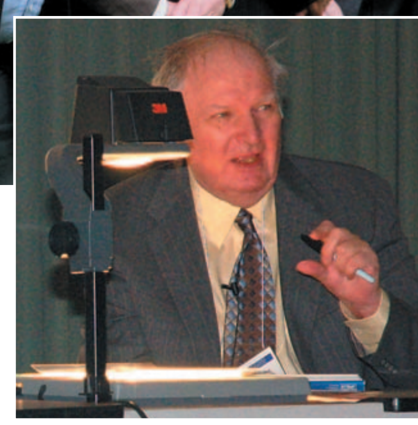
# Physics Illinois News

THE DEPARTMENT OF PHYSICS AT THE UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN • 2008 NUMBER 1


## BCS@50

Mao-Chuang Yeh



James P. Wolfe

*Above: Superconductivity pioneers at BCS@50—Dale Van Harlingen, Lev Gor'kov, Charles Slichter, David Pines, Leon Cooper, Marvin Cohen, Michael Tinkham*

*Right: J. Robert Schrieffer (PhD '57)*

It's been hailed as one of the greatest discoveries in theoretical physics in the 20th century—a theory that has provided essential insight into scores of physics problems, from the structure of atomic nuclei to the cores of neutron stars. And to commemorate this remarkable intellectual achievement by its own John Bardeen, Leon Cooper, and J. Robert Schrieffer (PhD '57), the Department of Physics did what it always does—it threw a party and *everybody* came.

Published in December 1957, the Bardeen–Cooper–Schrieffer (BCS) theory of superconductivity provided the first analytical solution to the 46-year-old mystery of superconductivity —a problem that stumped all the other greats of 20th-century physics. To celebrate the theory's golden anniversary, scientists from around the world converged on the University of Illinois in October for four days devoted to superconductivity—"ancient and modern," to use Tony Leggett's phrase. The conference featured talks by nine Nobel laureates in physics, including Leon Cooper and Bob Schrieffer.

Charlie Slichter, whose experiments had laid some of the groundwork for the theory, remembered Bardeen's walking up to him in the hall of the old Physics Building one day. "It was clear that John had something he wanted to say to me," Slichter said. But Bardeen wasn't much of a talker, and Slichter had learned not to pre-empt him if he wanted to hear what Bardeen had to say. He waited. "It seemed like we stood there looking at one another for 5 minutes," Slichter said. Finally, Bardeen let it out: "Charlie, I think we've solved superconductivity."

"I thought, WOW!" Slichter said. "It was one of the most exciting moments in science that I've ever experienced."

"It's 50 years later, and BCS still stands as a singular contribution to theoretical physics," said Philip Phillips, professor of physics and the chair of the conference organizing committee. "It's a one-of-a-kind theory with an impact on essentially all areas of physics. Indeed, part of the beauty of BCS, apart from its seeming simplicity, is its true generality."

Phillips recounted how the idea for a conference to celebrate BCS came about. "One day in the fall of 2004, Tony Leggett came to my office in state of great excitement and exclaimed, 'Philip, in three years it will be 2007!' I replied, mystified, 'Yes, Tony…and in four years, it will be 2008.' Tony waited expectantly for me to grasp the significance of 2007. I never did, so my punishment was to organize this conference."

Each day of the conference explored different aspects of superconductivity. The first day focused on the history and people behind the BCS theory. Charlie Slichter, David Pines, Leon Cooper, and Bob Schrieffer shared personal reminiscences about those heady times in Urbana, and Michael Tinkham, Ivar Giaever, Yoichiro Nambu, and Philip Anderson provided their unique insights. Lev Gor'kov spoke about the impact of BCS in the late 1950s and early 1960s in Russia.

David Pines described the Bardeen bottom-up, experiment-based approach to theoretical physics, of which BCS was a perfect example:

- Focus first on the experimental results via reading and personal contact
- Develop a phenomenological description that ties different experimental results together
- Explore alternative physical pictures and mathematical descriptions without becoming wedded to any particular one
- Thermodynamic and other macroscopic arguments have precedence over microscopic calculations
- Focus on physical understanding, not mathematical elegance, and use the simplest possible mathematical description
- Keep up with new developments in theoretical techniques—for one of these may prove useful
- Decide on a model Hamiltonian or wave function as the penultimate, not the first, step toward a solution
- Choose the right collaborators
- DON'T GIVE UP: Stay with the problem until it is solved

Current trends in superconductivity, including high-$T_c$ superconductors, were featured on the second day. A high point was the wide-ranging theory roundtable

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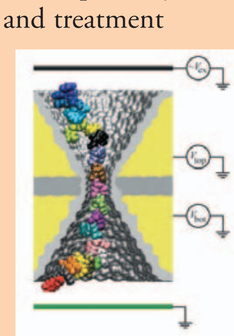
## Bio meets nano at Physics Illinois

L. Brian Stauffer

Using computer simulations, researchers at the University of Illinois have demonstrated a strategy for sequencing DNA by driving the molecule back and forth through a nanopore capacitor in a semiconductor chip. The technique could lead to a device that would read human genomes quickly and affordably.

Being able to sequence a human genome for $1,000 or less could open a new era in personal medicine, making it possible to precisely diagnose the cause of many diseases and tailor drugs and treatment procedures to the genetic make-up of an individual.



"Despite the tremendous interest in using nanopores for sequencing DNA, it was unclear how, exactly, nanopores could be used to read the DNA sequence," said Assistant Professor of Physics Aleksei Aksimentiev. "We now describe one such method." (G. Sigalov, J. Comer, G. Timp, and A. Aksimentiev, "Detection of DNA Sequences Using an Alternating Electric Field in a Nanopore Capacitor," *Nano Lett.* **8**, 56–63 [2008])

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## Bardeen stamp unveiled




On March 6, 2008, the Department of Physics hosted the Urbana Postmaster, Kathleen J. Burr, regional U.S. Postal Service officials, University administrators, and family and friends of John Bardeen at a special unveiling ceremony for the 2008 U.S. postage stamp commemorating his achievements. One of four American scientists being honored this year, Bardeen was recognized for his co-invention of the transistor and his contribution to the first fundamental explanation of superconductivity. (The other scientists being recognized are biochemist Gerty Cori, chemist Linus Pauling, and astronomer Edwin Hubble.)

"We are absolutely delighted to see John Bardeen remembered in this way," said Department Head Dale J. Van Harlingen. "It is particularly timely that he is being honored this year; May 23, 2008, will mark the centennial of his birth. We are very pleased that the Urbana postmaster chose to have the ceremony here in Loomis, where Professor Bardeen studied and taught for 30 years."

In honor of the event, the Champaign-Urbana Stamp Club has created a first-day cover, incorporating a cachet featuring drawings of Bardeen and of Loomis Laboratory and bearing the stamp and a special first-day Urbana cancel. If you would like to obtain one of the first-day covers, write to Celia Elliott at cmelliot@uiuc.edu. ■

## Message from the Head

This year the Department of Physics and the entire physics community celebrated the 50th Anniversary of the BCS Theory—the remarkable microscopic theory of superconductivity developed by John Bardeen, his postdoc Leon Cooper, and his graduate student Robert Schrieffer at the University of Illinois in 1957. This work is arguably the single most important scholarly achievement to ever come out of the Department and the University and earned the authors the 1975 Nobel Prize in Physics. To mark this occasion, we hosted BCS@50, an international conference in Urbana in October. It was truly a memorable event, with more than 250 attendees, including 9 Nobel Laureates. We are most grateful to Philip Phillips for organizing this meeting and investing his energy, passion, and vision into making it an unforgettable success. Besides being inspirational and fun, BCS@50 reminded us all of how fortunate we are to be associated with such a great Physics department and how grateful we are to our predecessors who established our legacy of excellence. Many people said very nice things about the Department of Physics at this event—we should all be very proud and appreciative and inspired to preserve and enhance the Urbana tradition that BCS represents.

As I move through my second year as head of the department, I continue to be motivated by the talents and ideas of my colleagues and the enthusiasm and desire of our students to learn and grow. I also must admit that despite a whole year of experience under my belt, I am finding this year to be rather more of a challenge. I suppose the first year I just continued things the way they were done before—now I am examining more closely how we can maintain and enhance the quality of the department while we deal with the serious financial realities that face the department and the University. We are in a time of unbounded ideas and energy but limited resources. Strategic planning has inspired us to think outside the box to generate innovative plans and creative visions, but the box is presently short of the means to implement all of them. The bottom line is that we are facing tough choices in deciding what to do and what to invest in, and even tougher decisions on what we can no longer continue to do as we move forward. It is a difficult time for our economy at all levels but there is good news ahead, an upcoming national election that will give us an opportunity to move in a new and more productive and compassionate direction and a campus administration at the Dean, Provost, and Chancellor levels that is firmly committed to engaging the faculty and department administrators in following the best path for sustaining and advancing the stature of our great University.

Despite the limitations set by the budget, it has been a very good year so far for the Department of Physics and the University of Illinois. Three faculty were promoted for the 2007/08 academic year, Naomi Makins and Taekjip Ha to professor of physics, and Matthias Grosse Perdekamp to associate professor of physics with indefinite tenure. Nigel Goldenfeld has been appointed a Swanlund Endowed Chair, the most prestigious endowed position on campus, with the formal investiture ceremony scheduled for March. Joint Physics and Astronomy Professor Charles Gammie has been named a University Scholar, one of the highest honors granted by the University of Illinois. Two faculty members have received recognition from the American Physical Society, Russ Giannetta elected as a Fellow and Gordon Baym awarded the prestigious Lars Onsager Prize for Statistical Physics, along with former Illinois Professor Chris Pethick. The campus has also received notable recognition in the form of research support, with UI partnering with UC Berkeley on a $500M grant from British Petroleum to develop biofuel production and winning the $200M National Science Foundation competition to build Blue Waters, the next generation petaflop supercomputer, on the Urbana-Champaign campus. Physics researchers were instrumental in attracting both of these projects and will be key players in their execution.

The department also continues to grow our research program and start new initiatives, striving always to be a major force and leader in science research and education.

This year we welcome two remarkable young faculty members at the assistant professor level to the department. Mark Neubauer joins the Experimental High Energy group from Fermilab—he will focus on projects designed to search for the elusive Higgs boson and the sources of dark energy and dark matter at the Large Hadron Collider, the world's highest energy particle accelerator, which will be turning on at CERN in Switzerland in the next year. Benjamin Lev is an experimentalist in atomic, molecular, and optical (AMO) physics and arrived in January from NIST Boulder to set up a program in ultracold atomic and molecular physics, quantum optics, and quantum information science. We have also had two departures—Richard Martin, a computational condensed matter physicist who is retiring to spend time with his grandchildren in California, and Thomas Junk, taking a research position at Fermilab.

This year also marks the launching of an exciting new venture in the department, the Institute for Condensed Matter Physics (ICMT). This center, made up of theory faculty from Physics and many other departments in the Colleges of Engineering and Liberal Arts and Sciences, will focus on cutting-edge research in condensed matter physics and its intersections with other disciplines. ICMT will organize rapid-response workshops on key issues, sponsor visitors in theory and experiment, support postdoctoral researchers and graduate research students, and serve as center-piece for interdisciplinary theory research on campus. We are currently remodeling the 3rd floor of the Engineering Sciences Building to house the ICMT, with occupation scheduled for Summer 2008. We are pleased that Paul Goldbart has agreed to serve as the first director of the center, with Tony Leggett as the chief scientist.

Another project underway is to modernize the student-staff machine shop housed in the adjacent Materials Research Laboratory. In a joint venture with MRL, Physics is investing in new equipment for the shop and a new machinist to train students and help research groups with design projects. The ability to make custom parts for innovative instrumentation is crucial for our experimental efforts all areas, particularly condensed matter and atomic/molecular/optical physics. I consider it a high priority of the department to maintain the high level of technical infrastructure that has helped to make our research program productive and vibrant.

When I became head a year ago, one of my goals was to enhance the depth of the academic experience and the quality of life for students, staff, and faculty. This spring semester, we will open two new student lounges, one for the undergraduate Physics majors and one for the graduate research students, on the second floor of Loomis Laboratory. We hope that these lounges will provide a location for students to meet fellow students, relax, exchange ideas, and keep up-to-date on activities in the department. Our next target is create a faculty staff lounge in space being freed up as the library transitions to a more electronic resource and back volumes of journals, now available online, are archived.

