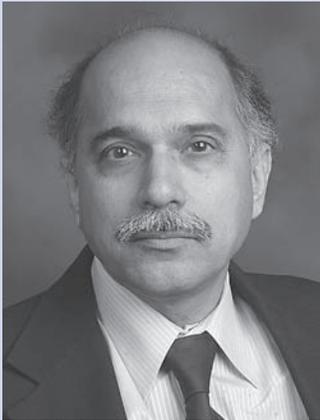




Greetings from the Chair —



Assuming you were familiar with the department as described in the last Newsletter of Spring 2003, what would you notice if you dropped by for a visit?

First, you will find me a lot happier than in this photograph. Of the many reasons let us begin with people. You would run into a lot of young and dynamic faculty. I will say just a few words about each since details follow later in the newsletter. Helen Caines, who was a Research Scientist at WNSL, joined the faculty as assistant professor effective July 2004. She is an emerging leader in the field of relativistic Heavy Ion Collisions. Eric Dufresne (mechanical engineering with a joint

appointment in physics) works in soft condensed matter, often collaborating with Simon Mochrie. It is a pleasure to welcome Eric to the faculty after having had him as a (star) student in my class years ago. (He vehemently denies that he still owes me Problem Set 15, overdue by 10 years!) Richard Easter joined us in January 2004. He works in the interface between particle physics and cosmology and has already strengthened our ties to Astronomy. Bonnie Fleming joined us in fall 2004. Bonnie works on neutrinos and is a terrific pedagogue. Steven Furlanetto will start in January 2006 as assistant professor. Steve, who specializes in the re-ionization period of the early universe, is going to be central to our efforts in Astrophysics. Walter Goldberger joined the particle theory group in January 2005. He is primarily interested in physics beyond the Standard Model of particle physics.

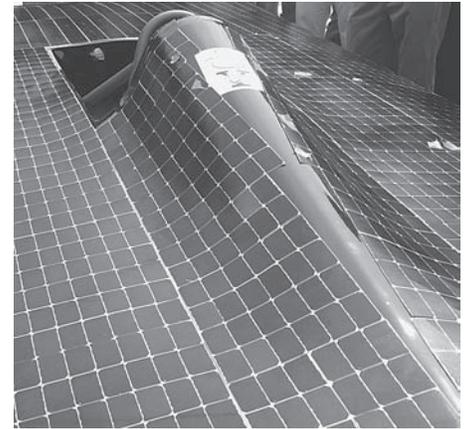
Walter completes our theoretical particle physics group, which now has four members, the others being Tom Appelquist, Witold Skiba (recently tenured), and Richard Easter. A section of Sloane Physics Lab is being renovated to allow this group to function at its best. The AMO group is also fully operational thanks to two new appointments: Jack Harris, who joined in fall 2004, and Dan McKinsey, who joined a year earlier. Jack works on the interface between atomic-molecular-optical and condensed matter physics. He is busily building up his lab in Sloane. Dan is engaged in several ambitious projects aimed at ferreting out dark matter and dark energy and probing neutrinos. His research spans many areas and many buildings: he operates out of Sloane and a newly constructed portion in WNSL. Finally, Volker Werner joined the faculty in July 2005, after a one-year postdoctoral appointment with us. Volker will operate out of WNSL and study nuclear structure, phase transitions, and collective behavior.

In addition to these faculty and their research teams of postdocs and graduate students, you will also see a very large number of undergraduates engaged in research. We have an unprecedented level of research on campus that students can participate in. You will find new labs of David DeMille, Jack Harris, Dan McKinsey, and Bonnie Fleming in Sloane and Gibbs. At WNSL and its extension you will also find the labs of Helen Caines and Dan McKinsey.

You will also find several familiar faces missing. Tilo Wettig left our Nuclear Theory group to assume a tenured position in Regensburg in Germany in June 2004. Con Beausang left us in August 2004 to go to the University of Richmond

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A Solar-Powered What?



Yale's Team Lux runs with the sun. See page 3.

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Chair's Message *continued from page 1*

to become the Robert E. and Lena F. Loving chair. Yale physics will remain grateful to him for his brainchild, the Physics Olympiad, now in the hands of Peter Parker. Con will, however, return to work at WNSL and the Yale Summer School. Charlie Sommerfield retired at the end of 2004. He and Linda are exploring life in Florida with the possibility of staying at Gainesville. While we wish them luck, we would be delighted to have them back. (I need Charlie as my czar for office allocations. In his absence Sam MacDowell will take over. We are all watching breathlessly as this transition of power takes place.) Subir Sachdev has accepted a position at Harvard. He will be sorely missed in his various capacities: friend, oracle, and computer wizard. We like to think that we are not losing a friend but gaining one in Harvard. Jeff Snyder left in December 2004 to assume a new position at the Institute for Defense Analyses in Washington DC. Jeff played a serious role in our efforts to revamp the undergraduate labs. Lastly, in September 2004 Victor Zamfir accepted the position of Director of the National Institute for Nuclear Physics in Romania.

Besides these inevitable transitions we also lost two dear colleagues. D. Allan Bromley, Sterling Professor, passed away February 10, 2005, lecturing till the very last day. A memorial was held in his honor and a symposium is scheduled to take place this fall under the leadership of Franco Iachello. Jack Greenberg, professor emeritus, passed away after a brief illness on March 30, 2005. These two colleagues, who were a part of our department for so many decades, will be remembered and missed.

Our commitment to undergraduate education continues unabated. The Committee on Undergraduate Programs reforms are complete, and the revised curriculum has drawn many new students to physics. The BS track for those with other serious pursuits and alternate career goals, perfectly suited to Yale's unique student body, is drawing a lot of students. The students, who continue to enjoy an intense sense of community with their regular Society of Physics pizza meetings with faculty, Chairman's Teas, and annual picnics, now have a place they can call their own: a brand new lounge (inaugurated by Dean Peter Salovey) loaded with plenty of sofas (for sleeping), a gourmet coffee machine (to stay awake), tables, blackboard, mini-library and numerous computers and wireless connection.

Graduate students continue to thrive under the stewardship of Steve Girvin, director of graduate studies, and registrar Jo-Ann Bonnett. New students continue to receive laptops loaded with all the software they will likely need right away. Several incoming students receive the prestigious Leigh Page Prizes. Our graduate students are a very active group, with frequent seminars and journal club meetings and a semi-monthly happy hour after Physics Club. The department will award from the Sloane endowment funds three fellowships to allow students to attend conferences or summer schools.

Finally, if you wandered into my office, you would see some new faces. Giselle De Vito took over last summer for Diane Altschuler, who moved to the neighboring department of MCDB after years of splendid service. Linda Ford, who used to be the undergraduate registrar, is now working in the office of the chairman. Daphne Klemme has taken over undergraduate affairs as well as assisting Jo-Ann with graduate student affairs. Daphne



also manages our website, www.yale.edu/physics. Harley Pretty continues as our dynamic business manager, responsible among other things for overseeing the numerous renovations.

In short, the department is a vibrant community, with an active student body and a dynamic and diverse faculty and staff at its core. Thanks to all of you alums for writing to us about yourselves. Keep those letters coming and turn to this newsletter for periodic updates on how your friends and beloved department are doing.

R. Shankar, Chair
J. R. Huffman Professor of Physics

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Your comments, suggestions and news are most welcome!

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Solar-Powered Car Gears up for Another Race: Next Stop Nascar?

Don't laugh, because the *John Lee*, Yale's solar-powered car, can go 75 miles an hour! The vehicle is a project of Team Lux, a group of undergraduates who have been designing, building, and racing solar-powered cars since 1997.

The *John Lee*, which is named after a generous donor alumnus, is the team's fourth car. It weighs 300 pounds, runs with less than two horsepower, and is powered by solar energy alone, but it can reach speeds comparable to those of gasoline-powered vehicles.

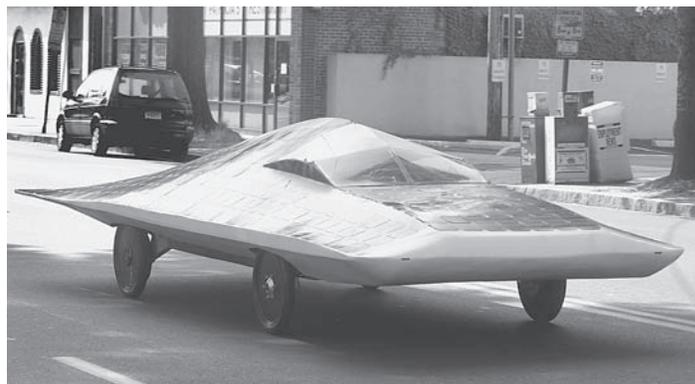
The car was built in collaboration with Sikorsky Aircraft, with the team designing the car and Sikorsky providing the facility, tools, and equipment for building it. "It was an ideal partnership between students and industry," says Moshe Gai, adjunct professor of physics and chair of the team's faculty advisory board.

A partnership was also formed with the car's sponsors. The *John Lee* was built out of space-age carbon alloys and cost \$400,000. Half of the money was provided by Yale president Richard Levin, and the other half was raised through an "Adopt-a-Cell" matching program, in which faculty, students, and interested outsiders "bought" one or more of the 3,051 photo-voltaic cells on the surface of the vehicle.

In addition to designing and building the car, the team also does the testing and driving. In May 2004 Team Lux competed in the Phaethon solar car rally in Greece. The team finished in seventh place in the 800-kilometer contest, only twelve minutes behind the winner of the race and right behind the winner of the Australian World Solar Challenge.

Every race is a team effort. Although the car carries only one person lying down, the team must provide lead and chase vehicles, each with a driver and a radio man, as well as extra supply drivers for the *John Lee*. A typical racing day lasts six hours, with at least two drivers working in turn.

The team has attracted a great deal of attention from university leaders, industry sponsors, and curious highway patrol



officers. "These students are raising the Yale banner very high," says Professor Gai. "We have been good for 300 years in the classics, but Team Lux shows that we are also very good in science and engineering."

The team's most recent efforts were focused toward modifying the *John Lee* for competition in the North American Solar Challenge in July 2005 on 2600 miles of public roads from Austin, Texas to Calgary, Alberta.

So that's the flying saucer you saw in the rear-view mirror!

