

## Van Harlingen named 10th head of Physics



On July 1, 2006, Dale J. Van Harlingen, Center for Advanced Study Professor of Physics and Donald Biggar Willett

Professor of Engineering, became the 10th head of the Department of Physics at the University of Illinois at Urbana-Champaign.

Van Harlingen has spent his entire professional career at Illinois, joining the Physics faculty in 1981 as an assistant professor. He received his bachelor's degree in physics in 1972, and his PhD in physics in 1977, from The Ohio State University. After a year as a NATO postdoctoral fellow in the Cavendish Laboratory at the University of Cambridge, England, working with Professor John Waldram, Van Harlingen held a postdoctoral research position at the University of California, Berkeley for three years, where he worked on non-equilibrium superconductivity and dc SQUID electronics with Professor John Clarke.

Focusing on the study of superconductivity and superconductor device physics, Van Harlingen has pioneered experimental techniques in low-temperature physics to investigate phase coherence and quantum phenomena in solid-state materials. His ground-breaking experimental confirmation of the orbital *d*-wave pairing state of high-temperature superconductors has led to major progress in superconductivity. Current interests are determining the pairing symmetry in unconventional superconductors, fabricating Josephson pi-junctions for the design of solid-state qubits, developing scanning magnetic microscopy instruments, and characterizing transport in nanoscale superconducting structures.

Van Harlingen is a Fellow of the American Physical Society, a member of the American Academy of Arts and Sciences and the National Academy of Sciences, and a recipient of the 1998 APS Oliver E. Buckley Prize in Condensed Matter Physics.

Former heads of Physics are Samuel W. Stratton (1890–1896), Albert P. Carman (1896–1929), F. Wheeler Loomis (1929–1957), Frederick Seitz (1957–1963), Gerald M. Almy (1963–1970), Ralph O. Simmons (1970–1986), Ansel C. Anderson (1986–1992), David K. Campbell (1992–2000), and Jeremiah D. Sullivan (2000–2006).

## Exotic relatives discovered

BY RICK KUBETZ

In October, the CDF collaboration—which includes researchers from the University of Illinois—announced at Fermi National Accelerator Laboratory the discovery of two rare types of particles, exotic relatives of the much more common proton and neutron. Kevin Pitts, an associate professor of physics at Illinois, is one of the co-leaders of the CDF physics group performing this measurement.

“This is the first observation of the  $\Sigma_b$  (“sigma-b”) baryon, which is an extremely heavy cousin to the proton, much like an atom of iron is an extremely heavy cousin to an atom of hydrogen,” Pitts explained. “We have just added to the mankind’s knowledge of the ‘periodic table of baryons.’”

Utilizing Fermilab’s Tevatron collider, currently the world’s most powerful particle accelerator, physicists can recreate the conditions present in the early formation of the universe, reproducing the exotic matter that was abundant in the moments after the big bang.

Baryons (derived from the Greek word “barys,” meaning “heavy”) are particles that contain three quarks, the most fundamental building blocks of matter. The CDF collaboration



Postdoc Anyes Taffard and graduate student Christopher Marino working on the CDF high-speed digital processing system

discovered two types of  $\Sigma_b$  particles, each one about six times heavier than a proton. The new particles are extremely short-lived and decay within a tiny fraction of a second.

To overcome the low odds of producing bottom quarks—which in turn transform into the  $\Sigma_b$ —scientists take advantage of the billions of collisions produced by the Tevatron each second.

One of the largest university groups in the CDF collaboration is from the University of Illinois at Urbana-Champaign. In addition to

playing a major role in the analysis of the data, Pitts, along with his team of engineers, postdoctoral researchers, and graduate students, developed important components in the CDF data acquisition system that made this measurement possible.

“To observe a handful of these new particles, we had to sift through more than 100 trillion Tevatron collisions,” said Pitts. “This discovery would not have been possible were it not for the high-speed processing system developed here in Urbana.”

Another key component of the CDF detector is the “Central Outer Tracker” (COT), which is heavily utilized in event identification and reconstruction. Pitts, along with Tony Liss of Illinois, played major roles in the construction of the COT.

“The University of Illinois has been a one of the leading groups on the CDF experiment since its inception,” said Liss, who was the co-leader of the CDF working group responsible for the discovery of the top quark in 1995. “We are proud of our contributions to this important work, and as we continue to take data at unprecedented rates, we look forward to many more discoveries in the coming months and years.”

## Logbook: single top production

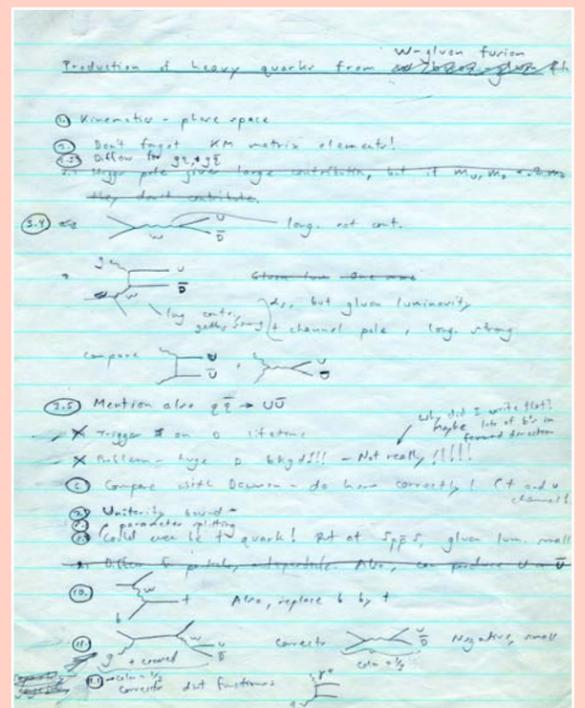
BY KURT REISELMANN

In 1985, ten years before scientists at Fermilab discovered the top quark, Scott Willenbrock was a graduate student at the University of Texas at Austin. He and Duane Dicus were wondering how likely it would be for a particle collider such as the Fermilab Tevatron to produce a single heavy quark.

Willenbrock remembers that the eureka moment came when he was sitting in a UTexas shuttle bus on his way home. There he realized that a subatomic process called “W-gluon fusion” could lead to a single heavy quark. To outline the calculation, Willenbrock made this to-do list and included the remark, “Could even be t quark!”

“Back then we were thinking about a hypothetical fourth generation of quarks [labeled U,D in the list],” says Willenbrock, now a professor at the University of Illinois at Urbana-Champaign. “Physicists had no idea how heavy the [third-generation] top was, and we didn’t know whether this calculation would be relevant to the top.”

In 1995, the CDF and DZero experiments at Fermilab observed top quarks for the first time, produced in pairs via the strong nuclear force. The particle was so heavy that scientists began to search for single top quark production as well. In December 2006, about twenty-one years after Dicus and Willenbrock published their predictions [Phys. Rev. D 34, 155–161 (1986)—ed.], the DZero collaboration reported the first evidence for single top production at the Tevatron.



Production of heavy quarks from W-gluon fusion

Story courtesy Symmetry Magazine, Vol. 4, No. 1, January/February 2007. Reprinted with permission. See [www.symmetrymag.org/cms/?pid=1000431](http://www.symmetrymag.org/cms/?pid=1000431).

## Message from the Head



Over six months have passed since I became the 10th head of the Department of Physics. In that time, I have attended more meetings, signed

more forms, and answered more emails than in the whole of my 25 years as a professor of physics here. But I have also had the unique opportunity to learn about the ambitions and accomplishments of the talented faculty and staff that make up this great department. This experience has reinforced what I have long believed, that there is no better place to do physics and no warmer community in which to work than here in Urbana.

The Department of Physics and the University of Illinois are undergoing significant changes—in just the last year or two we have a new department head,

a new dean in the College of Engineering, a new provost, a new chancellor, and a new president. We live in a new world—one that is rapidly changing and facing new threats to our economy and our security. All of this will bring new challenges and new opportunities and in turn requires and inspires new ideas.

The campus has undergone an extensive strategic planning exercise and is focusing emerging programs into the challenges of information, sustainable energy, and human health care. At the same time, initiatives are underway to extend the impact of the University of Illinois on the international stage, by globalizing our research portfolio and launching a global online campus designed to educate a larger and more diverse student population. Such initiatives are not without costs and commitments by the already busy faculty, so the University is simultaneously undergoing an internal evaluation of its educational programs, research infrastructure, diversity profile, and financial model in order to face the challenges of the 21st century.

Physics has ambitious plans also. One of my goals as head is to re-establish the strong infrastructure and support for the research programs of the department that have always been a hallmark of our program. Initiatives to strengthen the technical facilities, nucleate an Institute for Theoretical Condensed Matter Physics, and partner with departments across the campus in STEM (science-technology-engineering-mathematics) education are in motion.

Physics has a broad wavefunction that extends into a wide range of interdisciplinary areas. We are committed to maintaining our core disciplinary strengths while expanding our impact via exploration at the intersections of physics and other fields across campus, including engineering, materials sciences, biological sciences, environmental sciences, medical sciences, nanoscience, and information technology.

This year marks the 50th anniversary of the famous BCS paper on the theory of superconductivity produced on this campus by John Bardeen, Leon Cooper, and J. Robert

Schrieffer in 1957. This is arguably the single most significant academic achievement ever to come out of the University of Illinois, and we will honor it by holding a major international conference in Urbana this October, a great opportunity to celebrate work that exemplifies the impact that our department has and can have when we approach problems in the “Urbana style,” bringing strong theoretical and experimental expertise to bear on a single goal.

We are always appreciative of the interest and support from our Physics alumni and friends, and I hope that this newsletter helps to give you a glimpse of the energy and quality of this remarkable Department of Physics. Our message of creativity and discovery that you help us spread and the generous contributions you make to the Department continue to drive and enhance our programs as we move forward.

Dale J. Van Harlingen

## Changing the teaching of physics

### FROM 1956 TO 2006

BY CYNDI PACELEY

The 1950s' Cold-War global struggle with the Soviet Union set the stage for launching a new physics high school curriculum in the United States, one with central ties to the Department of Physics at the University of Illinois.

With the outbreak of the Korean War in 1950, concern about a shortage of scientists grew to encompass its implications for national security. The 1955 publication of an in-depth assessment of Soviet technical power focused the American public's view of the situation. The 1957 launch of Sputnik added to fears that American schools lagged dangerously behind in science. In response, the federal government provided funding for the development of

technical and scientific training in the United States.

MIT professor Jerrold Zacharias, in some of the earliest meetings of the Office of Defense Mobilization's Science Advisory Committee, heard repeatedly how “the Russians were getting ahead of us and that we had to do something about education.”

With the backing of his colleagues on the Science Advisory Committee and officials at the National Science Foundation, Zacharias began assembling a team in July 1956 that would come to be known as the Physical Science Study Committee (PSSC).

In a paper prepared for the PSSC 50th anniversary celebration in Summer 2006, former Physics faculty member Edwin L. Goldwasser recalls in “PSSC Reminiscences” how Illinois became involved in PSSC.



### Tradition of physics education innovations continues

According to a study of U of I physics undergraduate students published in *Physical Review Special Topics*, multiple-choice tests are better than test questions that require students to work out extended problems with a pencil and paper (M. Scott, T. Stelzer, and G. Gladding, “Evaluating multiple-choice exams in large introductory physics courses,” *Phys. Rev. ST Phys. Ed. Res.* **2**, 020102/1–14 [2006]).

The work of Physics Education Research (PER) group members Gary Gladding, associate head for undergraduate programs, Timothy Stelzer, research assistant professor, and graduate student Michael Scott was also included in the American Physical Society's August 7 *EurekaAlert*.

Their study evaluates the conversion of mid-term and final exams from a free-response to a multiple-choice format as part of the department's reform of the introductory physics sequence, which started in Fall 1996.

A comparison with longer-format tests showed not only that multiple-choice questions are roughly as good at evaluating students' relative performance, but they also provide additional benefits over calculation-crammed test booklets. Multiple-choice tests ease grading demands in large classes, minimize grading ambiguity and inconsistencies between graders, and significantly reduce the number of contested grades.

To assess the exams' reliability, the PER group performed a split-exam analysis to determine the uncertainties in students' semester exam scores for all four introductory physics courses. The analysis involved splitting a semester set of exam questions (~130) into two equivalent groups of questions to form “even” and “odd” exams and then evaluating the differences in these scores. By looking at cumulative results for 32 different course semesters (this data set includes 128 exams, 4250 questions, and 12,281 students), a Gaussian fit to PER data reveals that students' semester exam scores vary by only 3.1 percent. For A+ to C– students in these courses, this exam uncertainty translates to a letter grade uncertainty of less than 1/3 of a letter grade.

To assess validity, PER's intensive study looked at how 33 students answered twenty questions from a final exam they took in the calculus-based E&M course. Using a Monte Carlo simulation and a log-likelihood fit, the PER researchers found that the true correlation between the students' multiple-choice score and their score based on their written work on the same questions was greater than 0.94 at the 95-percent confidence level.