All of these projects require resources, and we are warmly appreciative of the interest and financial support that is generously given by our Physics alumni and friends. One of our objectives is to maintain contact with our extraordinary alumni and make them feel a part of the Physics family and the legacy they helped to build. As you read this newsletter, I invite you to remember your Illinois experience and celebrate with us in how the Department of Physics has evolved and remains a leader in fundamental and applied physics research and education. ■

Dale J. Van Harlingen

## Bio meets nano at Physics Illinois

*(continued from page 1)*

"Through molecular dynamics simulations, we demonstrate that back-and-forth motion of a DNA molecule in a nanopore capacitor 1 nm in diameter produces an electrostatic fingerprint that can be used to read the genetic sequence," said Aksimentiev, who also is a researcher at the Beckman Institute.

In the researchers' simulations, performed at the university's National Center for Supercomputing Applications, the nanopore capacitor consists of two conducting layers of doped silicon, separated by an insulating layer of silicon dioxide.

As DNA passes through the nanopore, the molecule's electric field induces sequence-specific electrostatic potentials that can be detected at the top and bottom layers of the capacitor membrane.

A semiconductor device capable of reading the electrostatic potentials and decoding the genetic sequence is within the grasp of current technology, Aksimentiev said. "Nanometer pores in electronic membranes have been manufactured, and the voltage signals resulting from DNA movement through such pores have been recorded."

The next big challenge, Aksimentiev said, is to minimize noise in the system and reduce the speed of DNA molecules moving through the pore.

Aksimentiev received his PhD in chemistry *cum laude* from the Institute of Physical Chemistry, Warsaw, Poland, in 1999, after completing a master's degree in particle physics at the Ivan Franko Lviv State University in his native Ukraine in 1996. He received postdoctoral training at the Materials Science Laboratory R&D Center of Mitsui Chemicals, Tokyo, Japan, from 1999 to 2001, when he joined the Theoretical and Computational Biophysics Group at the University of Illinois as a postdoctoral research associate. He accepted the position of assistant professor of physics at Illinois in 2005. ■

The work was funded by the National Institutes of Health and the University of Illinois. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the funders.

# So, what did you do with your physics degree?

## Meet alumnus Frank Lederman

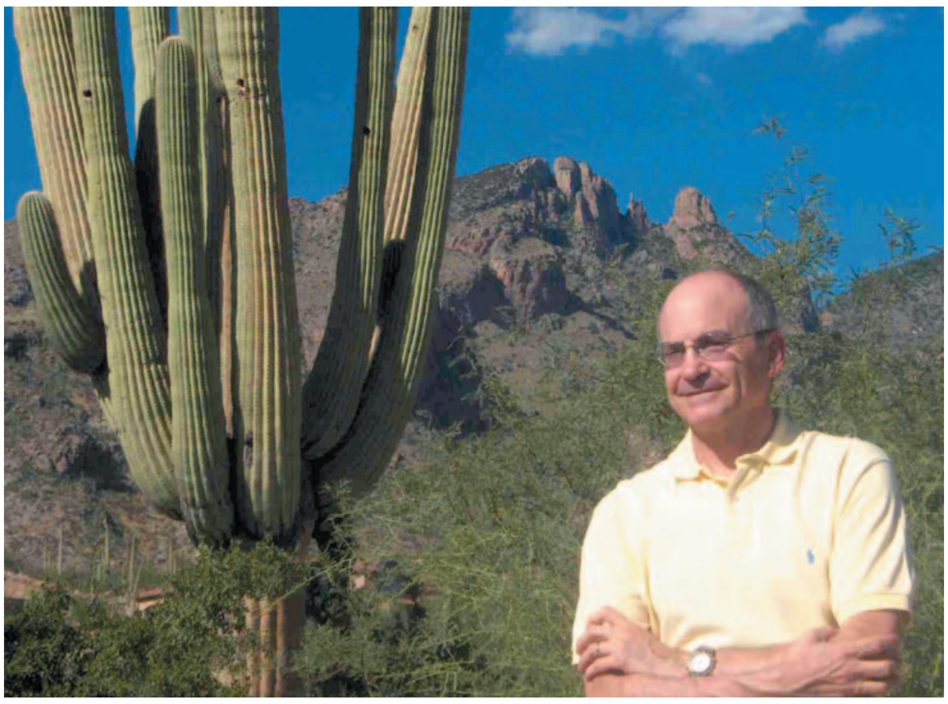
BY JOYCE MAST

Observe, collect data, make decisions, solve problems—and make changes. These physics principles led Frank Lederman into management and guided the former chief technology officer and vice president of Alcoa throughout his more than 30-year career in research management and technology development.

Lederman graduated with a PhD in both theoretical and experimental solid state physics from the University of Illinois in 1975. He liked academia but was intrigued by industry. "The environment I saw was fast-paced and exciting. Many of my interview discussions were interrupted with colleagues' bringing new results of theories. They were working on real-world, practical problems, but with plenty of hard science."

Lederman began his career at General Electric as a physicist, conducting research in different subjects, including ultrasonic imaging; he was one of the designers of GE's first medical ultrasonic system. Within a year, he was given the opportunity to coordinate a large study for the group vice president—Jack Welch. To carry out such a role so fresh out of school was "very unusual," he recalled.

During his 12 years at GE, Lederman observed a frustrated colleague's attempts to lead and decided that management was his calling. He became an excellent leader with a passion for pursuing the best solution for a problem. "It means change, often when others are most resistant to it," Lederman says. "But that's what leaders do; they make changes. I remember one thesis adviser telling me that you can't



change the course of a river by paddling downstream."

General Electric gave Lederman many opportunities to make changes during his 12-year tenure there. He held eight different positions, and was even occasionally tempted by academic physics. While working on the ultrasound projects, he was offered the alternative to collaborate with a medical doctor and write a review article on the science of ultrasound technology or be promoted within the company to a higher management position. He opted for management, even though it took him away from ultrasound, which is now a billion-dollar business for GE.

Lederman left GE in 1988 for Canada-based Noranda, a metallurgy and mining company, where he was senior vice president of technology, and then for Alcoa, the world's leading producer of aluminum and its products, where he served as the vice president and chief technical officer for six years.

As CTO, Lederman secured Alcoa's "technical health." He was responsible for research, development, and engineering at the corporate laboratories and at the business units, which oversaw product lines. His job was to ensure that the technological strategy and technology of the company's products and processes were all running smoothly. This was an ideal job for a physicist, he said, because "Physicists deal with a broad range of technologies, including biotechnology, nanotechnology, metallurgy, etc., so physics is the perfect platform for designing and leading a company's technological strategy."

As a member of Alcoa's executive team, Lederman participated in Alcoa's business decisions, and his physics again came in handy. "A physics background gives you experience in taking big complex problems and breaking them down into bite-size pieces. You need to look at the toughest part of a project first, to see if it can be done. It is systems thinking." Physics also taught him what questions to ask to identify the underlying mechanism driving a particular problem.

Lederman's most satisfying moment as a CTO came when he convinced the CEO and key business managers that they needed to play a larger role in deciding which technologies get pursued and how they are managed. The technologies ranged from the design of alloys for an airplane wing to "enabling technologies" such as the physical chemistry behind production processes.

"We formed a 'virtual technology organization'" Lederman recalled, "I gave up a lot of direct control over people, and I think I was respected for putting the company first, with a structure that is more global for a global company."

Lederman is retired now but is still involved in technology management as a member of the board of directors of Cray Inc. and as an emeritus member of the Industrial Research Institute, which consists of past and present CTOs. He also volunteers his time on several university advisory boards.

For students and colleagues interested in a career in technology management, Lederman suggests, "Get exposure to a lot of different things, and develop a vision for using your unique abilities to follow your passion." On what academic subject should you build a triumphant technology management? "There's no question," he says, "Physics is the right science. I wouldn't pick another." ■

[*Ed.* This article is based on an interview appearing in the April 2007 *APS News*.]

## BCS@50 *(continued from page 1)*

chaired by Philip Phillips; panelists were Philip Anderson, Sudip Chakravarty, Andrey Chubukov, Matthew P.A. Fisher (PhD '86), Steven Kivelson, David Pines, George Sawatzky, Douglas Scalapino, Chandra Varma, and Jan Zaanen.

Unconventional superconductors—and the problems they pose for BCS—were highlighted on the third day. Speakers included Dale Van Harlingen (Josephson interferometry and mapping the pairing state of unconventional superconductors), Joe Thompson (superconductivity in heavy-fermion materials), Andrew Mackenzie (superconductivity and electron correlations in the ruthenates), and Paul Chaikin (organic superconductors). Paul Chu provided a glimpse of the future in "From BCS through HTS to RTS."

The last day of the conference featured the impact of BCS on other areas of physics, including neutron stars (Gordon Baym), nuclear superfluids (Ben Mottelson), superfluid $^3$He (Doug Osheroff and Tony Leggett), the BCS–BEC crossover in cold atoms (Debbie Jin), and BCS quantum Hall states (James Eisenstein). More than 250 physicists and students took part in the celebration. ■

Mao-Chuang Yeh

James P. Wolfe

*Left: Leon Cooper*
*Above: Myron Salamon and Miles Klein*

# The sports television revolution

BY RICK KUBETZ

It used to be that you "couldn't tell the players without a scorecard."

These days, watching sports on television is often a better experience than being there. Now, high-definition, big screen TVs, knowledgeable commentators, and a host of special effects bring you into the game as viewer, scorekeeper, and sometimes the athlete's wingman.

One of the people responsible for this on-screen revolution is alumnus Marvin White (BS '69), chief technology officer of Sportvision, the premier global provider of enhancements for sports television. An expert in the development of mapping technology, White has been with Sportvision since its inception, where he has led the development of numerous broadcast enhancement systems, including the two-time Emmy-winning virtual yellow 1st and Ten Line™, the Emmy-winning KZone™ virtual strike zone, and the Virtual Caddy™ golf enhancement system.

*Sportvision*

"I majored in physics, so naturally, that background was helpful in modeling flight of baseballs, footballs, etc., as well as many other projects we have undertaken," White said. "The mathematics I learned at Illinois has been at least as helpful in my career as physics. Indeed, it is hard for me to think of any course, from English to differential equations to German, that hasn't been helpful."

Ironically, it wasn't his alumni status that brought him back in touch with his alma mater. It was Alan Nathan's studies on the physics of baseball that completed the connection.

"I had been carrying on a correspondence with Bob Adair (professor emeritus of physics at Yale and the author of the book, *Physics of Baseball*) about our pitch tracking, and I believe he mentioned our work to Alan (Nathan)," White explained.

A medium-energy/nuclear experimentalist, Nathan has combined his scientific expertise with a lifelong passion for baseball—particularly as practiced by the Boston Red Sox—to explore the physical forces that make America's favorite pastime so interesting.

"If you can track the pitch, you can study the forces on the ball as it travels through the air," said Nathan, who was on hand in August 2006, when Sportvision installed its equipment at U.S. Cellular Field, home of the Chicago White Sox.

"The company isn't necessarily interested in what I'm interested in, but they have been very open with me about how they do the tracking and they have provided data," Nathan remarked. "This is pretty precise stuff that they do. Now that I have geared up to do the analysis of what they send me, we'll be able to pin down these aerodynamic forces.

"What they do is use video cameras to track the ball from the pitcher to home plate, which they enhance with graphics to show you on the screen," Nathan added. "They send me the actual trajectory data, which I use to determine the drag and lift forces."

"Professor Adair's insights definitely changed how we were tracking pitches," White explained. "In particular, we replaced our original K-Zone system, which focused on the near vicinity of home plate, with PITCHf/x that tracks the pitch from release to home plate. This gave us the ability to compute break and other pitch characteristics. (*Ed. note:* Nathan recently used the PITCHf/x data to calculate the trajectory of Barry Bonds' record-breaking 756th career home run—see http://webusers.npl.uiuc.edu/~a-nathan/pob/bonds/b756.html.)

"The mathematics I learned at Illinois has been at least as helpful in my career as physics. Indeed, it is hard for me to think of any course, from English to differential equations to German, that hasn't been helpful."

"We had already made that change by the time I met Alan and have not made significant changes in our algorithms since. However, I expect we will make changes as we learn more about atmospheric drag in working with him. He indicated that he sees more information in the tracking data that will permit us to improve our constant acceleration model with one that more accurately estimates drag over the course of the trajectory. We just have to find time to do that work."

Located in Mountain View, California, Sportvision is an independent provider of television viewing enhancements to a number of different sports broadcasts—from the NFL and college football, to the NBA, NASCAR, NHL, and Major League Baseball. Just as the virtual yellow 1st and Ten Line™ provides the football viewer with a better feel for the game, Sportvision features allow for better storytelling, stronger messaging, and new advertising within the program content.