COUP Takes Over Physics Program

The physics department has begun an ambitious overhaul of its undergraduate program, making significant changes in the student curriculum, facilities, and social life.

The changes began two years ago, when, concerned about the decreasing number of physics majors, chairman R. Shankar convened a Committee on Undergraduate Programs (COUP).

The COUP, chaired by Thomas Appelquist, found that the undergraduate program had been static since the 1960s. Laboratory facilities were in poor repair, courses were outdated, and morale was diminished. The committee wrote an internal evaluation and then began implementing changes.

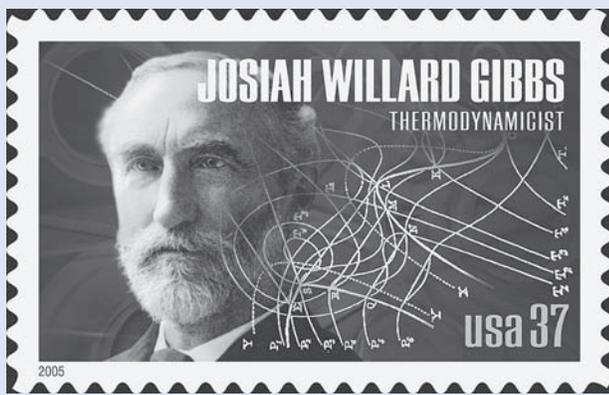
First, changes were made in the curriculum to remove unnecessary barriers to undergraduates who wish to study physics. There are now two parallel tracks for majors: an intensive BS for those wishing to pursue graduate study in physics, and a regular BS for students whose interests are broader. The intensive BS requires a senior research project, which gives students the opportunity to work with established scholars on current problems in the field.

The department also reduced slightly the number of advanced courses required for the major. This revision makes it possible for students to begin the major in the sophomore year, and the department can then attract students who discover a love of physics after they arrive at the university. The course reduction also facilitates double majoring, making the major more accessible than it was before.

The department has also begun offering new advanced elective courses. Many physics majors had complained that

continued on page 4

Better than a Chaired Professorship



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Our own Gibbs (1839-1903) is one of four US scientists honored in a new series of first-class postage stamps unveiled at Yale in May 2005.

they did not get to work on new material, and students in other sciences regretted that they could not study the more exciting areas of physics without first taking a raft of prerequisites. The department has begun to address this problem by offering new sophomore courses on such topics as nanoscience, cosmology, physics of the environment, and biophysics. These courses remain experimental, and their success will be evaluated over the next year before they are made a permanent part of the curriculum.

In a second wave of changes, the department also undertook the renovation of the undergraduate laboratories. During summer 2004, three laboratories and two classrooms underwent extensive renovation. The labs now feature refinished floors, new wiring, and new cabinets, and the classrooms have been fitted with motorized projection screens and new lighting. The equipment in the laboratories is now the same as that used by Yale researchers, so that students will be able to go directly from their studies into work in a real laboratory.

Finally, the department worked on fostering a greater sense of community

“In only three years, the number of physics majors rose dramatically from 10 to 24.”

among undergraduates. A new series of Chairman’s Teas allows majors to meet with the chairman in an intimate, unpressured setting to discuss “Who Got the Nobel Prize and Why?” and other topics on the frontiers of physics. Friday pizza lunches financed by the department gather students to hear faculty members talk about their research. And a new undergraduate lounge now offers a place to study, socialize, and sleep. (See article below.) Other special events, such as a tee-shirt contest, a yearly departmental picnic, and a physics career website, all have boosted morale among the undergraduates.

The result of all of these changes has been an enormous increase in the number of students studying physics. In only three years, the number of majors rose dramatically from 10 in 2002-03 to 24 in 2005-06, with a projected increase to 35 in 2006-07.



The progress made by the department has been confirmed not only by the numbers but also by an outside committee. In fall 2004 a consulting team from the National Task Force on Undergraduate Physics came to Yale to evaluate the physics program. They met with faculty members, interviewed students, and toured the laboratories and classrooms. The conclusion? Their report confirmed both the problems and solutions that the committee had already identified.



New Lounge for Busy Electrons

Are you tired of spinning around the same old nucleus again and again? Well, if you’re a physics student at Yale, you can now take a break in a new lounge just for undergraduates.

Tucked away on the third floor of Sloane, the lounge features comfortable purple leather lounge chairs, four tables with chairs, two computer stations, six Internet-wired workstations, a small library, and a kitchenette. A large window on the south side gives a view of the spires and skyscrapers of downtown New Haven.

The lounge, which was designed by the students themselves, was inaugurated by Dean Peter Salovey in April 2005.

YCAA Makes MUSYC, Sells GOODS

The Yale Center for Astronomy and Astrophysics is happy to report a number of exciting new projects.

The MUSYC survey (MUltiwavelength Survey of Yale and Chile) is using deep surveys of the sky to identify galaxies and black holes in the formation in the early universe.

Another project is GOODS (Great Observatories Origins Deep Survey), which has found a large population of hidden black holes in the centers of distant, young galaxies. GOODS involves Hubble, Spitzer, and Chandra—the three “Great Observatories” of NASA.

In the future, the center plans to get involved in space projects like SNAP, an ambitious project to study dark energy, and Astro-E2 and Constellation-X, which are advanced observatories for X-ray astronomy. The center is also pursuing an advanced large-format, high-resolution camera for the WIYN telescope (a facility partly owned by Yale), which will provide images of the sky that are almost as sharp as those provided by the Hubble Space Telescope but covering nearly one thousand times the area of sky.

The YCAA continues to grow, attracting new postdocs and now, thanks to a generous donation from Gilbert and Jaylee Mead, a funded prize postdoctoral fellowship. “So things are really hopping at the YCAA,” says director Meg Urry.

Faculty News — Recent Appointments

Helen Caines was promoted from research scientist to assistant professor in July 2004. She holds the PhD and bachelor's degrees from the University of Birmingham in England. Before coming to Yale, she held research fellowships at Ohio State University.

Professor Caines has already created an impressive record of research in the field of relativistic heavy ion physics. Over the past three years she has delivered eight invited talks at international conferences and workshops, and has produced 28 journal publications.

She is currently concentrating on research with the STAR collaboration at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory. The aim of this research is to study the properties of matter under extreme conditions and thus further our understanding of the quark structure of matter. She is particularly interested in the production of hadrons containing strange quarks, and their properties at high momentum, which helps to shed light on the physics of the initial scattering processes.



fellowships at the Waseda University in Japan; at Brown University; and at the Institute of Strings, Cosmology, and Particle Physics at Columbia.

Professor Easter is one of the world's leading young theoretical particle physicists working in the frontier areas of cosmology and string theory. These interests place him in the center of modern work in cosmology, including the understanding of the dark energy that is driving the accelerating expansion of the universe. His strengths include both creative model building and numerical simulation of complex cosmological phenomena.

He also brings to Yale an impressive record as a teacher. He has lectured widely all over the world, and has taught during his research appointments at Brown and Columbia.



Eric Dufresne was hired as an assistant professor of mechanical engineering in July 2004, with a joint appointment in physics beginning in January 2005. He earned his PhD from the University of Chicago and his BS from Yale in 1996.

Professor Dufresne has held a postdoctoral fellowship at Harvard and has also worked as a consultant for McKinsey & Co. He is the co-founder of Arryx, Inc., a Chicago

company that uses holographic laser steering at microscopic and nanoscopic levels to improve manufacturing and processing productivity. He holds three patents for optical manipulation instruments.

Professor Dufresne is an experimental condensed matter physicist working in the area of fluid dynamics, complex fluids, and classical statistical mechanics. His joint appointment strengthens the department's coverage of the soft matter subfield of condensed matter. He is working in collaboration with physics professor Simon Mochrie.

Richard Easter joined the faculty in January 2004 as assistant professor. He earned his bachelor's and doctorate degrees from the University of Canterbury in New Zealand and has held research



Bonnie Fleming joined the department in fall 2004 as assistant professor with a specialty in accelerator-based neutrino physics. She earned a PhD at Columbia and a BA at Barnard College. Before coming to Yale she was a Lederman Fellow at the Fermi National Accelerator Laboratory.

In her current research, Professor Fleming collaborates on the Fermilab's MiniBooNE experiment, which is expecting its first results in the fall. She also serves as spokesperson for the FINeSSE effort to study neutrino scattering physics, and she is exploring efforts to use massive liquid argon detectors for long-baseline neutrino oscillation physics. In her new laboratory at Yale, prototyping work for these detectors is underway. Professor Fleming has extensive experience in public presentations. She presented seven invited talks at international conferences last year and sixteen presentations at seminars and colloquia over the past three years.

Steven Furlanetto has been hired as an assistant professor beginning in January 2006. He is currently the Lee A. DuBridge Prize Postdoctoral Fellow in Theoretical Physics and Astrophysics at the California Institute of Technology. Professor Furlanetto earned his PhD from Harvard University in 2003 and his BS from Carleton College in 1998, with a Certificate of Advanced Study in Mathematics from the University of Cambridge in the interim.



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Faculty News — Recent Appointments *continued from page 5*

Professor Furlanetto has emerged as a leader in studies of the high redshift universe. He has worked on other topics in cosmology, including the composition and structure of the intergalactic medium, galaxy formation, constraints on the nature of dark matter, and gamma-ray bursts.

At Yale, Professor Furlanetto will play an important role in the growing astrophysics and cosmology activities of the Yale Center for Astronomy and Astrophysics, including the planned deep survey with a new-technology wide-field camera for Yale's WIYN telescope in Arizona.

Walter Goldberger joined the department in January 2005 as assistant professor. He comes to Yale from a postdoctoral fellowship at the Lawrence Berkeley National Laboratory at the University of California at Berkeley. He earned his PhD from Cal Tech and his bachelor's degree from MIT.

Professor Goldberger is a creative young theorist working on extensions of the standard model of strong and electroweak interactions. It is known that this model must break down at the energies that will be attained in the next generation of high-energy particle colliders. The question of what will be found there is perhaps the most exciting in all of fundamental physics. Professor Goldberger is also an expert on the detection and interpretation of gravity waves, and he is a gifted teacher with over three years of experience giving seminars in his field.

Jack Harris joined the department in fall 2004 as assistant professor. He earned his PhD from the University of California at Santa Barbara and his BA from Cornell.