## Goldwasser shares APS *Excellence in Physics Education Award*

The inaugural award for the American Physical Society's new *Excellence in Physics Education* prize was presented to Edwin "Ned" Goldwasser at the 2007 March meeting. Goldwasser and co-recipients John H. Dodge, A.P. French, Robert Gardner, Robert Hulsizer, John G. King, and Uri Haber-Schaim were honored for their contributions to the Physical Science Study Committee, a collaborative effort by MIT and Illinois in the late 1950s that transformed the way physics was taught in U.S. high schools. The citation reads, "For the revitalization of subject matter through the involvement of teachers and researchers at all levels, the elevation of the instructional role of the laboratory, the development and utilization of innovative instructional media, and the emphasis on discipline-centered inquiry and the nature of physics, PSSC Physics has had a major and ongoing influence on physics education at the national level." Goldwasser shares his reminiscences of the PSSC project, and his hope for the future of physics teaching, in a companion article.

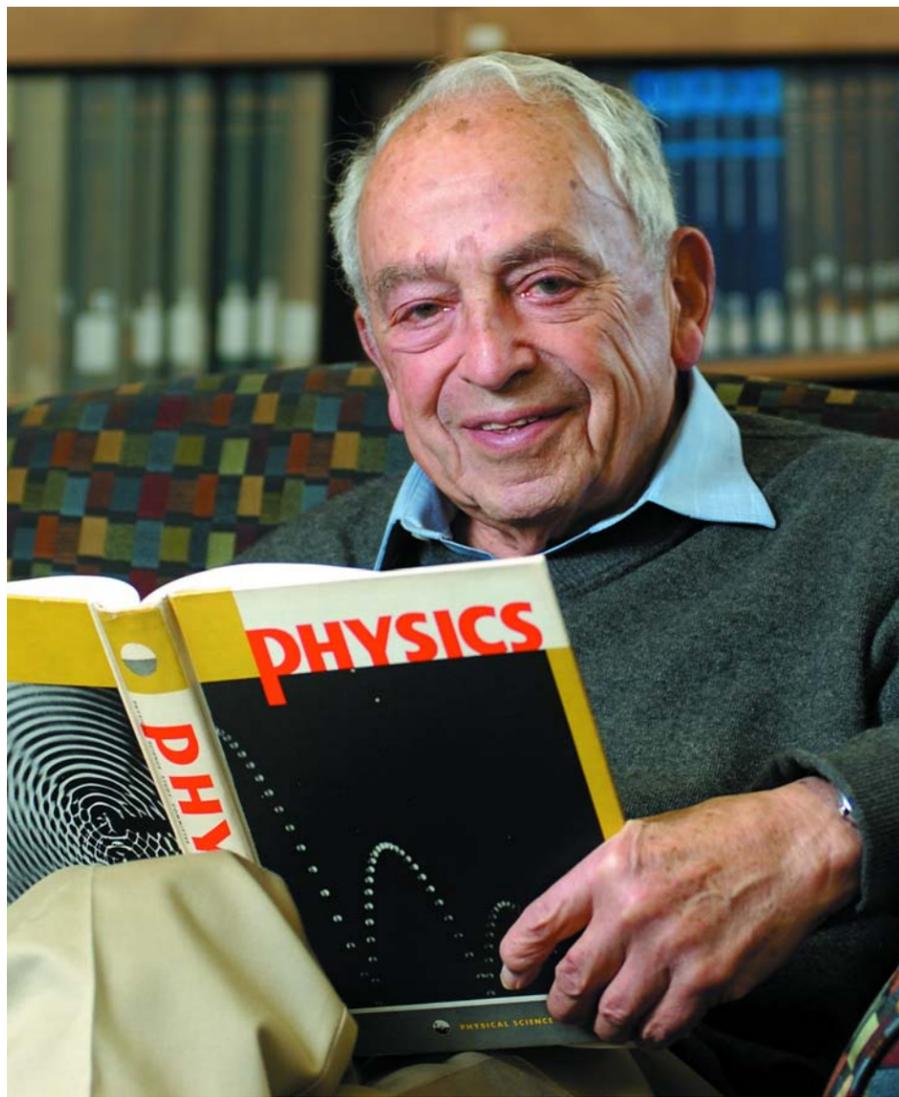
Goldwasser is a graduate of the Horace Mann School in New York City, received his bachelor's degree in physics from Harvard (1940) and his PhD in physics from the University of California, Berkeley (1950), where his thesis research was on cosmic rays. He then joined the University of Illinois in

1951 as a research associate, working on the 22-MeV and 300-MeV betatrons.

In 1959, Goldwasser was asked to chair the Illinois group that was collaborating with MIT's Physical Science Study Committee to create a new high-school physics curriculum. Illinois' assignment, which took three years, was to create the teacher's guide for the new textbook. He also became an active advocate for bringing a frontline accelerator to the Midwest. In 1967, with an Illinois site chosen, Goldwasser was appointed deputy director of the new facility, Fermilab.

He returned to the University eleven years later as provost, a position in which he served for eight years. He next went to Berkeley where, for two years, he joined the Central Design Group for the "Supercollider." Following his "retirement," Goldwasser was asked to fill temporarily the position of director of the University of Illinois' Computer-assisted Education Research Laboratory and, following that, he was appointed a "Distinguished Scholar" at Caltech to work on the LIGO project.

Goldwasser is a member and fellow of the American Physical Society and the American Association for the Advancement of Science. He has received Fulbright and Guggenheim fellowships and has served on the AEC's General Advisory Committee and on the University of California's committees that oversee its three national laboratories.



Ned Goldwasser with *Physics*, the new approach to teaching high-school physics developed by the Physical Science Study Committee in the 1950s

## PSSC reminiscences



Ned Goldwasser as a young *Physics* faculty member

It is always a mixed pleasure for me to attempt to describe events of my past. On the one hand, I enjoy the nostalgia that accompanies any such effort. On the other hand, in the process, I invariably realize that my reconstruction of events would have been far easier had I done it when I still had a reliable memory. In any case, as I sit down to write about my early days in the PSSC project I've decided that my memory of those days is probably more to the point than would be the results of research that any nonparticipant could undertake to ferret out what officially recorded facts might be found.

As my memory has it, sometime during the fall of 1956, Wheeler Loomis, head of the University of Illinois Physics Department, was approached by Jerrold Zacharias, initiator and chairman of a newly formed steering committee of a Physical Sciences Study Committee (PSSC) that he had established at MIT. The membership of that steering committee, replete with university presidents, CEOs, and Nobel Prize winners, is convincing proof that, in those days, we lived in a world very different from the one in which we find ourselves today. Leaders in government, industry and academia were deeply concerned by the rate at which the USSR was building its strength in science and engineering, and they felt that national security demanded that this nation take action to retain its leadership in those areas. Loomis and Zacharias had worked closely together at MIT during World War II. That relationship led Zacharias to approach Loomis with a suggestion that the latter might explore with his faculty the possibility of a collaboration between Illinois and MIT to pursue the ambitious goal that had been embraced by his PSSC Steering Committee—creation of a new high school physics course that would represent a dramatically different alternative to then-current high school courses.

Loomis himself had always had a strong commitment to the

improvement of the teaching of physics at the university level, and he felt that the number of students enrolled in those courses could be significantly increased and their quality enhanced by improving the preceding high school courses and teaching. He readily agreed to serve as chairman of a cooperating Illinois group—if he could find sufficient interest in forming one. His own enthusiasm was contagious.

Initially about a half a dozen individuals expressed an interest in attending a December planning meeting at MIT to get a better feel for the direction in which the project was moving and to get some idea about how an Illinois contingent might fit in. Our interest in pursuing the matter further was motivated largely by a deep dissatisfaction with the quality of high school physics courses of that day (textbooks in particular). As I remember it, our *bête noir* was a widely used textbook featuring a picture of a steam shovel on the frontispiece—misguidedly suggesting that was an informative characterization of the discipline of physics. Another weakness in high school physics teaching stemmed from the fact that it often was relegated to the care of any available staff member—often, if not usually, to the coach of a football, basketball or baseball team. We all knew that had to be changed. [Eds. note: Today, fewer than 80 percent of Illinois high schools

offer physics. Of those who do, 54 percent of the physics classes are taught by someone whose certification is in a discipline other than physics.]

Following the December meeting, a few of us agreed to spend the summer at MIT to participate in further discussions about the project in general, to engage in a more sharply focused development of the text, and, finally, to explore, seriously, a number of different roles that the Illinois group might possibly play.

Everyone agreed that a multi-pronged approach would be required to accomplish the necessary major changes to bring the teaching of physics more closely in touch with the modern philosophy and hopes of currently active physicists. To realize that kind of improvement, it was decided, among other things, to give up the standard packaging and ordering of the various parts of standard physics curricula and to start the course, for example, with a broad look at the universe—developing some basic understanding of the concepts of space and time and of the process of measurement.

The multi-pronged approach that was envisioned included, first and foremost, a new textbook, and work on such a book had already been started at MIT. A set of new, inexpensive classroom demonstrations

*continued on page 4*

## PSSC reminiscences *(continued from page 3)*

and new laboratory experiments were thought necessary to supplement the text and, for those demonstrations or experiments that might turn out to be too difficult or too expensive for the average high school, a set of movies should be made as stand-ins. Those movies were to feature distinguished, currently active physicists as principal protagonists. Finally, it was agreed that a guide would be necessary to help teachers implement the new course. Somewhat independently, an effort was to be made to enlist the help of a number of distinguished physicists to contribute to a series of small, paperback books presenting descriptions of their specialties or introducing readers to the giants in the history of physics. (One of my favorites was a biography of Galileo, authored jointly by Laura Fermi, a one-time physics teacher herself, and Gilberto Bernardini, highly respected for his research in elementary particle physics.)

Finally, and very importantly, Zacharias realized that with the adoption of the new course there would certainly be a disconnect between that course and the then-standard college entrance examinations. He successfully persuaded those responsible for the development of those exams to create a different set of physics examinations for students who had been taught physics the PSSC way.

As for the Illinois group, we decided that major participation in continuing work on the text would be difficult at a distance of 1,000 miles from the principal authors at MIT. (Remember that there was no Internet and no e-mail in those days.) We felt that our group, to work effectively, should have a large measure of autonomy so that our work could proceed as an almost independent entity. We asked for and were assigned the creation of the Teacher's Guide. We believed that such a guide would be an important feature to upgrade the performance of experienced teachers and an absolute necessity to introduce neophyte teachers to the PSSC course. Homework problems that were devised at MIT were sent to Illinois, where solutions were worked out and imbedded in the Teacher's Guide.

Wheeler Loomis chaired the Illinois group during 1957/58. I had a previous commitment to spend that year in Italy on sabbatical leave. When I returned to Urbana, I was taken by surprise when Loomis asked me to take over the chairmanship of the group, by then comprising about 20 members. Various chapters of the text were assigned to individual members of the group in accord with their expressed preferences, and they produced drafts of what they thought

was needed. We strongly believed that, wonderful though the new course was in the minds of a group of highly experienced, senior physics teachers and researchers, many high school physics teachers would need help to understand the why and wherefore of the new approach and to learn how best to put it across. The Teacher's Guide was our attempt to provide that help. There was a heavy traffic of materials—text book chapters from MIT to Illinois and Teacher's Guide chapters from us to them. Those exchanges gradually led to a meeting of the minds and to the preparation of two independent books, the PSSC Text and the PSSC Teacher's Guide.

Even before the first edition was published, drafts were used at a number of schools by "master teachers," many of whom had been actively involved in the production of the materials and were ready to take the plunge of teaching the new course. At Illinois, we were fortunate in finding a mathematician, David Page, whose home was in our College of Education, but who himself had both

a strong background in physics and experience in the creation of a groundbreaking new math course, the "New Math," that had been developed at Illinois several years earlier. He taught the embryonic PSSC physics course at our University High School. One or

another member of our group attended each of his classes. We and he fed experiences, reactions, comments, and advice to the group at MIT. Our group was also fortunate to have as a colleague Gilbert Finlay, another faculty member of our College of Education having a specialty in the teaching of high school physics. He served as an adviser to us while also serving as a liaison between the PSSC and teachers who were trying out the new materials. One of the conclusions that was reached during the "dry run" of the course was that it would be desirable to add to the program a set of teacher institutes, which would provide some further guidance to teachers interested in using the PSSC materials.

In addition to the production of the Teacher's Guide, several members of our group made substantial contributions to other parts of the project. As I remember it, Charlie Slichter, Jim Smith and, later, Leon Cooper (one of PSSC's bevy of Nobel Prize winners) made significant contributions to rewrites of Parts 1 and 3 of the text as well as to one of the movies. (Leon Cooper participated in PSSC meetings at Illinois, but most of his contributions to the PSSC project came after he left Illinois for Brown University.) David Lazarus and Geoff Ravenhall round out the membership of the original group still to be found at Illinois.

