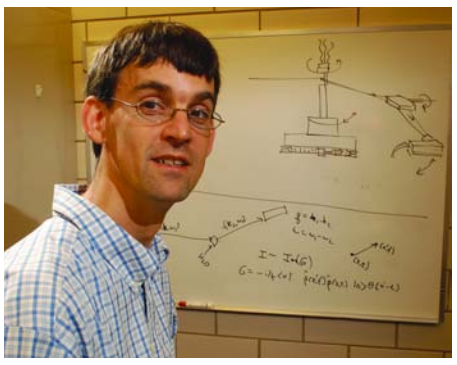
He was a Fellow of the American Physical Society and a member of Sigma Xi. Other activities included service with the National Research Council sub-committee on neutron measurements and standards, 1948–50; committee for the review of nuclear programs of the National Bureau of Standards, chairman 1965; co-chairman, with Peter Axel, of the Gordon Conference on Photonuclear Reactions, 1959.

Professor Hanson was a member of the Unitarian Universalist Church, was active with the Boy Scouts, and enjoyed hiking, canoeing, and camping with his family. In retirement, he joined his wife in several Earthwatch expeditions and in co-stewardship of the Tomlinson Pioneer Cemetery Savannah-Prairie Remnant, now a dedicated Illinois State Nature Preserve in Kerr Township of Champaign County. He conducted the first prescribed burns of the Urbana Park District's (later much expanded) Meadowbrook Propagated Prairie. ■

Department News

Six New Faculty Call *Physics Illinois* Home

Summer 2005 brought a flurry of remodeling and moving to Loomis Laboratory of Physics as the department made room for six outstanding new faculty members: Peter Abbamonte (MS '94, PhD '99), Aleksei Aksimentiev, Raffi Budakian, Nadya Mason, Jose Mestre, and Smitha Vishveshwara.



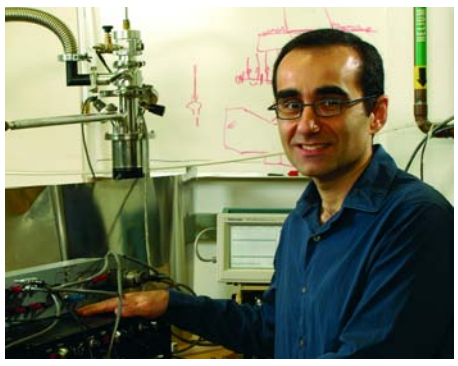
Peter Abbamonte

A condensed matter experimentalist, Peter Abbamonte received his PhD in physics from the University of Illinois at Urbana-Champaign in 1999, after obtaining a bachelor's degree in physics from the University of Texas, Austin, in 1992. He was a National Science Foundation Fellow in the Materials Science Centre at the University of Groningen, the Netherlands, and a visiting scientist at Brookhaven National Laboratory from 1999 to 2001. He received postdoctoral training in biophysics at the Laboratory of Atomic and Solid State Physics, Cornell University, from 2001 to 2003, where he developed new concepts for studying attosecond phenomena, in particular energy transfer in photosynthetic membranes, using x-ray scattering. He worked as an assistant physicist at the National Synchrotron Light Source at Brookhaven National Laboratory and as an adjunct assistant professor at SUNY, Stonybrook, from 2003 to August 2005, when he joined the Department of Physics as an assistant professor. His research interests include resonant soft x-ray scattering and inelastic x-ray scattering; unconventional superconductors and high T_c superconductivity; and elementary processes in condensed matter that occur on the attosecond time-scale.

Aleksei Aksimentiev

Alek Aksimentiev is a theoretical and computational biophysicist interested in molecular motors, mechanical proteins, F-ATP synthase; high-throughput DNA sequencing, silicon biotechnology, nanosensors; membrane transport, ion channels, and biomolecular modeling. He received his PhD in chemistry *cum laude* from the Institute of Physical Chemistry, Warsaw, Poland, in 1999, after completing a master's degree in particle physics at the Ivan Franko Lviv State University in his native Ukraine in 1996. He received postdoctoral training at the Materials Science Laboratory R&D Center of Mitsui Chemicals, Tokyo, Japan, from 1999 to 2001, when he joined the Theoretical and Computational Biophysics Group at the University of Illinois as a postdoctoral research associate. He accepted the position of assistant professor of physics at Illinois in August 2005.

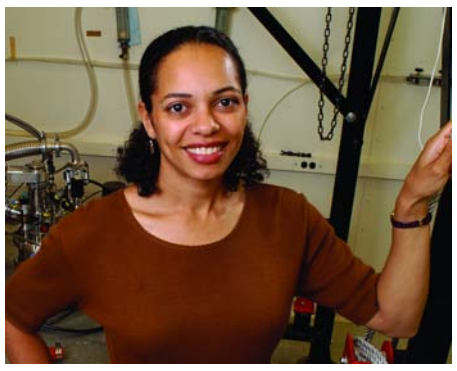
Aksimentiev's recent work includes a collaboration with experimentalists and theorists in electrical engineering and physics at Illinois, who are exploring the use of nanometer-diameter artificial pores in ultrathin silicon membranes to sequence single molecules of DNA under physiological conditions. In principle, the chemical sequence of a DNA molecule can be determined by analyzing the electrical signals produced by the molecule as it squeezes through the nanopore in the membrane. Using MOSFET fabrication technology, a low-noise amplifier is being integrated with a nanopore, enabling rapid detection and amplification of the electric signals resulting from the DNA-nanopore interaction.



Raffi Budakian

Part of the team that first imaged the spin of a single defect in glass (*Nature* **430**, 329–332 [2004]), Raffi Budakian's research focuses on developing ultra-sensitive spin detection techniques for single spin imaging and quantum readout. His current research includes design and fabrication of micro-machined silicon cantilevers for sub-attonewton force detection; development of spin detection/manipulation protocols that enable force detection at the thermal limit; imaging single dopants and defects in semiconductors; spin control via active feedback; and combining magnetic resonance force microscopy (MRFM) with electron nuclear double resonance (ENDOR) for high sensitivity nuclear spin detection.

Budakian earned his bachelor's, master's, and PhD degrees in physics from the University of California, Los Angeles. From 2002 to 2005, he was a visiting scientist at the IBM Almaden Research Center in San Jose, California, where his research focused on detecting the spin of a single electron using MRFM. The long-term goal of this work is to achieve three-dimensional sub-surface imaging of atomic structure, a capability that would transform our understanding in areas ranging from the determination of protein structure to the characterization of buried interfaces in semiconductor devices.



Nadya Mason

A person of enormous energy, Nadya Mason found an outlet in her earlier years as a gymnast in Houston, training with the legendary Bela Karolyi and becoming a member of the U.S. National team. Mason received her bachelor's degree in physics from Harvard University in 1995 and her PhD in physics from Stanford University in 2001. Prior to joining our faculty, Mason was a junior fellow of the Harvard Society of Fellows, where she collaborated with Professors Charles Marcus and Michael Tinkham on projects related to both carbon nanotubes and nanostructured superconductors.

A condensed matter experimentalist, Mason will focus on how electrons behave in low-dimensional, correlated materials, where enhanced interactions are expected to give novel results. She is particularly interested in the effect of reduced dimensionality and correlations on electron coherence, the control of which is relevant to a variety of systems, including quantum communication, information storage, and qubit control in quantum computers. Mason will exploit modern fabrication techniques to make and study a variety of nanostructures, such as quantum dots and wires, as well as arrays of superconducting dots.

Jose Mestre

Jose Mestre received bachelor's and PhD degrees in physics from the University of Massachusetts in 1974 and 1979, respectively. He has spent his entire career to date at the University of Massachusetts, rising rapidly through the ranks from research associate to full professor. He came to Urbana in August 2005 as a full professor of physics and of educational psychology. Although trained as a nuclear physicist, his academic interests evolved more than 20 years ago to the questions of how students *learn* physics. He is a distinguished scholar of physics learning and arguably the most highly regarded researcher in the field of physics education in the United States. He has adapted tools from cognitive and educational psychology to investigate forefront issues in the development of scientific knowledge and how it is conveyed in instruction, and he brings great strengths and new perspectives to the physics education research group at Illinois. His research interests focus on cognitive processes pertaining to learning science, the role and interaction of language in problem solving, and the use of technology in science and mathematics education.

Smitha Vishveshwara

A condensed matter theorist with wide-ranging interests, Smitha Vishveshwara received her bachelor's degree in physics *magna cum laude* from Cornell University in 1996, and her PhD in theoretical physics from the University of California, Santa Barbara, in 2002. She served as a postdoctoral research associate with Paul Goldbart and Tony Leggett in Physics at the University of Illinois at Urbana-Champaign from 2002 to 2005, working on tunneling and fractional statistics in quantum Hall systems, Aharonov–Bohm effects in carbon nanotubes (*Science* **304**, 1132–1134 [2004]), and critical dynamics in charged superconductors. She joined the department as an assistant professor in August 2005.

Vishveshwara's research interests span a broad range of topics in theoretical condensed matter physics, and she maintains strong collaborative ties with experimentalists. Over the next few years, she plans to extend ongoing projects and to expand her research into problems involving ultracold atoms trapped in optical lattices, electronic properties of single-walled nanotubes, and exotic features of quantum Hall states. ■

Physics Welcomes Displaced Professor

By Jodi Heckel

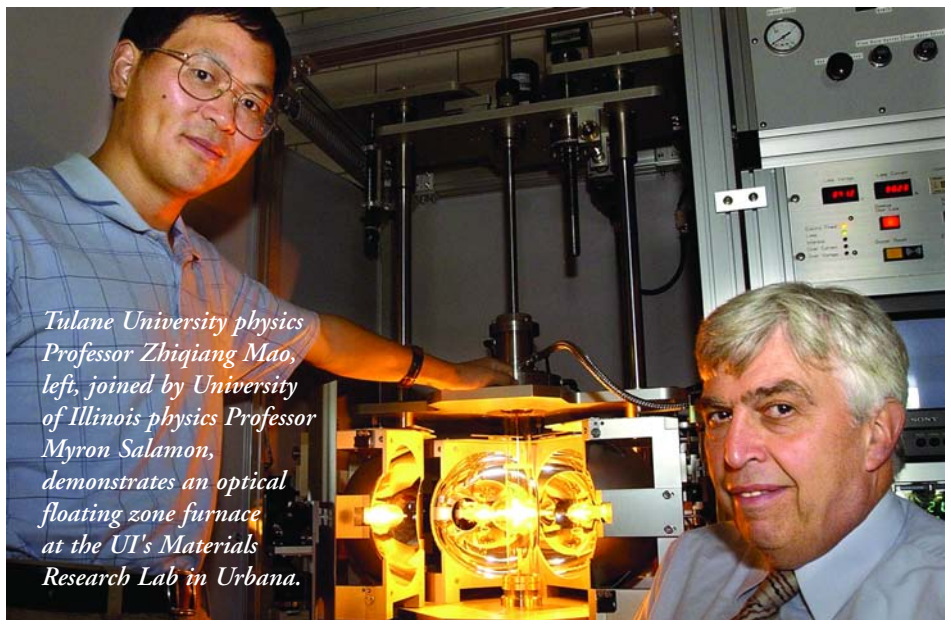


Photo by John Dixon/The News-Gazette

Tulane University physics Professor Zhiqiang Mao, left, joined by University of Illinois physics Professor Myron Salamon, demonstrates an optical floating zone furnace at the UI's Materials Research Lab in Urbana.