After completing his doctorate, he held a research fellowship at the Harvard/MIT Center for Ultra Cold Atoms with Wolfgang Ketterle and John Doyle, working on a new technology for producing extremely large samples of Bose-condensed atoms. As a graduate student in the group of David Awschalom (UC Santa Barbara), he used micromechanical resonators as sensitive force transducers to study magnetized materials.

With experience on both sides of the growing interface between atomic-molecular-optical and condensed-matter physics, Professor Harris complements the existing strength in the physics department. He has developed a novel research proposal in which he plans to attack issues traditionally classified as quantum optics using the micro-resonator technology from his Ph.D. work.

In addition to his promise as a researcher, Professor Harris is an enthusiastic teacher. His postdoctoral advisor, John Doyle,

described him as perhaps the most gifted explainer of ideas he has ever worked with.



Daniel McKinsey joined the department in fall 2003 as assistant professor. Before coming to Yale, he held a postdoctoral fellowship at Princeton and earned his PhD from Harvard and his BS from the University of Michigan.

As a graduate student, he did work leading to the

first magnetic trapping of neutrons. At the same time, he independently developed a proposal for a new technique to detect weakly interacting particles, with unprecedented low levels of background that mask the desired signals. This method is based on using cryogenic noble gases (particularly liquid neon) as a detector material, and is closely related to his neutron-trapping work.

His method has wide applicability to the study of various problems, such as the properties of neutrinos, the structure of the sun, the dynamics of supernovae, and the makeup of the dark matter that accounts for most of the mass of the universe. Professor McKinsey's work can be characterized broadly as low-energy physics with areas of interest in several active subfields, including atomic, nuclear, particle and astrophysics. His work has been recognized with the Sloan and Packard fellowships.

Volker Werner was promoted from postdoctoral associate to assistant professor in July 2005. He holds a PhD from the University of Köln in Germany, where he led the gamma-ray spectroscopy group before coming to Yale.

Professor Werner has already achieved an impressive record of research in nuclear structure physics. He has written over 42 publications in refereed journals, delivered several invited talks at international conferences, and received over 350 literature citations.

His research focuses on collective modes in atomic nuclei, especially those involving either isoscalar or isovector quadrupole excitations. He is one of the world's leading experts on the concept and use of Q-invariants to study the equilibrium structure of collective nuclei, and of mixed symmetry states in which the proton and neutron components of the nuclear many-body system move partly out of phase. He has studied both their collective correlations and their underlying single particle structure.

Recently Professor Werner has been studying phase transitional behavior in finite nuclei. One key result was a completely new interpretation of E₀ transitions in such regions that supplants the standard interpretation for the last 20 years.



IN MEMORIAM: FACULTY

D. Allan Bromley, Sterling Professor of the Sciences and former Dean of Engineering at Yale, died suddenly on February 10, 2005, in New Haven at the age of 78.

One of the world's leading nuclear physicists, Professor Bromley was founder and director of the A. W. Wright Nuclear Structure Laboratory at Yale from 1963 to 1989. He carried out pioneering studies on both the structure and dynamics of atomic nuclei and was considered the father of modern heavy ion science. From 1972 until 1993, he held the Henry Ford II Professorship in Physics, and from 1970 to 1977, he served as chair of the Physics Department. As Dean of Engineering from 1994 to 2000, he began developing interdisciplinary programs in environmental engineering and biomedical engineering.

Professor Bromley was an outstanding teacher; from 1965 to 1989, his laboratory at Yale alone graduated more doctoral students in experimental nuclear physics than any other institution in the world. Professor Bromley published over 500 papers in science and technology, and edited or authored twenty books. He received numerous honors and awards, including, in 1988, the National Medal of Science, the highest scientific honor awarded by the United States.

For more than two decades, Professor Bromley was a leader in the national and international science and science policy communities. As chair of the National Academy of Science's Physics Survey in the early 1970s, he was central to charting the future of physics in the subsequent decade. As president of the American Association for the Advancement of Science and of the International Union of Pure and Applied Physics, he was one of the leading spokesmen for U.S. science and international scientific cooperation.

From 1989 to 1993, he served under George H. W. Bush as the first Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy. He chaired and revitalized the Federal Coordinating Council for Science, Engineering and Technology, and he achieved an unprecedented level of cooperation and communication among the more than twenty federal agencies that support U.S. science and technology. He was responsible for the first formal published statement of U.S. Technology Policy and played a central role in expanding cooperation between the federal government and the private sector toward effective use of technology in U.S. society.

Professor Bromley also chaired the President's Council of Advisors on Science and Technology and the Intergovernmental Council on Science, Engineering and Technology. During the first Bush Administration, he testified often before Congressional committees and delivered more than 400 addresses to major audiences across the country and the world as the senior representative of American science and technology.

Prior to his appointment to the first Bush Administration, he served as a member of the White House Science Council during the Reagan Administration and as a member of the National Science Board in 1988–1989.



Born in Westmeath, Ontario, Canada, Professor Bromley received a B.Sc. degree with highest honors in 1948 from the Faculty of Engineering at Queen's University in Ontario. For his graduate work in nuclear physics, he received an M.Sc. degree from Queen's University in 1950 and a Ph.D. degree from the University of Rochester in 1952. He was subsequently awarded thirty-two honorary doctorates from universities in Canada, China, France, Germany, Italy, South Africa and the United States. He joined the Yale faculty as associate professor of physics in 1960, after beginning his academic career at the University of Rochester and serving as the Senior Research Officer and Head of the Atomic Energy of Canada, Ltd.

Colleague and former student Richard Casten remembers Professor Bromley as “a larger-than-life figure — a great scientist who was the father of heavy ion nuclear physics, who had a vision of science that was unique, broad, with international scope, and who could expound his agenda so that it could be put into practical realization.”

Professor Bromley combined intellectual prowess with an unpretentious demeanor, says Casten. “Though he was incredibly busy and a formidable presence, he always had time to mentor his students, before and after their studies, and he possessed an uncanny knack for dispelling clouds of confusion with just a few words.”

Adapted from Yale Weekly Bulletin and Calendar

Faculty News — Recent Promotions

Paoli Coppi was promoted from associate professor of astronomy to professor with tenure in July 2003. He earned his PhD from Cal Tech in 1990 and did postdoctoral research at the Fermi Institute before coming to Yale in 1994.

Professor Coppi specializes in high energy theoretical astrophysics and is a highly regarded researcher in the field of computational astrophysics. Some of his most interesting research has focused on the highest energy TeV photons and their propagation throughout the cosmos. His team has demonstrated that the universe is opaque to the highest energy photons, and his related computations have allowed this fact to be used to put limits on cosmology. Recently Professor Coppi has been studying star formation in the early universe. In 2000 he delivered an invited lecture at the Yukawa Memorial Symposium in Japan.

Homer Neal was promoted from assistant to associate professor in January 2005. He earned his PhD at Stanford in 1995 and then

worked as a scientific associate at CERN before coming to Yale in 1999.

In a short time Professor Neal has established an international reputation as a particle physicist in the area of electron-positron collisions. He has carried out experiments at the leading research facilities in the world, Stanford's SLAC and LEP at the CERN laboratories in Geneva. He has published research on babar resistive plate chambers, on non-universal SUGRA points, and on chargino and neutralino production.

Witold Skiba, who was appointed as an assistant professor in 2002, was promoted to associate professor with tenure on July 1, 2005. He earned his PhD at MIT in 1997.

In 2003, he received an Outstanding Junior Investigator Award from the Department of Energy, and co-organized the principal particle physics workshop at the Aspen Center for Physics involving 50 of the world's leading theoretical particle physicists. At Yale, he has taught superbly

at the graduate level, redesigning our core graduate course on quantum field theory.

Professor Skiba's research has focused on the new physics that lies beyond the standard model of strong and electroweak interactions, and will appear experimentally at the TeV energy scale. Professor Skiba and collaborators have proposed and studied a mechanism for breaking supersymmetry called gaugino mediation, which is very simple and elegant, relies on extra dimensions, and has clear testable signatures at the LHC.

Most recently, Professor Skiba, with graduate student Zhenyu Han, is developing a general framework for implementing the constraints from all previous precision electroweak experiments. So far, there is no comprehensive analysis of all these effects using the existing precision measurements. The results of this new work should be an important guide for future model building and for analyzing the next generation of collider experiments.

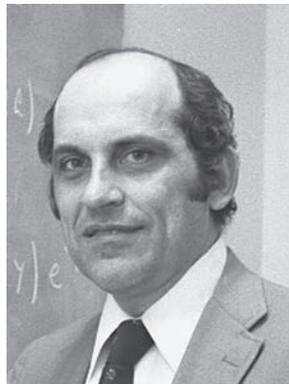
Faculty News — Retirements

Samuel MacDowell retired as professor of physics at the end of 2003. He was born in Pernambuco, Brazil, and earned his bachelor's degree from the University of Pernambuco in 1951. After completing his doctorate at Birmingham University in England, he worked at the Centro Brasileiro de Pesquisas Físicas in Rio de Janeiro and then at the Institute for Advanced Study in Princeton.

In 1965 Professor MacDowell, who had become known for his seminal contributions to meson physics, was hired by Yale. His research has focused on elementary particle physics, especially weak interactions, dispersion relations, strong interactions, S-matrix bounds, field theory, renormalization, supersymmetry and supergravity.

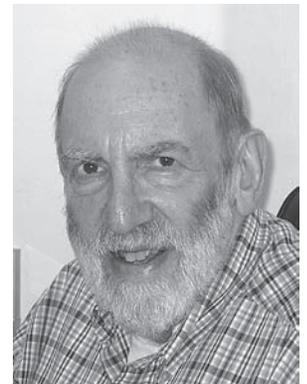
Among other awards, he received the Medal of the Order of Grao Cruz of Scientific Merit of the Brazilian Government in 1998. He is a member of the Brazilian Academy of Sciences and a fellow of the American Physical Society.

At a retirement party in November 2004, long-time colleague Tom Appelquist described MacDowell as "one of the most disengaged, pleasantly forgetful people I have ever known in my life, someone who gives new meaning to the term 'absent-minded professor.'" But, said Appelquist, MacDowell knew exactly what he was doing when he forgot to attend faculty meetings.