With the "completion" of the

Teacher's Guide," I felt that the work of our group had reached a natural end. A set of "yellow pages," to guide teachers through the lab experiments, was added to the Illinois materials by the group at MIT. Improving, editing, and updating were a continuing process, and a new corporation, Educational Services Inc., had been created at MIT to take over those functions. I soon became more deeply engaged in my own research and gave up any direct communication with the PSSC project. I also brought to a close the formal involvement of the Illinois group.

Shortly afterwards I was unexpectedly called back for one final, fascinating adventure. A group of faculty members at Makerere College in Uganda had learned of the PSSC program and had asked that they be given the PSSC materials and the training necessary to introduce the new course to schools in Uganda. Zacharias felt that it would not be wise to have PSSC materials used in a setting in which students were inadequately prepared to be successful. I was asked to go to Uganda, to visit a cross section of schools, and to see whether or not such an experiment had a good chance of succeeding. That I did, and it is a whole story of its own. I was joined in Uganda by Francis Friedman, the principal author of the PSSC textbook.

In closing I'd like to express my personal views concerning the impact of the PSSC venture on the teaching of physics at the high school level. First and foremost, it is clear to me that the new course spoke and speaks in a language that was and is consistent with the widely accepted physicist's view of what the essence of physics really is. Furthermore, the course has been enthusiastically received by most students and teachers. That observation has been amply supported by talks that have been given as well as by opinions that have been expressed in celebrative articles that have been published on the web and elsewhere to mark the project's 50<sup>th</sup> anniversary.

On the other hand, successful though the course has been, I believe that it has addressed only one part of a major problem—and a small part at that. The general public in this country remains abysmally ignorant about science in general and about physics in particular. Today, decisions must be made about a host of complex, technical, and scientific problems. The general public is ill equipped to make rational judgments about the performance of its government in addressing those issues. I believe that Thomas Jefferson once

commented that democracy would work only if there were an educated electorate. We don't have one today—certainly not in the areas of scientific fact and fiction.

One possible attempt at a solution to this problem would be to simply require a more vigorous exposure to physics throughout students' elementary and secondary school years. In addition to that, though, I can imagine the creation of a new course, taught by physics teachers, that would attract more attention and interest, and therefore higher enrollments, than do today's courses. Such a new course, for example, might be structured so that it indirectly introduced fundamental physics principles by directly addressing those technical and scientific issues that face our society today. For example, the problem of providing for our energy needs while reducing today's dependence on fossil fuels could be studied. Such a study could lead to the development of an understanding of energy itself and to the existence of accessible energy in wind and in solar radiation. It also could lead to studies of radiation, absorption and reflection; to studies of the binding energy of molecules, of the process of burning and the dissociation of molecules, and of the existence of atoms and nuclei and of the phenomena of fusion and fission. Whenever the wonders of a hydrogen-fueled economy might be promoted in the future, any student who had been exposed to such a course would immediately ask about the source of the hydrogen and the energy required to free it. Other current problems that could be studied could be the energy

savings of so-called "hybrid" cars and global warming, with its melting of glaciers and raising of the seas.

The above examples illustrate the approach of such a new course. In implementing that approach, it would be essential to treat subjects with scrupulous objectivity, presenting all the "pro's" and "con's" in a manner that would be a self-teaching

demonstration of how scientists treat experimentally established facts and data. At the same time, every opportunity should be seized to remind students that the beauty of physics lies in its support of the unstinting drive of human beings to understand more about their surroundings—from the sub-microscopically small to the unlimitedly large.

Edwin L. Goldwasser  
Urbana, Illinois  
January 2, 2007

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**Every opportunity should be seized to remind students that the beauty of physics lies in its support of the unstinting drive of human beings to understand more about their surroundings**

## Faculty News

### Two elected to National Academy of Sciences

Physics professors David Ceperley and Laura Greene were among 72 scientists elected in 2006 to membership in the National Academy of Sciences, considered one of the highest honors that can be accorded a U.S. scientist or engineer. They will be formally inducted in April 2007.



David M. Ceperley

Laura H. Greene

L. Brian Stauffer

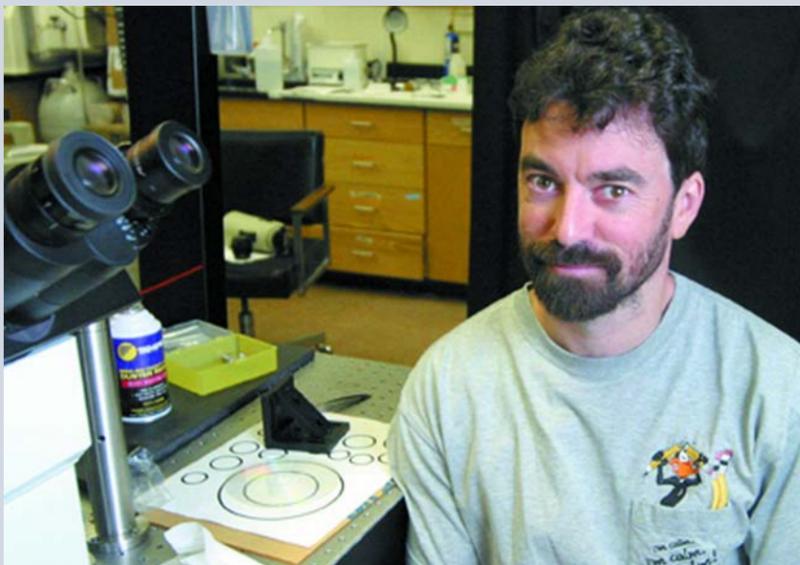
In addition to serving on the Physics faculty, Ceperley is also a staff scientist at the National Center for Supercomputing Applications and a researcher at the Beckman Institute for Advanced Science and Technology and at the Frederick Seitz Materials Research Laboratory.

An expert in developing methods for microscopic simulations of quantum systems, Ceperley has created computational techniques that are used by physicists, chemists, and engineers to predict the behavior of matter. Ceperley won the Eugene Feenberg Memorial Medal in 1994 and the APS Aneesur Rahman Prize for Computational Physics in 1998. He is a Fellow of the American Physical Society and a member of the American Academy of Arts and Sciences. Ceperley joined the Department of Physics in 1987.

Greene is a Swanlund Professor of Physics and a researcher at the Frederick Seitz Materials Research Laboratory. Her research interests focus on strongly correlated electron systems, primarily the investigation of the mechanisms of unconventional superconductivity.

A leading experimentalist in the physics of novel materials, Greene has performed pioneering experiments that elucidate how the electronic properties of low- and high-temperature superconductors interface with other materials. She is a Fellow of the American Physical Society, the American Association for the Advancement of Science, and the American Academy of Arts and Sciences. She won the APS Maria Goeppert-Meyer Award in 1994 and the Ernest Orlando Lawrence Memorial Award for Materials Research in 1999. Greene joined the Illinois faculty in 1992.

“David Ceperley and Laura Greene each have made fundamental contributions to advancing scientific knowledge,” said Chancellor Richard Herman. “Their presence on the faculty of this university is a great source of pride, and their work exemplifies the discovery and innovation that happens at Illinois.”



Kerame Ross

John Bardeen Faculty Scholar Paul R. Selvin, professor of physics and of biophysics, has been named a 2007 University Scholar, one of six selected campus-wide this year. The University Scholar program recognizes excellence, while helping to identify and retain the University's most talented teachers, scholars, and researchers. “The University Scholars Program is the premier recognition accorded to faculty at the UI by their colleagues,” said Richard Herman, the Urbana chancellor. “In honoring these outstanding members of the faculty, selected by their peers, we recognize at the same time the highest values of the university.”

### Hubler wins 2006 Nordsieck Award

Alfred W. Hubler received the sixth annual *Arnold Nordsieck Award for Teaching Excellence in Physics* for exemplary classroom teaching on April 20, 2006. The Nordsieck Award, named in honor of former Professor of Physics Arnold T. Nordsieck and endowed by a gift from his family, was established to recognize and reward outstanding teaching in the Department of Physics. In particular, Hubler was cited for “bringing passion and skill to teaching and for inspiring his students to be great teachers.”



Ross Alborn

Alfred Hubler

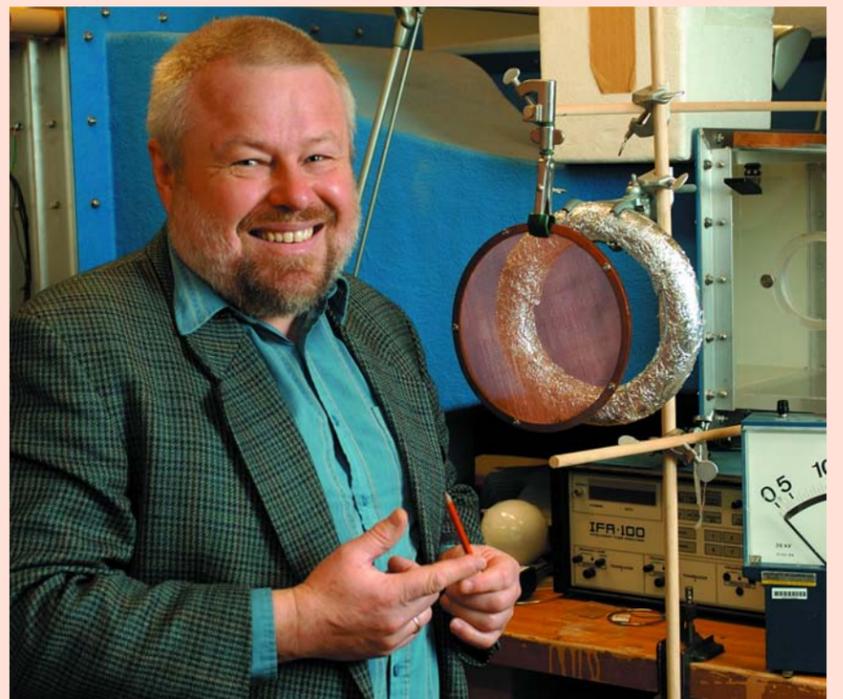
Legendary for his enthusiastic teaching, Hubler has taught physics at every level at Illinois—from freshman “discovery” courses for non-physics majors, to the introductory physics courses for engineers, to upper-level graduate courses. Taking examples from systems as different as corn fields and resonant oscillators, he makes the wonder of complex systems and nonlinear dynamics come alive for his students. Their teaching evaluations sparkle with superlatives: “interesting and enthusiastic lectures,” “highly skilled,” “wants to make sure students learn.” Hubler also strives to involve undergraduates in his research group, and many have published papers on their work—usually as first author.

The director of the Center for Complex Systems Research, Hubler and his group study the phenomena of systems having large throughput, such as turbulence, lightning, and information flow on the Internet. Nonlinear dynamics, neural nets, cellular automata, genetic algorithms, and artificial life models are used to describe these systems. Ultimately, the researchers try to build simple physical systems that can self-assemble, self-repair, and adapt to their environments.

Hubler has pioneered developments in nonlinear science research, including the control of chaos, the resonant coupling of nonlinear oscillators, and resonant stimulation and novel spectroscopies in nonlinear systems. He was among the first to recognize that seemingly erratic, random motion associated with deterministic chaos could, in fact, be controlled and that chaotic systems could be more adaptable than systems undergoing more regular motion.

Hubler received his *diplom* in 1983 and PhD in 1987, *summa cum laude*, from the Department of Physics, Technical University of Munich. After a postdoctoral fellowship at the University of Stuttgart, he came to the University of Illinois as a visiting assistant professor in 1989 and became an assistant professor in 1990. Later that year, he also became the associate director of the Center for Complex Systems Research at Illinois, of which he is now the director. Hubler served as a Toshiba Chair Professor at Keio University, Tokyo, in 1993/94, and he is the executive editor of *Complexity*, the premier international journal on complex systems.

Arnold T. Nordsieck, a professor of physics at the University of Illinois from 1947 to 1961, was a brilliant theorist with an uncommon affinity for experiment. A specialist in the mathematics of computation, he (with Hicks and Yen) successfully solved the full nonlinear Boltzmann equations for several nonequilibrium flow problems—a pioneering computational effort and a breakthrough in computational fluid dynamics and rarefied gas dynamics. He also proposed the first electrostatically supported gyroscope and built the first computer to be used at Lawrence Livermore National Laboratory, the Nordsieck Analog Computer. In 1953, he proposed the “Cornfield System,” a naval air-defense system that was one of the first applications of digital computer technology to complex decision-making.



## Faculty News

# Ceperley named Founder Professor of Engineering

On November 10, 2006, David M. Ceperley was invested as a Founder Professor of Engineering at the University of Illinois. Longtime friends and collaborators Malvin H. Kalos (MS '49, PhD '52) of Lawrence Livermore National Laboratory and Richard M. Martin of Illinois, spoke eloquently of Ceperley's contributions to condensed matter physics.