*Sportvision*

*Sportvision's Emmy Award-winning virtual first-down line—a high-tech entertainment technology that has changed the game for armchair quarterbacks*

Today, Sportvision's digital tracking technology creates digital records enabling new content across many sports, better broadcasts, and new subscription content. According to the company, these products help the viewer "see the invisible" and understand the game better. For example, Sportvision's Virtual Caddy system enables TV golf analysts to "draw" directly on the green or fairway, illustrating different elements of play such as landing zones, putting accuracy, slope and contour. The technology provides powerful visual insights into player performance. Other products include the Emmy-Award-winning TOURCast viewing application on PGATOUR.com and annotated course flyovers.

In 1996, one of Sportvision's founders, Stan Honey, then at Fox Sports, led a team (many of whom are now at Sportvision) that developed a way to track hockey pucks with a glowing highlight for National Hockey League broadcasts as a benefit to television viewers. It was assumed at that time that viewers had a hard time keeping track of the puck in lightning-fast NHL play. Although "FoxTrax" is no longer on air (since Fox no longer broadcasts NHL games), it was the start of what eventually became "1st & Ten" and the formation of the Sportvision company, both in 1998.

"'1st & Ten' became a major hit with television viewers when it appeared in that year's Super Bowl broadcast," White said. It has since become part of all standard football broadcasts.

As part of a highly skilled team of developers, White is often "hands on," especially for projects involving applied mathematics and physics—tracking balls or players, calculating trajectories, and handling voluminous data flows.

Another popular Sportvision product is seen with broadcasts of NASCAR races. GPS tracking is used in its RACEf/x technology to create virtual flags above the cars during a race broadcast, so that television viewers can follow their favorite drivers more easily.

As part of a highly skilled team of developers, White is often "hands on," especially for projects involving applied mathematics and physics—tracking balls or players, calculating trajectories, and handling voluminous data flows. Project development involves software and hardware design and development as well as research and feasibility assessment, covering topics from real-time high-definition broadcast enhancement to vehicle, player, and ball tracking. Sportvision is the market leader for sports and entertainment products for fans, media companies and marketers and is widely recognized as the most innovative contributor to sports broadcasting. Their operations involve more than 600 sports broadcast and webcast events per year.

Prior to joining Sportvision, White was general manager of commercial solutions for Etak, a digital mapping company, where he was responsible for development of Etak's core mapping technology, operation of a large digital map production operation, and the commercial mapping business. He developed his expertise in digital mapping as principal researcher at the U.S. Census Bureau, where he received international recognition for his work in applied mathematics research. He is regarded as one of the world's leading experts in automated mapping and related areas. While at the Census Bureau, White and his team built the foundation for the TIGER system, used for all the decennial censuses since 1980.

In addition to his degree from Illinois, White did a year of graduate study in physics at UCLA. He has published more than 30 professional papers and has been awarded 13 patents. White leads product development and field operations for Sportvision. ■

# Alumni award for distinguished service

*To Ralph O. Simmons, for landmark contributions to the understanding of point defects in metals and to definitive measurements of thermodynamic, defect, and dynamical properties of prototype solids formed from noble and other gases, in particular solid helium, and for superlative leadership and unstinting service to the Department of Physics and the College of Engineering at the University of Illinois.*

On April 26, 2007, alumnus (PhD '57), professor, and former Physics department head Ralph O. Simmons was thus recognized by the College of Engineering at the University of Illinois for his innumerable contributions to physics and to the university.

After earning a BA in mathematics from the University of Kansas, Simmons was a Rhodes Scholar at Oxford University, where he earned a second BA in physics in 1953 and a master's degree, also in physics, in 1954. His PhD thesis at Illinois, "X-ray study of deuteron irradiated copper near 10 K," was done under the supervision of James S. Koehler.

Following a postdoctoral appointment at Illinois, Simmons joined the physics faculty in 1959, teaching and establishing a research group studying properties of condensed gases (with support from the U.S. Atomic Energy Commission). He was promoted to full professor in 1965, and became department head in 1970.

A formidable researcher, Simmons (with R.W. Balluffi) first proved that self-diffusion in the close-packed metals (Al, Cu, Ag, Au) proceeds by atomic vacancies. The "Simmons–Balluffi method" became a textbook example, notable as the direct and unambiguous way to determine the net vacancy content in crystals.

Simmons' interests then shifted to a neglected column of the periodic table—the noble gases—for which thermodynamic properties in the crystalline state had been limited to calorimetric and crude elastic studies. After techniques were perfected for growing and characterizing excellent crystals, a series of thermodynamic measurements on the whole family—Xe, Kr, Ar, Ne and its isotopes—redefined, by two orders of magnitude, the precision with which such anharmonic properties as the thermal expansion are known. These studies provided data for critical tests of the theories of anharmonic lattice dynamics being developed in the 1960s.

His success in experimental physics has been grounded in the development of new techniques in cryogenics and in imaginative X-ray instrument design. Going to higher pressures and lower temperatures, Simmons' group produced what remains the only direct X-ray measurements of the equilibrium vacancy content of helium solids and unique X-ray structural studies of crystalline phase transformations in both solid helium and solid molecular hydrogen. No other laboratory has succeeded in carrying out similar X-ray work, despite considerable effort. Simmons' work may be pivotal in understanding the recently discovered "supersolid" phase of helium.

In the 1980s, Simmons pioneered the direct measurement of atomic momentum distributions in crystals of helium, neon, argon, molecular hydrogen, and other molecular solids, using pulsed neutron time-of-flight spectrometers. In the 1990s, his group used synchrotron X-rays to make the first quantitative studies of atomic vibration amplitudes in both crystal $^3$He and $^4$He. These neutron and X-ray scattering measurements have given definitive data for direct confrontation with the newest sophisticated computer simulations of quantum crystals. He also worked with several students to produce the first X-ray inelastic scattering studies of electronic excitations in solid and liquid helium and the first X-ray inelastic scattering measurements of phonon excitations in solid helium, especially the isotope $^3$He. Motivation for this work is elucidation of the dynamics, over extreme ranges of density and temperature, of the most extreme bulk 3D atomic quantum system known.

As department head, Simmons recruited 43 faculty, including the now-Nobel laureate A.J. Leggett, and saw the completion of 514 PhD theses. His vision, leadership, and selection and mentoring of new faculty helped solidify the department's "Top 10" status and #1 ranking in condensed matter physics. He also began the expansion of faculty in biomolecular physics, a significant part of current physics research at Illinois.

Simmons also built strong ties with the Department of Astronomy, including joint faculty appointments, more astrophysical research, and the physical relocation of that department in proximity to Physics. For a decade, he chaired a university committee to establish a Department of Atmospheric Sciences and oversaw its programs.

In 1986, Simmons returned to teaching and to continuing his research as a member of the Frederick Seitz Materials Research Laboratory (of which he was a founding member). Altogether, he has supervised 33 doctoral dissertations at the University of Illinois and several other universities in Finland, the Netherlands, and Germany, and he was a pioneer in focusing national attention on the under-representation of women in US physics.

Simmons also played an instrumental role in the development of a massive proposal to the National Science Foundation for a super-computing center, which stimulated and eventually helped define a national policy for supercomputing centers and the establishment of the National Center for Supercomputing Applications at Illinois.

In addition to numerous leadership and committee assignments at the University of Illinois, Simmons served a variety of science organizations including the American Association for the Advancement of Science, American Institute of Physics, American Physical Society, and Institute of Physics (UK). He is a former chair of the Office of Physical Sciences for the U.S. National Research Council. He chaired user and program committees at Argonne National Laboratory and the Rutherford Appleton Laboratory (UK).

Simmons was elected a Fellow of the American Physical Society in 1962, just five years past his PhD. He is a Fellow of the American Association for the Advancement of Science (1984), and a Senior University Scholar at Illinois. He received the Alexander von Humboldt Foundation Senior US Scientist Award in 1992. ■

# Old Physics Building designated historic site

To commemorate the pioneering work of University of Illinois researchers in understanding the mechanism of superconductivity, the American Physical Society has designated the old Physics Building, 1304 West Green Street, Urbana, as a site of historic significance to physics.

*Left: The original Physics Building Right: Dedication of the Laboratory of Physics at the University of Illinois in 1909*

Leo Kadanoff, president of the APS and former Illinois faculty member, presented a bronze plaque to Chancellor Richard Herman during a ceremony on October 11 in conjunction with the BCS@50 conference. The plaque, mounted at the Green St. entrance to the building, reads, "In this building, the home of the University of Illinois Physics Department from 1909 to 1959, John Bardeen, Leon Cooper, and J. Robert Schrieffer created the 'BCS' theory of superconductivity in 1956–57. For this great achievement of theoretical physics, they were awarded the 1972 Nobel Prize in Physics. Historic Physics Site, Register of Historic Sites, American Physical Society."

"The designation of the old Physics Building as a national historic physics site by the APS is a singular honor to the university," said Gordon Baym, the George and Ann Fisher Distinguished Professor of Engineering and Center for Advanced Study Professor of Physics. The first analytical solution to the problem of superconductivity, the Bardeen-Cooper-Schrieffer (BCS) theory has been hailed as one of the greatest discoveries in theoretical physics in the 20th century, Baym said. Added John D. and Catherine T. MacArthur Chair and Center for Advanced Study Professor of Physics Anthony J. Leggett, "I think it really is one of the landmarks in 20th-century physics. It had a tremendous spinoff on various other areas." One of those areas was Leggett's own work on superfluidity, for which he shared the 2003 Nobel Prize in Physics.

James P. Wolfe

*Chancellor Richard Herman accepts bronze plaque from APS President Leo Kadanoff*

The old Physics Building is the 12th historic site in the U.S. to be honored by the APS. Other sites include the Franklin Institute in Philadelphia, in recognition of Benjamin Franklin's pioneering work in electricity; The Johns Hopkins University, where Henry Rowland revolutionized spectroscopy with his ruled gratings; and Washington University in St. Louis, where Arthur Compton conducted his famous X-ray scattering experiment.

Completed in 1909 at a cost of $220,000, the Physics Building was the home of the physics department until 1959, when the department moved to the "new" Physics Building (now Loomis Laboratory of Physics). The original "Laboratory of Physics" was renamed the Metallurgy and Mining Building in 1963 and currently houses the Department of Materials Science and Engineering.

Founded in 1899 to advance and diffuse the knowledge of physics, the APS has more than 48,000 members worldwide. ■

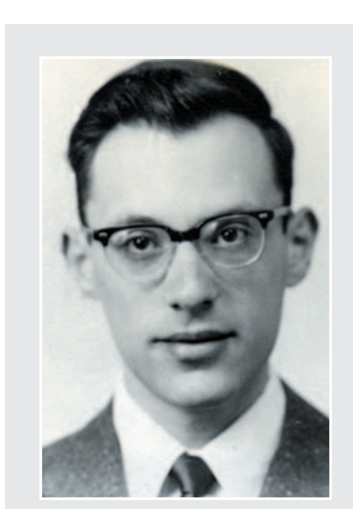
# Faculty News

## Donald M. Ginsberg

### 1933–2007

*"The Flautist Who Couldn't Play* Forte*"*

Donald M. Ginsberg, a world authority on superconductivity, passed away on May 7, 2007, at his residence in Urbana, Illinois. He was awarded the 1998 American Physical Society's Oliver E. Buckley Prize (the highest award in condensed matter physics) for his work on high temperature superconductivity. Among the achievements for which he was honored, Ginsberg created what were universally acknowledged at the time to be the world's finest samples of yttrium-barium-copper-oxide, and freely shared them to the scientific community worldwide. Because of the sensitivity of *d*-wave superconductivity to impurities, this advance was the key ingredient in establishing the properties of the high $T_C$ superconductors, allowing the determination of the *d*-wave state, the fluctuations and other novel features. For many years, Ginsberg authored the section in the *Encyclopaedia Britannica* on superconductivity; in addition, he wrote several influential review articles and book chapters, starting with his review (with L. C. Hebel (PhD '57)) on "Nonequilibrium properties of superconductors" in the seminal two-volume set edited by R. D. Parks in 1964. During the early 1990s, Ginsberg edited the definitive five-volume book, *The Physical Properties of High Temperature Superconductors*, to which he also contributed.