1977

Charles Sommerfield retired at the end of 2004. A native of Brooklyn, Professor Sommerfield earned his bachelor's degree from Brooklyn College and his PhD from Harvard, working under future Nobel laureate Julian Schwinger. He did postdoctoral research and teaching at Berkeley and then back at Harvard before coming to Yale in 1961 as one of the first faculty members in the field of elementary particle theory.



During the early 1960s he started a new seminar series in theoretical physics. According to colleague Tom Appelquist, the field was owned by former chairman Gregory Breit, a distinguished but rather difficult scholar. Nothing was supposed to happen without his blessing, "but Charlie came in, challenged this senior professor, and just started the new seminar series, which continues to this day," said Appelquist.

More recently, Professor Sommerfield has published papers on Aharonov-Bohm and Coulomb scattering, supersymmetric matrix theory, and Abelian bosonization.

He is spending the academic year 2005-06 at the University of Florida in Gainesville, where his wife Linda Bartoshuk, an experimental psychologist, is helping to organize a research and clinical program in the chemical senses.

IN MEMORIAM: FACULTY



Jack Greenberg, professor emeritus and a leading experimental researcher in nuclear, atomic and elementary particle physics, died March 30, 2005, in New Haven at the age of 77.

Professor Greenberg engaged in a broad scope of experimental research. Using innovative measurements, he provided essential tests of evolving theories and experimental evidence suggesting new phenomena.

He focused on the fundamental aspects of collective structure in nuclei, weak interactions, the development of high-energy atomic physics with very high-Z atomic systems for studies of quantum electrodynamics of strong fields, and the possible production of new low-mass lepton states and hyperon states.

“As a scientist he was exceptional for his breadth of expertise – from atomic to nuclear to particle physics,” said Jay Hirshfield, adjunct professor and a close friend of Greenberg’s. Professor Hirshfield said that Greenberg’s later work concerning the

sparkling of the vacuum, applying quantum mechanics and quantum field theory to vacuums, was among the most exciting of its time.

Jack Greenberg was born May 23, 1927, in Warsaw, Poland. In his youth his family emigrated to Canada, where he was raised and educated. His undergraduate and master’s training in physics was at McGill University, and he received his PhD from the Massachusetts Institute of Technology in 1955. He continued his training as a Rutherford Memorial Postdoctoral Fellow at the Swiss Federal Institute of Technology’s Institute of Physics the following year. He came to Yale as an instructor of physics in 1956, was tenured in 1966, appointed full professor in 1976 and retired as emeritus professor in 1999.

In recognition of his achievements, Professor Greenberg received the British Association Medal, the Rutherford Memorial Fellowship, traveling fellowships from Canada, and the Senior U.S. Scientist Award of the Alexander Von Humboldt Foundation.

Physics professor emeritus Charles Sommerfield said Professor Greenberg was known as a dedicated physicist who worked with the precision of a watchmaker. “He was known as a truly fastidious researcher,” Sommerfield said.

Adapted from Yale Weekly Bulletin and Calendar

Faculty News

Charles D. Bailyn was designated the Thomas E. Donnelley Professor of Astronomy in May 2004. He is an expert in theoretical and observational galactic astronomy, binary star systems, and black holes.

Rick Casten and **Francesco Iachello** were awarded honorary doctorates from the University of Bucharest, Romania, for career achievements in the study of nuclear structure.

Rick Casten has served since 2003 as chair of the Nuclear Science Advisory Committee, which advises the Department of Energy and the National Science Foundation on nuclear science research. The committee has set research priorities through 2011.

David DeMille was awarded the 2004 Conde Teaching Award for Teaching Excellence in Physics, Applied Physics and Astronomy, by Yale College and the Conde Fund.

Michel Devoret was awarded the 2004 Agilent Technologies Europhysics Prize by the European Physical Society for the “realization and demonstration

of the quantum bit concept based on superconducting circuits.” The prize is awarded for achievement in condensed matter physics. Professor Devoret has also been named the Frederick William Beinecke Professor of Applied Physics

Steven Girvin has been designated the Eugene Higgins Professor of Physics. He was also recently elected to the American Academy of Arts and Sciences.

Martin J. Klein, Higgins Professor Emeritus, has been awarded the first Abraham Pais Award for the History of Physics for “pioneering studies in the history of 19th and 20th century physics.”

Daniel McKinsey was awarded a David and Lucille Packard Fellowship in Science and Engineering. Of 100 nominations from 50 invited universities, Professor McKinsey was one of 16 fellows to be awarded \$625,000 over a five year period beginning in November 2004. He will use the award to develop a new low-radiation instrument which will use liquid noble gasses to detect and analyze hard-to-find cosmic particles that compose dark matter. Then in February

2005 Professor McKinsey received a \$45,000 Sloan Research Fellow Award.

Vincent Moncrief was invited to accept the Rothschild Visiting Professorship at the Issac Newton Institute in Cambridge for Fall 2005 to lecture on Mathematical General Relativity.

David Rabinowitz and fellow researchers have discovered a new planetoid. Nearly the size of Pluto and more than three times as far away, it has been designated “2003 VB16” and unofficially named “Sedna.” The discovery was made on Nov. 14, 2004, with a specially constructed detector mounted on the 48-inch-diameter telescope at the Palomar Observatory in California. The new planetoid is the most distant known object in the solar system.

Subir Sachdev and **Nicholas Read** were the subject of an article in the spring 2004 *Yale Scientific Magazine* for their work on quantum phase transitions. The article praised Professors Sachdev and Read for “unraveling the underlying foundations of phenomena that bewilder inquiring minds.”

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R. Shankar was named the John Randolph Huffman Professor of Physics in 2004. Then in May 2005 at the Yale College Senior Class Day program, he was awarded the Harwood F. Byrnes/Richard B. Sewall Teaching Prize for the professor who “has given the most time, energy and effective effort” to educating undergraduates. In the award citation, he was praised for his “gift for elegant explanation.” He has served as chair of the department since 2001.

A. Douglas Stone was recently appointed the Carl A. Morse Professor of Applied Physics. He is currently director of the Divisional Committee of the Physical Sciences at Yale, which advises the administration on science-related issues and oversees the tenure process in the physical sciences.

Meg Urry was appointed co-chair of the National Research Council’s Committee

on Astronomy and Astrophysics. She continues her work on behalf of women in science, appearing on National Public Radio’s Science Friday and writing an op-ed piece in the *Washington Post* in response to Harvard President Larry Summers’s comments on the dearth of women in science.

New Research Laboratories

The last few years have seen significant expansion in laboratory space and equipment for the department.

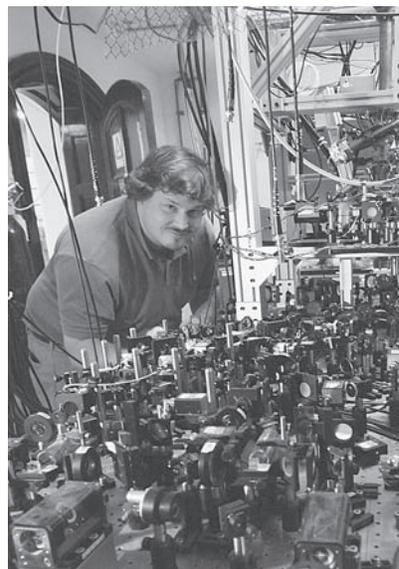
The Wright Nuclear Structure Laboratory is now the home of a **new facility headed by Dan McKinsey** to be used for the construction of experiments based on scintillations in liquefied noble gases, such as liquid neon, liquid argon, and liquid xenon. These liquids will be used to search for the missing “dark” matter of the universe, to detect low energy neutrinos from the sun, and to measure the mass of the neutrino.

The facility has a large pit to hold cryogenic experiments; two levels to allow access from both above and below; extensive gas, vacuum, and chilled water utilities; and a hatch in the roof to allow experiments to be removed easily after construction.

Says McKinsey, “We designed the lab in such a way that we could build a several-ton experiment there, make it work, and then ship it to a deep underground site to perform experiments in low-background physics.”

Another new lab, headed by Jack Harris, will research the interaction of light with very sensitive micromechanical structures. Harris is particularly interested in the tiny force that light exerts on a mirror. Writ large, this force is what drives “solar sails,” a type of spaceship whose motion is produced solely by the pressure exerted by sunlight. However, when the light involved is much dimmer than sunlight--when it is reduced to a few microwatts or nanowatts--the laws of quantum mechanics cause the light’s particulate nature to begin to manifest itself. This particulate nature radically alters the properties of the pressure exerted by the light. These altered properties have never been observed before, but Harris hopes that they will provide an excellent means for exploring the border between quantum and classical physics, particularly as it relates to measurements. According to Harris, these quantum effects should also provide a powerful new means for controlling light; when a mirror moves in response to the quantum fluctuations of the light incident upon it, the light it reflects is altered at the quantum level. In addition, the altered light doesn’t leave the mirror unaffected - under the appropriate circumstances, the light should actually cool the mirror well below the ambient temperature.

In **new laboratory space in the basement of Sloane, David DeMille’s research group** has begun several new experiments



using diatomic molecules as tools to study a variety of topics ranging from particle physics to quantum computation. One experiment will measure parity violation in molecules as a way to study a property of the Zo boson that is not accessible in other systems. Another experiment has the goal of trapping and cooling a gas of polar molecules to unprecedented low temperatures. This work could lead to the

construction of a large-scale quantum computer, studies of strongly-correlated Bose-Einstein condensates, and many other new directions. The new laboratories house extensive laser, vacuum, and cryogenic equipment for these experiments.

Finally, **a new lab in Gibbs headed by Bonnie Fleming** will focus on research and development for the next generation of neutrino detectors. Neutrinos are notoriously difficult to produce and detect, and because of this, detectors are very large and often do not have fine-grained tracking capabilities. Fleming is studying a kind of detector, a liquid argon time projection chamber, which combines fine-grained detection techniques with total absorption calorimetry. Massive liquid argon time projection chambers require the use of extremely pure argon to drift ionization electrons produced in neutrino interactions over large distances. Purification techniques and purity measurements under study here are crucial to developing this technology further.

As well, Fleming and her group will study light and charge production in these detectors to understand how this information can help with particle identification. This program is part of a larger effort to build a 150-ton to 15-kiloton liquid argon detector to study accelerator neutrino interactions at laboratories in Japan and the US.