Combining incisive physical insight with computational virtuosity, Ceperley has profoundly influenced modern understanding of strongly interacting quantum many-particle systems. He has turned the path integral formulation into a precise tool to understand quantitatively the properties of electrons in solids, of liquid and solid helium, and other systems. His computational methods have defined the state of the art. His electron gas equation-of-state calculation with Alder—a *tour de force*, with some 4000 citations—is one of the most valuable results in computational science, providing basic input data for numerical applications of density functional theory to electronic systems.

Ceperley's groundbreaking work was recognized by the 1998 Aneesur Rahman Prize in Computational Physics, awarded by the American

Physical Society, "for important and deep methodological contributions to computational physics, and for highly significant research using those methods in multiple areas of physics." He received the Eugene Feenberg Memorial Medal in 1994 for his seminal contributions to many-body physics.

A fellow of the American Physical Society and a member of the American Academy of Arts and Sciences, Ceperley was elected to the National Academy of Sciences in 2006.

The College of Engineering created the four Founder Professorships in Engineering to recognize distinguished senior members of the faculty for their achievements in teaching, research, and service. The name commemorates Stillman Williams Robinson, the first faculty member to teach engineering at the University of Illinois, and the first dean when the College of Engineering was organized in 1878. Robinson is also the reason that Physics is located administratively in the College of Engineering at Illinois—in 1870, he introduced and taught a course in physics, believing that a knowledge of physics is fundamental to the education of every engineer.



Newly invested Founder Professor of Engineering David M. Ceperley addresses the audience while Department Head Dale J. Van Harlingen, Dean Ilesanmi Adesida, and Professor Richard M. Martin look on

# Selvin wins inaugural Sackler Prize in Biophysics



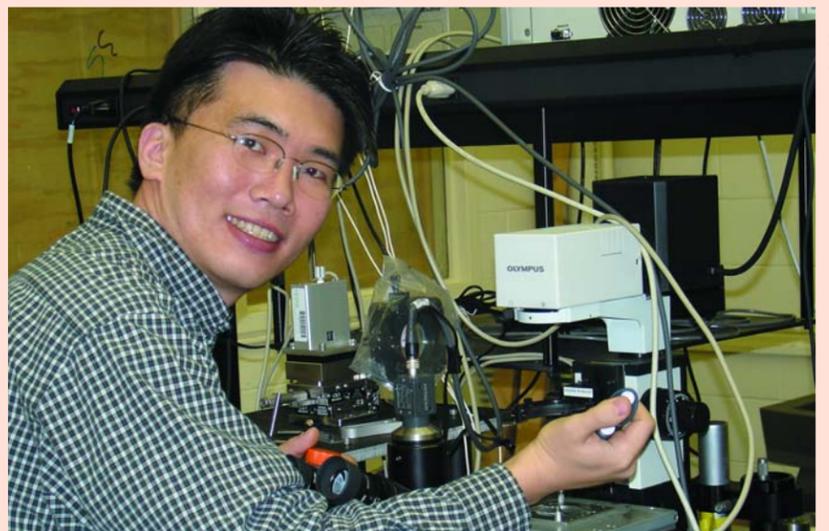
L. Brian Stauffer

Paul R. Selvin, John Bardeen Faculty Scholar and professor of physics and of biophysics, shared the Raymond and Beverly Sackler International Prize in Biophysics in 2006, the first year the prize was awarded. Selvin was selected for his pioneering experimental work in single-molecule biophysics—specifically his development of novel tools to reveal atomic-scale conformational changes in biological macromolecules, both *in vitro* and *in vivo*.

A major focus of Selvin's work has been the development of new methods of resonance energy transfer, including single-molecule detection, ultra-sensitive instrumentation, and new luminescent lanthanide-based reagents. His ground-breaking techniques have

been successfully applied to molecular motors, voltage-controlled ion-channels, dynamics of the bc1 family of proteins involved in electron transport, and protein-DNA interactions.

The Sackler Prize in Biophysics was established through the generosity of Raymond and Beverly Sackler and is administered by Tel Aviv University. The prize is intended to encourage dedication to science, originality, and excellence by rewarding outstanding scientists of age 45 years or younger. Selvin and his co-winner, Dr. Harvey T. McMahon (Medical Research Council, Laboratory of Molecular Biology, Cambridge, England), were awarded the prize in Tel Aviv on May 23, 2006, during the annual meeting of Tel Aviv University's Board of Governors.



Sua Myong

Taekjip Ha, professor of physics and Howard Hughes Medical Institute investigator, received the Michael and Kate Bárány Award for Young Investigators from the American Biophysical Society at its annual meeting on March 5, 2007, in Baltimore. Ha is being honored for his development and application of novel single-molecule fluorescence spectroscopy and microscopy methods and for his groundbreaking discoveries in protein-DNA interactions and enzyme dynamics. He also received the Fluorescence Young Investigator Award of the Biophysical Society in 2002. He is a Fellow of the American Physical Society and the recipient of an Alfred P. Sloan Foundation Fellowship, a Cottrell Scholar Award, and a Searle Scholar Award.

# Wandelt makes major contributions to Planck space mission

BY CYNDI PACELY

A University of Illinois Physics and Astronomy faculty member's significant involvement in the European Space Agency's (ESA's) Planck space mission brought a model of the spacecraft to the Loomis Laboratory lobby.

Building on the award-winning legacy of NASA's 1989 Cosmic Background Explorer (COBE) satellite, the Planck mission seeks to obtain definitive maps of the cosmic microwave background anisotropies and detailed all-sky observations of other components of the microwave sky. When it launches in Summer 2008, Planck will look for traces of the fundamental structure and components of the infant Universe and for the details of how individual and giant clusters of galaxies formed out of the initial fireball.

Benjamin Wandelt, an internationally recognized expert in the analysis of cosmic microwave background (CMB) data, is a member of the theory and simulations team for the ESA/NASA Planck space mission. He co-leads Planck's harmonic analysis effort and has invented innovative algorithms that make the analysis of huge new data sets tractable. Through Wandelt's work, the UI physics department is one of only a few elite American institutions to be involved in this major international cosmology endeavor.

"Displaying the model in the lobby of Loomis was a great way to show our involvement in such a front-line, international space project in cosmology," Wandelt said.

The model's companion poster—visualizing the immense leaps in knowledge of the CMB background that the Planck mission hopes to achieve—was displayed at the entrance to the Astronomy Building.

## Related Research

Wandelt's graduate students and a postdoctoral researcher are now developing new techniques for analyzing the data that will be sent back to Earth from the Planck spacecraft. It was Wandelt's creation of new algorithms, which are a billion times faster than previously known approaches, that will make the analyses possible.

"Analyzing the data will be one of the most challenging computational problems ever attempted," Wandelt commented. "The payoff of solving these analysis problems is massive. The Planck data promise to be the best data set for years to come for understanding the detailed composition of the Universe, the physical processes that occurred when the Universe first formed, and the primordial seeds of all structure in the Universe that eventually led to the



Ben Wandelt with the Planck spacecraft mock-up

formation of our Galaxy, our solar system, and life," he added.

In addition, Wandelt is training the next generation of researchers to work on the analysis of the Planck project and the following round of CMB observations.

A theoretical cosmologist, Wandelt's recent projects include studying the bispectrum of the CMB anisotropy as measured by the

COBE/DMR space mission to constrain the non-linearity of the perturbations created during inflation. He has also participated in efforts to predict the properties of exotic forms of dark matter, designed to solve puzzles related to observations of the clustering properties of matter on galaxy scales.

Wandelt received his PhD in theoretical physics from Imperial

College, London. He worked as a postdoctoral fellow at the Theoretical Astrophysics Center in Copenhagen, Denmark, and as a research associate at Princeton University's physics department before joining the University of Illinois in August 2001.

## Measure Twice, Install Once

Made in Europe by a company that builds mock-ups for ESA, the Planck model crossed the Atlantic before making stops at institutions whose scientists are involved in the project.

During 2005, the model was housed on the campus of the Jet Propulsion Lab at Caltech. In 2006, it made an appearance at the annual meeting of the American Astronomical Society (AAS) in Washington, D.C., then took up residence for a semester at Haverford College in Pennsylvania before arriving in Urbana in June 2006.

Once it arrived, Wandelt and his students moved the crated model from the loading dock into the space between the classrooms on the ground floor of Loomis Laboratory before realizing there were no doorways wide enough to move the crate into the lobby.

After considering various routes, they found that the second floor door to the staircase leading into the lobby is slightly wider and would allow passage of the uncrated model.

"It took three of us to carry the model into the elevator in the center of Loomis, then up to the second floor and through that doorway with not one-tenth of an inch to spare," Wandelt said.

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## Department News



Gordon Baym

BY GORDON BAYM

A special symposium was held September 29–30, 2006, at Loomis Laboratory of Physics to celebrate the life and science of Vijay R. Pandharipande (1940–2006), Donald B. and Elizabeth M. Willett Professor of Physics.

Vijay, who joined the faculty in 1972, was the leading figure of his generation in the development of the nuclear many-body problem. His seminal research program to describe nuclear systems in terms of elementary two- and three-body interactions of the constituent nucleons led to a state-of-the-art comprehensive, quantitative, and reliable theory of nuclei, neutron matter, and neutron stars, as well as strongly interacting atomic and condensed matter systems.

Vijay remained throughout his life the center of a close scientific family, including the new generation of nuclear and many-particle theorists that he trained and his other coworkers. This symposium brought together his scientific family and other friends, not only to remember his manifold contributions, but also to look forward to nuclear and condensed matter physics made all the richer by Vijay.

The keynote speaker, Nobel Laureate Ben Mottelson (NORDITA), opened the symposium Friday afternoon with the provocative question, “Do we really understand the nuclear shell model?” That evening, the participants shared memories of Vijay and a sumptuous Indian feast, hosted by Vijay’s wife, Dr. Rajeshwari Pandharipande, at the new Alice Campbell Alumni Center.

Speakers on Saturday included Gordon Baym (Illinois), Bob Wiringa (MS ’74, PhD ’78, Argonne National Laboratory), Chris Pethick (NORDITA), Tony Leggett (Illinois), Joe Carlson (MS ’79, PhD ’83, Los Alamos National Laboratory), Ingo Sick (Basel), and Wick Haxton (U. Washington). Copies of all talks are available for download at [www.physics.uiuc.edu/vijay.htm](http://www.physics.uiuc.edu/vijay.htm).

*Participants in the special symposium Celebrating Vijay!, September 29–30, 2006*

### Vijay R. Pandharipande Prize in Nuclear Physics

The Department of Physics is very pleased to announce the **Vijay R. Pandharipande Prize in Nuclear Physics**. In addition to his extraordinary scientific achievements, Vijay will be remembered with great affection for his unstinting dedication to his students.

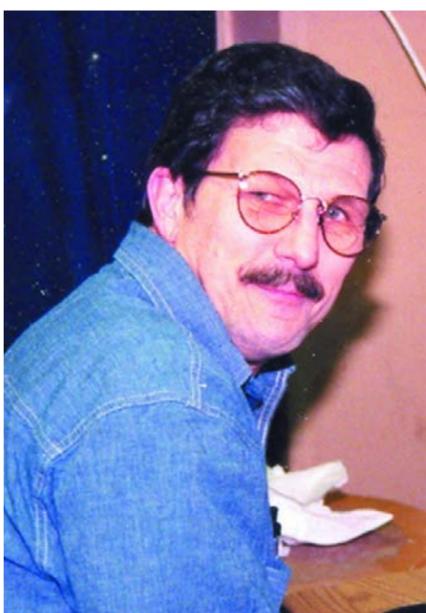
A special fund has been endowed at the University of Illinois Foundation for the prize; earnings from the endowment will be used to present in perpetuity an annual cash award and plaque to the year’s outstanding nuclear physics graduate student.

If you would like to make a gift to the prize fund, please send your check to the University of Illinois Foundation, 1305 West Green Street, Urbana, IL 61801-2962. Be sure to include the fund number (**773489**) with your remittance.

You may also make a gift online at [www.physics.uiuc.edu/support](http://www.physics.uiuc.edu/support). Once you enter your gift amount, you will be directed to the secure University of Illinois Foundation’s “Online Giving” site for your personal and credit card information.

If you have questions about the prize or about giving to the University of Illinois, please contact Celia Elliott, Department of Physics, 217.244.7725, [cmelliot@uiuc.edu](mailto:cmelliot@uiuc.edu).

## Remembering Larry Bell



Larry L. Bell

BY JANET L. KANE

Larry L. Bell, Physics facility manager for the past six years, died Monday, September 11, 2006, following an early-morning bicycle accident. Larry began his employment in the Department of Physics in 1996 as a cryotechnician for the helium liquefier.

Larry’s contributions to the department were broad and deep. He assisted in the oversight of many of the recent construction and remodeling projects—the main lecture halls in Loomis, the theoretical condensed matter physics floors in the Engineering Sciences Building, Loomis’s new roof, two new

conference rooms, and many research laboratories. As Physics’ “go-to guy,” he also handled day-to-day facility problems, such as burned-out lights, leaking pipes, contrary locks, and strange smells, with tireless efficiency and friendliness.