*Don Ginsberg in 1959, when he applied for a job at the University of Illinois*

Donald M. Ginsberg was born on November 19, 1933, to Maurice Jesse and Zelda Robbins Ginsberg in Chicago. He joined the department of physics at the University of Illinois immediately after finishing his graduate work with Professor Michael Tinkham at the University of California, Berkeley, in 1959. He took sabbatical leaves at Cambridge University (UK), UC Berkeley, UC San Diego, The Ohio State University, and IBM T.J. Watson Research Laboratory. In addition to being a Fellow of the American Physical Society, his awards include the Sloan Foundation Fellowship, the Daniel C. Drucker Tau Beta Pi Eminent Faculty Award (U. Illinois), University Scholar (U. Illinois), associate in the Center for Advanced Study (U. Illinois), and the Oliver E. Buckley Prize of the American Physical Society.

Ginsberg's research was in superconductivity, and he played a major role in almost every fundamental aspect of this field since the late 1950s. Building on his far-infrared graduate experience, he helped to develop planar quasiparticle tunneling spectroscopy as a vital probe of the energy gap of metallic superconductors. In the 1970s, he contributed greatly to the understanding of the effects of magnetic and non-magnetic impurities on the electronic structure of superconductors through a wide variety of measurements, including electronic transport, thermal conductivity, specific heat, and magnetic susceptibility. In the 1980s, Ginsberg extended his research to incorporate binary and ternary compounds, finally focusing on the molybdenum chalcogenides (sometimes referred to as Chevrel compounds), perhaps the most complex superconducting materials known at the time. Because of their complexity and inherent sensitivity and instability, Ginsberg realized the necessity of growing his own well-characterized and clean crystals in order to measure their fundamental properties, and thus became a world leader in preparing samples of these compounds. Ginsberg not only determined the structure and physical properties of the Chevrels, but he supplied crystals to dozens of colleagues for a broad variety of measurements.

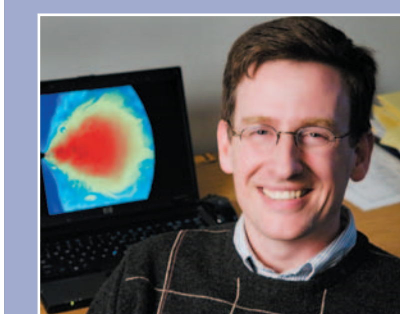
Following the discovery of cuprate superconductors, Ginsberg was quick to redirect his lab in this direction. He tried every published recipe for creating good samples but was dissatisfied with all of them, finally developing his own approach. He claimed that the most important hint for the best recipe came from a colleague whom he met in a chance encounter at an airport. Not only did he make the most careful transport and equilibrium thermodynamic measurements, but he generously shared his best-in-the-world crystals with colleagues at numerous institutions around the world, despite the intense competition in the field. Working with the group of Dale Van Harlingen, he established the high-temperature superconductor YBCO to have *d*-wave pairing symmetry and shared the Oliver E. Buckley Prize with Van Harlingen and J. R. Kirtley and C. C. Tseui of IBM's Thomas J. Watson Research Center.

At Illinois, Donald Ginsberg was widely recognized for his outstanding classroom teaching. Thirty-six PhD students did their research under his direction. Donald Ginsberg published more than 240 papers with many hundreds of coauthors at two dozen domestic and foreign institutions. He was greatly appreciated by his colleagues for his science, but equally for his wide range of interests outside of physics and his direct and often humorous way of expressing his thoughts. To celebrate his retirement, on April 19, 1997, a day-long symposium entitled "Superconductivity with a Smile" was held at Illinois and attended by more than 100 colleagues, former students, and friends, some of whom traveled hundreds or thousands of miles to be there. Many others from around the world who could not attend sent their best wishes.

In addition to his accomplishments in physics, Ginsberg enjoyed the cultural side of life, especially music, which he indulged by playing the flute, and poetry. After his retirement, he wrote several books of poetry, which featured his whimsical observations of physics, physicists, and personal life. No event was too small to be lampooned by his fiendishly dry wit and droll turn of phrase. For example, in considering his own long career at Illinois, Donald remarked simply to a colleague a few months ago, "When they ask about the old days, just tell them we had a good time." With the passing of Donald Ginsberg, the world has lost a resourceful and clever physicist and a uniquely multi-faceted personality. We'll miss him very much. ■

*Nigel Goldenfeld (University of Illinois)*
*Laura Greene (University of Illinois)*
*Miles Klein (University of Illinois)*
*Thomas Lemberger (The Ohio State University)*
*Dale Van Harlingen (University of Illinois)*

## Gammie named 2007 University Scholar



Charles F. Gammie has been named one of six 2007 University Scholars at the University of Illinois. The program recognizes excellence and helps to identify and retain the university's most talented teachers, scholars, and researchers, said Chancellor Richard Herman in announcing the appointments.

Gammie, a professor of physics and of astronomy at Illinois, has made pioneering contributions to understanding the structure and dynamics of accretion disks around black holes and newly formed stars. He has also made significant contributions to understanding turbulence in gas threaded by magnetic fields in a variety of astrophysical settings. His focus has been on problems that require large-scale computations for solution, and he has helped to formulate new approaches and algorithms to tackle long-standing, unsolved problems in astrophysics. According to head of Astronomy, You-Hua Chu, "Charles Gammie is uniquely poised to excel in these fields because he is simultaneously strong in mathematics, physics, and numerical computation."

Gammie was also cited for his effective and innovative teaching. As part of a National Science Foundation PECASE Award, he produced an online "Digital Demo Room" (http://rainman.astro.uiuc.edu/ddr/)—a suite of tools for users ranging from novice undergrads to advanced researchers—to simulate disk galaxy dynamics, stellar structure and evolution, one- and two-dimensional hydrodynamics, and even supernovae explosions. As he noted, "What could be more fun than blowing up a star?"

Different versions of the simulations are available (beginner, intermediate, advanced), depending on the user's level of knowledge. Gammie has also been instrumental in involving undergraduates in his pioneering research, raising the competitiveness of the next-generation of physical scientists. ■

# Beck receives 2007 Nordsieck Teaching Award

Douglas H. Beck was recognized with the 2007 Arnold T. Nordsieck Award for Excellence in Teaching for his creation of an honors introductory mechanics course in Physics and for his leadership in transforming the way calculus is taught to engineers.

Beck, a nuclear experimentalist, is the intellectual leader of the G0 experiment at Thomas Jefferson National Accelerator Facility (JLab), a collaboration of more than 80 senior physicists from 18 institutions. The Illinois group, under Beck's leadership, was responsible for the main instrumentation for the experiment, including a $3M superconducting magnet and associated control electronics, which were designed and tested here before being installed in the experiment at JLab. Beck thus understands the rigors of real-life engineering practice, and this insight translates to superb teaching for engineers.

*Doug Beck, center, with students James Porretta and Alex Chesebro, working on a group problem in the new "Calculus for Engineers" class*

One problem that Physics has always faced in the introductory classes is the wide disparities in the high school preparation of engineering undergraduates. Some students, who come from large suburban schools, often take two high school physics courses, including advanced placement courses; others, from smaller rural schools, may not have had any physics at all. While it was clear early on that the underprepared students needed assistance to be successful in the introductory physics classes, it took a while longer to recognize the need to provide meaningful instruction to "overprepared" students, too, those who might otherwise just go through the motions. The department thus began several years ago to offer a one-hour "honors" supplement to the calculus-based introductory physics classes. Students who elect this option take, in addition to the standard introductory physics classes, a supplemental one-credit-hour companion class that allows them to explore, under the guidance of a senior faculty member, interesting problems in considerably more depth.

With only the initial idea of creating some sort of "physics-plus" experience for more advanced students, Beck tackled the job of creating an honors curriculum from scratch for the calculus-based introductory general mechanics course over one memorable Christmas break. A major innovation was incorporating the use of Mathematica®—remember, these are freshmen and sophomores—to allow the students to characterize a physical situation by solving differential equations. Students also learned to make more use of graphs to present their results, and in particular to explore dimensionless combinations of quantities and generalize a problem by removing constraints. Beck created new homework problems to exploit particular mathematical techniques, from simple trigonometric identities to taking limits. In all cases, Beck related abstract concepts to real world problems. For example, students advance from considering the tension on a rope suspended between trees to thinking about how a capstan works (and using the "plot" function in Mathematica® to calculate $e^x$ from the series solution for the problem).

Beck also introduced a "project" component to the course. Instead of working instructor-selected homework problems all semester, teams of students now select a problem of their own choosing to study for the last four to five weeks of the course. They then collaboratively write a scientific paper (at the level of *The American Journal of Physics*) that presents the problem and discusses their results. In one paper, "All Chained Up," students Jon Adams, Lauren Aycock, David Grayson, and Lauren McNeil showed that the solution to a problem given in a popular introductory physics textbook is incorrect! They also expanded the problem to consider the case of a very long chain (one extending from the loading bay of the International Space Station nearly to the surface of the Earth) to introduce a non-uniform gravitational field. In another paper, Jie Chou and Daniel Joe analyzed the "linear optical trajectory" of a fly ball to explain why a popular explanation of the curved path on the ground that an outfielder takes to catch the ball is incorrect.

Says Beck, "The skill set emphasized in the project portion of the course—working collaboratively in teams, communicating science, acquiring a formal scientific writing style—is as important an addition to the students' intellectual toolkit as the mathematical techniques they learn in the first part of the course."

In addition to his work in the honors mechanics course, for the last two years Beck has nucleated a College of Engineering/Liberal Arts and Sciences project to revamp the way calculus is taught to engineers. As Beck describes it, the COE/LAS Calculus Project started a bit by accident, when he was contacted by the former undergraduate program director in Math, Randy McCarthy, who was trying to drop a course taken by some Physics students. "In talking to Randy, we realized that we both felt passionate about teaching a more appropriate version of calculus to scientists and engineers. He brought in Rob Ghrist (from Mathematics) and co-opted Keith Hjelmstad (then associate dean for academic affairs in the COE), and we just started teaching."

Their purpose was initially to establish a baseline for students' knowledge of and ability to use calculus. Beck and Ghrist built the new course in real time one frantic fall semester; according to Beck, "the overlap of what Rob and I were thinking was, in retrospect, quite remarkable." Like the curriculum revisions pioneered earlier in the Physics introductory courses for engineers, the new calculus course combines a formal lecture with discussion sections. The lecture is intended to raise the students' general level of sophistication in logical thinking as well as to convey the specific calculus content, while the discussion sections feature group work on specific problems that illustrate the material covered in lecture.

The problems are drawn from other courses—physics, chemistry, and engineering—and Beck was surprised to learn that students often complain, especially at the beginning of the course, that the discussion problems "don't have anything to do with the lectures."

"The students are unable to make the connection that calculus is a tool to apply to real problems, not an end-all in itself. In the past, I expected the students to be able to make this link with no help at all," said Beck. "Teaching the course has shown us, as instructors, that we must work on 'language skills'—helping the students to translate math to English and English to math."

Beck received his bachelor's degree in physics from the University of Saskatchewan in 1979 and his PhD in physics from Massachusetts Institute of Technology in 1986. After working as a senior research fellow at the California Institute of Technology for two years, he joined our department as an assistant professor in 1989. He was promoted to associate professor in 1994 and to full professor in 1999. ■

## Leggett honored with plaque

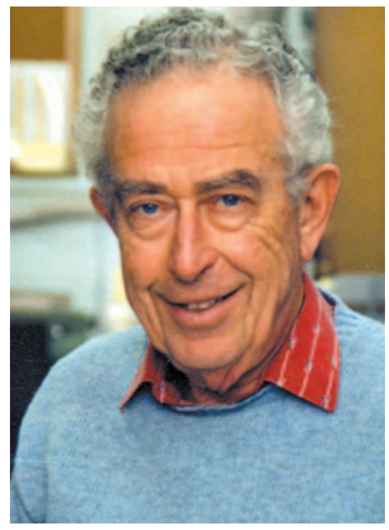
Katherine Freeman

*Anthony J. Leggett, the John D. and Catherine T. MacArthur Professor and Center for Advanced Study Professor of Physics, was recognized this fall with a University historical marker honoring him for his elucidation of the theory of superfluidity, for which he shared the 2003 Nobel Prize in Physics. The plaque is one of about 40 installed across the Illinois campus to recognize noteworthy individuals and their discoveries. Colleagues, friends, and students gathered at a reception on November 30 to celebrate the unveiling of the historical marker, located at the west entrance to Loomis Laboratory on Goodwin Avenue.* ■

# Faculty News

# Albert Wattenberg

## 1917–2007



*Albert Wattenberg*

Professor Albert Wattenberg died at the age of 90 on June 27, 2007, at Clark-Lindsey Village in Urbana. He served on the faculty of our department from 1958 until his retirement in 1986. A superb high-energy experimentalist, he continued to publish scientific articles until 2003.