Graduate Student News —

Entering graduate students:

Fall 2005

Peter Adshead (University of Canterbury, New Zealand), Colin Anderson, (University of Maryland), Jerry Chow (Harvard), Anson D'Aloisio (University of California, Riverside), Kevin Garrity (Dartmouth), John Giblin (Holy Cross), Steven Linden (Columbia), Ethan Neil (Duke), William Pontius (Columbia), William Shanks (Harvard), Amar Vutha (Indian Institute of Technology)

The 2005 Leigh Page Prize for an incoming graduate student was awarded to Peter Adshead.

Fall 2004

Stephen Baumgart (University of California, Davis), Robert Casperson (Oregon State), John Challis (University of Kentucky), Hanghui Chen, (Peking University), Mara Daniel (M.I.T.), Ran Duan (Peking University), JiJi Fan (University of Science & Technology of China), Li Ge (Peking University), James Gilmore (University of Western Australia), Pailhsien Hsu (National Taiwan University), Thomas Jackson (Princeton), Blake Johnson (Harvard), Faith Jordan (University of Oklahoma), Louis Kastens (Valparaiso University), Walter Hugh Lippincott (Princeton), Xinhui Lu (Nanjing University), Margaret Trias (Mt. Holyoke College), Elizabeth Williams (Yale), Yung-Ruey Yen (University of California, Berkeley), Benjamin Zwickl (Purdue).

The 2004 Leigh Page Prizes for incoming graduate students were awarded to John H. Challis, Mara S. Daniel, JiJi Fan, Thomas S. Jackson, and Benjamin M. Zwickl.

Fall 2003

Latchezar Benatov (Dartmouth), Yi-Zen Chu (University of California, Berkeley), Adrian DelMaestro (University of Waterloo), Gustavo Fernandes (Yale), Nathan Gilfoy (Tufts), Stan Guthrie (Montana State), Paul Hamilton (Harvard), Anders Knospe (Pomona College), Guoji Lin (Peking University), Vladimir Manucharyan (Moscow Institute of Physics & Technology), Christine Natrass (Colorado State), Sebastian Schmidt (Free University of Berlin), Joseph Schreier (Rensselaer Polytechnic), Ryan Winkler (University of Connecticut), Christopher Wrede (University of Victoria & Simon Fraser University), Terri Yu (MIT)

The 2003 Leigh Page Prizes for incoming graduate students were awarded to Joseph Schreier and Terri Yu.

DGS Report

Director of graduate studies Steven Girvin reports that the physics department has seen a significant upturn in the number and quality of graduate applicants.

In recent years, the number of applicants has grown to more than 250. In the last two years, several of Yale's matriculants have received fellowships from the National Science Foundation, the Department of Defense, and Lucent. Girvin also reports that in the summer of 2004, Deseree Meyer in physics and Bethany Cobb in astronomy were among 50 graduate students from the United States to attend the 54th Lindau Nobel Laureates meeting in Germany in June and July, where they had the chance to meet with Nobel Prize-winning scientists.

Graduate Student Dissertations, Advisors, and Job Placements:

May 2005

Grace Chern, "Lasing Spiral and Square-Shaped Optical Microcavities"; Richard Chang; Army Research Laboratory, Adelphi, Md.

Ke Li, "A Time-Dependent Angular Analysis of Bos to J/psi phi and Bod to J/psi Kstaro and A Measurement of the Width Difference in the Bos System"; Michael Schmidt; Goldman Sachs, New York.

Yi Wei, "Bosonic and Graded Color-Flavor Transformation for the Special Unitary Group"; Tilo Wettig; postdoctoral fellow, University of Koeln, Germany.

December 2004

Jonathan Gans, "Inclusive Charged Hadron Transverse Momentum Spectra at Center of Mass Energy of 200 GeV for p+p and d+Au Collisions at the Relativistic

Heavy Ion Collider"; John Harris; MIT Lincoln Laboratory.

Vinod Krishna, "Vibrational Relaxation of Molecules on Metal Surfaces"; John Tully; postdoctoral fellow, University of Utah.

Harald Schwefel, "Directionality and Vector Resonances of Dielectric Microcavities"; A. Douglas Stone; postdoctoral fellow, Yale University.

Jacob Ulmschneider, "Polypeptide Folding using Monte Carlo Sampling, Concerted Rotation and Continuum Solvation"; William Jorgensen; visiting researcher, University La Sapienza, Rome.

Wenyong Wang, "Electrical Characterization of Self-Assembled Monolayers"; Mark Reed; National Institute of Standards & Technology.

May 2004

Michael Miller, "Measurement of Jets and Jet Quenching at RHIC"; John Harris; Pappalardo Fellow, MIT Physics Department.

Adam Hecht, "Nuclear Chiral Symmetry in the Mass A ~ 130 Region"; Cornelius Beausang; Argonne National Laboratory.



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Michael Greene, “A Search for B Meson Decay to a Muon, a Neutrino, and a Photon”; Homer Neal; Pennsylvania State University.

Haibin Zhang, “ $K^*(892)$ Resonance Production at the Relativistic Heavy Ion Collider”; Jack Sandweiss; research scientist, Brookhaven National Laboratory.

Ari Tuchman, “Quantum Fluctuations in a Bose-Einstein Condensate”; Mark Kasevich; postdoctoral fellow, Stanford University.

Anatoly Dementyev, “Spin in the Quantum Hall Effect: OPNMR Studies of Skyrmions and Composite Fermions”; Sean Barrett; postdoctoral associate, Yale University.

December 2003

Peter Andrews, “Quasar Counts from Variability and Color Selected Samples”; Charles Baltay; Cold Spring Harbor Laboratory, Long Island.

Jeffrey Fixler, “Atom Interferometer-Based Gravity Gradiometer Measurements”; Mark Kasevich.

Anatoli Polkovnikov, “Manifestation of Quantum Fluctuations in Strongly Correlated Systems”; Subir Sachdev; postdoctoral fellow, Harvard University.

Dale Visser, “Particle Decay Branching Ratios for States of Astrophysical Interest in ^{19}Ne ”; Peter Parker; postdoctoral fellow, University of North Carolina/Oak Ridge National Laboratory.

May 2003

Frederik Bay, “Construction of an Apparatus and Preliminary Measurements for a Search for the Electric Dipole Moment of the Electron using Lead Monoxide”; David DeMille; Boston Consulting Group, New York.

Mark Caprio, “Structure of Collective Modes in Transitional and Deformed Nuclei”; Richard Casten; postdoctoral fellow, Yale University.

Swati Khandelwal, “Chaos and Interactions in Quantum Dots”; Yoram Alhassid; MSCI Barra, University of California, Berkeley.

Grigor Peradze, “Aspects of Membrane Instanton Calculations in Strongly Coupled String Theories”; Gregory Moore; Lehman Brothers, New York.

Hakan Tureci, “Wave Chaos in Dielectric Resonators: Asymptotic and Numerical Approaches”; Douglas Stone; postdoctoral fellow, Yale.

Ho-Ung Yee, “Explorations of Universal Extra Dimensions”; Thomas Appelquist; postdoctoral fellow, Korean Institute for Advanced Study, Seoul.

Zhaoou Yu, “Bottom Quark-Antiquark Production and Mixing in Proton-Antiproton Collections”; Michael Schmidt; AMBAC Financial Group, New York City.

December 2002

Huaizhang Deng, “Precision Measurement of the Positive Muon Anomalous Magnetic

Moment”; Vernon Hughes; postdoctoral fellow, University of Pennsylvania.

Chad Fertig, “Laser-Cooled Rubidium-87 Clock”; Kurt Gibble; postdoctoral researcher, National Institute of Standards & Technology.

Mehmet Gokcedag, “Mesoscopic Thermodynamics and Chaos in Quantum Dots”; Douglas Stone and Yoram Alhassid; Barclays Capital Group Risk, London.

Matt Horsley, “A Measurement of the Charged Particle Ratios π^-/π^+ , K^-/K^+ and Anti Proton/Proton at High Transverse Momentum in an Ultra-Relativistic Heavy Ion Collision”; John Harris; MIT Lincoln Laboratory.

Liquan Li, “X-ray Single Photo Imaging Spectrometers using Superconducting Tunnel Junctions”; Daniel Prober.

Fabio Peixoto, “Enhanced Loading of a Lithium 7 Magneto Optical Trap using Transverse Cooling and Frequency Spread Light”; Mark Kasevich.

Christopher Wilson, “Optical/UV Single-Photo Imaging Spectrometers Using Superconducting Tunnel Junctions”; Daniel Prober; postdoctoral fellow, Chalmers University, Sweden.

Ying Zhang, “Competing Orders in the Cuprate Superconductors”; Subir Sachdev; postdoctoral fellow, University of Maryland.

Two Career Networks Now Available

You may recall that the physics department hosts an online network that offers career information for undergraduate and graduate students – and for alumni as well.

This database now consists of 270 Graduate School and Yale College alumni in physics, with name, occupation, specialization, and a comment section with valuable advice. For example, a quick survey of the network turns up information on job openings at NIST, a discussion of therapeutic radiology, remarks on job satisfaction with various employers, and this encouraging advice: “A PhD in physics is the best preparation for any career.”

To reach the physics alumni network, go to www.yale.edu/physics and then click on “graduate studies” and “careers in physics.”

Now, in addition to this specialized network, the Association of Yale Alumni has developed a new online service called the Yale Career Network (Yale^{CN}), a database of alumni in all fields

who wish to communicate with other alumni about careers. It offers searches according to industry, company name, job function, or job title.

The advantage of this network is that you can contact alumni from departments outside as well as inside physics, and you can tailor your searches quite narrowly. For example, you might search for all alumni who are employed in the energy field, or for all alumni working for NASA, or for all alumni working in basic science research in San Diego. You can also join career discussion groups primarily for alumni working in nonacademic careers.

If you have already entered your data in the physics database, we encourage you also to join the Yale^{CN}. To either give or to receive career advice, visit the Yale^{CN} at www.aya.yale.edu/career, and a simple profile wizard will walk you through the process of entering the database.