When physics Professor Zhiqiang Mao left his home in Metairie, Louisiana, and his lab at Tulane University the day before Hurricane Katrina hit, he faced losing valuable research time.

Now he's at the University of Illinois and ready to start work again.

"This is the ideal place for me," Mao said. "If I couldn't stay here to continue my work, it would have a huge impact on my research."

Mao is on campus at the invitation of Myron Salamon, a UI physics professor, associate dean in the College of Engineering and director of the Engineering Experiment Station.

Salamon and Mao are part of a small group of scientists worldwide who work with a family of materials based on three elements and study their fundamental physical properties.

Mao is an expert in growing the materials in an optical floating zone furnace—a furnace that focuses a beam of light on material to melt it and form a crystal. The furnace provides the necessary superclean environment for growing the compounds, which are sensitive to impurities. And the UI is one of a half-dozen places in the country with such a furnace.

Salamon had never met Mao before he arrived in Champaign-Urbana, but Salamon knew Mao's work and is one of several UI researchers who have used samples grown by Mao. When the hurricane hit New Orleans, Salamon thought of Mao and tried to e-mail him to offer him a place to work. He couldn't reach Mao by e-mail but tracked him down through his former adviser at Penn State.

"My first thought was to send a check to the Red Cross, and I did that," Salamon said of his reaction to news of Hurricane Katrina. "But I thought, is there anything I can do as a colleague to help the people we know? We know what Dr. Mao does. We read his papers. We compete with him. If we can't beat him, we'll bring him up here. It seemed natural, if he came here and we had a furnace, we'd all benefit from it."

"My concern is we have young scholars early in their careers, and this is a big disruption" for them, he added.

When Mao left New Orleans with his wife, Yu Wang, and their 10-year-old daughter Alice, they drove to Houston—and what is usually a five-hour trip took 15 hours because of heavy traffic flowing out of New Orleans. They stayed with a friend, who also took in one of Mao's graduate students and his family, and another friend and his family. Mao said 11 people stayed in the one-bedroom apartment for a week.

Then Mao and his family flew to North Carolina to stay with relatives and decide where he would go from there. He had offers to work at universities in Japan, the United Kingdom and at Florida State University. But he wanted to stay in the U.S. and Florida State couldn't accommodate his graduate students.

So he arrived at the UI a little over a week ago. The UI is providing free housing to Mao and his two graduate students at its Orchard Downs complex, an office and a modest amount of supplies for Mao, use of the furnace, and the privileges of UI faculty, such as being able to use the bus system for free. Tulane is still paying his salary.

When he arrived, the local chapter of the American Red Cross helped Mao and his wife get prescription refills and it provided hepatitis shots, vouchers for clothing, a voucher for a night in a hotel and some supplies. It also helped them with enrolling their daughter in school.

"We didn't expect we'd receive so many helps," Mao said.

Alice is attending King Elementary School in Urbana, which has a Chinese language program, much to Mao's delight. The family speaks Chinese at home, but Alice will be able to work on her reading and writing skills at King, he said.

Mao has received some good news from home, as well. A friend checked his house in Metairie and found minor water damage from a leak, but it was not flooded and a tree that fell in the back yard missed the house.

"My lab is probably OK," he added. "The damage may be very minimal. My lab is on the fifth floor, so it shouldn't be flooded."

He'll have no access to his samples or data there for some time, but "I can reproduce the samples very quickly," he said. "We've ordered the chemicals. I think we can start our work right away when we receive those chemicals.

"The research atmosphere is wonderful, just wonderful," Mao said of his impression of the UI. "I feel I'm so lucky. My house is undamaged. I got so many helps from the University of Illinois and Professor Salamon. I really appreciate all these helps." ■

New Gift Benefits Biological Physics

From his perspective, the University of Illinois has been very good to Lewis (Lonnie) Edelheit and his wife, Susan. So when an opportunity arose to show his appreciation, Edelheit eagerly stepped forward with financial support for the Physics Department.

His gift creates the L.S. Edelheit Family Endowed Fund in Biological Physics, which will be used for an annual graduate fellowship to the best student in biological physics (theory or experiment).

"I had three key reasons for giving back and for choosing the biological physics area in particular," Edelheit said. "I've been pretty fortunate in my life and realized just how much I owed the U of I for my circumstances," he continued. Above and beyond his education, he also met his wife of 40 years while at the U of I.

Recognized as one of GE's leaders in modern-day medical imaging, Edelheit liked the idea that the fund would reflect his career's work—that of studying and refining the interaction of radiation with the human body.

As the holder of a PhD in solid state physics who works in industry, he was also concerned about the divergent paths of physics and industry.

"It seemed that the biotechnology area would be a great place to bring physics and industry closer together, and that is another goal of the fellowship," he added.

"We will award the fellowship to a student who has already demonstrated outstanding research ability and who shows great promise for making substantial contributions to the biological physics field," said Jeremiah Sullivan, head of the physics department.

The award will free the student from other responsibilities to allow him or her to make maximum progress during the fellowship year, completing the PhD as early as possible.

An obvious assist to recruiting top students, the fellowship will benefit a physics faculty adviser as well.

"In working with the award recipient, the faculty adviser will have the opportunity to explore new ideas in promising areas that are not yet funded," Sullivan added.

"In this way, the Edelheit name will be associated with those students who are most likely to have a significant impact on biological physics. Winning the fellowship award will provide assistance at a critical juncture in their careers," Sullivan noted.

Credited with helping to lead General Electric into the medical imaging sector, Edelheit's personal impact on the field has been far-reaching and profound. His contributions have been recognized by his election to the National Academy of Engineering and receipt of the George E. Pake Prize of the American Physical Society. He is also a Society fellow.

In a career that spanned 33 years—all but six in various capacities with GE—Edelheit championed the field of medical imaging. He served as the first project manager for a computed tomography (CT) scanner and went on to oversee GE's emergence in the medical electronics market, today heralded as one of the company's most successful enterprises.

At his retirement in 2002, he directed the Schenectady, NY-based GE Research and Development Center, one of the world's largest and most diversified industrial laboratories. He concluded his career as GE's senior vice president for corporate research and development, as well as a member of the company's corporate executive council.

After earning an undergraduate degree in engineering physics and master's and doctorate degrees in physics from the University of Illinois, Edelheit began his career as a physicist at the GE R&D Center, where he made significant contributions to all-video fluoroscopic x-ray systems and to fast-scan, "fan-beam" computed x-ray tomography scanners.

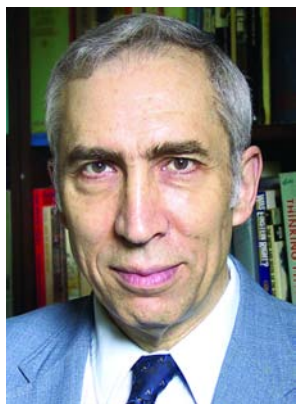
His patent (#4,063,097) covers the concepts for GE's first CT x-ray system, a major advance in medical imaging he helped to pioneer through his own seminal scientific contributions and through his leadership of engineers and scientists from a wide range of technical disciplines.

Edelheit credits his three UI degrees with providing important knowledge in the broad nature of physics and the ability to think about complex systems—electrical, mechanical, computer, and mathematics.

"I would have been hard pressed to find an area that called on complex systems analysis more than that of medical imaging," he said. ■

Alumni News

Alumnus Bill Edelstein Honored with AIP Prize



By providing detailed pictures from the depths of the living body, magnetic resonance imaging (MRI) has saved many lives and dramatically increased knowledge of human anatomy, particularly the brain. More than 22,000 scanners worldwide now perform some 60 million scans annually. But without the ingenuity of an industrial physicist and his colleagues, magnetic resonance would not have made its sudden jump in the early 1980s from a tool for esoteric laboratory research to a widely available medical technology. For his pioneering developments in the commercialization of high-resolution MRI for medical applications, Physics alumnus William A. Edelstein (BS '65) received the 2005/2006 American Institute of Physics Prize for Industrial Applications of Physics.

Edelstein joined the General Electric Corporate Research and Development Center in Schenectady, New York, in 1980. He spent the next 21 years making key contributions to MRI science and technology and the development of GE's MRI systems. While Edelstein retired in 2001 from GE, he remains active as an independent scientist and consultant and a visiting scientist at nearby Rensselaer Polytechnic Institute. He is also a senior research associate at Case Western Reserve University, where he has done theoretical research on shielding pulsed gradient fields to reduce eddy-current-induced acoustic noise.

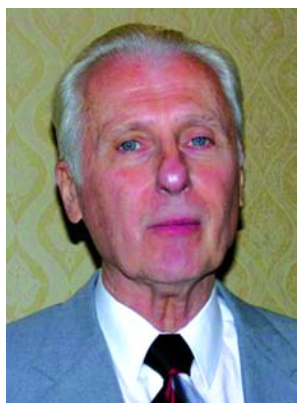
After receiving a PhD from Harvard University, Edelstein was a postdoctoral research fellow at Glasgow University, working on gravitational wave detection. He moved to Aberdeen University, also in Scotland, as a research fellow from 1977 to 1980, and was part of a pioneering effort to develop MRI. There, he collaborated in constructing one of the first whole-body scanners and was the primary inventor of the "spin warp" imaging method still used in all commercial MRI systems.