Larry’s most recent contribution has benefited researchers across the campus—he oversaw the installation of a new helium liquefier in Loomis. This complex and challenging project consumed much of Larry’s energy and time through the summer of 2006. Thanks to his experience, insight, and plain hard work, we now have a reliable, high-capacity liquefier that will serve the campus for the next decade or more.

Outside of work, Larry’s life revolved around his church, his family, and anything to do with airplanes. In recent years, his hobby was constructing intricate airplane models, but the first 20 years of his career were spent in the U.S. Air Force, repairing B-52s. During his Air Force career, he was stationed both in the United States and abroad and served in some harsh locations.

Larry was a talented, conscientious, and very likable man. He is sorely missed by all of us, although we are doing our best to “Improvise, adapt, and overcome!”—Larry’s approach to his work and the tag line on all his email messages.

# James S. Koehler, 1914–2006

Professor James Stark Koehler was a pioneer in metal defects and their interactions. During wartime, he studied deformation of metals and measured self-diffusion in uranium. After the war, he formulated the first accurate theory for the motion and damping of pinned dislocations. At Illinois, his students perfected methods to quench point defects into very pure metals and to study their properties and subsequent interactions through careful temperature-time sequences of annealing. He led a comprehensive program of radiation damage investigations, with studies of both metals and semiconductors. After visiting Cambridge in 1957, he organized the first Illinois capability for direct study of defects in solids through transmission electron microscopy. The classification scheme proposed by Koehler's group, identifying the mechanisms involved in the various stages of radiation damage annealing in metals, was often challenged but remains in place today.

Koehler was born November 10, 1914, in Oshkosh, Wisconsin. His study of physics began in the local college (now the University of Wisconsin, Oshkosh), where he graduated in 1935. For graduate study he went to the University of Michigan, then notable for its summer symposia on theoretical physics, which began in 1928. These symposia brought leading theoretical physicists from Europe to spend their summers in Ann Arbor. At Michigan, Jim did theoretical research on hindered rotation in methyl alcohol with David Dennison, discoverer of the spin of the proton. In his 1940 thesis, Jim acknowledged Professor Dennison's stimulation and also thanked Professor H. M. Randall for his "encouragement and advice." Randall, beginning in 1910, had built Michigan Physics into a prominent department. It was in Ann Arbor in 1938 that Jim met his future colleague Frederick Seitz, one of the summer lecturers.

Michigan awarded Koehler a Rackham Traveling Postdoctoral Fellowship, which he used at the University of Pennsylvania with Seitz. At Penn, his research interests changed to the theory of solids, in particular to problems of mechanical deformation, and his second publication was already in this field. The next year he went to Westinghouse as Research Fellow, one of the positions created in Pittsburgh by Ed Condon as associate director of research. Koehler became a physics instructor at Carnegie Tech in 1942, where a substantial commitment to research in the solid state was being made, and he set up an experimental lab, funded by the National Defense

Research Committee. His original focus was on plastic waves in metals upon impact. By 1944, Koehler joined the Manhattan Engineer District, to study effects produced in solids by irradiation. One of his many contributions was measurement of the self-diffusion activation energy of uranium, which was used to calculate the change in shape of the cylindrical uranium slugs in the Hanford plutonium-producing reactors. After the war, the new Office of Naval Research in 1947 began support for his work on plastic deformation.

In 1949, Koehler was invited to join the new Illinois department program in condensed matter physics. Koehler moved his Navy equipment to Urbana, and ONR support continued through 1970. Upon his arrival, substantial support from the Atomic Energy Commission began for a program in radiation damage, which used the Illinois cyclotron. Later his dream was realized to have a dedicated facility for "simple" radiation damage (2-MeV electrons) in the new Illinois Materials Research Laboratory. Koehler also enjoyed years of research support from the Army Research Office (Durham).

Altogether, Koehler supervised 45 doctoral dissertations, 7 at Carnegie Tech (now Carnegie Mellon University) and 38 at the University of Illinois Urbana-Champaign, where he enjoyed the contributions of over two dozen postdoctoral associates and the presence of frequent visitors from other research centers in defect physics. In part because of this widespread scientific family, and in part because of his pioneering discoveries, Koehler had a big presence at many international conferences on defects in metals.

In theory, Koehler continued personal research on defect problems, and he supervised the work of several students in dislocation-related theses. In experiment, his students and associates used many different techniques: internal friction, macroscopic deformation, electrical resistivity, X-ray diffraction, energy release, transmission electron microscopy, X-ray anomalous transmission, proton channeling, and the emission of channeling radiation. Koehler's publications span 57 years.

Among the achievements of Koehler's many students and postdoctorals were prominent careers in industry (Bell Laboratories, General Electric, Philips, several aerospace companies, and others), of teaching and research at universities (among



*Jim Koehler, 1959, in his laboratory*

them Columbia, Illinois, Missouri, Northwestern, Utah, Wisconsin and abroad in Tokyo, Seoul, and in Europe) and of research and administration at national laboratories (Argonne, Oak Ridge, Sandia, and

abroad in Japan and Germany).

Koehler was a Fellow of the American Physical Society and was awarded a J.S. Guggenheim Fellowship. He retired from teaching in the summer of 1981, and that fall attended the Yamada Conference V on

Point Defects and Defect Interactions in Metals, Kyoto, Japan, where he was honored by his many colleagues who had spent periods of time in Urbana.

His name is easily attached to some fundamental properties of defects in crystals. The Peach–Koehler formula gives the basic relation now widely used for the force on a dislocation in terms of an applied stress, and the vibrating string model is the first formulation of the equation of motion underlying dislocation dynamics. Almost nobody believed Koehler's 1952 prediction of  $L^2$  and  $L^4$  loop segment length dependence of the elastic modulus and internal friction, respectively, until 1956 measurements by Thompson and Holmes of Oak Ridge National Laboratory showed it to be correct. Thereafter, this signature became the standard for identifying dislocation losses, and one of the most sensitive detectors of interstitials available. Basic results in radiation damage were the Cooper–Koehler–Marx experiment, the first to show that interstitials move at very low temperatures in metals, which meant that previous room-temperature measurements were of little use in

understanding the atomic details of radiation damage, and the Magnuson–Palmer–Koehler experiment, the first to show the existence of interstitial-vacancy close-pairs. Extensive further work, on interstitial-impurity interactions, demonstrated that these interactions, specific to each impurity, play a decisive role in the annealing of radiation damage. Finally, the Bauerle–Koehler experiment on gold first showed convincingly how vacancy properties can be studied quantitatively by rapid quenching and systematic annealing.

Jim Koehler was an inquisitive, critical and cheerful man. Every morning he would appear in the lab, often with a glint in his eye and the greeting "I've got a wild idea!" This frequently led to critical discussion and sometimes to experimental exploration and improvement. He was tightly focused when working on a problem, he spoke and wrote economically, and he could ignore bureaucratic demands.

Koehler had many scientific visitors, for example, Gunther Leibfried of Jülich. Although their personal styles could only be described as complementary, their mutual focus and honesty about the basic questions of defect physics, not to mention tennis, drew Leibfried and Koehler together, with Leibfried making annual visits.

Jim and his wife Harriet entertained warmly and often in their home in Champaign. Local students and staff got to meet many internationally known personalities in defect physics informally in this way. The Koehlers' interests in music were obvious. For a time, their living room was filled with two grand pianos, which Harriet and her friend Betty Seitz played together. Jim loved reading, upon which he increasingly relied for pleasure in his retirement. In later years, he was devoted to the welfare of Harriet, who even as her health deteriorated before her death six years before his, retained remarkable talents on the piano. He died in Urbana on June 19, 2006.

Ralph O. Simmons  
Andrew V. Granato  
Urbana, Illinois  
2006

# Department News

## Bumper crop of APS Fellows in 2006



Charles F. Gammie



Robert G. Leigh



Mats A. Selen



Scott S. Willenbrock

A record four Physics faculty, two former Physics postdocs, and five distinguished alumni were recognized in December as 2006 APS Fellows for their seminal contributions to physics.

**Charles F. Gammie**, professor of physics and of astronomy, was honored for his work on elucidating astrophysical turbulence, particularly in black hole magnetospheres, star-forming interstellar clouds, and circumstellar disks. Associate Professor **Robert G. Leigh** was recognized for his pioneering contributions to string theory, supersymmetric gauge theory, the theory of the electroweak phase transition, and the theory of D-branes.

His leadership and hardware contributions to the CLEO collaboration and contributions to the understanding of charm hadronic decays and excited states were cited for Professor **Mats A. Selen**. And Professor **Scott S. Willenbrock** was honored for his pioneering work in single top quark production at hadron colliders and for contributions to understanding of the associated production of Higgs and vector bosons as a discovery channel at the Tevatron and the Large Hadron Collider.

Former postdocs **Girsh Blumberg** and **Jörg Schmalian** were recognized for their outstanding work in condensed matter physics. Blumberg, a researcher at Bell Labs Innovations in Murray Hill, New Jersey, was cited for his seminal contributions to elucidating the physics of spin, charge and superconducting correlations in 1D and 2D complex oxide compounds using Raman scattering techniques. Schmalian, an associate professor in the Department of Physics and Astronomy at Iowa State University, was recognized for his pioneering contributions to the theory of strongly correlated materials, including studies on the role of disorder, frustration, and unconventional pairing in quantum many-body systems.

**Shirley Suiling Chan** (MS '71, PhD '77 [Biophysics]), a research associate in physics at Princeton University, was recognized for explorations of the spectra, structure, and dynamics of proteins and nuclei acids and for her

dedicated service to the American Physical Society.

**Peter M. Gehring** (MS '84, PhD '89), a physicist at the National Institute of Standards and Technology in Gaithersburg, Maryland, was cited for his major contributions to our understanding of the lattice dynamics of relaxor ferroelectrics and for elucidating the nature of the spin dynamics of cuprate oxides by neutron scattering.

**Eli I. Rosenberg** (MS '66, PhD '71), a professor in the Department of Physics and Astronomy at Iowa State University, was honored for his definitive contributions to the first measurements of quark structure of the pion, the electronics design for the DELPHI electromagnetic calorimeter, and the development of the BaBar on-line software.

**Lawrence B. Schein** (PhD '71) was recognized by the Forum on Industrial and Applied Physics for his lifelong contributions to electrophotography, electrostatics, and transport in organic solids. A holder of 10 patents, Schein has pioneered copier and printer technology advancements at Xerox Research (1970–1983), IBM (1983–1994), and as an independent consultant (1994–present).

**David W. Snoke** (MS '84, PhD '90), an associate professor in the Department of Physics and Astronomy at the University of Pittsburgh whose current interest is Bose–Einstein condensation of excitons in two and three dimensions, was cited for his pioneering work on the experimental and theoretical understanding of dynamical optical processes in semiconductor systems.

Each year, no more than one-half of one percent of the then-current membership of the Society is recognized by their peers for election to the status of Fellow. Each new Fellow is elected after careful and competitive review and recommendation by a fellowship committee on the unit level, additional review by the APS Fellowship Committee, and final approval by the full APS Council. Fellowship is therefore a distinct honor signifying recognition by one's professional peers. We congratulate all our Fellows on achieving this major career milestone.

## A legacy of achievement

After 28 years on the Physics faculty, Enrico Gratton retired in 2006. With William Mantulin, Gratton established at Illinois the first national facility dedicated to fluorescence spectroscopy, the Laboratory for Fluorescence Dynamics (LFD). The LFD, supported by the National Center for



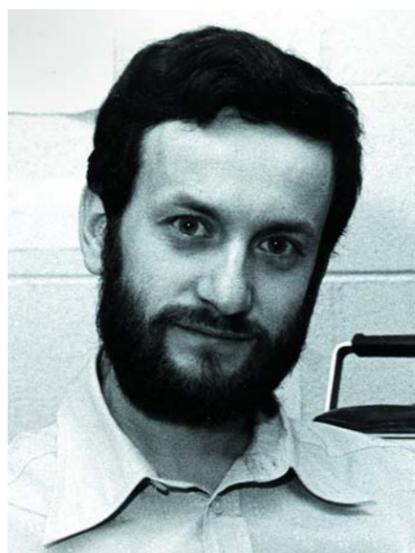
articles. He was the thesis adviser of 33 doctoral students and supervised 26 postdoctoral researchers and numerous visiting scientists at the LFD.

Recently, Gratton developed a non-invasive diagnostic tool to study changes occurring at the surface of the brain.

The technique behind the tool is based upon near-infrared spectroscopy and is less expensive than other methods, such as functional magnetic resonance imaging and positron emission tomography. Gratton explained how the technique works. "Whenever a region of the brain is activated—directing movement in a finger, for example—that part of the brain uses more oxygen," he said. "Our technique works by measuring the blood flow and oxygen consumption in the brain."