News from Alumni —

Peter Andrews '03 PhD is a senior scientific programmer for a neuroscience project at Cold Spring Harbor Laboratory on Long Island. He and his wife bought a house in Westbury, New York, in November 2004. He says, "My group is looking for more talented programmers, preferably physicists – send me your resume!"

Steve Axelrod '86 PhD works for a small Silicon Valley startup, Xoft, Inc. The company has developed a tiny 50 kV x-ray tube which will be used to treat breast cancer by irradiating the tumor bed from the inside following removal of the tumor. Other types of cancer treatment with the micro-tube are planned for the future.

A. Baha Balantekin '82 PhD was recently promoted to Eugene P. Wigner Professor at the University of Wisconsin-Madison.

Douglas Bergman '98 PhD was recently appointed as a research assistant professor in the physics department at Rutgers, and will become a tenure-track assistant professor in September. He is working in astroparticle physics as a member of the High Resolution Fly's Eye Experiment and the Telescope Array Experiment.

Sidney Bludman '51 PhD has been retired from the University of Pennsylvania since 1998, but he is doing full-time research in theoretical cosmology at Deutsches Elektronen Synchrotron DESY, Hamburg, Germany. He is publishing and lecturing on the nature of dark energy and on historical astronomy.

Manuel Calderon de la Barca Sanchez '01 PhD worked at Brookhaven Lab, first as a post-doc, then as assistant physicist. In fall 2004 he became assistant professor at Indiana University. He continues to do heavy-ion research in the STAR collaboration at RHIC, where the question as to the nature of the matter created has been a hot topic. His focus for the past year has been on studies of heavy-quark production.

Martin Cobern '74 PhD is vice president, research and development, for APS Technology, Inc., in Cromwell, Connecticut. The company designs and manufactures high-tech monitoring equipment used in oil and gas drilling. He and his wife, Dorie, have two daughters and one grandson. He is active in alumni affairs, currently serving as chair of the Graduate School Alumni Association executive committee and on the AYA Board of Governors.

Thomas H. Curtis '68 PhD writes, "After almost 30 years of Research and Development at Bell Labs in New Jersey, I left in 1999 to start an optical switching company—Ultra Fast Optical Systems—with an Engineering Professor from Princeton. We had limited success but lots of fun, and did push the state of the art of all-optical switching. I am now the director of the newly opened NJ branch office of the Johns Hopkins Applied Physics Lab, supporting defense communications R&D work at nearby Fort Monmouth. One of my four children, Cathy, graduated from Yale in 1984 with a degree in Applied Mathematics."

Anatoly Dementyev '04 PhD has accepted a new postdoc position at David Cory's lab at MIT, after working as a postdoctoral associate at Yale. He is working on Solid State NMR Quantum Computation.

Chad Fertig '02 PhD and his wife have both joined the faculty of the University of Georgia in Athens. He is assistant professor in the physics department, and she teaches in the school of public health.

Aimé Fournier '98 PhD is a project scientist at the Institute for Mathematics Applied to Geosciences, National Center for Atmospheric Research. His research focuses on strong multiscale interactions in geophysical fluid dynamics (GFD), using rigorous multiresolution-based theoretical and numerical methods to investigate those interactions. In recent projects he has applied high-resolution spectral-element methods to solve realistic 3D GFD with massively parallel, static mesh adaptivity and has worked on idealized 2D flow problems with dynamic adaptivity.

Dmitry Green '01 PhD worked as consultant in strategy and operations for financial institutions at McKinsey & Co. for three years after his PhD. He recently joined BlackRock as vice president in advisory services. He has a one-year-old son named Christian and reports that he has no regrets about leaving academia. "And I'm still waiting for the glacial pace of academia to allow my advisor to publish some of my (of course, brilliant) research."

Ilya Gruzberg '98 PhD is assistant professor in the physics department and the James Franck Institute at the University of Chicago. He recently received a Research Innovation Award from Research Corporation and a fellowship from the Alfred P. Sloan Foundation. His research focuses on understanding fractal



shapes that appear in two dimensions as a result of stochastic and deterministic growth processes, as well as critical clusters in statistical mechanics systems. The other direction of his research is the study of fermions in random potentials, and their localization properties.

Mark Heald '54 PhD writes, "From 1954-59 I was group leader for microwave diagnostics of magnetically confined plasmas at Project Matterhorn, Princeton University, which was the precursor of the Princeton Plasma Physics Laboratory. This early work towards controlled fusion in Stellarators was declassified in 1958 at a U.N. "Atoms for Peace" conference in Geneva, Switzerland, where I helped plan the displays and captioning of Princeton's part of a major technical exhibit of fusion research. In 1959 I joined the faculty of Swarthmore College. The majority of my teaching has been in electromagnetism, classical mechanics, optics, and laboratory subjects. During sabbaticals I returned to plasma research, once at Culham Lab in England, twice at PPPL, and once at MIT's Plasma Fusion Center. My senior colleague Bill Elmore and I published the textbook *Physics of Waves* in 1969. I retired from active teaching in 1992 and moved to a Tennessee retirement community in January 1998."

Adam Hecht '04 PhD is living in Chicago and working in the physics division at Argonne National Laboratory.

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Stuart Henderson '91 PhD spent 10 years at Cornell University, first as a post-doc on the CLEO experiment, and then as a research staff member working in the Electron Storage Ring Operations Group. He moved to Oak Ridge National Laboratory to work on the accelerator design, construction and commissioning for the Spallation Neutron Source, DOE's largest science construction project, with a budget of \$1.4 billion and an expected completion in 2006. He is the Accelerator Physics Group Leader, leading a group of 15 physicists in the beam commissioning of the SNS. He lives with his wife, Jacqueline Soltys '94 PhD, and his two girls, Sophia and Grace, in Knoxville.



Lawrence Ho '96 PhD has recently been appointed vice president of engineering at Applied Identity, a Silicon Valley high-tech company. Previously he served as director of engineering at Extreme Networks. Before that, he worked for Bell Labs in both their research and advanced technologies divisions. He has won eight industry awards in recent years for the networking technology and products he designed and developed with his teams. He also serves as a venture capitalist at Rustic Canyon Partners, specializing in the financing of high-tech businesses. He can be reached at lawrenceho@aya.yale.edu.

Anuradha Jagannathan '82 MPhil is working as associate professor of physics, specialising in theoretical condensed matter physics, on the Orsay campus of the University of Paris. She is teaching basic undergraduate physics and also graduate level courses in solid state theory. Last year she wrote a habilitation treatise (in French!) on the electronic properties of quasicrystals, the subject of her research since moving to France from Los Angeles in the early nineties.

David Kalinsky '72 PhD left the field of nuclear physics in 1977 after four years as a post-doc and research staff physicist at the Weizmann Institute of Science in Israel. Since then he has been designing embedded systems software and teaching professional engineers about this subject, with particular focus on high-availability and safety-critical applications. More information on his work is available at www.kalinskyassociates.com. Last year he traveled from his home in Sunnyvale, Calif., to Oak Ridge to attend the wedding of the daughter of Danny Shapira '74 PhD. He writes, "It was wonderful to see Danny and his wife Hanna after a hiatus of almost 30 years, and to celebrate with them as their daughter Efrat was married. Danny still plays a mean accordion."

Stanley L. Kaufman '68 PhD has worked as an industrial physicist since 1984, developing scientific instruments for commercial production. He has published peer-reviewed papers fairly regularly, in non-physics journals such as *Analytical Chemistry*, *Analytical Biochemistry*, and *Journal of Aerosol Science*. He has invented a new means for characterizing

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IN MEMORIAM: ALUMNI

Basil B. Beeken '49 BS, '52 MS died on June 1, 2004, at the age of 84. In World War II he served in the European theater, earning a Bronze Star and Purple Heart. At the A. C. Gilbert toy company, he helped design a number of scientific educational toys while also teaching physics and chemistry. He later taught at the University of New Haven and then took a position with Pitney Bowes, where he helped to create a line of devices collectively called "fluidic computers," which allowed for sophisticated control of pneumatic devices. When he retired, he started a small business in White Plains refinishing and restoring antique furniture.

Daniel Binder '50 PhD died on February 25, 2004, in Sewanee, Tenn., at the age of 77. A veteran of the U. S. Navy serving during World War II, he worked as a nuclear physicist at Oak Ridge for several years and later became a seminar scientist for Hughes Aircraft in Los Angeles. He was an avid chess player with many trophies and an amateur architect.

Jeffrey Cohen '66 PhD died on October 12, 2003, in Darby, Pa., at the age of 63. A faculty member at the University of Pennsylvania

for 25 years, he published more than 100 papers on astrophysics and relativity. He and two co-workers were able to solve a complex physics problem raised by Albert Einstein in 1915 on his theory of relativity. He was also an environmentalist and the inventor of a high efficiency solar collector for which he received the "Best Invention" Award from the Franklin Institute.

Robert P. Coleman '46 PhD, aviation pioneer, died on July 26, 2003, in Bryn Mawr, Pa., at the age of 94. He worked for the National Advisory Committee for Aeronautics (now NASA) at the Langley Aeronautical Laboratory near Newport News, Va. He contributed to the development of several theories, including one on ground resonance developed with Arnold M. Feingold, and others on self-excited mechanical oscillations of hinged rotor blades and ground vibrations of a two-blade helicopter rotor. He also solved the flutter and vibration problems of helicopters that caused them to shake apart in the air. Later he worked on radar projects at the Franklin Institute Research Laboratory, followed by a job with the Burroughs Corporation.

Robert E. Dillon '47 MS died on June 12, 2003, in Maryland at the age of 81. He retired in 1992 from the Mitre Corp. in McLean, Va., after working there for more than 30 years as a systems analyst.

E. Allan Farnsworth '49 MS died January 31, 2005, at the age of 76. A professor at Columbia Law School since 1954, he was considered the country's foremost legal authority on contracts, spending more than 50 years studying and explaining their legal underpinnings. In the 1970s he led a project to write a definitive guide to contract law, a three-volume work that remains widely used 25 years later. He also wrote "Farnsworth on Contracts," which is among the most frequently used reference works on contract law and, more recently, "Changing Your Mind: The Law of Regretted Decisions." He represented the United States at diplomatic conferences on trade and on the United Nations Commission on International Trade Law. at the Universities of Paris and Istanbul in addition to teaching at American law programs in Austria, China, France, Greece, and the Netherlands.