After joining GE in 1980, his early analysis and experimental work on MRI signal-to-noise ratios helped establish what was then high field 1.5-T (64-MHz) imaging and its commercial feasibility. Edelstein was part of the team that produced the first 1.5-T image and spectra of the head. He collaborated in the development of the rf "birdcage" imaging coil that operated successfully at 64 MHz and built a version that made the first 1.5-T whole-body image.

Recently at GE he elucidated the sources and pathways of acoustic noise generated in MRI systems and assembled an experimental system having substantially reduced noise. He is continuing that work as an independent scientist and consultant in collaboration with university and industrial partners.

Edelstein is a Fellow of the American Physical Society, a Fellow of the Institute of Physics (UK), and a Fellow of the International Society of Magnetic Resonance in Medicine (ISMRM). He was awarded the Gold Medal Prize from ISMRM in 1990, and in 1991 was named a Coolidge Fellow, GE's highest corporate scientific honor. He joins fellow Illinois alumni Charles H. Henry (PhD '65) and Joseph E. Killpatrick (BS '55, Electrical Engineering) as winners of the AIP Industrial Applications of Physics Prize. ■

Nelson Receives Prestigious Award from IEEE



Wayne Nelson (MS '59, Physics; PhD '65, Statistics) received the 2005 Lifetime Achievement Award from the Reliability Society of the Institute of Electrical and Electronic Engineers (IEEE). After receiving a bachelor's degree from Caltech, Nelson earned a master's degree in physics and completed all work for his doctorate except for the thesis. In 1962, he switched to statistics and received his PhD from Illinois in that field in 1965. Nelson remarked, "As a statistical consultant on engineering applications of statistics, I have found my physics background invaluable."

Formerly a statistical consultant with the General Electric Research and Development Center for 25 years, Nelson now consults and offers courses for companies, professional societies, and universities. He recently spent four months in Argentina on a Fulbright Award, doing research and lecturing on analysis of product reliability data.

The Reliability Society award recognized Nelson's many innovative developments of practical methods for analysis of reliability and accelerated test data, his effective and knowledgeable teaching of thousands of reliability practitioners, and his skilled consulting, which lengthened the life of hundreds of clients' products—including toasters, heart pacemakers, car and jet engine components, and aluminum siding.

In addition to this most recent honor, Nelson is a Fellow of the IEEE, the American Society of Quality, and the American Statistical Association. He also earned the American Society for Quality's Shewhart Medal in 2004 for his technical leadership. ■

Gendron Tapped to Head Woodward Governor

Thomas A. Gendron (BS '83) became president and chief executive officer of Rockford, Illinois-based Woodward Governor Company, effective July 1. He was also elected to the company's board of directors.

Only the sixth person to lead Woodward in its 135-year history, Gendron had served for more than 14 years in both the aircraft and industrial businesses, providing leadership in sales, marketing, business development, and product support management. He was named president and chief operating officer in September 2002 after serving as vice president of the industrial controls division. Prior to joining the company, he held positions with Sundstrand Corporation and Thermotron. "Tom has been the primary architect of our business strategy, which has delivered results and continues to be very successful. Along with his years of experience at Woodward, Tom will be supported by an established team of senior executives as he begins his tenure as CEO," said John A. Halbrook, Woodward's chairman of the board.

Woodward is the world's largest independent designer, manufacturer, and service provider of energy control solutions for aircraft engines, industrial engines and turbines, power generation, and mobile industrial equipment. The company serves global power generation, transportation, process industries, and aerospace markets from locations worldwide. ■

Save the Date!

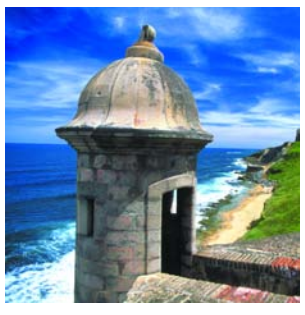
Physics Alumni Association "March Meeting" Reception

In keeping with its proud tradition of having the best party at the APS March meeting, the Physics Alumni Association will host a reception for alumni and friends at the 2006 meeting in Baltimore. Mark your calendar for Tuesday evening, **March 14, 2006**, and check your meeting program for room location.

Photo by Don Ricci

Professor Charlie Slichter and John Carlisle (PhD '93), a physicist at Argonne National Laboratory, reminisce at the 2005 APS Illinois Alumni Reception in Los Angeles.

Calling all Nuclear and Particle Physicists!



The physicists of Illinois are organizing the 2006 Conference on the Intersections of Particle and Nuclear Physics (CIPANP 2006), which will be held **May 30 to June 3** at Westin Rio March Beach, Puerto Rico. The conference will explore the "intersections" between particle and nuclear physics in an environment where both communities can meet and share. Go to cipanp.physics.uiuc.edu for details.

Defining the Art of Teaching

By Cyndi Paceley

Passion, determination, and persistence are at the core of Alfred Hubler's teaching excellence, and these habits figure prominently in the success of his research group as well.

Hubler is consistently named to the campus list of faculty ranked as excellent and, each semester for the past two years, all eligible graduate students associated with his complex systems research group were also on the list. But the accolades don't end there.

Members of the Hubler group of outstanding teachers. From left, back row: Vadas Gintautas, Eila Stiegler, Alfred Hubler, Anne Hanna, Glenn Foster, and Peter Fleck. Front row: Jian Xu, Davit Sivil, Chris Strelioff, and Tim Wotherspoon.

Photo by Darren Wright

In the past seven years, five members of his research group received the Physics Department's Scott Anderson Award in recognition of outstanding teaching assistants.

The National Science Foundation also took notice, underwriting several complex systems research projects and naming Hubler principal investigator of a recently concluded three-year study of adaptation to the edge of chaos and critical scaling in the self-adjusting perioxidase-oxidase reaction.

At the center of this attention is a scholar whose personal love of learning influences his students' quests for knowledge.

"As a high school student, I was fascinated by seemingly unsolvable problems, such as predicting earthquakes and volcanic eruptions, traveling faster than the speed of light, and philosophical questions about defining knowledge and intelligence," Hubler said. "I became interested in complex systems because the beauty of the experiments appealed to me—examining fractal river networks, turbulent flows, dynamics of swarms of birds and fish."

As director of the Center for Complex Systems Research, Hubler's current study focuses on system identification with nonlinear resonances and optimal control of adaptive and non-adaptive noisy chaotic systems using the Chua oscillator. His article, "Predicting Complex Systems with a Holistic Approach," appeared in *Complexity,* the field's leading journal, in 2005. He also co-authored a paper on formation and structure of ramified charge transportation networks in an electromechanical system (*PNAS* **102**, 536–540 [2005]). These join Hubler's more than 100 published works. He also helped originate an annual complex systems conference in 2000 and has chaired its organizing committee each year.

He is a master at translating research findings to the classroom—and his students' evaluative comments prove it.

One such remark: "Professor Hubler does an excellent job of conveying very difficult subject matter using real world examples, traditional teaching techniques, and computer programming."

Other student observations include: "Professor Hubler wanted to make sure his students learned" and "Interesting and enthusiastic lectures; he is highly skilled in using computer technology as a tool for instruction and research."

It's easy to see why "energetic" and "enthusiastic" are descriptors frequently found in students' evaluations of his teaching. By his own admission, Hubler is passionate about originating and imparting new ideas. He creatively applied the principles of nonlinear resonance to develop an intuitive, interactive Web-based software package used to teach a variety of university science courses, both at the University of Illinois and around the world. Dubbed "CyberProf," the software analyzes student homework problems in real time and provides individualized feedback to each student.

Although his most recent research results are the fabric of his graduate courses, Hubler also weaves research findings into the curriculum of his Behavior of Complex Systems class—one of the University's small-section Discovery courses for freshmen. To encourage their interest in physics beyond the classroom, he also strives to involve undergraduates in research.

His own education was completed in his native Germany, capped by earning a PhD, *summa cum laude,* from the Department of Physics at the Technical University of Munich. After a postdoctoral fellowship at the University of Stuttgart, Hubler came to the U of I as a visiting assistant professor in 1989. The following year, he was named an assistant professor and the associate director of the Center for Complex Systems Research, which he now directs. Hubler served as a Toshiba Chair Professor at Keio University in Tokyo in 1993/94. ■

Student News

Physics Sweeps 2005 Goldwaters

Physics undergraduates Laura Book, Guy Bresler, Dan Dorris, and Andrew McCormick have been named 2005 Barry M. Goldwater Scholars, the only University of Illinois at Urbana-Champaign students to receive the award this year. This prestigious national scholarship competition recognizes outstanding academic performance and demonstrated promise in scientific research. The Barry M. Goldwater Scholarship and Excellence in Education Program was established by Congress in 1986 to honor Senator Barry M. Goldwater, who served his country for 56 years as a soldier and statesman, including 30 years of service in the U.S. Senate. The purpose of the Foundation is to provide a continuing source of highly qualified scientists, mathematicians, and engineers by awarding scholarships to college students who intend to pursue careers in these fields.

Laura Book, who graduated from University High School in Urbana, is a junior in physics. Her goal is to earn a PhD in astrophysics and do research at a national laboratory or university, concentrating on theoretical astrophysics. She has been working with Charles Gammie since Summer 2004 on the propagation of photons in curved spacetime near spinning, uncharged black holes. She spent the past summer doing research at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts.

Guy Bresler, also a graduate of University High School, transferred to Illinois from Princeton University after a successful 2003 summer REU project with George Gollin, where he worked on a Fourier series kicker for the TESLA damping ring. He is a dual major in electrical engineering and engineering physics, and he intends to earn a PhD in electrical engineering. His ultimate career goal—conduct research and teach at the research university level focusing on wireless communication, coding theory, and/or cryptography.

Dan Dorris, a member of the theoretical astrophysics and general relativity undergraduate research team supervised by Frederick K. Lamb and Stuart L. Shapiro, continues a solid tradition of Goldwater winners in the group, joining alumni Patrick Draper (BS '05), Randall Cooper (BS '03), Harish Agarwal (BS '02), David Webber (BS '02, MS '03), Jared Mehl (BS '01), Eric Engelhard (BS '00), and Kevin Huffenberger (BS '00) as winners of this prestigious award. Dan is a junior in engineering physics from Leroy, Illinois. He plans to obtain a PhD in theoretical physics and join the professoriate in physics at a major research university.