Most recently, this technology has been used to study brain oxygenation and hemodynamic changes in individuals with obstructive sleep apnea syndrome (OSAS). For the first time, physicians and researchers gained information on how the brain's vascular system responds to diminished oxygen supply during apnea episodes.

"Through our current research, we verified that we indeed 'see' the brain," said physician and physiologist Antonios Michalos, a staff scientist at the LFD. Other recent research efforts include the use of frequency-domain methods to obtain near-infrared optical images of thick tissues, single-molecule studies of protein dynamics, and the development of optical monitors to detect vascular insufficiency in peripheral tissues. Friends and colleagues worldwide celebrated Gratton's legacy of such discoveries with a retirement symposium—which coincided with his 60th birthday—on May 20, 2006.



Enrico Gratton as a brand new assistant professor, 1978

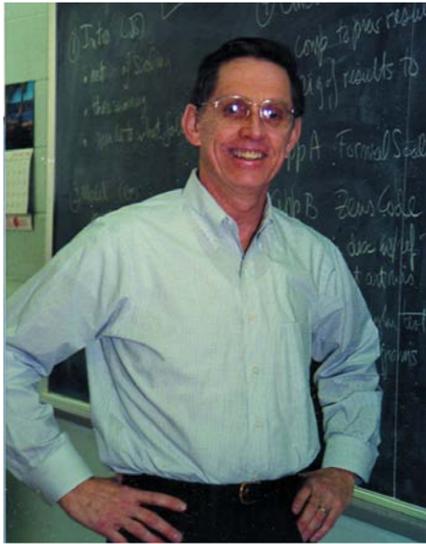
"It was clear that I am not alone in my admiration and respect for Professor Gratton," said Julie Wright, who worked with him for 20 years. "His friends and colleagues eagerly took time from their busy schedules and came from as far as Denmark, Italy, and Germany to celebrate his career."

After his retirement from Illinois, Gratton moved to the University of California, Irvine, where he is a professor in the Department of Biomedical Engineering. The LFD has also moved to UCI.

# It's all in the timing

## A look at Jeremiah Sullivan's 39-year career

BY CYNDI PACELEY



Jeremiah Sullivan in 1992

Jeremiah Sullivan is certain of two facts concerning his academic career: the timing was one of the most exciting periods for the field of physics and the University of Illinois was the best place to spend those 39 years, the last 6 of which he served as department head before retiring in July 2006.

After receiving his PhD from Princeton University in 1964, Sullivan spent three years as a research associate in the theoretical physics group at the Stanford Linear Accelerator Center (SLAC). In his third year, the lab became operational and began producing ground-breaking results.

### High-energy theory

SLAC's success paved the way for future complementary experiments at a higher-energy accelerator to be built in Illinois. Sullivan knew that the decision to site the laboratory—later named the Fermi National Accelerator Laboratory (Fermilab)—in Illinois would provide great possibilities for the state and its universities.

"I saw that the new laboratory would be the next place where exciting discoveries would be made in my area of physics," Sullivan said.

The potential for major discoveries in particle physics led many universities across the nation to expand their faculty numbers in high-energy physics. That was good news for a promising new PhD. Sullivan was recruited by both Illinois and the University of California, San Diego, but chose Illinois and "never doubted" that he had made the right decision.

"When I first visited Illinois, I sensed a warmth of spirit here—often referred to as the 'Urbana spirit'."

Sullivan commented. "All of us are proud of that collegial atmosphere, which goes back to the era of Wheeler Loomis, and each subsequent generation has been careful to preserve it."

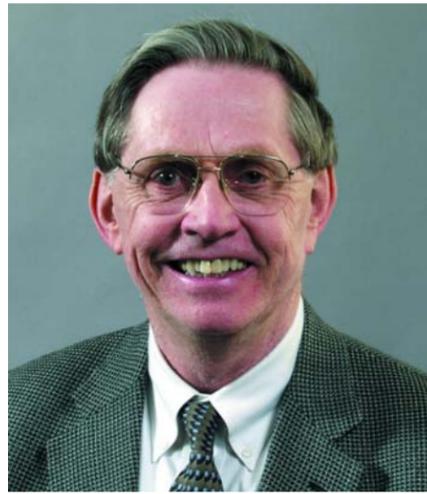
Sullivan advanced rapidly. From his start as an assistant professor in 1967, he was promoted to associate professor two years later and attained the rank of full professor in 1973. In those early years of his career, Sullivan made significant contributions to particle physics, particularly to electromagnetic interactions and to hadron-hadron processes at high energy.

### A change of direction

In 1974, he began what ultimately developed into his major research direction when he accepted an invitation to become a member of JASON, a group of experts who provide technical analyses to the United States government on scientific issues relevant to national security. He became increasingly interested in arms control and nuclear nonproliferation.

In part, his participation in JASON prompted faculty members involved with the Illinois Program in Arms Control, Disarmament, and International Security (ACDIS) to name Sullivan as the first paid, part-time director in 1986. Established in 1978, the program brought together a core group of faculty, as well as associates, affiliates, and students from more than 20 disciplines, in pursuit of progressive and relevant academic research in international security.

Sullivan's directorship of ACDIS strengthened his commitment to other roles in the evolution of U.S. defense policy. Through his work with a number of important studies and reviews, he became known for his significant contributions to the technology of peace over the course of 20 years. The campus-wide experience of being ACDIS director was, he feels, one of the best preparations he had for



his later role in leading the Department of Physics.

"Working with an interdisciplinary framework was a great experience," Sullivan explained. "With representation in ACDIS from political science, geography, history, engineering, mathematics, philosophy, and numerous other fields, we contributed to sound, interdisciplinary perspectives on important issues of peace and security."

In 2001, he was selected by the Secretary of Energy to lead the Nuclear Nonproliferation Subcommittee of the U.S. National Nuclear Security Administration Advisory Committee. In addition, he received a four-year appointment to the Advisory Panel of the security-related Civil Science and Technology Sub-Programme of the NATO Science Committee.

His detailed calculations of shock wave profiles from underground nuclear tests—a collaboration with Professor Fred Lamb, his Physics colleague at Illinois—along with studies of technologies for enhancing the effectiveness of peace operations, comprehensive nuclear test ban issues, science-based stockpile stewardship, technology and policy of ballistic missile defenses, arms control verification, military and civilian uses of space, and science and public policy were recognized with the Leo Szilard Award from the American Physical Society in 2000.

### At the helm

Named interim head of Physics in March 2000, Sullivan became head in March 2001. At the outset, he was involved in remodeling the five floors of Physics space in the Engineering Sciences Building, which enabled the relocation of the condensed matter theory faculty, together with their

postdocs and students, and of all of the upper-level teaching laboratories. Completing the two-year project freed up much-needed office and research space in Loomis to accommodate the hiring of additional faculty members.

Following the trends of the field and the needs of the department, Sullivan oversaw the addition of professors in astrophysics, condensed matter and nanoscience, optical physics, biological physics, high-energy physics, and nuclear physics, as well as in physics education research.

"I'm proud to have increased the diversity of our faculty as well," he added. "Now, 7 of the 69 full-time faculty members are women."

Another positive change was the addition of a departmental information technology administrator, for whom Sullivan secured partial funding from the College of Engineering.

"The IT sophistication of the department is state-of-the-art on the U of I campus and also stacks up well among departments nationwide," Sullivan said.

### Retirement plans

Now Sullivan and his wife, Sheila, are looking forward to spending more time with their son, daughter, and granddaughter, as well as to their first retirement travel adventure—a much-anticipated trip to New Zealand.

His career-long commitment to the Department of Physics, the University of Illinois and to arms control work remains his focus for the coming years. Through connections with his former colleagues at ACDIS and elsewhere, Sullivan is still working to influence the future—giving talks in U of I classes, presenting information to students and faculty at other universities around the country, and working with government and non-government agencies.

He points to recent renewed interest in the ultimate goal of the global elimination of nuclear weapons, a vision endorsed by President Ronald Reagan and Soviet General Secretary Mikhail Gorbachev at their historic 1986 Reykjavik Summit. In an early January 2007 *Wall Street Journal* op-ed, George Schultz, William Perry, Henry Kissinger, and Sam Nunn called for urgent new action to be taken toward fulfilling the Reykjavik vision. In a late January 2007 *WSJ* op-ed, Gorbachev added his full endorsement.

"The growing spread of nuclear weapons poses a threat to all and new initiatives are badly needed," Sullivan said.



Marion Evans and Jeremiah Sullivan setting up a demonstration for Physics 108.

## Department News



### Julie Wright experiences the rewards of retirement

After 20 years in a variety of capacities with the Department of Physics, Julie Wright retired in October 2006. Wright spent most of her 20 years working with Enrico Gratton and William Mantulin in the Laboratory for Fluorescence Dynamics (LFD). Wright joined the LFD in 1986, one month after it was founded.

"I've enjoyed working for Physics," Wright said. "It's a good department that really tries to accommodate its staff."

Prior to coming to Physics, she worked for the Office of University Audits and for the Atmospheric Sciences Section of the Illinois State Water Survey. Her first campus position was with the Department of Agronomy.

Wright points to the advances in computer technology as the biggest change during her entire 40-year working career. She's experienced the progression first-hand, starting with her first job as a keypunch operator for Zenith Corporation.

"While working at the Illinois State Water Survey, we procured one of the first word processing machines—a Wang system that was the size of a desk and recorded on cassette tapes," Wright said. "At University Audits, I used an IBM 'recording typewriter' and then moved up to a DOS-based personal computer. When I came to Physics, I became familiar with the Macintosh computer, along with D-Base III and programs for preparing manuscripts. The World Wide Web, as it was known then, was just coming over the horizon."

A native of Paris, Illinois, Wright now lives near Villa Grove, nearer her son and daughter and their families. In her free time, she enjoys reading, scrap booking, and crocheting. She is also very involved in activities at her church.

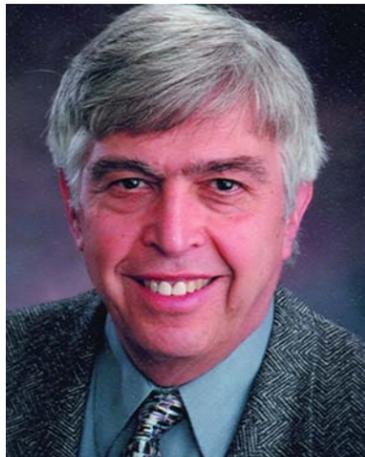
And, at least for a little longer, Wright is still on the University of Illinois campus, serving as an administrative assistant with the Howard Hughes Medical Institute, working part-time for Physics Professor Taekjip Ha, an HHMI investigator.

## Salamon named dean at UT Dallas

Myron B. Salamon, former professor of physics and associate dean of the College of Engineering at the University of Illinois at Urbana-Champaign, became dean of the School of Natural Sciences and Mathematics (NS&M) at The University of Texas at Dallas (UTD) on October 15, 2006. Salamon also holds a newly endowed distinguished chair position in physics.

"I was attracted to UTD by its drive to become a major public research university and, in particular, by NS&M's pivotal role in achieving that goal," Salamon said. "My aim is to make the school a model for 21st-century academic research and education. It will draw strength from traditional disciplines, but will attack scientific and technological problems and the training of young scientists from an integrated, cross-disciplinary perspective."

"We are delighted to have such a highly regarded scientist and administrator as Myron Salamon accept this important academic leadership position at UTD," said university president David E. Daniel. "This is a key hire for UTD as it pursues its goal of joining the ranks of the nation's top research universities."



Daniel and Salamon were colleagues at Illinois, where Daniel served as dean of the College of Engineering before he became the fourth president of UTD on June 1, 2005.

"Having worked closely with Dr. Salamon, I know him to be both an expert researcher and gifted administrator," Daniel said. "In particular, he is a very effective recruiter of academic talent, which will serve NS&M well as it continues to expand its faculty, degree programs, and areas of research. Dr. Salamon is exceptionally well prepared to make a very significant, positive impact at UTD."

Salamon received a bachelor's degree in physics from the Carnegie

Institute of Technology (now Carnegie-Mellon University) and a PhD degree in physics from the University of California, Berkeley. In 1966, he joined the Department of Physics at the University of Illinois. Since 2000, he has been the associate dean and director of the Experiment Station in Illinois' College of Engineering.

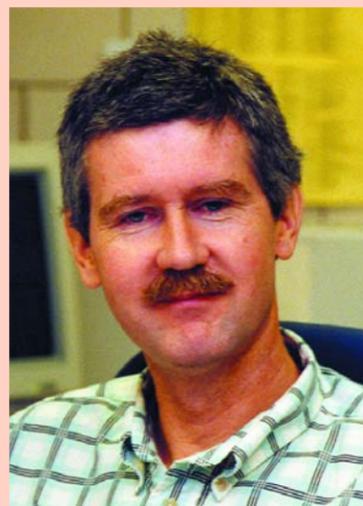
A condensed matter experimentalist, Salamon is noted for his work on phase transitions, superconductivity, and the properties of magnetic materials. Most recently, his research has focused on the magnetic behavior of oxides and nanophase materials and on phase transitions in high-temperature superconductors. He supervised 25 PhD theses while at Illinois.