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News from alumni *continued from page 14*

macromolecules as well as a new detector principle for liquid chromatography.

Michael Lauterbach '77 PhD now lives in Hamden, just a 12-minute drive from the Yale Nursing School, where his wife is associate dean for research. He is now in his 24th year at LeCroy Corporation, maker of the world's finest oscilloscopes. He visits electrical design engineers all around the world who are working on next generation cell phones, computers, aerospace, automotive and other electronics.

Robert S. Lawrence '50 MS worked as a research physicist at the National Bureau of Standards for 33 years after leaving Yale. He published some 60 papers on the propagation of electromagnetic waves (radio through light) through the open atmosphere. He retired from government work in 1983 at age 58, but continued using his accumulated knowledge of wave propagation in various consulting activities. In 2005 he fully retired and has begun to indulge his hobby of using computers for recreational mathematics.

Linwood Lee '55 PhD recently took emeritus status at SUNY, Stony Brook, where he has been teaching since 1965, following ten years of basic research at Argonne National Lab. He set up and directed the Nuclear Structure Lab at Stony Brook for 18 years. The lab has a tandem Van de Graaf purchased in 1966 and a superconducting linac built in the

early 80's in collaboration with the applied superconductivity group at Cal Tech. He is no longer doing research but still teaches a freshman course.

Craig S. Levin '93 PhD worked for several years at the UCLA School of Medicine applying physics to biomedical imaging. In 1998 he became assistant professor of radiology and nuclear medicine physicist at the UC San Diego School of Medicine. In 2004 he moved to the Stanford School of Medicine to work in the new Molecular Imaging Program as well as the Division of Nuclear Medicine. His research focuses on the development of novel instrumentation and software for non-invasive functional biomedical imaging. He has two NIH grant awards to build new ultra-high resolution PET imaging systems for breast cancer and for studying disease models in small laboratory animals non-invasively.

Frank C. Lin '57E, '65 PhD has retired from the math and computer science department of the University of Maryland Eastern Shore, and has been named Professor Emeritus. Currently he is Visiting Professor at the Advanced Virtual and Intelligent Computer Center at Chulalongkorn University in Bangkok, Thailand. He reports, "It is quite satisfying to have the sun shining on you every day, and the low cost of living allows me to have a great life!"

Mark H. Mortensen '78 PhD is vice president of strategy at Telcordia Technologies in Piscataway, NJ. He also recently joined the advisory board of the College of Arts and Sciences of UMass Lowell.

John Nagle '60 BA, '65 PhD, a professor of physics and biological sciences at Carnegie Mellon, returned to Yale in December 2003 to speak at the Lars Onsager Symposium to mark the 100th

Anniversary of Onsager's birth. He shared with Dr. Stephanie Tristram-Nagle the 2003 Avanti Award for theoretical and experimental biophysics from the Biophysical Society. He is a past chair of the Division of Biological Physics of the American Physical Society.

George Pieper '52 PhD reports that he spent 22 years with NASA, most of it as Director of Space and Earth Sciences at the Goddard

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IN MEMORIAM: ALUMNI *continued from page 14*

Jack Lockwood '48 PhD died April 24, 2005 in Durham, New Hampshire, at the age of 85. He joined the faculty of the University of New Hampshire in 1948. In 1954 he established the cosmic ray neutron monitor on Mount Washington to measure time variations of cosmic radiation. In coordination with NASA he helped develop experiments at the Compton Gamma Ray Observatory. He published more than 150 papers on cosmic ray modulation, energetic solar flare proton events, gamma-ray and neutron emissions from the sun, and cosmic ray intensities in the outer heliosphere, using data from the Voyager and Pioneer spacecraft. In his memory, the University of New Hampshire has established the John A. "Jack" Lockwood Prize for outstanding graduate students in space science.

Cabell Arnold Pearse '56 PhD died April 12, 2003, in Washington, DC, at the age of 78. As a scientist at the Naval Research

Laboratory, he participated in early tests of atomic weapons and was a member of Project Vanguard, which carried out experiments on early US satellites. In 1962 he joined the technical staff at Bellcomm, where he worked on systems engineering projects for the NASA Apollo project. In the early 1970s he formed Pearse and Associates, Inc., a company that specialized in the design and installation of multi-user computer systems.

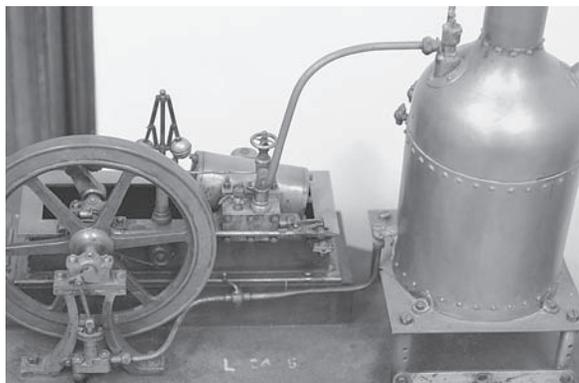
Richard A. Rhodes, II '47 MS died on May 9, 2003, in Florida at the age of 81. He completed his PhD in physics at Brown. He taught physics to an Army unit at Bowdoin College and then worked in the sound division at the US Naval Research Laboratory in Washington, DC, where he held the rank of ensign in the Naval Reserve, retiring in 1972 as a commander. He also taught at the University of Connecticut for 15 years and at the University of Florida in Gainesville for four before coming to

Florida Presbyterian, now Eckerd College, from 1966 to 1994.

Robert D. Spence '48 PhD, died on January 5, 2005, in Michigan, at the age of 87. He taught in Michigan State University's physics department from 1947 to 1985. He was a Guggenheim fellow, an American Physics Fellow and an MSU Distinguished Faculty recipient.

Stephen Sydorik, '48 PhD died on May 15, 2003, in Santa Fe, NM, at the age of 85. During the war years he worked on radar research and development at MIT. After completing his PhD, he began doing research on low temperature physics for Los Alamos National Laboratory, which he continued until his retirement in 1980. He also worked on the International Temperature Scale and, along with Ed Grilly and Ed Hammel, was the first to liquify He₃. He was also an accomplished Ukrainian dancer.

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Space Flight Center. Then after five years as professor of Aerospace Engineering at the Naval Academy, he retired. He lives now in a retirement community in Atlantic Beach, FL, and enjoys fishing for large mouth bass. He says, “I marvel at the wonders of the Hubble Telescope and Huygens Titan lander, but have very little feel for string theory. I’d

like to hear news of others of my vintage at Yale.”

Michael Ritter '84 PhD just started a new job as senior vice president of technical marketing at Vyvo, a public company that does broadband over wireless and cable.

Bruce Roscherr '01 PhD is managing director for the New York Statistical Arbitrage group at Prediction Company. His wife, **Susan Kurien** '01 PhD, is a staff

member in the Mathematical Modeling and Analysis group (T-7) at Los Alamos National Lab. They live in Santa Fe, New Mexico.

Marc S. Rosenthal '82 PhD was involved in medical physics research at the University of Pittsburgh from 1984 to 1993, working on digital imaging and scatter compensation in single photon emission computed tomography

imaging. In 1994 he entered medical school in osteopathy, and since 2002 he has been on the faculty of the Wayne State University Department of Emergency Medicine as an attending physician and assistant residency director. His current research is focused on disaster medicine, and he is also a staff medical officer with the Michigan Disaster Medical Assistance Team. He is married to Mary K. VanDrasek; they have one son.

Vahid Sandoghdar '93 PhD did a postdoctoral fellowship at the Ecole Normale Supérieure in Paris and then moved to the University of Konstanz in Germany as an assistant. In 2001 he obtained his “habilitation” in physics and became full professor at the Swiss Federal Institute of Technology in Zurich. His research focuses on high-resolution optical spectroscopy and microscopy at the nanometer scale with application in fields ranging from quantum optics to biophotonics.

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IN MEMORIAM: ALUMNI *continued from page 15*

Julia A. Thompson '69 PhD, a physics professor at the University of Pittsburgh for 32 years, died on August 16, 2004, in a car accident in Wood River, Ill., at the age of 61. After teaching and research stints at the University of Utah and Brookhaven National Laboratory in Upton, NY, she joined the faculty at Pitt in 1972. In 1992, she created a research program to bring more women and ethnic minorities into fields such as physics and chemistry. She also worked as an adjunct professor at the University of Missouri at St. Louis, where she helped to organize a project enabling students to join a national network of people tracking cosmic rays.

Arthur R. Tobey '42 BS, '48 PhD died on December 19, 2003, in Santa Cruz, Calif., at the age of 83. He served in World War II with the MIT Radiation Laboratory Radar group in Europe and the Caribbean. After earning his PhD, he taught at Washington State College for two years, and then spent three years leading a research team at the Armour Research Institute in Chicago. In 1953, he joined the Stanford Research Institute, where he was a key member of the Television Lab during the early '50s, when it was doing pioneering work in color TV for RCA and Technicolor. In later years, as a staff scientist, he became one of the Institute's most respected general-purpose systems analysts, his strong physics and

mathematics background helping him to address issues ranging from national defense to weather satellites.

Robert M. Walker '54 PhD died on February 12, 2004, in Brussels, Belgium, at the age of 75. He was a world leader in studies of microscopic particles preserved in meteorites, which led to their identification as actual stardust. He first spent 12 years as a research physicist at General Electric in Schenectady. In 1966, he became the first McDonnell professor of physics at Washington University, and in 1975 he became the first director of the McDonnell Center for the Space Sciences, not retiring as director until 1999. As a consultant to NASA, he helped allocate samples collected from the first moon landings. His laboratory was instrumental in studying moon rocks in order to decipher data on the evolution of the moon, solar system and galaxy. Last year, Washington University's board of trustees honored him with the university's highest distinction, an honorary doctor of science. A member of the National Academy of Sciences, Professor Walker won many awards for his work, including the academy's 1991 J. Lawrence Smith Medal.

Donald L. Woernley '43 PhD died on November 9, 2003, in Amherst, NY, at the age of 90. His career in science began with a position as a full-time assistant to the chairman of the Yale physics department.