A student of Enrico Fermi's, Al was a member of the team that built the first successful nuclear reactor under the stands of the University of Chicago stadium, leading to the first controlled nuclear chain reaction on December 2, 1942. Al was also one of the signatories of the "Szilard Petition" asking the President of the United States not to use the nuclear bomb without warning. After the war, he was among the founders and activists of the Federation of Atomic Scientists (now the Federation of American Scientists).

Al grew up in New York City. His first interest in science came from his brother, a chemist, who trained Al "to keep his glassware very clean." He also gave Al his first camera, which led to an early interest in optics. At Dewitt Clinton High School, Al helped his team win New York math championships. He received his BSc from City College (1938), and his MA from Columbia (1939). The summer after college, Al took a hands-on spectroscopy course at MIT that greatly influenced his life and career.

Deeply concerned about fascism and economic justice during the Depression, Al became politically active during his undergraduate years. He organized several student strikes and, although he was the president of his senior class, he boycotted his 1938 graduation ceremonies in protest against the pro-Italian fascist sentiments of the City College president.

Jobs were scarce, so Al was delighted when, in 1939, he got a job with the Schenley Corporation, a maker of distilled spirits, doing spectroscopic analysis of chemical compounds. In 1940, when Al was recruited by US Steel, Schenley countered by giving him a large raise and decreasing his work load to 30 hours a week, which allowed him to return to graduate school at Columbia.

In 1941, Al was close to finishing his PhD but the war effort intervened. Fermi invited Al to join his group, studying the fission of uranium. As a young and talented instrumentalist, Al learned to use Geiger counters, served as a draftsman and a machinist, and maintained and built photon and neutron detectors. Herb Anderson, another member of the group, trained Al to make neutron sources and, after 1943, Al made and maintained all the radium and beryllium sources for the entire Manhattan Project. He also worked with Fermi on measuring the neutron activity in the uranium graphite structure. It was here that Al observed Fermi's enormous thoroughness and redundancy in experimental work, an example that affected Al's approach to experiments for the rest of his life.

In 1942, the group moved from New York to the University of Chicago. The construction of the first pile started on November 16, 1942. On December 2, 1942, the group obtained the first controlled nuclear chain reaction. Eugene Wigner presented Fermi with a bottle of Chianti, which everybody present signed. As a young member of the group, Al cleaned up after the event—and kept the historical bottle until 1980, when he donated it to Argonne National Laboratory.

Al completed his PhD at the University of Chicago in 1947. Rather than accept any of several academic job offers, he decided to stay at Argonne to work with Fermi, who had returned from Los Alamos, building reactors to produce intense neutron beams for neutron diffraction studies.

In 1949, Al was appointed acting director of the Physics Division at Argonne National Laboratory. Although the lab focused on the development of reactors, Al wanted to work on elementary particle physics. This interest, together with the growing intense scrutiny of government employees for "Communist" leanings during the late 1940s, led Al to leave Argonne in 1950. He stayed one year at the University of Illinois and then moved to MIT, where he did research and taught until 1958. At the MIT synchrotron, he studied properties of nucleons in nuclei and worked on K-meson decays. Al's insight about the similarities of the weak and electromagnetic interactions of nucleons earned him an acknowledgment in Gell-Mann's paper about testing vector interactions in $\beta$ decay. The conserved vector current hypothesis was one of the steps that led to the standard model of weak and electromagnetic interactions.

In 1958, the University of Illinois recruited Al by offering him a special research professorship; teaching was voluntary. Although he did teach—much to the benefit of generations of Illinois physics students—Al also appreciated the freedom to pursue research in particle physics. In the 1950s and 1960s, Al worked with his Illinois colleagues on experiments studying K-meson decays in Brookhaven and Argonne, looking for symmetry violations—time reversal, CP, and CPT. In 1967, Al published a paper with the theorist J.J. Sakurai on interference experiments to distinguish matter from antimatter. Al continued to design and build instruments. He authored more than 115 articles between 1953 and 2003.

Over his career, Al built large Cerenkov counters at Fermilab and quantum mechanics experiments for the graduate teaching laboratories at Illinois. He worked with huge liquid scintillation counters and with tiny millimeter-sized fibers. He worked on $J/\psi$ and charm production, first at Fermilab, with neutron beams (*E358, dimuon production by neutrons*); later with the wide photon beams (*E87, photoproduction of $J/\psi$ and charmed mesons*)—an important experiment that demonstrated the hadronic nature of $J/\psi$, and finally at SLAC, using $e^+e^-$ colliding beams, in the first comprehensive study of the charm sector by the Mark III collaboration. Al's largest and last project in experimental particle physics was the construction of more than 700 proportional muon counters for the Mark III detector.

After retirement, Al participated in the Forum of the History of Physics of the American Physical Society, serving as its secretary-treasurer and as a councilor. He was the editor of the *Forum's History of Physics* newsletter for eight years. Al participated in the Program in Arms Control, Disarmament, and International Security at the University of Illinois and continued to contribute to the *Bulletin of the Atomic Scientists.* Over the years, he gave numerous talks to physicists and to general audiences about the beginnings of the nuclear era and about his work with Fermi. In 2001, he contributed to the celebration of the 100th anniversary of Enrico Fermi's birth, which was held at the University of Chicago.

In addition to being a remarkably gifted scientist, Al Wattenberg was an inspiring example of honesty, integrity, and abiding friendship. He will be deeply missed. ■

*Inga Karliner*
*Jon J. Thaler*
*Gary E. Gladding*

*Argonne National Laboratory*

*Reunion of the Chicago atomic scientists on the steps of Eckhart Hall at the University of Chicago, Dec. 2, 1946. Al Wattenberg is in the center of the front row; Fermi is standing next to Walter Zinn, to Wattenberg's right, and Leo Szilard is in the trench coat* to his left.

# Goldenfeld awarded Swanlund Chair

On March 24, 2008, Professor of Physics Nigel Goldenfeld was invested as a Swanlund Chair, the highest endowed title at the University of Illinois. In making the announcement on September 26 of the four new Chairs—Tamer Başar, electrical and computer engineering, Arthur F. Kramer, psychology, and Gene E. Robinson, entomology, in addition to Goldenfeld—Chancellor Herman said "I congratulate these accomplished faculty for their truly exceptional contributions to our university and to the broader society we serve. Their creativity, innovative approaches and overall excellence are ultimately in service to nurturing the spark, the source, the wellspring at the heart of this great institution."

*Charles Slichter congratulates newly invested Swanlund Chair Nigel D. Goldenfeld*

Goldenfeld received his PhD from the University of Cambridge (UK) in 1982, and was a postdoctoral fellow at the Institute for Theoretical Physics, University of California, Santa Barbara, from 1982 to 1985. He joined the Department of Physics at Illinois in 1985. In commenting on the award, Goldenfeld said, "It is a great honor to join the other truly distinguished scholars who hold this appointment. I am thrilled and grateful that the department recognized my unusual research directions sufficiently highly to nominate me."

His research explores how patterns evolve in time—the growth of snowflakes, the microstructures of materials, the flow of fluids, geological formations, and even the spatial structure of ecosystems. Goldenfeld's interests in emergent and collective phenomena range from condensed matter physics, where he has contributed to the modern understanding of high-temperature superconductors, to financial markets, to quantitative biology, where his current work focuses on evolution and biocomplexity. He is the theme leader on biocomplexity in the UI Institute for Genomic Biology.

In 1996, Goldenfeld co-founded NumeriX, a company specializing in high-performance software for the derivatives marketplace. Goldenfeld has been an Alfred P. Sloan Foundation Fellow, a University Scholar of the University of Illinois, a recipient of the Xerox Award for Research, and a recipient of the Nordsieck Award for his outstanding graduate teaching. He is a member of the editorial board of the *International Journal of Theoretical and Applied Finance* and is a Fellow of the American Physical Society.

Goldenfeld joins Physics colleagues Laura H. Greene and Klaus J. Schulten, who also hold Swanlund Chairs; no other department in the University has had three faculty members awarded this highest honor.

The Swanlund Chairs were made possible by a gift from alumna Maybelle Leland Swanlund, who received a degree in library studies from Illinois in 1932. Her $12 million gift was made with the aim of attracting leaders in the arts and sciences to the University of Illinois and to recognize current faculty members who have made exceptional contributions to their fields. ■

# Neubauer joins high-energy group

Mark Neubauer joined Physics Illinois in August 2007 as an assistant professor. He received his bachelor's degree *summa cum laude* from Kutztown University (Kutztown, Pennsylvania) in 1994, and his PhD in physics from the University of Pennsylvania in 2001.

As a PhD student at the University of Pennsylvania, Neubauer worked on the Sudbury Neutrino Observatory (SNO) experiment, which was designed to resolve the long-standing deficit of solar $\nu_e$ observed in previous experiments. His thesis, *Evidence for $\nu_e$ Flavor Change through Measurement of the $^8$B Solar $\nu$ Flux at SNO,* demonstrated in 2001 that before detection on Earth, approximately two-thirds of all solar $\nu_e$'s change flavor ($\nu_e \rightarrow \nu_{\mu\tau}$), which can occur only if neutrinos have non-zero mass and mixing. This result was published soon thereafter in a *Phys. Rev. Lett.* article that became the most cited paper in physics in the two years following its publication.

As a postdoctoral fellow at MIT and then the University of California, San Diego, Neubauer conducted research at the current energy frontier provided by proton-antiproton collisions at the Fermilab Tevatron. As member of the Collider Detector at Fermilab (CDF) experiment, he made important contributions to heavy flavor and high-pt physics, including searches for the Higgs boson and new physics.

In 2002, Neubauer and colleagues at MIT undertook a complete redesign of the CDF analysis computing model, resulting in the the CDF Analysis Facility (CAF), for which he served as project leader from 2002 to 2004. He played a leading role in the study of electroweak dibosons at CDF as convener of the Diboson Physics Group (2006–2007). In 2006, he led the first-ever observation of *WZ* diboson production. In 2007, he and colleagues provided the first evidence for *ZZ* production at a hadron collider and the most stringent limits on Higgs boson production to date (in decay to *W* boson pairs).

According to department head Dale J. Van Harlingen, Neubauer is a talented and dynamic researcher who will play a key role in the department's efforts to become a major player in the ATLAS project at the Large Hadron Collider (LHC), which will begin taking data early next year. "This will truly be a remarkable decade in high-energy physics," said Van Harlingen, "and we believe that Mark Neubauer has the experimental skills and scientific insights to become a world-leader in this effort. In particular, he will be the lead person in establishing Illinois as a Tier-3 data center for ATLAS, an essential step in allowing us access to the wealth of data expected to pour in from LHC as it searches for the Higgs boson, supersymmetry, and the origins of dark matter and dark energy." ■

# Faculty News

## Two new faces in experimental biological physics

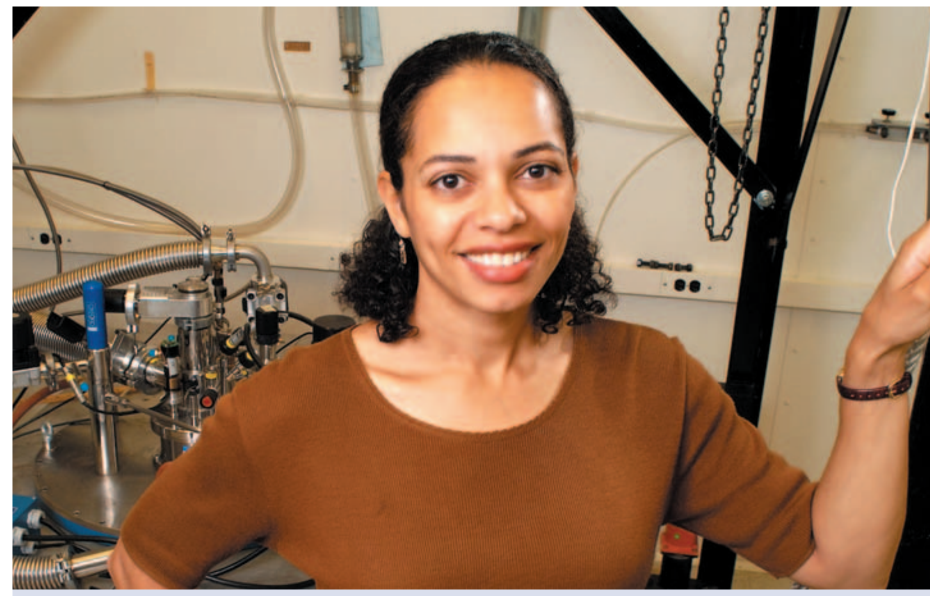
Two new assistant professors, Yann R. Chemla and Ido Golding, have joined the department. Both are experimental biological physicists.