Andrew McCormick is a Chancellor's Scholar from Charleston, Illinois—a dual major in physics and mathematics. He has worked with Professor Thomas Junk on the CDF experiment at Fermilab (Summer 2003) and with Dr. Achim Franz on the PHENIX experiment at Brookhaven National Laboratory (Summer 2004). He also worked for a semester at Illinois on the detector test stand for the PHENIX muon trigger upgrade at Brookhaven. Andy received a grant to present his work on PHENIX at the 2004 fall meeting of the Division of Nuclear Physics of the APS in Chicago. He plans to earn a PhD in physics and conduct research in the field of quantum mechanical physics, with an emphasis on discoveries to engineer new devices and methods.

The Goldwater Scholars were selected on the basis of academic merit from a field of 1,091 mathematics, science, and engineering students who were nominated by the faculties of colleges and universities nationwide. Of the Scholars, 165 are men, 155 are women, and virtually all intend to obtain a PhD as their degree objective. Twenty-seven Scholars are mathematics majors, 239 are science majors, 45 are majoring in engineering, and 9 are computer science-related majors. Many of the Scholars have dual majors in a variety of mathematics, science, engineering, and computer disciplines. ■

Students Present at Undergraduate Research Conference

Photo by Hazel Kim

Undergraduates Yongsun Kim, Hye Ryong (Hazel) Kim, and Aaron Veicht have been working with Professor Matthias Grosse Perdekamp on the upgraded muon trigger for the PHENIX experiment at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory. All three were selected to present their research at the special undergraduate research conference held in conjunction with the American Physical Society's Division of Nuclear Physics annual meeting September 18–22 at the Ritz-Carlton Hotel in the Kapalua Resort on the island of Maui. The DNP's "Conference Experience for Undergraduates" allows undergraduate students who have conducted research in nuclear physics to present their results and to interact with one another and with the larger community. About 75 U.S. students received travel support to participate this year. ■

Endowed Student Awards

Every year, the "Physics on-the-Campus Luncheon" on the last Thursday in April provides a venue for us to celebrate the achievements of our student scholars. The luncheon, which is supported by the Physics Alumni Association (PAA), was held this year on April 29 at the Illini Union. Many of the prizes that are awarded each year have been made possible by the vision and generosity of the department's faculty, alumni, and friends. In this section, we highlight some of these remarkable students as they begin their physics careers. Joining the University of Illinois Alumni Association automatically makes you a member of the PAA, and a portion of your dues supports Physics activities such as POTCL.

Felix T. Adler Fellowship

Dan Chitwood and **Kazutaka Nakahara** shared the 2005 Felix T. Adler Award, which recognizes outstanding work by a graduate student in nuclear physics. Dan, who is advised by David Hertzog, is involved with the precision measurement of the positive muon lifetime in the μLan experiment at the Paul Scherrer Institute in Switzerland. He earned a bachelor's degree from the University of Missouri–Rolla in 1999. With his wife Jessica, he is the proud father of Malia and Kieontai.

Kaz Nakahara is studying parity-violating electron-proton scattering in the D0 experiment at the Thomas Jefferson National Accelerator Facility in Newport News, Virginia. His thesis adviser is Douglas Beck. He notes, "When I was an undergrad [at Carnegie Mellon University], I had to make a choice between majoring in physics, chemistry, philosophy, or history. In hindsight, I made the right choice." Professor Adler would agree.

The Adler Award was endowed by the family and friends of the late Felix T. Adler, a theoretical nuclear physicist who was instrumental in making Illinois into a center for reactor science and engineering in the 1960s.

Ernest M. Lyman Prize

The 2005 Ernest M. Lyman Prize, which is awarded to the outstanding senior physics student, was presented to **Wing Ho Ko** (BS, '05), an international student from Hong Kong majoring in physics and mathematics. In addition to the Lyman Prize in physics, Wing Ho received the Mathematics Department's H. Roy Brahana Prize, which is presented to the "graduating senior with the most exceptional undergraduate mathematics career."

Wing Ho, who was also a Bronze Tablet Scholar, was a regular on the Physics Van crew and participated in the Van's "Snoozeum" at the Museum of Science and Industry in Chicago in February.

The award is named for Ernest M. Lyman, who served on the faculty for 36 years. In addition to making seminal contributions to experimental nuclear physics—he was a world expert on electron scattering—Lyman maintained great interest in teaching undergraduate physics.

Scott Anderson Award

The 2004/05 Scott Anderson Outstanding Teaching Assistant Awards, which recognize superlative performance in teaching by graduate students, were awarded to **Tamara Gossman** for her work in Physics 111 in the Spring 2004 semester and to **Peter Fleck** for his Physics 213, 214 contributions in the Fall 2004 semester. Both Tamara, a Physics Van veteran, and Peter are superb classroom instructors who are regulars on the University's "Incomplete List of Teachers Ranked as Excellent by Their Students."

Peter, a graduate of Friedrich-Alexander University Erlangen–Nürnberg in 2000, is working in Alfred Hubler's group on microscopic hardware implementations of artificial neural networks. He wrote of his success in teaching, "I would especially like to thank Professor Jim Wolfe for his continued kindness and support."

Tamara (BS '03, Animal Science), a veterinary medicine student, often finds herself answering the question, "Why ***physics***?" Her answer, "Why not! It's fun!" She goes on to say, "I really enjoy working with the students. And I really enjoy working in this department. I think it gets taken for granted a bit, but the atmosphere here is just amazing! I don't think that there's another department anywhere on campus with such a positive and proactive attitude towards teaching. (Believe me—I have experience with a lot of other departments.) It's such a pleasure for me to be able to be a part of it!" (*Editor's Note*: Tamara became even more a part of Physics in March when she married graduate student and fellow Physics Van veteran Tim McArdle.)

The award is named for Physics alumnus Scott Anderson (MS '37, PhD '40), who founded Anderson Physics Laboratories in Urbana in 1944. A creative and prolific entrepreneur, Anderson developed metal halide lighting systems that are used worldwide. It was through Anderson's initiative as president of the Physics Alumni Association and his generous philanthropy that the Anderson Award was endowed.

Renato Bobone Award

The Renato Bobone Award, which recognizes the year's outstanding European graduate student based on academic achievement, was awarded for 2005 to **Kalin Vetsigian** of Plovdiv, Bulgaria. A 2000 graduate of MIT, Kalin is working with Nigel Goldenfeld on the role of horizontal gene transfer in microbial evolution and the evolution of the genetic code.

This award was created by Physics alumnus Renato Bobone (PhD, '60), a student of Hans Frauenfelder's, who spent his entire career (1960–1987) at the General Electric Knolls Atomic Power Laboratory in Schenectady, New York. When he endowed the award in 1985, Bobone wrote: "Interest in physics and the education I have been privileged to receive in Italy, first, and then in this country, have carried me over many obstacles and will be with me ever. I look on the award as another bridge between countries already joined by many ties of people, culture, and friendship."

John Bardeen Award

The John Bardeen Award is given annually to recognize outstanding research achievements in condensed matter physics or the physics of electronic devices by a physics graduate student. The 2005 award was presented jointly to **Sergey Frolov**, an experimentalist, and **Eun-Ah Kim**, a theorist.

Sergey, who graduated from the Moscow Institute of Physics and Technology in 2000, is working with the Van Harlingen research group on ferromagnetic Josephson pi-junctions. He is interested in their fundamental properties as well as their applications for quantum computers. About his time in Urbana, Sergey says, "I enjoy the Illinois Physics graduate program a lot. I like the atmosphere, the science, the people. It has been both challenging and stimulating to study and work here."

Eun-Ah, a 2000 graduate of Seoul National University, is concentrating on quantum Hall tunnel junctions, Luttinger liquid physics, quantum coherence effects, and fractional quantum numbers. Her thesis adviser is Eduardo Fradkin. In her spare time, Eun-Ah loves to explore different ethnic cuisines and about other cultures through cooking.

Harry G. Drickamer Fellowship

The 2005 Drickamer Fellowship was presented to **Joseph Altepeter**, whose thesis adviser is Paul Kwiat. Harry G. Drickamer, for whom the Drickamer Fellowships were named, was a distinguished member of the Departments of Physics, Chemical Engineering, and Chemistry at Illinois. Drickamer's work led to advances in the understanding of the molecular, atomic, and electronic properties of matter and provided the tools to study these properties with greater detail and precision.

Joe started his research with Kwiat as an undergraduate in the quantum optics laboratory at Los Alamos National Laboratory, where he worked on the first experiment to demonstrate the existence of two-particle "entangled" quantum states that were immune to certain forms of decoherence, the essential noise process that is the bane of quantum information processing. At Illinois, he devised a novel compensation scheme to achieve a new world record in entangled photon production, nearly an order of magnitude better than previous sources. As a graduate student, Joe has also formalized and extended his characterizations of the processes that affect entangled photons. This work resulted in the first implementation of a method to completely characterize all quantum processes. Says Kwiat, "Joe is continuing to push the frontiers of research in quantum information processing, and I am confident that he will one day he will be one of the true leaders in our field."

Jordan S. Asketh Fellowship

Alexandros Gezerlis was selected to receive the 2005 Jordan S. Asketh Fellowship, which recognizes the work of an outstanding European graduate student. Alexandros enrolled at Illinois in 2003, after graduating from the National Technical University of Athens in electrical and computer engineering, "although I always knew that what I really wanted to do was physics." He is working on computational studies of Fermi gases with Vijay Pandharipande.

The Asketh fellowships were endowed by the late Jordan Asketh to fund "graduate study grants" for students in the fields of physics, chemistry, and medicine. To honor his Greek heritage, Asketh specified that, whenever possible, these fellowships should be awarded to graduate students of Greek descent who are pursuing advanced degrees at the University of Illinois.

Richard K. Cook Scholarship

The 2005 Richard K. Cook Scholarship, recognizing a meritorious undergraduate engineering physics student at the end of his or her sophomore year, was presented to **Aaron Veicht.** In addition to his formal studies, Aaron has worked with Matthias Grosse Perdekamp on the design and simulation of a drift chamber for a resistive plate counter test stand being built for the muon trigger upgrade of the PHENIX detector at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory.