In that position he contributed to the construction of a signaling device for the Army Signal Corps, for which he earned a letter of commendation from the secretary of war. In 1944, he began working as a physicist with the Monsanto Chemical Company in Dayton, Ohio, where he organized two research laboratories, including one devoted exclusively to the development of atomic weapons. A year later he began to teach physics at the University of Buffalo, and in 1949 was named chief biophysicist at what is now the Roswell Park Cancer Institute.

Lemuel D. Wyly, Jr. '49 PhD died on September 5, 2004, at the age of 88. He began his teaching and research career at Georgia Tech in 1939. During World War II he left the university to serve as a Major in the United States Army. At the end of the war he returned to the physics department at Georgia Tech, where he was appointed Regents Professor. He remained there until his retirement in 1983.

Edward J. Zadina '42 MS died on September 30, 2004, in Colorado at the age of 86. A nuclear physicist, he worked with Boeing and Lockheed testing weapons systems. In addition to his work on the design and testing of hydrogen bombs, he came up with a series of calculations to determine the effects of nuclear explosions on the upper atmosphere and outer space.

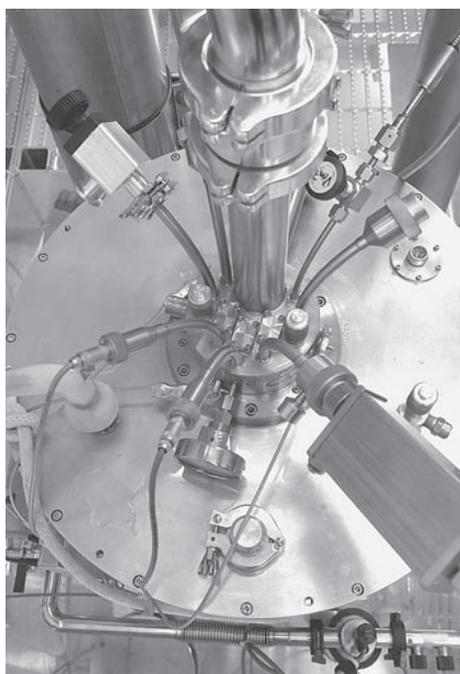
Jeffrey Satinover '02 MS is completing his PhD in physics at the Condensed Matter Physics Laboratory of the University of Nice, France, under the direction of Didier Sornette. His research involves the development of techniques for the prediction of complex systems in various domains. He also teaches civil liberties and constitutional law part time in the department of politics at Princeton.

Harald Schwefel '04 PhD is a postdoctoral associate at the Yale Department of Applied Physics.

Phil Scott '69 PhD is living in Houston and enjoying practicing ophthalmology. He writes, "Though I am no longer in physics, I think fondly of the department. I would welcome seeing any grad school physics alumni who are visiting the area."

Kin Seng '98 PhD reports, "We have 3 little girls aged 3, 8 and 10 to dote on and will definitely bring them back to Yale and its lovely environment one day. I am currently doing research in solid-state lasers and non-linear optics in the DSO National Laboratories in Singapore."

George S. Stanford '56 PhD retired from Argonne National laboratory in 1995, after 36 years of research related to the safety of nuclear reactors, with a side interest in nuclear weapons policy. He is a co-author of *Nuclear Shadowboxing: Contemporary Threats from Cold War Weaponry*. The first volume, *Cold War Redux*, was released in December 2004, and volume two is forthcoming. He says, "With co-authors from both sides of the Iron



Senthil Todadri '98 PhD was featured in the January 6, 2005 issue of *Nature* for his work in condensed matter physics. According to the article, "One of the more unconventional ideas Senthil has pursued is that an electron added to a material can 'split' under the right circumstances, so that a fraction of its charge goes one way, and a bit of its 'spin' the other." This year he left his position at the Massachusetts Institute of Technology and returned to India, where he is now leading a theoretical group at the Indian Institute of Science in Bangalore.

Says department chairman R. Shankar, "It was a pleasure to see Senthil singled out for special mention in *Nature* as one of four young theorists 'who are making waves.' He gave me a run for the money as a graduate student in my class and now as a colleague in condensed matter theory, he keeps all of us riveted to his work through a string of extremely creative papers."



Curtain, we think the book offers a unique perspective. Comments from anyone who happens to read it will be welcome."

Charles I. Sukenik '93 PhD is currently associate professor in the physics department at Old Dominion University in Norfolk, Virginia. He has a substantial experimental research program in ultracold atomic and molecular physics, with some of the research conducted at the Free Electron Laser at Jefferson Laboratory. He recently received the 2004 Gene W. Hirschfeld Faculty Excellence Award.

Teri L. Vierima '74 PhD is project manager at Resource Strategies, Inc., a small consulting firm in Madison, Wisconsin. He is in charge of EMF Gateway, a service that monitors, screens, and summarizes scientific research on the potential biological and health effects of electric and magnetic fields, primarily those emitted by electric power lines and by mobile telephones and transmission towers. He writes, "I am pleased to run into Bob and Eleanor Adair at conferences on occasion."

Paul Wainwright '77 PhD writes, "I bet I'm the only Yale PhD in physics that is now a full-time artist. Upon graduation in 1977, I went to work for Bell Labs, first in various locations in New Jersey, and then in North Andover, MA. In 2001 when the telecommunications industry went belly up, I was more than happy to take an early retirement to do large-format black & white photography full time. I'm divorced and very happily re-married, and I live in Atkinson, New Hampshire."

Michiel de Wit '60 PhD retired from Texas Instruments in 1996 after 36 years. The first half of his career was in solid state physics, EPR and lasers. The second half was involved

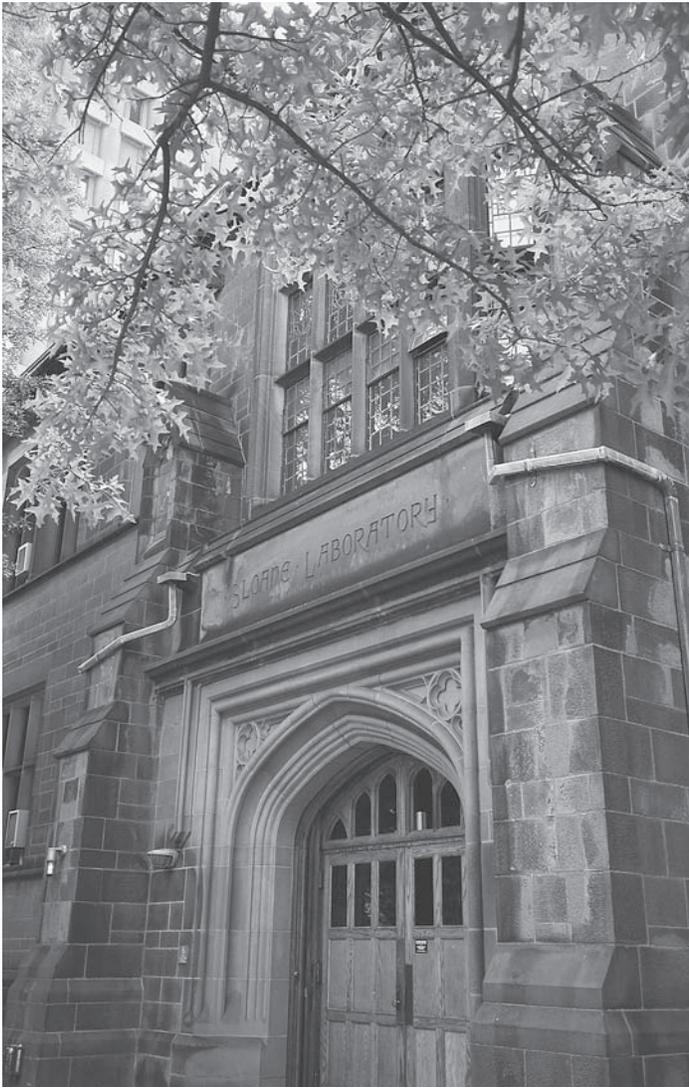
with analog integrated circuit development and design. In retirement he is trying to catch up with some of the newer physics he didn't have time for while working.

Sukeyasu (Steve) Yamamoto '55 BS, '59 PhD continues his work as part-time director of the International House at RIKEN (the Institute of Physical and Chemical Research) in Tokyo. He writes, "I've given up being active in physics. I've been involved in international projects on science and spirituality, and organized an international symposium in Tokyo on this subject in 2002. I visit America often, and plan to be at Yale for my 50th reunion."

Marshall Yovits '51 PhD writes, "After I received my PhD I quickly became involved in computer science and have been in that field ever since. This was a field for which my degree in theoretical physics prepared me well. I have recently retired as Dean of Science at Indiana University-Purdue University Indianapolis."

George O. Zimmerman '58 BS, '63 PhD, now professor emeritus at Boston University, is writing a history of the university's physics department. He continues to research the theory of colossal magnetoresistance materials and the aging of high temperature superconductors. In more applied fields, he has designed and constructed a 10,000-ampere electric current lead to go between 4 K and room temperature. He has been giving lectures comparing the post-9/11 era to the times he lived through during World War II and the Holocaust. His wife, Isa, who retired from being a school superintendant, is now director of technology education at Lesley University.

Greetings from Yale Physics



Miller-Breit Lectures

Frank Wilczek, Nobel Laureate and Herman Feshbach Professor of Physics at MIT, delivered the Miller-Breit Lectures in September 2005. He gave a lecture for physicists on “The Origin of Mass and the Feebleness of Gravity” and a lecture for the general public on “The Universe Is a Strange Place.”

Leigh Page Prize Lectures

Alan H. Guth, the Victor F. Weisskopf Professor of Physics at MIT, gave three Leigh Page Prize Lectures in April 2005: “Cosmic Inflation and the Accelerating Universe,” “Eternal Inflation,” and “Time Travel and Cosmic Strings: A Playground for Theoretical Physicists.”

Kathryn A. Moler of Stanford University gave a series of three Leigh Page Prize Lectures on electron pairing in April 2004: “Quantum Mechanics of Nanostructures,” “Superconductivity,” and “Spin-charge Separation.”

Hanan Rosenthal Lectures

Gerald Gabrielse, the George Vasmer Leverett Professor of Physics at Harvard, delivered the 31st Rosenthal Lecture in January 2005 on “Setting a Trap for Antimatter.”

Deborah Jin, JILA - University of Colorado, gave the 30th Rosenthal Lecture in April 2004 on “Making Condensates with a Fermi Gas of Atoms.”

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