**Yann Chemla** received his PhD in physics from the University of California, Berkeley in 2001. Although trained as a condensed matter experimentalist working in applied superconductivity, he developed an interest in biology through his study of magnetotactic bacteria using a superconducting magnetometer and the development of a biosensor based on functionalized magnetic nanoparticles. Chemla made the "leap" to biophysics as a postdoctoral fellow, moving down the hall to Carlos Bustamante's laboratory at Berkeley. There, he learned the techniques of single-molecule manipulation and used an optical trap to study viral DNA packaging. In 2005, he received a prestigious *Career Award at the Scientific Interface* (CASI) from the Burroughs-Wellcome Fund. Chemla's research focuses on understanding the mechanism by which molecular motors operate, and specifically, the process of mechano-chemical conversion.

**Ido Golding** received his PhD in physics from Tel Aviv University (Israel) in 2002. Although trained as a condensed matter theorist, he has spent the last five years learning the experimental arsenal of modern molecular biology. From 2002 to 2006, Golding was a Lewis Thomas Research Fellow in the Department of Molecular Biology at Princeton University.

Golding's research interests are in the spatio-temporal dynamics in living cells—real-time studies having single-event resolution. He studies the *E. coli* bacterium and its virus, the bacteriophage lambda. He has developed and applied new quantitative tools for probing cellular interactions within these systems by combining genetic manipulation and high sensitivity fluorescence imaging.

According to Head Dale J. Van Harlingen, "We were very fortunate to attract these two extraordinary young scientists to Illinois to further expand our growing biological physics program." ■



## Mason named "Emerging Scholar"

Nadya Mason, an assistant professor of physics at Illinois, has been recognized as one of the Emerging Scholars: The Class of 2008 by the publication *Diverse: Issues in Higher Education.* The award is given to 10 young researchers from various disciplines who have demonstrated outstanding abilities in research and teaching. They were profiled in the January 10, 2008, issue.

A condensed matter experimentalist, Mason focuses on how electrons behave in low-dimensional, correlated materials, where enhanced interactions are expected to give novel results. She is particularly interested in the effect of reduced dimensionality and correlations on electron coherence. The understanding and control of electronic coherence is relevant to a variety of systems, including quantum communication, information storage, and qubit control in quantum computers.

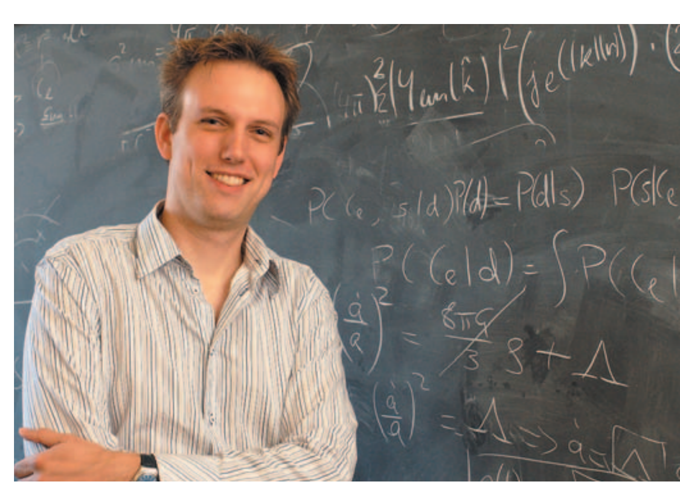
Mason's prior research has focused on the quantum behavior of nanotubes and on 2D and nanostructured superconductors. In both of these areas, her previous work provided insight into coherence and correlations in low-dimensional materials.

In her work with nanotubes, she developed new fabrication techniques to control quantum properties of dots and wires. In her work with two-dimensional superconductors, she discovered unusual correlated phases and developed methods to control and elucidate these phases. At Illinois, Mason is carrying out tunneling experiments in carbon nanotubes to study unusual correlated states, such as Luttinger liquids, and tuning electronic correlations in nanotubes and nanowires via proximity effects caused by metallic, magnetic, or superconducting current leads. She is also branching out into studies of graphene.

Mason was a recipient of a National Science Foundation CAREER award in 2007 and was named a Junior Fellow of the Harvard Society of Fellows in 2002. She earned a bachelor's degree in physics at Harvard University and her doctorate in physics at Stanford University. She joined the Illinois physics faculty in 2005.

Besides her academic commitments, Mason takes a deep interest in increasing the diversity and inclusiveness of the physics community and in attracting young people to science. ■

# Cosmology@Home



Want to help unravel the mysteries of the universe? A new distributed computing project designed at the University of Illinois allows people around the world to participate in cutting-edge cosmology research by donating their unused computing cycles to contribute to front-line research in precision cosmology. The project is called Cosmology@Home and is similar to SETI@Home, a popular program that searches radio telescope data for evidence of extraterrestrial transmissions.

As described by its creator, project leader Benjamin D. Wandelt, a professor of astronomy and of physics at Illinois, "C@H is a 4-teraflop supercomputer running entirely on enthusiasm."

"When you run Cosmology@Home on your computer, it uses part of the computer's processing power, disk space and network bandwidth whenever your computer would otherwise sit idle," said Wandelt. "Our goal is to search for the cosmological model that best describes our universe and to find the range of models that agree with the available astronomical and particle physics data."

To achieve this goal, participating computers calculate the observable predictions of millions of theoretical models using different parameter combinations. The predictions are then compared with actual data, including fluctuations in the cosmic microwave background, large-scale distributions of galaxies, the acceleration of the universe, and observations of primordial element abundances.

According to Wandelt, in addition to picking out possible models, Cosmology@Home could help design future cosmological observations and prepare for the analysis of future data sets, such as those to be collected by the Planck spacecraft mission.

He added, "I would have to say, I have been absolutely floored by the level of community enthusiasm for the project already, despite its not even having been officially launched yet. Without any official announcement—just by people stumbling on our alpha test implementation via search engines—we already have 264 teams from 77 countries, comprising 2,372 participants with 5,755 hosts, who have contributed cycles amounting to more than 1.6 million hours of computation on a recent CPU. This made us realize the potential of Cosmology@Home as a way to connect our research group with people who are enthusiastic, or at least curious, about cosmology, astrophysics, and computing in the world at large."

If *you're* curious, go to http://cosmologyathome.org to become part of the project; we'd love to have you on the Physics Illinois team. ■

*[Ed. Seed funding for Cosmology@Home was provided by the National Science Foundation. It officially went into beta testing on October 25, 2007.]*

# Department News

## Illinois launches Institute for Condensed Matter Theory

*Visitor Ruslan Prozorov (Iowa State University/Ames Lab) takes a look at remodeling plans with ICMT Director Paul M. Golbart*

*Goldbart in his office, explaining his objectives for the ICMT*

A new feature of the landscape of the Illinois Physics Department is the Institute for Condensed Matter Theory, which was launched during the October 2007 BCS@50 Conference. This institute—ICMT—aims to foster a highly interactive, cutting edge research environment that encourages members to take on the most challenging, long-term research questions in condensed matter theory and related areas. ICMT is led by Director Paul Goldbart and Chief Scientist Tony Leggett, who are assisted by staff members Becky McDufee and Sue Lynn Herdle.

Currently, ICMT brings together some 30 Illinois faculty as members—drawn not only from Physics but also from departments in the College of Engineering—whose research is in condensed matter theory and related areas. The membership of ICMT also includes visitors to Illinois, along with postdoctoral and graduate researchers.

ICMT's research activities will initially be promoted through four core mechanisms: postdoctoral fellowships, a visitors program, workshops and small conferences, and support for graduate researchers. The postdoctoral fellowships, which are expected to run for three years, are designed to attract outstanding young researchers and give them the freedom to work on topics of their choice with a wide range of Illinois faculty members in the highly interactive setting that ICMT provides. More than 100 applications were received for the opening-year fellowships. The visitors program will enable stimulating visits to ICMT, from days to months in duration, by senior and junior theorists and experimentalists. These visits will foster interactions among the ICMT community and will lead to further collaborative activities. ICMT will also host workshops and small conferences in exciting areas of condensed matter physics, especially newly emerging ones, often with a short lead-time to capitalize on breaking discoveries.

Home for ICMT is a purpose-built environment in the Engineering Sciences Building, just north of the Materials Research Laboratory. Originally conceived by Goldbart, Michael Stone, and Director of Budget and Resource Planning Jan Kane, the setting is designed to enhance communication and collaboration. It features seminar rooms and offices that open on to ample communal discussion areas that are equipped with the theorists' vital resources: chalkboards on virtually every wall and a high-caliber espresso machine. ICMT is located adjacent to the concentration of Illinois condensed matter expirementalists, thus promoting the close collaboration between these two communities that has long been the hallmark of condensed matter physics at Illinois.

ICMT activities are currently supported by funds generously made available by Illinois Provost Linda Katehi and Physics Head Dale Van Harlingen. To learn more about ICMT's activities, visit the ICMT website (www.icmt.uiuc.edu) or contact ICMT Director Paul Goldbart (217-244-ICMT). ■

## Theoretical physics across the globe

*Richard Martin and alumnus Nithaya Chetty*

"The Institute of Condensed Matter Theory at the University of Illinois will create wonderful opportunities for international collaborations," according to associate professor Nithaya Chetty (PhD '90), who is the interim deputy director of the new National Institute of Theoretical Physics (NITheP) in South Africa. "The basis is already there, since over the past ten years, several Illinois physicists have participated in the Chris Engelbrecht Summer School in Theoretical Physics held in annually in South Africa."

Through the South African National Research Foundation, the South African Department of Science and Technology, the Ford Foundation, the International Centre for Theoretical Physics, and other funding sources, "we have been able to attract an increasing number of physicists from other African countries—many of whom work in incredible isolation—to our workshops and conferences," said Chetty, "and in this way the involvement of our international visitors is having a growing ripple effect in southern Africa and beyond."

"We are trying to develop this mode of engagement very strongly through NITheP," said Chetty. "Mobility funds are being set aside to increase intra-African contact, and NITheP is particularly keen to include graduate students and young faculty members from other African countries in our programmes."

The structure of NITheP is novel, with its headquarters at Stellenbosch, and with regional centres at the University of Witwatersrand in Johannesburg and the University of KwaZulu-Natal in Durban, where Chetty is currently based.

South Africa has its own challenges related to historical imbalances, and this de-localized system ensures maximal impact on all regions in the country. Officially approved by the Department of Science and Technology on May 31, 2006, the NITheP has been involved in intense negotiations with the government and with the theoretical physics community in South Africa over the last two years on its structure and mission. NITheP will be fully operational next year when a full-time director is appointed. An international search is underway for a high quality theorist who is committed to the ideals of NITheP.

Chetty, who was a graduate student of Richard Martin's and who is currently president of the South African Institute of Physics, played a significant role during the negotiations with government. "It should be considered nothing short of remarkable that the government has agreed to fund such an institute in a country that continues to grapple with deep and resistant socio-economic difficulties, and entrenched racial inequities," said Chetty.

The physics community has been at the very forefront in arguing for science as an instrument for development in the country. The South African government is on track to committing 1 percent of its GDP to research and development by 2008. According to Chetty, "There is now a huge moral responsibility on the body of scientists to help deliver on the developmental agenda of the country. There are growing opportunities for international physicists to participate in the goals of helping to strengthen the culture of science in Africa."

NITheP aims to be a theoretical physics user facility, not unlike similar other institutes such as the Kavli Institute in Santa Barbara, albeit on a smaller scale. The core academic activities include theoretical physics seminars, mini-workshops, summer schools, winter schools, longer research programs, and conferences. NITheP supports a graduate student bursary program, and the aim is to attract a substantial number of postdoctoral fellows, including foreign ones.

A small number of full-time researchers (equivalent level of associate professor) will be employed by NITheP. The opportunity exists for individuals as well as groups to formally become associates of NITheP.