The scholarship is made possible by the generous gift of Richard K. Cook (PhD '35), who spent his entire career at the National Bureau of Standards (now the National Institute of Standards and Technology [NIST]). Dr. Cook specialized in ultrasonics and acoustics.

Laura B. Eisenstein Award

Laura Book, who also received a prestigious Goldwater Scholarship, was named the Laura B. Eisenstein Award recipient for 2005. The Eisenstein Award recognizes outstanding undergraduate women physics students and is named for Laura B. Eisenstein, a Fellow of the American Physical Society who was deeply concerned about the status of women in physics. Eisenstein served the Department and the biological physics community with distinction from 1969 until her untimely death in 1985.

A graduate of University High School in Urbana, Laura intends to earn a PhD in astrophysics and pursue a career in research. She is off to a great start; she has been working with Charles Gammie since Summer 2004 on the propagation of photons in curved spacetime near spinning, uncharged black holes. In Summer 2005, she worked with Lee Hartman at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, on time-dependent calculations of simple accretion disk models with an aim toward explaining FU Orionis outbursts. Another musical physicist, Laura sings with the UI Concert Choir and plays the viola in string quartets with her family.

Congratulations to our Chancellor's Scholars

The Chancellor's Scholars program recognizes academic excellence by annually selecting the top 100 students campuswide, regardless of class year or discipline. Physics had a record number (five!) of Chancellor's Scholars again in 2004/05—**Paul Dalach** (BS '05), **Patrick Draper** (BS '05), **Irina Marinova** (BS '05), **Nathan VanHoudnos** (BS, '05), and **Amy Waitz** (BS '05).

Three Receive Lorella Jones Summer Research Fellowships

Thanks to the vision and generosity of the family and friends of former Professor Lorella M. Jones, three outstanding undergraduate students were able to pursue hands-on independent research projects this summer as part of the department's "senior thesis" program.

Kyle Arnold, who graduated from Marmion Academy in Aurora, Illinois, in 2002, is a double major in engineering physics and mathematics. He credits his high school physics teacher, who was also a research physicist at Fermilab, with stimulating his interest in physics. He used the Jones Fellowship to work with Paul Kwiat on quantum information science—specifically on developing and testing an optical storage system for a quasi-deterministic single-photon source. Kyle is also a member of the Illini Tae Kwon Do Club and teaches a class in the sport.

Rachel Hillmer, an Urbana High School graduate, spent the summer working with Federico Capasso at Harvard University, where she studied the Casimir force using various atomic force microscopy techniques. The experience was a revelation for Rachel, who discovered a real interest in and flair for experimental physics.

Working with Russell Giannetta, **Zane Shi** spent the summer measuring the low-temperature penetration depth of the organic superconductors κ-$(ET)_2Cu(SCN)^2$ and κ-$(ET)_2Cu[N(CN)_2]Br$. Another musical physicist, Zane considered majoring in piano performance before settling on physics. As he explained, "Physics can explain much of the world around us, but there is still much in physics that we don't understand. I want to solve some of these unknowns to further our understanding of science."

Lorella Jones was an outstanding theoretical high-energy physicist. The first woman to attain tenure and a full professorship in the Department, Jones was a superb researcher and a dedicated and innovative teacher who was particularly interested in using computers for physics education. In 1985, she pioneered the use of computerized quizzes for a large elementary physics course at Illinois—one of the earliest developments of its kind nationwide. She died in 1995.

Guilio Ascoli Award for Experimental High-Energy Physics

The Ascoli Award is made possible by the generosity of the family and friends of Guilio Ascoli, a member of the faculty from 1950 to 1986. During his career in high-energy physics, Ascoli participated in the design and fabrication of hardware and in the development of algorithms for data analysis for experiments at CERN, Argonne National Laboratory, and Fermilab. The Ascoli Award is presented annually to the outstanding graduate student in high-energy physics. The 2005 recipient is **James Kraus.**

James, who graduated from the University of Toledo in 1999, is working with Kevin Pitts on the Collider Detector Facility experiment at Fermilab. He worked on development of high-speed digital electronics for the CDF data acquisition system. He is currently measuring the production rate of bottom quarks in high-energy proton-antiproton collisions produced by the Fermilab Tevatron.

Outstanding Senior Thesis Awards

The discretionary funds provided by the Department's Excellence in Physics endowment allowed us to recognize once again two outstanding undergraduates for their work in the Department's "senior thesis" courses. An integrated three-semester sequence, "senior thesis" emphasizes communications and research skills and introduces students to fundamentals of scientific ethics, collaboration, and peer review while providing the opportunity to do hands-on research. Beginning in 2006, thanks to a gift by W. Dale Compton (PhD '55) and his wife Jeanne, the Robert E. Hetrick (BS '63, MS '64, PhD, '69) Prize will be given to recognize two outstanding senior thesis students.

Wing Ho Ko (BS '05), was recognized for his theoretical thesis with Richard Martin on "Diffusion Monte Carlo Method in Few-Electron Systems." A graduate of the Diocesan Boys' School, Hong Kong, Wing Ho is now a first-year graduate student in physics at MIT.

Zachary Hensel (BS '05), a graduate of Blue Valley Northwest High School in Overland Park, Kansas, was recognized for the best experimental project. He worked with Zvonimir Dogic at Harvard University on "Chiral Liquid Crystals in Suspensions of *Salmonella* Flagella" during the summer of 2004. Zach is pursuing a PhD in biological physics at Johns Hopkins University.

Bristow/Commonwealth Edison Scholarship

Kara Lamb, a sophomore who graduated from Peoria Notre Dame High School, was presented with the 2005 Beryl Bristow/Commonwealth Edison Endowed Scholarship, which recognizes an outstanding freshman or sophomore woman physics student. Kara plans to pursue a doctorate in physics.

The Bristow scholarship was established by Commonwealth Edison to recognize Beryl Bristow's achievements as part of its commitment to women in math, science, and engineering. After graduating from Illinois—she was the first woman to receive a master's degree in physics from Illinois—Bristow worked for CommEd as a data analyst.

Anthony Summer Research Fellowships

Jonathan Wilson and **Dustin Schwenk,** both undergraduates in engineering physics, were selected to receive the first Philip J. and Betty Anthony Summer Research Fellowships.

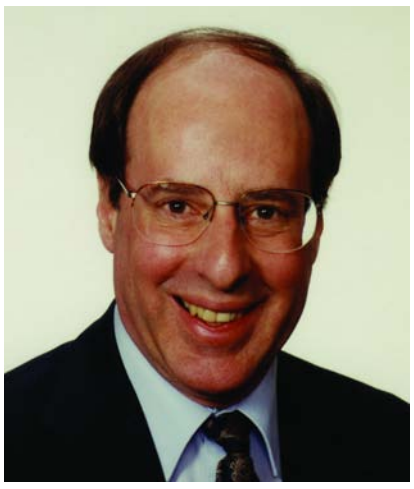
Dustin had a head start on research. As a sophomore, he participated in the "Research Experience for Undergraduates" program at Indiana University, where he worked with Caty Pilachowski to unravel the chemical composition of the globular cluster Omega Centauri, the most massive and most luminous cluster in the Milky Way. Using spectrographic data taken by the Cerro Tololo InterAmerican Observatory, Dustin determined each star's iron, calcium, aluminum, and europium content. His results were presented at the January 2005 meeting of the American Astronomical Society in San Diego. He is currently working with Susan Lamb on computer simulations of galaxy collisions to elucidate the evolution of dark matter halos.

Jon worked with Alexey Bezryadin on quantum mechanical effects and electron transport in superconducting nanowires. He got a start in research last summer in our own REU program, working with Susan Lamb's "Colliding Galaxies" group, using an N-body code to model the collision of two galaxies having a supermassive black hole in their centers of mass. He then switched to fly-by encounters between two galaxies at a large impact parameter and high relative velocity and compared simulation results with astronomical observations. Jon is now studying the quantum electronic properties of granular thin films with the Bezryadin group.

Physics alumnus Philip J. Anthony (MS '75, PhD '78) and his wife Betty provided summer stipends for Dustin and Jon to pursue their research.

Faculty News

Fred Lamb Elected to the American Academy of Arts and Sciences



At a gala induction ceremony on October 8 in Cambridge, Massachusetts, the American Academy of Arts and Sciences officially welcomed its 225th class of Fellows, including Professor of Physics and Astronomy and Fortner Endowed Chair in Theoretical Astrophysics Frederick K. Lamb. The Academy is an honorary society that recognizes outstanding achievement in the natural sciences, social sciences, arts, and humanities and conducts a varied program of projects and studies responsive to the needs and problems of society. Also in this year's class are television journalist Tom Brokaw; physicist and Nobel Laureate Eric Cornell; Harvard Law School dean and former White House official Elena Kagan; Chicago Symphony Orchestra musical director Daniel Barenboim; poet Susan Stewart; and genetics pioneer Nancy Wexler.

The American Academy of Arts and Sciences was founded during the American Revolution by individuals who contributed prominently to the philosophical foundations of the new nation and to the establishment of its government and institutions. John Adams, later to become the second President of the United States, initiated the chain of events that led to the formation of the Academy. On December 15, 1779, "an Act to incorporate a Society for the cultivation and promotion of Arts and Sciences" was read in the Massachusetts House of Representatives. On May 4, 1780, the Legislature, "although involved in all the calamities and distresses of a severe war," enacted the Charter of the Academy. Today, Academy projects have focused on the changing nature and needs of higher education and research, the well-being of the humanities in the United States and their central role in assuring the vitality of our cultural life, the emerging challenges of scientific and technological advances, geoglobal politics, population and the environment, and the welfare of children. Now in its third century, the Academy continues to mobilize the intellectual resources needed to anticipate, examine, and confront the critical challenges facing our society.