During 1995/96, Salamon served as a distinguished visiting professor with the Japan Ministry of Education at Tsukuba University, and in 1996 was the Berndt Matthias Scholar at Los Alamos National Laboratory. He received an Alexander von Humboldt Senior Scientist Prize in 1975 and was an A.P. Sloan Foundation Fellow. He is a Fellow of the American Physical Society and a member of the American Association for the Advancement of Science and the Neutron Scattering Society.

## Robinson moves to University College

Ian K. Robinson has left Urbana for the Department of Physics and Astronomy at University College, London, in part to take advantage of research possibilities offered by the new Diamond Light Source (DLS), a synchrotron radiation (SR) facility presently being built at the Rutherford Laboratory near Oxford.

Robinson received his doctorate in biophysics from Harvard in 1981, after receiving an MA in physics from the University of Cambridge in 1976. He was a member of the technical staff at AT&T Bell Labs (Murray Hill, New Jersey) from 1981 to 1992, where he shared responsibility (with P. Fuoss) for the development and implementation of an X-ray surface diffraction beamline at the National Synchrotron Light Source at Brookhaven National Laboratory. He came to the University of Illinois as a professor of physics in 1992. He supervised nine PhD theses while at Illinois.



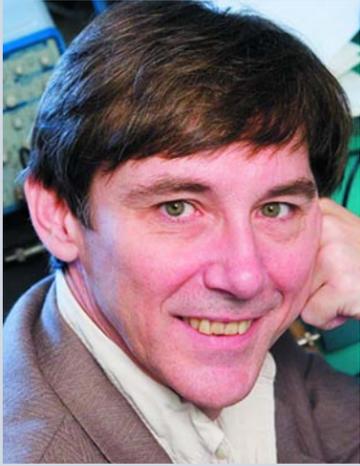
A condensed matter experimentalist, Robinson specializes in X-ray diffraction using synchrotron radiation. During his years at Bell Labs, he developed techniques for studying surface structure using X-ray diffraction. These methods, based on crystal truncation rods, have become the definitive technique for determining atomic positions at

surfaces and interfaces. These surface methods are still used today at the major SR facilities, including the National Synchrotron Light Source (Brookhaven), the European Synchrotron Radiation Facility (Grenoble), the Advanced Photon Source (Argonne) and Synchrotron Radiation Source (Daresbury).

More recently, Robinson has exploited the very high coherence of the latest SR sources to enable direct three-dimensional imaging of structure. Coherent X-ray diffraction methods, which Robinson will further expand at DLS, may be useful for examining strain distributions inside complex materials.

The DLS is the largest UK-funded scientific facility to be built for more than 30 years. It is located in south Oxfordshire on the Harwell Chilton science campus.

## Weaver joins Physics



L. Brian Sauffer

Formerly a professor in the Department of Theoretical and Applied Mechanics at Illinois, Richard Weaver joined the Department of Physics in August 2006.

Weaver's current research on the locking of nonlinear auto-oscillations in an ultrasonic system—called a uaser (pronounced wayzer)—has shown that the oscillations exhibit stimulated emission or absorption, depending on details of their properties, and that they exhibit super-radiance, in that their power output scales with the square of the number of oscillators.

"We anticipate that the systems may be useful for asking questions about the

dynamics of optical lasers," Weaver said. "It is our hope that the ultrasonic analog, with its longer wavelengths and convenient frequencies, should allow experiments not possible on optical lasers."

His theoretical work on the statistics of waves in random and multiply scattering media has applications to mesoscopic electronics, to quantum chaos, to seismology, and to structural acoustics. His experimental work explores the subject using ultrasound in solids. Preprints of selected recent publications on these and other topics

are available on Weaver's faculty page on the Physics website at [www.physics.uiuc.edu/people/WeaverR](http://www.physics.uiuc.edu/people/WeaverR).

Weaver received the Hetényi Award from the Society for Experimental Mechanics in 2004 and was elected a fellow of the Acoustical Society of America in 1996. He was a guest editor for the journal *Ultrasonics* in 1997, 2001, and 2003, and currently serves as associate editor of the *Journal of the Acoustical Society of America*. He received a PhD in astrophysics from Cornell University.

## Wolfe retires



Jim Wolfe as a brand new assistant professor, 1976

James P. Wolfe, who spent his entire faculty career at the University of Illinois, retired in Summer 2006 after 30 years in Urbana. He was a principal investigator in the Frederick Seitz Materials Research Laboratory (MRL), where he concentrated on the physics of excitonic matter and phonons in solids.

Wolfe received his bachelor's and doctoral degrees in physics from the University of California, Berkeley. He remained at Berkeley as an assistant research physicist, and with Carson Jeffries' group, he applied optical and microwave techniques to the newly discovered phenomena of electron-hole droplets in Ge. Using infrared imaging, they took the first photo of an electron-hole droplet. He joined the Department of Physics at Illinois in 1976.

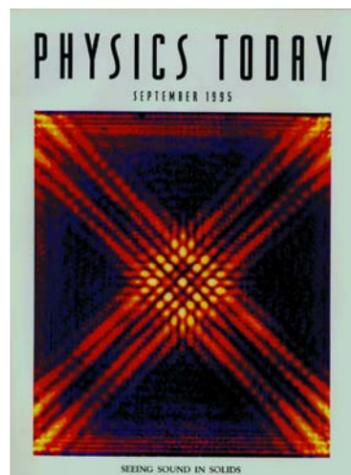
Best known for developing novel imaging techniques to study excitonic matter and phonon propagation at low temperatures, Wolfe's group created time-resolved luminescence imaging techniques to determine the spatial distribution and mobilities of electron-hole droplets and excitons in bulk semiconductors, such as Si, Ge, and  $\text{Cu}_2\text{O}$ . They discovered a Cerenkov-like "sonic barrier" for droplet motion in Si and observed (and explained) extremely high excitonic mobilities in  $\text{Cu}_2\text{O}$ . Their early spectroscopic evidence for Bose-Einstein condensation of excitons in  $\text{Cu}_2\text{O}$  led to extensive studies of this system that now point instead to a

classical gas of excitons in contact with short-lived biexcitons—a sort of excitonic "dark matter" yet to be observed directly.

In the MRL Laser Lab, Wolfe's group combined picosecond laser spectroscopy and micro-imaging to measure the in-plane motion of photoexcited carriers in semiconductor quantum wells. Rapid transport (at near sonic velocities) was found at low temperatures. They also performed photoluminescence experiments on excitons and biexcitons in GaAs quantum wells, observing ideal-gas-like thermodynamics at low densities and evidence for the onset of Bose-Einstein statistics at higher densities.

An amazing offshoot of the group's *exciton* experiments was the invention of a technique for imaging the ballistic propagation of *phonons* at low temperatures. Since its introduction in 1978, "phonon imaging" has contributed graphically and quantitatively to far-reaching topics in phonon physics. Utilizing tiny superconducting detectors and laser-scanned heat sources, phonon imaging has provided graphic insights into the areas of phonon focusing, lattice dynamics, and phonon scattering at interfaces, superlattices, and defects. Phonon imaging techniques were later extended to study *ultrasound* in anisotropic media and to probe the acoustic properties of "phononic lattices."

Most recently, Wolfe's group has observed a highly selective absorption of ballistic phonons caused by quasiparticles (unpaired electrons) in superconducting Pb. They are using this new probe to test Overhauser's hypothesis of an unusual spin-density-wave ground state in Pb.



Phonon imaging of internal diffraction of ultrasound in silicon (Hauser and Wolfe)



The physicist as grandfather—Anne is underwhelmed by maximizing the free energy of the conduction electrons

Wolfe directed multi-investigator projects for the National Science Foundation and the U.S. Department of Energy at the MRL. Between 1999 and 2002, he served as the Physics

associate head for graduate programs, directing graduate student admissions and appointments, which he says was "a terrific opportunity to meet and assist faculty and students in the department." He also served on several high-level campus committees over the years.

A dedicated and gifted teacher, Wolfe developed a textbook entitled "Elements of Thermal Physics" that is used in our introductory thermodynamics course. His research book *Phonon Imaging* (Cambridge University Press, 2005, ISBN-10: 0521620619) has been described by his peers as a "masterpiece" and a "comprehensive and highly readable review" with "spectacular graphics."

He has supervised the theses of 25 doctoral students during the course of his busy and productive career. His advice to young and aspiring professors: "Position yourself for discovery and keep an open mind, because nature is full of wonderful surprises."

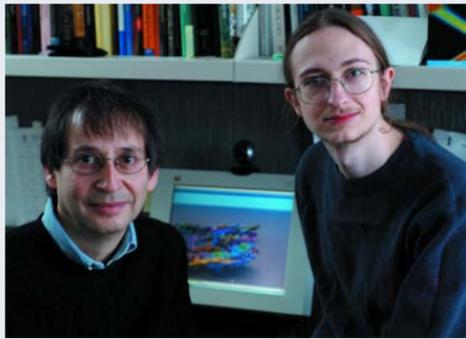
In 2004, Wolfe was awarded the Frank Isakson Prize of the American Physical Society "for contributions to the fundamental understanding of excitonic matter in semiconductors, including its propagation, made possible by pioneering development of imaging techniques that lend graphic insights to electronic and vibrational processes in solids." He has a number of collaborations in the United States and abroad. He received an Alexander von Humboldt Foundation U.S. Senior Scientist Award in 1988 (Munich), and a Japan Society for the Promotion of Science Fellowship in 1991 (Hokkaido). He is a Fellow of the American Physical Society.

While Wolfe is maintaining his research interests, retirement is allowing him and his wife, Kathy, who recently retired from a career in nursing, to spend more time with their coast-to-coast family and enjoy the thrill of grandparenting.

## Student News

### Guttenberg named first Edelheit Fellow

Nicholas Guttenberg, a graduate student in Nigel Goldenfeld's group, has been selected as the first recipient of the L.S. Edelheit Family Biological Physics Fellowship. The focus of Guttenberg's research is evolutionary dynamics; he uses numerical models to understand the consequences of evolutionary mechanisms and the properties exhibited by real evolving systems. He was selected for his demonstrated research ability and his great promise for making substantial contributions to biological physics. "I see physics as a toolbox for science," said Guttenberg.



Nigel Goldenfeld and Nicholas Guttenberg

By developing computer simulations to model evolutionary behavior, Guttenberg hopes to unravel the important behavioral factors observed in biology—diversity of species, complexity in biological systems, and the evolutionary effects of mechanisms such as horizontal gene transfer, mutation, crossover, and homologous recombination—and to learn how to build non-biological systems having biological properties. His thesis topic is exploring how invariance leads to structure in turbulent flows. The same sort of invariance would allow making a model of complexity that did not saturate—an actual mechanism is gene mutation.

Guttenberg has already studied how model biological systems evolve more and more structure and why they never seem to stop evolving at some point. He has discovered some very simple approaches to creating artificial life computationally that can continue to evolve complexity without stopping, and he has begun to analyze and systemize the behavior. These early results indicate that the popular model of a "free energy landscape" may not be a good starting point for evolution studies.

Guttenberg is also working in more mainstream areas of condensed matter theory; he has published results on scaling behavior in the dynamics of Abrikosov vortices in superconductors. His other non-biological research project concerns the attempt to understand the flow behavior of two-dimensional fluids in the turbulent regime.

Goldenfeld refers to Guttenberg's work as "representing an outstanding balance of analytical and computational theory, which, when coupled to Nicholas' inexhaustible curiosity, promises to be an excellent recipe for success in biological physics."

Guttenberg enjoys programming and has written "a bunch of games." He is also an accomplished bread baker.

### Walsh named 2006/07 Hayward Scholarship recipient

Engineering Physics undergraduate T. Patrick Walsh has won one of eight College of Engineering Harold and Ruth Hayward Scholarships for 2006/07. The scholarships are awarded for academic achievement, leadership, service, and initiative.

A senior from Riverside, Illinois, Walsh is a double major in engineering physics and economics. Cited for his involvement in the Illinois chapter of Engineers Without Borders, Walsh spent the summer of 2005 bringing electricity and hope to a village in rural India far from the country's power grid.

His experience in India taught Walsh that the problem of energy production and distribution in the developing world must be addressed much more comprehensively. "I'm now interested, first, in long-term development of technologies that will increase global energy production by orders of magnitude, and second, in short-term development of technologies that will directly benefit the world's poor." He is currently working on a project to design, fabricate, and mass produce small, highly efficient solar panel-charged and battery-operated LED lanterns to replace some of the >1 billion inefficient kerosene lamps now used in the developing world.

"Light emitting diodes—LEDs—have recently become more affordable and more power efficient," explained Walsh. "We seek to create the very first design providing a real, economically sensible alternative to kerosene lighting for a large portion of the people who lack access to electricity."

Walsh's project won a 2006 Phase-I, \$10,000 grant from the U.S. Environmental Protection Agency in what is called the "P3" (People, Prosperity, and the Planet) award program.