NITheP will forge strong collaborations between theoretical physics and mathematics that will allow South Africa to consolidate and considerably expand existing research programs in the fields of quantum systems, condensed matter physics, plasma and space physics, string theory and high energy physics, as well as cosmology and astroparticle physics. There will be a strong emphasis on computational physics and the computational sciences more generally. Research will support national priorities in experimental programs such as quantum optics, nuclear physics, and chemical and biological physics, and joint appointments are being considered with a number of national experimental facilities, including the South African Astronomical Observatory.

NITheP will also host graduate-level courses to fulfill its developmental obligations. "It is here, especially, that I will be requesting the assistance of Illinois faculty to deliver short intensive courses to help strengthen the basic foundations of our discipline. This is critical for us. NITheP will play a crucial role in developing a new cohort of theoretical physicists for Africa," said Chetty. ■

# Department News

## Wilde receives 2007 Chancellor's Distinguished Staff Award

L. Brian Stauffer

Johnetta Wilde, the mainstay of the introductory physics courses at Illinois, received the Chancellor's Distinguished Staff Award for 2007 for her exceptional performance. As the "Undergraduate Course Secretary," Wilde has the primary responsibility for the smooth operation of the Physics 100- and 200-level classes and is the "first responder" to some 25 faculty, 100 teaching assistants, and 5000 undergraduate students every semester.

A legend in the physics department, Wilde approaches her job with an unflappable sensitivity to others. In fact, on page 1 of an extensive job manual that she has created for the person who will someday succeed her, it states, "Students are treated with respect and care. Help them in any way you can, whether it be giving them sympathy for an illness or death, or helping them decide whom they should talk to if they have a problem. It is important that students should not be made to run all over campus to get an answer to a question."

In addition to her demanding departmental responsibilities, Wilde has recently served on a campus-wide committee that is managing the conversion of paper-and-pencil ICES forms to an electronic format. According to Associate Head Gary Gladding, "Her extensive experience makes her very well qualified to assist in this important advancement for the campus."

At the dinner honoring this year's CDSA recipients, Associate Provost Elyne G. Cole remarked, "Johnetta Wilde is obviously a treasure to the Department of Physics and to the University of Illinois. She has certainly earned the honor of being chosen as a recipient of the Chancellor's Distinguished Staff Award."

Wilde joined the Department of Physics in this position in 1997, after retiring from a 30-year career teaching high-school Spanish and French. In addition to her contributions to the University, Wilde frequently takes her goodwill "on the road." She regularly travels to Belize, where she and a small group of women from her church have built (literally digging foundations, pouring concrete, and painting walls themselves) and outfitted an elementary school for impoverished indigenous children. She made a similar humanitarian trip to Kenya last summer.

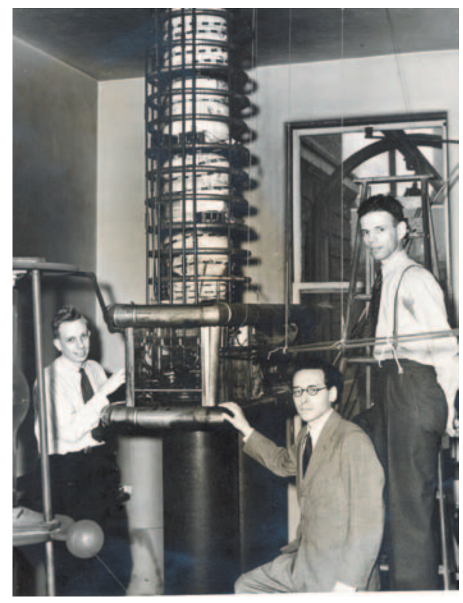
Just before her May 2007 trip, Wilde wrote, "My bags are very heavy because they are full of books and school supplies. I am very excited to get to Belize, because this will be the first time for me to see the school when the students are there. I plan to give lots of hugs and smiles! I am truly blessed!"

We're the ones who are blessed, Johnetta. Congratulations! ■

*Johnetta and Jen in Kenya*

# History of excellence

### The history of our department and its contributions to physics research and education is now online



*Young Physics faculty members John Manley, Maurice Goldhaber, and Leland Haworth with their newly completed Cockroft–Walton accelerator, ca. 1940 (Rev. Sci. Instrum.* ***12,*** *591 [1941]).*

An admittedly incomplete chronological history of the Department of Physics at the University of Illinois is now available on the Web in decade-by-decade "time capsules" of critical research breakthroughs, innovations in teaching and learning, and events that shaped the culture of physics at Illinois. Rediscover the physicists who defined the "Urbana spirit" while making seminal discoveries that changed the world.

Information presented in the time capsules is drawn from *A History of the College of Engineering at the University of Illinois, 1868–1945* (Ira O. Baker and Everett E. King, Urbana, Illinois), *Vignettes from a Century of Service, 1890–1990* (Lisa Warne, Urbana, Illinois, 1991), *A Century of Physics at the University of Illinois* (Gerald Almy, Urbana, Illinois, 1967), *Men and Ideas in Engineering: Twelve Histories from Illinois* (R.A. Kingery, R.D. Berg, E.H. Schillinger, University of Illinois Press, 1967), *Dedication of the Loomis Laboratory of Physics* (Urbana, Illinois, 1980, with a foreword by Charles P. Slichter), The Loomis Legacy (David Lazarus, Urbana, Illinois, 1987), and a treasure trove of annual head's reports to the dean of the College of Engineering, departmental correspondence, and historic photographs.

This Web site, like Physics at Illinois, is a work in progress; it is always being expanded and improved. Check back often. If you have stories to contribute or photographs to share, we would love to hear from you!

A limited number of Professor Lazarus's excellent monograph, *The Loomis Legacy, and Dedication of the Loomis Laboratory of Physics,* which contains much of Professor Almy's *Century of Physics,* are available; write to Celia Elliott (cmelliot@uiuc.edu) if you would like a copy. ■

# Need a transcript?

Need a transcript or verification of your Illinois degree? The Office of Admission and Records offers a convenient on-line order form for transcripts at www.oar.uiuc.edu/current/transcripts/request_former.html. A transcript includes a student's courses, grades, GPA, and degree. University of Illinois official transcripts bear the Registrar's signature and are printed on security paper. Although a raised seal is no longer used, the University seal is printed on the transcript.

Transcript requests are typically processed within five business days, and express delivery is available for an additional fee. (Transcripts are $5.00 each.) If you attended the University prior to Fall 1982, however, you'll need to allow extra time; those transcripts are archived in a secure location and may require an additional two to three weeks' retrieval and processing time.

If you need verification of enrollment or verification of your degree for an employer or background screening, but not necessarily courses and grades, the University of Illinois has authorized the National Student Clearinghouse (NSC) to provide enrollment and degree verification. Their contact information is:

**National Student Clearinghouse**
www.studentclearinghouse.org
**Phone:** 703-742-4200
**Fax:** 703-742-4239
**Email:** degreeverify@studentclearinghouse.org
**Mail:** National Student Clearinghouse, 13454 Sunrise Valley Drive, Suite 300, Herndon, VA 20171

# Student News

## Shell supports undergrad research

*Keith Hjelmstad, College of Engineering, accepts a presentation check from Phil Metzler, manager of industrial relations, Shell Oil Company. The Shell Foundation supports a number of educational and research initiatives at the University of Illinois.*

Since 1996, annual gifts to Physics from the Shell Foundation have outfitted a "commons room" for centralized TA office hours, multi-media discussion classrooms and a prototype student-response system, and a dedicated multimedia course preparation room for faculty. They have purchased laptops and portable LCD projectors for classroom use and equipment for the advanced optics lab.

In 2007, instead of investing in hardware for Physics teaching, Shell invested in people, initiating a "Shell Scholars" program to support undergraduate research. Five talented undergraduates received $3000 stipends to pursue independent, hands-on research projects during the summer, supervised by Physics faculty.

The range of projects was wide and the scope ambitious. **Julien Ansermet** worked with Laura Greene to fabricate niobium tips for tunneling spectroscopy measurements of unconventional superconductors. **Brent Chatham** studied mechano-chemical conversion in molecular motors with Yann Chemla. Ido Golding trained **Hazel Kim** to use optical tweezers to study the behavior of biomolecules *in vitro.* **David Pignotti** designed and built four different air-particle-velocity transducers to use in his research on the performance characteristics of wind instruments, part of Steve Errede's "physics of music" effort, and **Dustin Wooten** worked with Munir Nayfeh's group to develop new methods to adhere silicon nanoparticles to substrates for use in optoelectronic devices.

"We are very grateful to Shell for this investment in our future," said Department Head Dale J. Van Harlingen. "As more and more students expect to do independent research as undergrads, we have scrambled to find the resources to support them. Thanks to Shell, that just got easier." ■

## Akselrod named Hertz Fellow

Gleb M. Akselrod (BS '07) was one of only 15 students nationwide to receive a 2007–08 Hertz Foundation Fellowship. The Fannie and John Hertz Foundation, which focuses on identifying and cultivating scientific talent in the United States, makes the annual awards to support five years of graduate studies for students in the applied physical, biological, and engineering sciences.

Akselrod is enrolled in graduate school in physics at MIT, working in Isaac Chuang's group at the Center for Ultracold Atoms. His project involves investigating an ion-trap system for performing quantum operations on single polar molecules, a critical step on the road to realizing a quantum computer.

"A mere theoretical concept 25 years ago, the idea of quantum computing has blossomed into the promising field of quantum information, in which we try to harness the odd and often paradoxical behavior of single atoms and particles of light to build computers that are exponentially faster than classical computers and to create encryption protocols that are guaranteed to be secure by the laws of physics," Akselrod says. "Though major hurdles remain on the way to practical quantum computing, such as the need for deeper theoretical understanding and miniaturization and scalability of devices, I believe it has boundless potential for our information-based society."

"At Illinois, I was fortunate to have both great teachers and world-class research advisers," said Akselrod. "Professor Willenbrock beautifully presented electricity and magnetism and showed me how many physics problems could be solved by arguing 'What else could it be?' and Professor Hertzog embodied what it means to be passionate about his students' education and taught me the craft of communicating my scientific ideas. Doing research in Professor Kwiat's group is what led to my interest in AMO physics and quantum information."

When asked what advice he would give to today's students, Akselrod unhesitatingly replied, "If you are thinking about going to graduate school, do research—***now***. There is no better way to find out if a career in physics is right for you than by getting your hands dirty in the lab. And take PHYS 403, Modern Experimental Physics. It's more work than a typical class, but where else are you going to measure cosmic muons and use an atomic force microscope?"

"We are very proud of this year's class of Hertz Fellows," said Hertz Foundation President John F. Holzrichter. "They represent the very best young scientific talent in our nation. Not only are they very academically gifted, each Fellow embodies the drive, creativity, and deep curiosity required to solve difficult problems and make innovative contributions to our country's future." ■

## New prize for undergraduate research

*Dale J. Van Harlingen and Robert E. Hetrick*

The topics range across every area of forefront physics research: Developing low-loss optical switching for single-photon sources. Measuring the interplane London penetration depth in organic superconductors. Unraveling quantum interference effects in forked superconducting nanowires. Investigating the formation of tidal features through numerical simulations of galaxy mergers. Determining electron transitions in fluorescent dyes using steady-state anisotropy measurements.

Increasingly, today's undergraduate students, like their predecessors Kyle Arnold (BS '06), Zane Shi (BS '06), Robert Colby (BS '05), Irina Marinova (BS '05), and John Eichorst (BS '05), who worked on these projects, are taking their places in Loomis Laboratory alongside graduate students and postdocs.

A gift from alumnus W. Dale Compton (PhD '55) to honor his first student, Robert E. Hetrick (BS '63, MS '64, PhD '69), now makes it possible for the department to recognize two outstanding undergraduate scholars each year for their research accomplishments. "We are very proud of these fine young students," said Department Head Dale J. Van Harlingen, "and we appreciate very much the opportunity to call attention to their achievements at this early stage, when such recognition is critically important in a young person's career."

The two 2007 Hetrick Prize winners are Gleb M. Akselrod (BS, '07) and Benjamin P. Carls (BS '07). Akselrod worked in Paul Kwiat's group, where he developed a numerical model of double-crystal entangled-photon sources, of interest for the development of quantum computing networks. His model was used to characterize the produced quantum state and to develop temporal and spatial phase compensation methods for improving the purity and brightness of entangled-photon sources by reducing phase decoherence. Carls worked under the direction of Kevin Pitts on a project to improve the Level 1 trigger for $B_s$ mesons at the Collider Detector Facility (CDF) at Fermilab. He evaluated several different trigger strategies to improve $B_s$ retention, including two-track and three-track triggers. Carls ran trigger cuts over simulated Monte Carlo events of $B_s$ decays and applied a minimum-bias background sample to determine how many background events each prospective trigger would discard.