The Academy's membership, which is elected, represents distinction and achievement in the entire range of the intellectual disciplines and professions. Its 4000 U.S. Fellows and 600 Foreign Honorary Members are divided into four classes—the physical sciences, the biological sciences, the social arts and sciences, and the humanities and fine arts. Among its Fellows are 168 Nobel laureates and 58 Pulitzer Prize winners. Physics faculty Gordon Baym, David Ceperley, Hans Frauenfelder, Laura Greene, Miles Klein, Tony Leggett, David Pines, Charles Slichter, and Dale Van Harlingen are also members of the Academy. ■

Pandharipande Named Willett Professor

Interim Dean Ilesanmi Adesida announced June 8 that Center for Advanced Study Professor of Physics Vijay R. Pandharipande has been named a Donald Biggar Willett Professor of Engineering. Willett Professors are selected by the College Advisory Committee on Appointments and ratified by the Dean of the College of Engineering, the Campus Committee on Endowed Appointments, and the Provost. The Willett Professorship carries an annual stipend and has a renewable five-year term.

An internationally recognized nuclear theorist, Pandharipande has played the leading role in the development of the nuclear many-body problem. His contributions have led to a state-of-the-art comprehensive, quantitative, and reliable theory of nuclei, neutron matter, and neutron stars, and have been extended more generally to quantum liquids. His theoretical contributions have set the agenda for experimental work, significantly advancing the use of electron scattering as a probe of nuclear structure. Working with his graduate students and collaborators, he has initiated and carried through over several decades a successful research program to describe all nuclear systems in terms of the elementary two- and three-body interactions of the constituent nucleons. His pioneering variational Monte Carlo calculations have become the standard methods for the field.

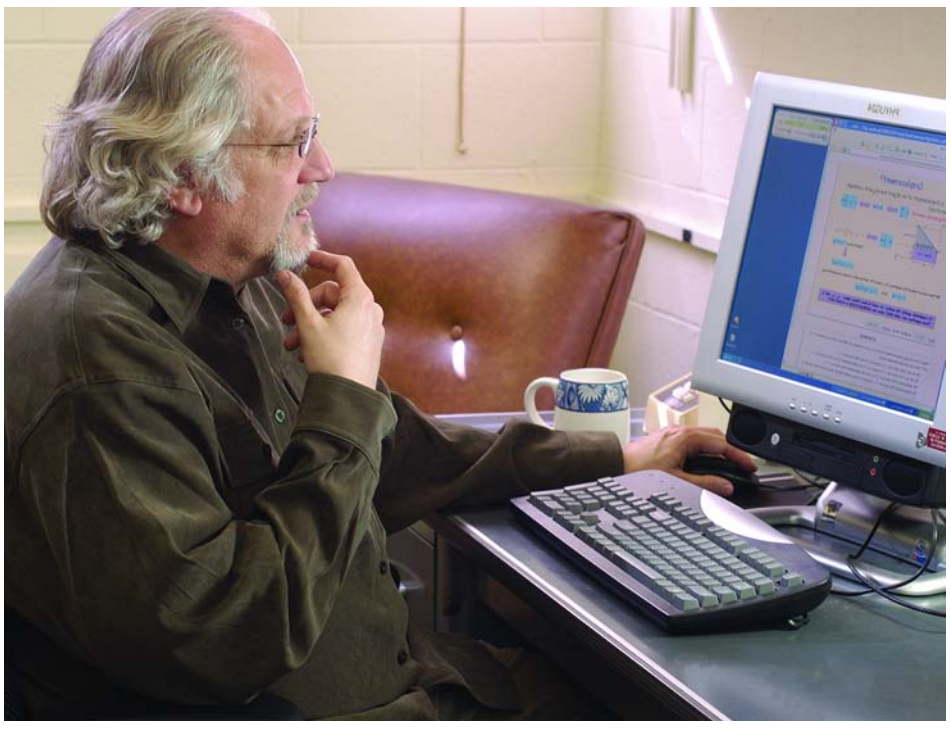
In addition to his nuclear studies, Pandharipande has applied his expertise to condensed matter physics, where his research has included Bose and Fermi helium liquids and drops, including structure, response, and elementary excitations in liquid helium. Most notably, he predicted structures subsequently observed in the dynamic response of superfluid ^{4}He and demonstrated the important effects of the enhancement of the effective mass at the Fermi surface of liquid ^{3}He. ■

Gary Gladding wins 2005 *Excellence in Undergraduate Teaching Award*

Associate Head for Undergraduate Programs Gary E. Gladding (BS, '65) received the 2005 *Excellence in Undergraduate Teaching Award* from the American Association of Physics Teachers for his lasting contributions to undergraduate physics teaching. At the AAPT annual meeting, held in August 6–10 in Salt Lake City, Utah, Gladding gave a featured lecture, "Reforming Introductory Physics Courses at Research Universities."

Gladding, an engineering physics alumnus, joined the Department of Physics as an assistant professor in 1973, after receiving his PhD from Harvard in 1971. He is currently involved in experiments using the silicon vertex detector (CLEO II) at the Wilson Synchrotron Laboratory at Cornell University to study charmed meson decays. Earlier, he made numerous original contributions to high energy experiments at the Stanford Linear Accelerator Center, where he was involved in experiments measuring the decay of *B* mesons produced in the decays of the *Z* boson (SLD collaboration) and the initial detailed studies of particles containing the charmed quark (MARK III collaboration). He also contributed to the first studies of the photoproduction of particles containing the charmed quark at Fermilab.

Beginning in 1996, Gladding led the faculty group responsible for the success of the massive curriculum revision that has fundamentally transformed the way introductory physics is taught at Illinois. This effort, spanning six years, has improved physics instruction for more than 20,000 science and engineering undergraduate students at Illinois. In addition, the Illinois model has been adopted at Purdue University, the University of Wisconsin-Madison, the University of Washington, Seattle, Chicago State University, Bradley University, and many community colleges throughout Illinois. He now leads the Physics Education Research Group at Illinois (http://www.physics.uiuc.edu/Research/PER/). ■



Gary Gladding works on an "interactive example"—a difficult numeric homework problem that offers detailed help to guide students to the correct answer. The help sequence proceeds through three different stages: a qualitative analysis, a strategic analysis, and a quantitative analysis, using questions that engage students in a Socratic dialogue. Students choose how much help they receive and can opt to answer the initial question at any point in the dialogue. Complete sets of interactive examples have been introduced into both the algebra-based and calculus-based introductory physics courses at Illinois.

Stelzer Receives Innovation Award

"I-Clickers made class fun because I felt like I was participating in the lectures instead of just being talked at."

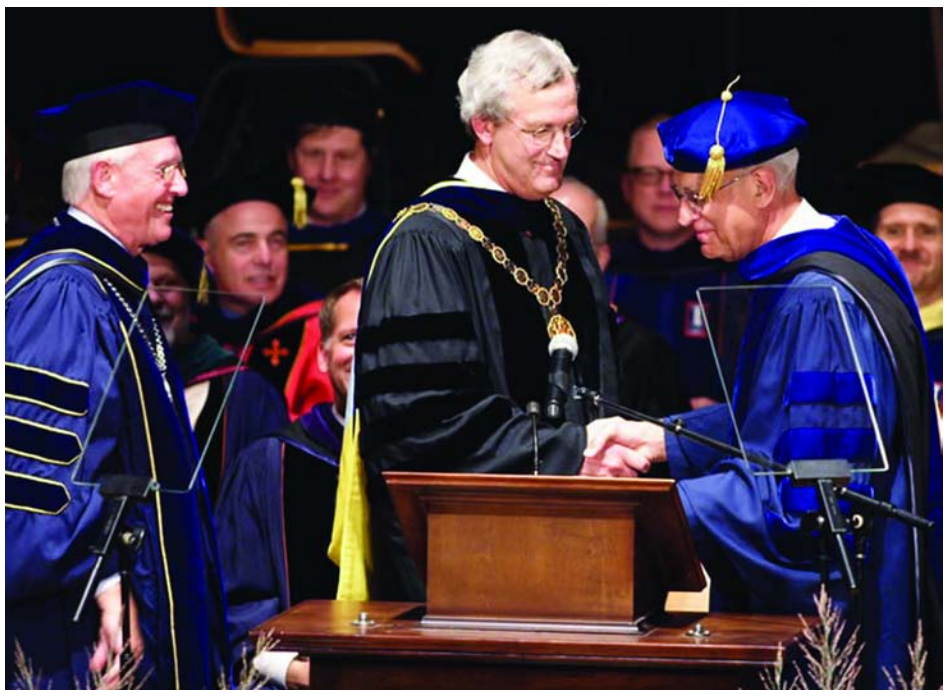
Assistant Research Professor of Physics Timothy J. Stelzer received the College of Engineering's 2005 *BP Amoco Award for Innovation in Undergraduate Instruction* for his leadership in the development of the I-Clicker, a two-way rf communication device the size of a TV remote control that promotes true instructor-student interactivity, even in large lectures.

"It encouraged me to think about the material as I was learning it. It also demonstrated concepts right on the spot, which helped solidify them for me. It encouraged me to know that even when I got a question wrong, many other students were thinking like me."

Student response to the I-Clicker has been phenomenal. The Department of Physics gives end-of-term surveys in all introductory classes, repeating certain questions every semester. The questions that we repeat are of the form "Overall, how important was *X in* helping you to understand the course material?" Students select one response: "essential," "very useful," "useful," "not very useful," and "useless." Looking at *X* = *lecture,* for Physics 101, Fall 2004 (the first time I-Clickers were used in this course), 76 percent of the students said the lectures were very useful or essential—the highest rating ever for "lecture" in this course. For example, in Fall 2003, when Tim Stelzer was also the lecturer but I-Clickers were not used, the same fraction was 59 percent.

"In a normal class setting I do not like to participate in class, but with the I-Clickers I was able to participate since I did not feel inferior if I answered the question wrong."

In an independent evaluation of I-Clicker use, Dr. Cheryl Bullock, head of educational research, Center for Teaching Excellence, and Laura Hahn, educational specialist, Center for Teaching Excellence, University of Illinois at Urbana-Champaign, documented the students' ready adoption of I-Clickers, their liking of the technology, and their improved learning of physics. ■



Inauguration Day

B. Joseph White, center, is congratulated by his predecessors, former UI presidents Stanley O. Ikenberry, left, and James J. Stukel, in a September 22 gala in which White was officially inaugurated as the university's 16th president. The ceremony included greetings by Edwin Goldwasser, a former provost at Urbana and 55-year Physics faculty member, who also represented Harvard University, his and White's alma mater. In his inaugural address, White promised strong leadership at every level to help the UI achieve "a brilliant future."