The Hayward Scholarships are made possible by a generous bequest from the estates of Harold and Ruth Hayward to the Illinois chapter of the Tau Beta Pi association. "Hap" Howard was a longtime member of the electrical engineering faculty and served as the director of the measurements program in the Engineering Experiment Station at the University of Illinois.



Patrick Walsh comparing the light output of a kerosene lamp with that of his proposed solar-powered LED lantern

Rick Kallers

## Alumni News

### Svazas appointed Fermilab medical director

BY CYNDI PACELEY

Brian Svazas's career proves once again that a physics degree is a flexible and useful tool—however you choose to use it.

As a University of Illinois undergraduate, Svazas completed his pre-med requirements while majoring in physics. He went on to earn a medical degree from Chicago Medical School at Rosalind Franklin University and interned at Hines/Loyola University Medical Center. Ten years later he returned to the U of I—this time at Chicago—to earn a master's degree in public health, concentrating in occupational and environmental health sciences. He also completed his residency at UIC.

Over the last 22 years, Svazas has pursued his interest in occupational medicine in various ways—as principal physician for Lockheed Missiles and Space and in a similar capacity for a Japanese-American auto plant, as a practicing physician for Edward Hospital in Naperville, and as medical director for British Petroleum Company's North American operations. He was also a medical officer in the Navy Reserves for 24 years.

In June 2006, he was named medical director at the Fermi National Accelerator Laboratory. "I commented to the Fermi interview panel that I anticipated coming home to physics, but in retrospect it's only a more formal relationship now because I never stopped using what I learned," Svazas said.

After spending much of his career in a treatment-based role, one of the most exciting opportunities at Fermilab is his interaction with colleagues in a prevention-based capacity.

"Currently, I'm using experience I gained in silicon chip manufacturing to help in some exotic metal work," he said. "I'm included on projects from the design stage, so not only do I get the joy of learning, but also the satisfaction that the human element is thoroughly considered and protected."

#### Hooked on Physics

Svazas found van de Graaff generators and other such experiments "very cool," but credits a gifted high school teacher with cementing his decision to pursue the subject in college.

"Dr. Tchalo—dubbed the Mad Macedonian for his zany teaching style—resembled Wolf Man Jack in appearance and speech, which made him all the more memorable," Svazas said. "He taught that physics is at the root of all science. I decided I couldn't go wrong doing something I liked that was so universally applicable."



Brian Svazas at Fermilab

"The thing I loved most about the subject was that no matter how you approached the problem, the answer came out the same," he added. "That was very reassuring and almost magical. The concept of the elegant solution is like studying the moves of the grand chess masters and is akin to "form following function"—when you provide the function in an efficient manner, you truly have something beautiful."

#### Giving Back

In addition to his depth of professional experience, Svazas offers his expertise to the occupational and environmental medicine field.

In conjunction with his master's degree, he received the Donaldson Award for academic excellence and significant contributions to public health. He also was elected to fellowship in the American College of Occupational and Environmental Medicine and in the Chicago Institute of Medicine.

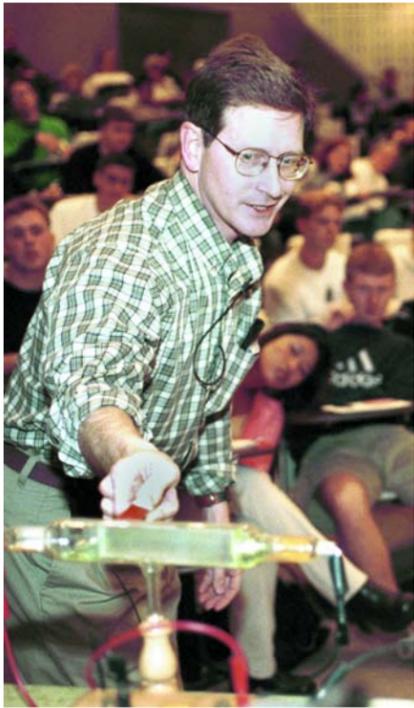
He currently serves as secretary/treasurer on the board of governors for the Central States Occupational Medicine Association, and for 10 years he has been a clinical instructor for DePaul University's nurse practitioner program.

With his new position, Svazas is clearly in an ideal place to continue calling on his love of physics in order to make further contributions to occupational medicine.

"I've always been curious about Fermilab from my undergraduate days when professors and teaching assistants would discuss experiments conducted at the lab," Dr. Svazas said. "Though this is familiar ground in terms of the industrial operations, the lab is constantly evolving, which brings a welcome challenge to learn new things."

R. Hahn, Fermilab Visual Media Services

## Dubson wins AAPT award



Larry Harwood, U. Colorado Boulder

Michael Dubson, University of Colorado at Boulder

Michael Dubson (BS '78), a senior instructor in the physics department at the University of Colorado at Boulder, received the American Association of Physics Teachers' 2006 *Excellence in Undergraduate Physics Teaching Award* earlier this year.

In addition to receiving the award, Dubson delivered a special lecture at the July AAPT national meeting on the school's move from traditional instruction toward methods that more fully engage students. According to Dubson, "Over the last 10 years, the way we teach freshmen and sophomore physics at the University of Colorado at Boulder has evolved away from traditional instruction toward a format full of interactive engagement, concept tests and peer instruction, online homework, Washington Tutorials, interactive computer simulations, and exams that emphasize qualitative reasoning. Student morale has improved, and we have seen dramatic learning gains as measured by standard exams. Our main strategy is the "Zeroth" Golden Rule—Reinvent Nothing. We let our esteemed colleagues at other institutions do the hard work, and then we import their successful techniques."

A member of the Colorado faculty since 1995, Dubson has worked on innovative teaching techniques, curriculum reform, and public outreach. Before that, he spent 10 years in research on superconductivity, metal-insulator transitions, and surface science at The Ohio State University and at Michigan State University. He was trained as a condensed matter experimentalist and received his PhD at Cornell University, where his thesis adviser was Donald Holcomb (MS '50, PhD '54).

Physics faculty member Gary Gladding (BS '65) won the 2005 AAPT *Excellence in Undergraduate Physics Teaching Award*.

## Mitchell receives 2006 COE Distinguished Alumni Award

Joan L. Mitchell (MS '71, PhD '74), a Fellow and Master Inventor at IBM, was honored with a 2006 College of Engineering Alumni Award for Distinguished Service. A member of the National Academy of Engineering, Mitchell is a leading authority on the compression of image data for more efficient processing, storage, and distribution. Facsimile machines, video conferencing, the Internet, digital photography, and printing all reflect her major contributions to industry standards such as G3 and G4, JPEG, and JBIG-1 and JBIG-2.

Immediately after graduate school, Mitchell joined the Exploratory Printing Technologies group at the IBM T.J. Watson Research Center. Since 1976, she has worked in the field of image processing and data compression and is a co-inventor on 68 patents.

Mitchell was a leader of the Joint Photographic Experts Group, the organization that developed JPEG image compression, the first color still-image data compression international standard. She headed the U.S. delegation in 1991–92 and also served as an editor of the standard's documentation—a very important role in ensuring its dissemination and adoption. She has coauthored two popular books—*JPEG: Still Image Data Compression Standard* (Van Nostrand Reinhold, New York, 1993) and *MPEG Video Compression*



Joan L. Mitchell

*Standard* (Springer, New York, 1996)—which give both the professional and the student answers and guidance on these compression standards.

Inside IBM, Mitchell's innovations have resulted in fundamental advances in high-performance compression/decompression hardware and software for a variety of products, from special-

purpose microprocessors to high-quality printers. She has received six IBM Outstanding Innovation Awards for achievements ranging from improved image compression algorithms to the Q-Coder. She was elected to the IBM Academy of Technology in 1997 and named an IBM Fellow in 2001, the highest distinction that the company awards to its employees. Mitchell is a Fellow of the Institute of Electrical and Electronic Engineers and was elected to the National Academy of Engineering in 2004.

Mitchell has remained connected to Illinois, spending a sabbatical semester in 1996 as a visiting professor in the Department of Electrical and Computer Engineering and as a visiting scientist at the Beckman Institute for Advanced Science and Technology. In February 2005 and April 2006, she returned to campus to share career advice with the Society of Women Engineers, physics women graduate students, and undergraduate students in physics and electrical and computer engineering.

## Scott Anderson, 1913–2006



Scott Anderson (right) presents the 1987 Outstanding Physics Teaching Assistant Award to Alain Kaloyeros

Scott Anderson (MS '36, PhD '40) died on October 1, 2006, in Urbana. He was 93. A strong supporter of the Department of Physics, Anderson served as the first president of the Physics Alumni Association and spearheaded the creation and endowment of the graduate-student teaching award that bears his name.

Anderson was the founder of Anderson Physics Laboratory (APL), the predecessor of APL Engineered Materials, Inc., of Urbana, which is the world's leading provider of metal halides and amalgams for the lighting industry. He started APL in 1944 to provide industry with the services of a physics laboratory for sponsored research.

There he developed techniques for the ultra-purification and controlled sizing of metal halides and mercury alloys. This work proved to be of great utility for the lighting industry and is largely responsible for the success of the metal halide lamp industry.

Prior to founding APL, Anderson was the first physicist to be hired by the Aluminum Corporation of America (later ALCOA) of New Kensington, Pennsylvania, and he taught physics briefly at Carleton College in Northfield, Minnesota. He worked in the Manhattan Project's metallurgy laboratory at the University of Chicago during World War II.

A founding member of the Urban League of Champaign County, Anderson and his wife Annabelle created Project Goodstart, a morning meal program for disadvantaged school children. He and Annabelle, who died in 2001, were also instrumental in founding New Beginnings, a faith-based effort to assist felons to successfully reenter society upon their release from prison.

Anderson was the holder of 11 U.S. patents, and APL materials dominate the global market. In 2004, James L. Schoolenberg, president and chief executive officer of the company, stated "Eighty-five percent of the metal halide lamps in the world use our materials."

If you walk down a street at night anywhere in the world and can see where you're going, thank Scott Anderson.

## Arnold earns scholarship to study abroad

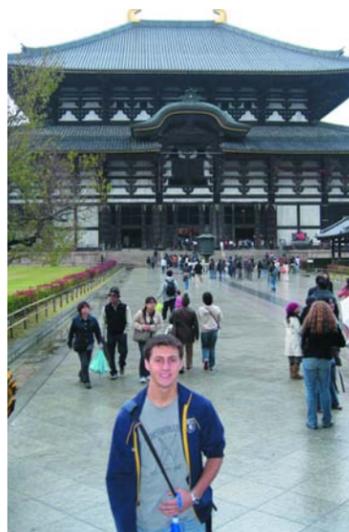
Kyle J. Arnold (BS '06) was one of four students at the University of Illinois at Urbana-Champaign to be awarded a National Security Education Program (NSEP) Boren Undergraduate Scholarship for study abroad during the 2006/07 academic year. He is the only Illinois scholarship recipient in the sciences; the other three students majored in international studies.

Arnold, who earned dual degrees in engineering physics and mathematics, is spending the year at Konan University in Japan. He took three Japanese language courses at Illinois, in addition to his other coursework.

According to David Schug, program director of the campus's Scholarships for International Study Office, Illinois has been among the national leaders in numbers of recipients for Boren Undergraduate Scholarships. "This year will match the most students we have ever sent abroad under this grant," Schug said. "It is a testament to the strong study-abroad programs and international emphasis at Illinois."

The merit-based scholarships provide undergraduates who are U.S. citizens the opportunity to study in Asia, Africa, Central and Eastern Europe, Latin America, and the Middle East. Arnold is one of 141 recipients from a national applicant pool of 720 undergraduates. Scholarship recipients are required to seek employment with the federal government in the Department of State, the Department of Homeland Security, the Department of Defense, or the national intelligence community, generally within three years of graduation. They also receive priority-hiring status from these agencies.

While at Illinois, Arnold did independent research in Paul Kwiat's quantum information group, where he worked on developing low-loss optical switching and storage for a single-photon source for parametric down conversion. His ultimate career goal is to earn a PhD in physics and carry out research in quantum information and quantum computing, which are applicable to cryptography.



Kyle Arnold visiting the Tōdai-ji ("Great Eastern") Temple, Kyoto



## Backward Glance

Four graduate teaching assistants in the Department of Physics competed in 1978 in the then-newly revived GE College Bowl. Their team, *The Coulomb Gauge*, swept all six local matches to become the University of Illinois' representative in the regional meet, which was held at Southern Illinois University in Edwardsville. The team was undefeated in that tournament as well, earning the right to compete nationally at the College Bowl finals in Miami Beach, Florida. Team members, shown above, were Greg DeWitt (MS '78), John Gardner (MS '78, PhD '80), Paul Schoessow (MS '79, PhD '83), and Marty Brophy (MS '78, PhD '85).

### PHYSICS ILLINOIS NEWS

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#### 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.

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*...not a place, a habit of mind...*