The students presented their results at the Sixth Annual Department of Physics Undergraduate Research Symposium on January 26, 2007, which Dr. Hetrick attended. ■

# Alumni News

## Park named 2007 Outstanding Young Researcher

Tuson Park (PhD '03) of the Condensed Matter and Thermal Physics Group at the Los Alamos National Laboratory is the recipient of the 2007 Outstanding Young Researcher Award (OYRA), an annual award to honor an outstanding young ethnic Korean physicist by the Association of Korean Physicists in America.

A student of Myron Salamon's, Park's thesis research focused on superconductivity in the boro-carbides, exploring the thermodynamic signature of the gap nodes that were predicted but never observed experimentally in these compounds. Park developed a novel ac calorimeter capable of making angle-resolved magnetic-field-dependent specific-heat measurements, using it to observe directly modulations in the specific-heat of $YNi_2B_2C$ as a function of magnetic field angle. The observed modulation provided direct confirmation of the momentum-space quasiparticle gap structure. Park also used his calorimeter to elucidate the anisotropic superconducting gap in $LuNi_2B_2C$.

After receiving his PhD in 2003, Park went to Los Alamos National Laboratory as a post-doctoral research associate to work with Joe Thompson and the members of the Condensed Matter and Thermal Physics group. Based on his successful research in 2003 and 2004, Park was named a J. Robert Oppenheimer Postdoctoral Fellow in 2005.

Physics faculty member Taekjip Ha received the 2001 OYRA. ■

## Dr. Veysey goes to Washington

John Veysey (PhD '06), who recently finished his dissertation with Nigel Goldenfeld, has traded the casual dress and flexible schedule of grad school for long hours, a suit, and receptions without end. But he hasn't gone to Wall Street. He's wandering around the halls of power in Washington DC, trying not to step on anybody's toes in a world of Blackberries, where people check their email more often than a laid-back graduate student. Veysey will be in Washington for one year, where he'll be working on Capitol Hill in the office of Senator Robert Menendez (D-NJ).

Veysey is one of 162 scientists and engineers participating in the American Association for the Advancement of Science (AAAS) Science and Technology Policy Fellowship program. This 34-year-old program places academic experts—young and old alike, from fields ranging from agriculture to physics—into Congressional offices and federal agencies. The American Institute of Physics, which participates in the AAAS program, selected and sponsors Veysey.

In Menendez's office, Veysey will be working on a portfolio of energy and environmental policy issues, helping advise the Senator during discussions on global warming and with his work on the Energy and Natural Resources Committee. According to John, "The Senator wants me to avoid scientific gobbledygook and to act as a secret weapon, lying in wait to surprise lobbyists discussing statistical or technological details."

*John Veysey on the job*

Veysey aims to make a contribution to what he sees as one of our nation's most pressing problems. As he put it, "We need to use our natural resources sustainably, finding long-term energy supplies that destroy neither our environment nor our economy. Solutions to these problems require scientists who can communicate effectively with lay people."

John's thesis focused on work done with Goldenfeld and collaborators, including Bruce Fouke in the Geology Department, studying the patterns that form at hot springs in Yellowstone National Park. This interdisciplinary experience helped prepare him for DC, training him to understand, collaborate, and communicate with experts in other fields. "Moreover," says John, "interdisciplinary approaches will be essential in solving sustainability problems."

Veysey was led to apply to the American Institute of Physics, which sponsors his Fellowship, by years of reading Bob Park's "What's New" column and several key Illinois experiences. Midway through John's graduate work, Goldenfeld put him in touch with Francis Slakey (PhD '92), another Illinois alumnus, who currently directs the American Physical Society's Washington DC office and teaches at Georgetown University.

Inspired by the notion that a physicist could leave academics to work purely on science policy, Veysey asked Fred Lamb to let him serve as a teaching assistant for his class on nuclear weapons, nuclear war, and arms control. This experience drove home the need to communicate clearly and succinctly about issues that can combine the worst of scientific, military, and political jargon. Veysey added, "Working with Professor Lamb also helped me see how combining expertise in physics with passion and idealism could result in real improvements to U.S. policies."

Having been in Senator Menendez's office for only a few weeks, Veysey has yet to find a "normal" routine. "It's been a maze of seminars, interviews, and meetings," he said, "but I've had an incredible opportunity to see how things work around here. The AAAS program afforded me a remarkable opportunity to meet and interview with a dozen different House and Senate offices."

In a town where the importance of networking cannot be overstated, the AAAS Fellows have a unique advantage. "We're all scientists," said Veysey. "I immediately knew 34 other Congressional staffers, almost 100 people in executive agencies, and I have access to almost 2,000 "alumni," many of whom are still involved in science policy." Perhaps the most famous program alumnus is Rush Holt, a plasma physicist who currently serves in Congress as Representative of New Jersey's 12th Congressional District, and who spoke to incoming Congressional Fellows during their orientation.

Veysey thinks it unlikely that his fellowship year will lead to a Congressional office, but he hopes to transition from academia into a career where he can use his interdisciplinary experience and communication skills to bring clear, usable information to policy makers. When asked what advice he might offer students interested in policy work, Veysey said, "Get involved in the upcoming elections, and the call for next year's fellowship applications went out last week on the AAAS website. Apply!" ■

# Edelstein receives DSc from Aberdeen

William A. Edelstein (BS' 65) received an honorary DSc degree from the University of Aberdeen on July 4, 2007. Currently Distinguished Professor of Radiology at the Johns Hopkins University School of Medicine, Edelstein is a pioneer of medical magnetic resonance imaging. He was the primary inventor of the "spin-warp" imaging method, a major breakthrough in imaging and still the method used in MRI scanners worldwide.

After receiving a PhD from Harvard University in 1974, Edelstein was a postdoctoral research fellow at Glasgow University working on gravitational wave detection. He moved to Aberdeen University, also in Scotland, as a Research Fellow in 1977, where he was part of a groundbreaking effort to develop MRI. He joined the General Electric Corporate Research and Development Center in Schenectady, New York in 1980, where he spent the next 21 years making seminal contributions to MRI science and technology and the development of GE's MRI systems.

Edelstein is a Fellow of the APS, a Fellow of the Institute of Physics (UK), and a Fellow of the International Society of Magnetic Resonance in Medicine (ISMRM). He was awarded the Gold Medal Prize from the ISMRM in 1990, and in 1991 was named a Coolidge Fellow, GE's highest corporate scientific honor. He received the American Institute of Physics Prize for Industrial Applications of Physics in 2006. ■

L. Brian Stauffer

*C. Duncan Rice, Principal and Vice Chancellor of the University of Aberdeen (Scotland) with William A. Edelstein (BS '65)*

# Franz recognized by AAPT

The American Association of Physics Teachers (www.aapt.org) announced on November 19 that the Melba Newell Phillips Medal has been awarded to Judy R. Franz (MS '61, PhD '65), executive officer of the American Physical Society (APS), in recognition of her creative leadership and dedicated service that have resulted in exceptional contributions within AAPT.

The Medal was presented to Franz at a ceremonial session of the AAPT winter meeting at the Marriott Waterfront Hotel in Baltimore, Maryland, on Tuesday, January 22, 2008.

Ken Heller, Chairman, AAPT Awards Committee, said, "Dr. Franz has been an unstinting contributor to all of the functions of the AAPT. Her leadership in the governance and direction of AAPT has had a lasting effect on the organization. She has been especially important in forging a productive relationship between the AAPT and the APS to further the goals of physics education. In her dedication to physics education and the AAPT, Judy Franz exemplifies the deep connection between physics, physicists, and physics education that characterized Melba Phillips."

"Judy has served physics education consistently throughout her career, as a professor and as a leader both nationally and around the world. She pursues with vigor and tenacity the goals of promoting effective physics teaching and research, increasing the visibility and impact of physics and physicists within the larger society, and attracting women and minorities to the field. As a colleague, I have developed the highest respect for her dedication and effectiveness," stated Toufic Hakim, AAPT's executive officer.

Franz is a condensed matter physicist and educator who has contributed a lifetime of service to the AAPT. She has been influential in guiding the policies and direction of AAPT and served as its president in 1990. Throughout her career, she has been instrumental in forging closer relations between AAPT and APS on issues of education. For example, she was the first chair of the joint College–High School Interaction Committee in 1983 and helped organized the first Physics Department Chairs meeting, which is still co-sponsored by AAPT and APS. She was a professor of physics at Indiana University, Bloomington, West Virginia University, and the University of Alabama, Huntsville. She is currently the executive officer of APS. In her position as executive officer, she is actively involved in the education, outreach, diversity, public affairs, and international programs of the APS.

In addition to her work within AAPT and at APS, Franz is the Secretary General of the International Union of Pure and Applied Physics (IUPAP), the international organization of physicists representing more than 50 member countries.

She is currently a member of the governing board and executive committee of the American Institute of Physics (AIP) and is a representative to the US National Committee to UNESCO. In the past, she has served on the AAAS Council, as well as advisory committees for the Department of Energy, Los Alamos National Laboratory, the Office of Naval Research, and the National Science Foundation.

Regarding the award, Franz stated, "I was amazed and delighted to learn that I would receive the Melba Phillips Award. I was inspired to major in physics by my introductory physics course at Cornell University, taught by then-AAPT-President-to-be Don Holcomb (MS '50, PhD '54). Since then I have worked to interest and excite young people about physics. I am grateful to the AAPT for its deep and continuing commitment to promoting excellence in the teaching of our fascinating discipline!"

Ken Cole

*Judy R. Franz*

## About the Award

The Melba Newell Phillips Medal honors Melba Phillips for her leadership and dedicated service to physics education. She was the first woman president of the AAPT and a founder of the Federation of American Scientists. Professor Phillips' research was in nuclear physics, and she served on the faculty of Brooklyn College and the University of Chicago. She was a champion of physics education throughout her life. This Award is given only occasionally to AAPT leaders who have demonstrated similar exceptional contributions. The first recipient of the Award was Melba Phillips herself (Emeritus, University of Chicago), in January 1982.

## About AAPT

The AAPT is the leading organization for physics educators, with more than 12,000 members worldwide. Its mission is to enhance the understanding and appreciation of physics through teaching. AAPT was founded in 1930, and is headquartered in the American Center for Physics in College Park, Maryland. The University of Illinois hosted the 2008 Illinois Section meeting of the AAPT in Urbana on April 4 and 5. ■

*[Ed. note: Judy Franz and Donald Holcomb were both students of another extraordinary physics teacher, Charles P. Slichter.]*

# Ahrenkiel and Crandall *"emeritus"* at NREL

Lifelong friends, colleagues, and Physics alumni Richard K. Ahrenkiel (BS, '59, MS '60, PhD '64) and Richard S. Crandall (MS '62, PhD '64) have retired from distinguished careers at the National Renewable Energy Laboratory. They are shown here with NREL colleague Tom Milne. The NREL awarded the honorary title of *emeritus* to the three researchers; they are the first to receive these prestigious appointments, which were initiated July 2006. Crandall and Ahrenkiel, world experts in photovoltaics, will continue to mentor NREL scientists, collaborate on technical issues, review projects and publications, and participate on national panels for the laboratory. ■

Mike Linenberger, NREL

*Tom Milne, Richard Crandall, and Richard Ahrenkiel*

## Backward Glance

In *The Loomis Legacy*, Professor David Lazarus wrote:

> Besides the off-hours parties for which the department was justly famous, specific departmental social functions were also taken as an important part of the department's responsibilities…Each spring heralded the glorious annual departmental picnic where *everyone* associated with the department always came with spouses and children of all ages. There would be an annual softball game at which the graduate students would usually force the faculty to an inglorious defeat. There were always balloons for the children, filled, on the spot, with "surplus" helium from the low-temperature labs, and each weighted, via a careful design of Charlie Slichter's, with a heavy steel washer so that it could not float up and away from a small, weeping child. There was a well-equipped playground for small children, complete with a hired supervisor, so that parents could indulge in more "adult" activities (like playing softball).

*From left, Donald M. Ginsberg, Lorella M. Jones, graduate student Lynn A. Garren (back to camera) (MS '76, PhD '82), graduate student Richard F. Martin (PhD '83) at the Physics picnic, ca. 1978–79.*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*not a place, a habit of mind…*


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