Gammie Named Third Sony Faculty Scholar

Charles Gammie, professor of physics and of astronomy, has joined colleagues S. Lance Cooper and Paul Selvin as a Physics Sony Faculty Scholar. His three-year appointment was effective in August 2005.

"Charles Gammie is a rising star in theoretical and computational astrophysics and is widely recognized and one of the top players in his area of research," said Head Jeremiah Sullivan in his recommendation to the Dean. "His research is central to understanding the physics that shaped the development of our universe and underlies extraordinarily powerful processes that are now being detected by satellite-based instruments."

Gammie received his bachelor's degree in mathematics in 1987 from Yale University and his PhD in astrophysical sciences from Princeton in 1992. He was a postdoctoral fellow at the University of Virginia from 1992 to 1994, and at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, from 1995 to 1998. He joined the faculties of physics and astronomy at Illinois in January 1999.

Gammie's research involves magnetohydrodynamics, star formation, and accretion physics. He is a leader in the computer simulation of astrophysical plasmas, the formation of interstellar clouds, and the collapse of dense clouds to form stars. He was named an NCSA Faculty Fellow in 2001, and he received a Presidential Early Career Award in 2002, the highest honor bestowed by the United States on young scientists and engineers.

Funding for the Sony Faculty Scholars comes from a long-standing Sony endowment to the University of Illinois. The appointment recognizes outstanding scholars at the early stages of their tenured careers. (Eligibility is restricted to associate professors or recently promoted full professors.) The Department of Electrical and Computer Engineering at Illinois also hosts three Sony Faculty Scholars. ■

Van Harlingen and Thaler Appointed to Center for Advanced Study

Van Harlingen Appointed CAS Professor

Professor of Physics and Donald Biggar Willett Professor of Engineering Dale J. Van Harlingen has been appointed a permanent professor of the Center for Advanced Study (CAS). The CAS serves as the intellectual nexus of the campus by providing the academic community with opportunities for top-flight interdisciplinary scholarship and interactions.

Selected from the faculty on the basis of their outstanding scholarship, the CAS Professors are among the most highly recognized members of the professoriate. The 24 CAS Professors form the core of the Center for Advanced Study community, meeting regularly for informal lunches and scholarly presentations. They also participate in a yearly roundtable discussion of research interests.

Other Physics CAS Professors are Gordon Baym, Nick Holonyak, Jr., Miles Klein (emeritus), Tony Leggett, Vijay Pandharipande, David Pines (emeritus), and Charles Slichter (emeritus).

Thaler Named 2005–06 CAS Associate

Center for Advanced Study associates are tenured faculty members whose proposals are selected in an annual competition. These appointments grant one semester of teaching release time to allow the associate to focus on an individual scholarly or creative project.

Thaler, a high-energy experimentalist, will use his appointment to pursue tantalizing questions at the intersection of particle physics and astrophysics. The evolution of the universe since the big bang depends crucially on the properties of the elementary particles that it contains. Several interesting puzzles have attracted Thaler's attention—the contribution of neutrinos to the formation of cosmological structure (stars and galaxies) and the nature of so-called dark matter and dark energy.

Thaler was one of only 12 associates selected from the entire campus for the current academic year. ■

Goldbart "Excellent" Teacher

The 2005 Arnold Nordsieck Physics Award for Teaching Excellence was presented to Paul M. Goldbart for his inspired and inspiring teaching—in the broadest meaning of the word—of graduate students. According to Jeremiah Sullivan, "Paul is a regular on the Incomplete List for his classroom teaching; indeed, one of my hardest jobs is coming up with fresh words, semester after semester, to commend Paul for his exceptional teaching. His success is a result of his meticulous preparation, his creativity, his boundless enthusiasm for doing physics, and his genuine desire to educate the next generation of scientists."

Goldbart is passionate about classroom teaching, and his coursework is painstakingly prepared and rigorously vetted. Not only does he meticulously prepare the entire course package, complete with comprehensive annotated lecture notes and extensive homework sheets, but he also rehearses prior to every lecture, so that the "performance" is the best that he can give. In a typical example of his organization and clarity, he ticks off his "guiding principles" of teaching:

- "To bring to the fore the essential structure of the subject, whatever it is, so that the technical elements have as natural a framework as possible into which to fit.
- "To be extremely clear and organized—physics is hard enough—without being obscured by the presentation.
- "To require the students to work very hard, but also to think very hard and, thus, really to extend themselves; and, at the same time, to engage the students personally and to help them feel like the vital members of the department that they are.
- "To treat students with the utmost respect—if they don't understand something, it is because I am not explaining it well.
- "To bring out the idea of science as a human enterprise, conducted by people just like our students. To this end, I try to illuminate my lectures with elements of the history and culture of science."

One of the things that Goldbart is best known for in Physics is his "office hours," a regular block of time set aside every week when he meets with the students taking his classes, and they work together to solve that week's homework problems. Typically, some two-thirds or more of the class attends, to work collaboratively through—often in exhaustive detail—various problems and exercises that Goldbart has chosen with scrupulous care. In his office hours, Goldbart captures the feeling of the centuries-old *schola*—the kind of learning we associate with Socrates or the medieval university, but seldom with modern U.S. higher education.

Perhaps Goldbart's skill and dedication can best be illustrated by the pensive comment that one of his students penciled on the back of an ICES form: "While sitting, confused, in other classes, I frequently thought to myself, 'If only Paul Goldbart were teaching this, I'm sure I would understand.'"

The Nordsieck Award was endowed by the family of former faculty member Arnold T. Nordsieck to recognize his commitment to superlative teaching. Former winners include Dennis J. Kane (BS, '72), Nigel D. Goldenfeld, George D. Gollin, and Naomi C.R. Makins. All five winners were able to meet with Nordsieck's son and daughter-in-law, Richard and Gerry Nordsieck, when they visited Urbana in September. ■

Photo by JPaul Goldbart

Clockwise from top left: Nigel Goldenfeld, Paul Goldbart, Sir Sam Edwards (Cambridge University), and Professor David Sherrington (Oxford University) in New College, Oxford, November 2004.

Stealing the Gold

Paul Goldbart is also a co-editor, with fellow Nordsieck Award recipient Nigel Goldenfeld (2002) and Professor David Sherrington (Rudolf Peierls Centre for Theoretical Physics, Oxford University), of *Stealing The Gold: A Celebration of The Pioneering Physics of Sam Edwards.* The book celebrates the career of British physicist Professor Sir Sam Edwards, who has led the field of condensed matter physics into new directions, ranging from the electronic and statistical properties of disordered materials to the mechanical properties of granular materials. The book describes the genesis, evolution and future prospects of the various subfields of condensed matter theory, written by the leaders of the field (including one chapter authored by Yoshitsugu Oono, and one chapter co-authored by Goldbart and Goldenfeld) along with reprints of a selection of Edwards' seminal papers that helped give birth to the subject. The title, *Stealing the Gold,* comes from Edwards' credo for selecting research problems—"The first person in the bank vault steals the gold."

The book also illustrates the complex "family" of physics—Edwards was the PhD adviser of Goldenfeld and Sherrington; Sherrington was the PhD adviser of Goldbart. Edwards' PhD adviser was Julian Schwinger, who was also the adviser of Illinois professors Gordon Baym and Shau-Jin Chang (among many, many others).

Stealing the Gold was published by Oxford University Press (2005) as part of the International Monographs on Physics series. ■

Physics Van Reunion

One weekend in March, former Physics Van crew members left behind their day jobs as physics teachers, engineers, graduate students, and researchers and returned to Urbana from as far away as Redmond, Washington, and Tucson, Arizona, for the first Physics Van Reunion. Timing their visit to coincide with Engineering Open House, the veterans critiqued the current Van show demonstrations, ate pizza at Papa Del's, took the hovercraft for a spin, and even found time to set off a few soap explosions. For more photos, see http://van.physics.uiuc.edu/van/reunion/reunionhome.htm.

Interview with Nithaya Chetty, President-Elect of the South African Institute of Physics

continued from page 1

instances, simply not permitted. For example, I remember being rejected for a bursary position from the Atomic Energy Board of South Africa because my race did not allow me to study nuclear science.

I chose to attend the University of Natal, a one-time whites-only university, for my undergraduate studies. By the time I enolled, the government had relented slightly, and a quota of 7% was permitted for people of color. I managed to make the quota based on my high school results, and then subsequently attained first-class passes with certificates of merit [first place] in each of my subjects for all four years of studies at Natal. I secured a Fulbright scholarship which took me to the University of Illinois in 1985.

I was fortunate to have had an excellent high school physics teacher in Mr. Kiran Maharaj, who made me yearn for a world of science beyond the classroom. I am very grateful to Professor Roger Raab (a Rhodes Scholar to Oxford), who was the head of physics during my undergraduate days and who motivated and encouraged me to pursue a career in physics. I save my highest praise for Professor Richard Martin, who supervised my PhD at Illinois and who is a deep source of inspiration for me, not only in physics but also in terms of human issues. Professor Martin has a profoundly deep understanding and intuition of physics combined with an inordinate amount of patience, creating for me a nurturing and supportive environment which enabled me to grow as a person and as a physicist during my graduate student days.

My five years at Illinois gave me a glimpse into a different world from that of my childhood. I was able to meet with people from all backgrounds, races and creeds and to interact with them on an equal basis. I had decided long ago to return to South Africa to help change the society in which I had grown up. I felt the best place to do this was within the realm of higher education, though it is ironic that I should return as a professor to the very same institution that gave me marginal access as an undergraduate student. Still, I would rather be here making an incremental contribution to improving the human condition than to enjoy a materially successful life elsewhere in the world.

Why did you choose the University of Illinois?

After completing my BS in physics in 1985, I was awarded a Fulbright scholarship for MS studies. I applied to a number of US universities. During my vacation work in 1984 at the Council of Scientific and Industrial Research in Pretoria, South Africa, I met Professor Carl Altstetter (Metallurgy, U of I), who strongly recommended that I go to Illinois. The rest, as they say, is history!

How did you choose your particular areas of physics?

I must admit that in 1985 I was initially attracted to the glamour of particle physics. However, with the department's strong tradition of world-class solid state and condensed matter physics, I very soon saw the advantages of pursuing a research career focused on more practical applications. Professor Martin's warm personality and superb intellect played no small part in influencing my decision. I was his first research student at Illinois.

Today, my field of endeavor is highly relevant for the burgeoning materials industry in South Africa.

How long have you been on the faculty at the University of KwaZulu-Natal?

I arrived in January 1997 after a short stint at the University of South Africa in Pretoria. Prior to this, I had postdoctoral appointments at the Brookhaven National Laboratory (1992–1995) and at the Technical University of Denmark (1990–1992). I am currently an associate professor, and I direct the undergraduate program in computational physics.

Tell us about the research project you currently find most exciting.

Our country is the largest supplier of natural diamonds, and the rich diamond fields are in the hands of the de Beers Mining Company, which was started by Cecil John Rhodes in the 19th century. De Beers also produces artificial diamonds and other hard materials, such as cubic boron nitride and silicon carbide abrasives for cutting tools that are needed in the heavy mining and metals industries.

My students and I are currently working on a new anisotropic coarsening theory that is being applied to anisotropic growth of silicon nitride. Our new theory and computational scheme is applicable to the study of a host of other anisotropic systems, such as silicon carbide.

My quest is to find research problems of scientific value that will contribute to the understanding of questions of relevance to South African research and development.

What is your favorite memory of your time at the U of I?

Attending the Thursday afternoon physics colloquia and meeting with my friends during tea time at the MRL lounge are cherished memories.

In addition, I enjoyed the Cosmopolitan Club and interacting with people from all parts of the world at a number of events, including skiing at Allerton Park and canoeing at Turkey Run State Park. I remember very fondly the great number of dinners at Richard and Beverly Martin's home, especially at Thanksgiving.

Have you had the opportunity to return to Illinois to take part in research or to work with your former professors?

I was very fortunate to secure a second Fulbright fellowship for visiting scholars in 2004. Naturally, I chose to return to Illinois where I spent the fall semester working with Richard Martin.

Tell us about the South African Institute of Physics.

I have been a Council member of the SAIP since 2003. I have held the portfolio of Transformation—focused on addressing issues that are of relevance to the new South Africa democracy, such as greater access for previously disadvantaged black students. I have also been charged with rewriting the Institute's constitution to bring it in line with the new ethos of democracy in South Africa.

David Ceperley and Nithaya Chetty in South Africa

I have also served on the South African IUPAP committee, which sent me to the General Assembly in Berlin, Germany, as a voting member of the South African delegation.

Within the Theoretical Physics Specialist Group of the SAIP, I have been involved in hosting the Chris Engelbrecht Summer Schools series that has brought a number of notable U of I physicists to South Africa, including David Ceperley, Richard Martin, Paul Goldbart, Tony Leggett, and Paul Ricker.

I currently chair the SAIP Working Committee on Computational Physics, whose primary brief is to promote computational physics in South Africa.

What do you feel is the organization's greatest strength? Greatest challenge?

Physics the world over has changed, and we do not possess the glamour that our discipline enjoyed during the previous century. This poses a huge challenge to attract good students and funding.

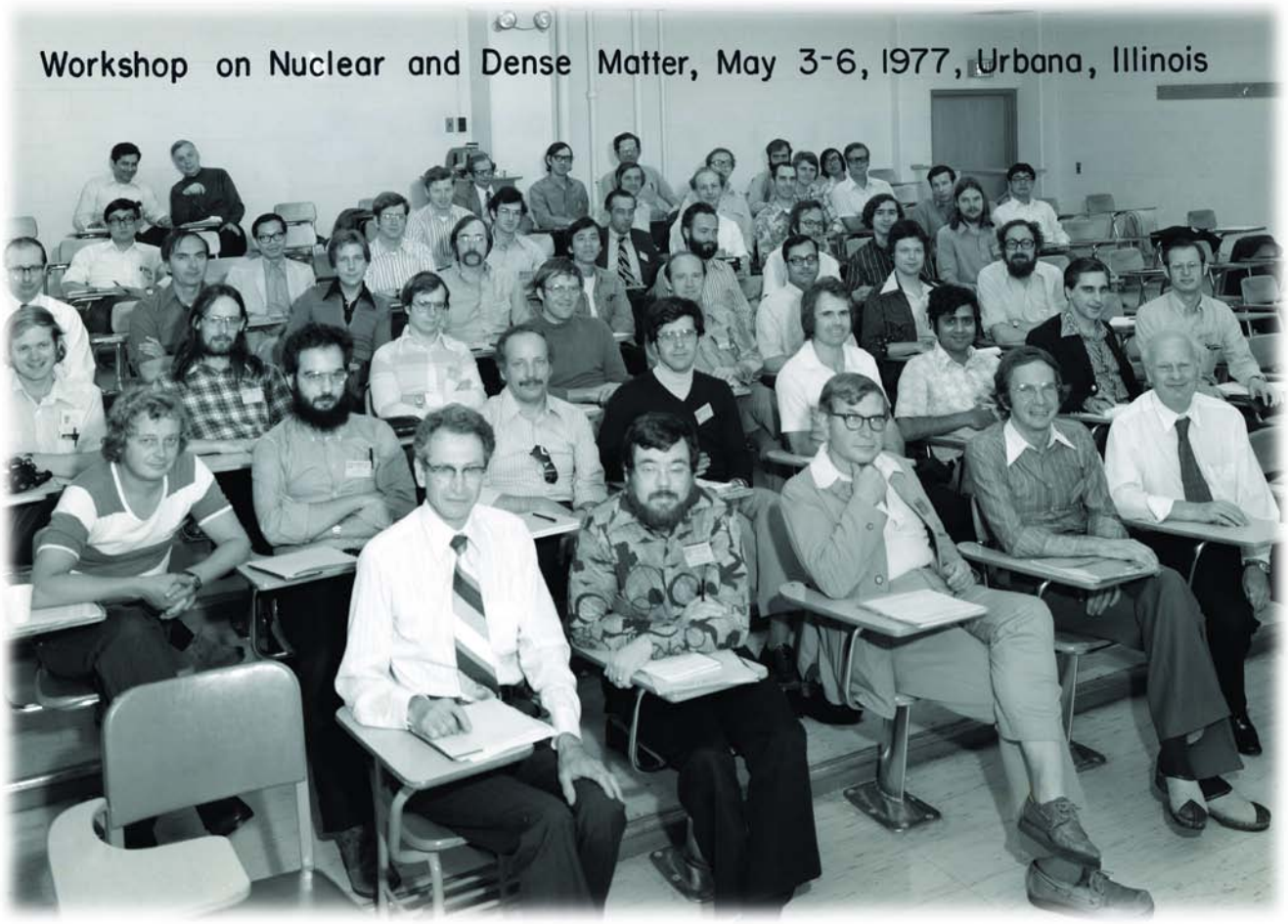
The SAIP has positioned itself in a developmental role in South Africa—this is one of its key strengths. Arguably, the single most important reason why Africa lags behind the rest of the world in terms of development is its lack of basic mathematical and scientific literacy in the mainstream. The South African physics community has championed the cause of scientific development as a vehicle for progress at all levels within society, including educational, commercial, industrial, governmental, etc.

What would you like to achieve during your presidency of SAIP?

I am actively promoting the internationalization of physics in South Africa. Thus far, the funding regimes in South Africa do not recognize the crucial importance of scientists' working with each other on an international basis. I would like to see more foreign postdocs gracing our shores. I would like to have more high quality international physicists participate in workshops, conferences, and schools in South Africa. At the same time, I want to see more African physicists, who often toil under difficult circumstances and in isolation, to spend more time in South Africa establishing collaborations, using our laboratory facilities, and interacting with our international visitors.

I have been involved in the establishment of the National Institute for Theoretical Physics from the outset. This will be a fantastic opportunity to ensure that the brightest of young African minds are exposed to the world's best physicists. I aim to draw on my Illinois connections to ensure that we have a steady stream of world-class visitors to this part of the world.

There are a number of pan-African initiatives that have come to fruition over recent times: The African Institute for Mathematical Sciences, The African Laser Centre, The Advanced African Institute for Information and Communication Technology, The African Materials Research Society, etc. More funding is becoming available from the Southern African Development Corporation, New Partnership for African Development, and the African Union. Under my presidency, the SAIP will ensure that it plays its role in maximizing the goals of these initiatives. ■



Backward Glance

In May 1977, Physics hosted 48 European, Canadian, Latin American, and U.S. physicists at a workshop on Nuclear and Dense Matter Physics. *Contemporary developments in the reaction-matrix and variational theories of quantum fluids, their application to simple Fermi systems, and to nuclear and neutron-star matter were discussed. Workshop organizer Vijay R. Pandharipande (second row, third from right) arranged formal and informal talks on topics including models of the nucleon-nucleon interaction, the type of matter properties they predict, and the scattering of nucleons and pions by the nuclear medium. Nobel Laureate Hans Bethe summarized the "Status of the Nuclear Matter Problem" and proposed a number of interesting model problems. Whom do you recognize?*

PHYSICS ILLINOIS NEWS

Physics Illinois News is published twice a year by the University of Illinois Department of Physics for its students, faculty, alumni, and friends.

MISSION
The mission of the Department of Physics of the University of Illinois at Urbana-Champaign is to serve the people of the State of Illinois, the nation, and the world through leadership in physics education and research, public outreach, and professional service.

EDITOR
Celia M. Elliott

COPY EDITOR AND PRODUCTION
Cyndi Paceley

ART DIRECTION & DESIGN
College of Engineering Communications Office

PHOTOGRAPHY
Thompson/McClellan Photography

ONLINE
www.physics.uiuc.edu/Alumni

WRITE TO US
Subscriptions are free. To place your name on our mailing list or to request an address correction, please contact us at:

cmelliot@uiuc.edu
(217) 244-7725

Physics Illinois News
215 Loomis Laboratory of Physics, MC-704
Department of Physics
University of Illinois at Urbana-Champaign
1110 West Green Street
Urbana, IL 61801-2982 USA

If you have suggestions for stories or features that you would like to see, comments about this edition, or requests for an electronic version of the newsletter, please write to us. We're listening!

The University of Illinois at Urbana-Champaign is an equal opportunity and affirmative action institution.

not a place, a habit of mind...

Physics Illinois

Department of Physics
University of Illinois at Urbana-Champaign
215 Loomis Laboratory of Physics
1110 West Green Street
Urbana, IL 61801