

Princeton Physics News

VOLUME 2, ISSUE 1
WINTER 2006



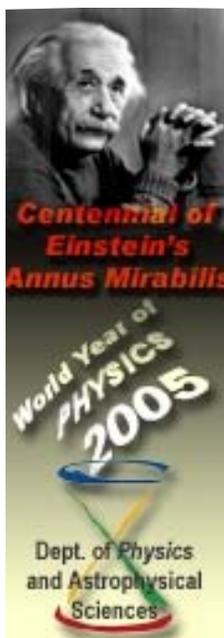
EINSTEIN CENTENNIAL

On the occasion of the Centennial of Einstein's Annus Mirabilis and of the World Year of Physics, the Departments of Physics and Astrophysics and Princeton University organized a series of public events that spanned 2005.

One of the physics colloquia dedicated to Einstein, titled "The Assassin of Relativity," was given by Peter Galison, Mallinckrodt Professor of the History of Science and Physics at Harvard University. It dealt with the friendship between Einstein and Friedrich Adler, a fellow student at the Zurich Polytechnic. In the midst of World War I, Adler assassinated the Prime Minister of the Austro-Hungarian Empire, and eventually spent years in prison trying to disprove the theory of relativity while corresponding with Einstein on this topic.

Brian Greene of Columbia University, author of *The Elegant Universe*, discussed "The Fabric

of the Cosmos," the topic of his most recent book. Alex Filippenko from Berkeley gave a series of lectures on cosmology, including "Einstein's Biggest Blunder? The Case for Cosmic 'Antigravity'."



In May, during a special reunion week-end event titled "Princeton and Einstein's Legacy," four Princeton alumni made presentations on the relationship between their current research and Einstein's 1905 papers. Speakers were Richard Gott from Astrophysical Sciences in Princeton, Hideo Mabuchi from Caltech, Edward Witten from the Institute for Advanced Study in Princeton, and Claire Yu from the University of California at Irvine. The event ended with an observation night at the FitzRandolph Observatory.

A fall finale featured an afternoon of music, "Superstrings: a Celebration of Einstein and Physics," and a talk titled "An Introduction to Einstein and Music."

FROM THE CHAIR



Dan Marlow

Dear Alumni and Friends:

On behalf of the faculty, staff, and students of the Princeton Physics Department, it's my pleasure to extend greetings to all of you.

The following pages contain information about several exciting developments, including the centennial celebration of Einstein's "miracle year" in 1905, the awarding of the Nobel Prize in Physics to David Gross and Frank Wilczek for work done here in Jadwin, and the founding of a new Center for Theoretical Physics. We hope you find the articles to be of interest.

For those of you too

continued on page 2

STUDENTS' FIELD TRIP TO CALIFORNIA



Photo courtesy of the HI-Desert Star, November 2, 2005

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STEW SMITH SUCCEEDS WILL HAPPER AS URB CHAIR



Professor Stewart Smith

A. J. Stewart Smith, a longtime Princeton faculty member and leading researcher in high-energy particle physics, has been selected to chair the University Research Board (URB).

He began a five-year term on July 1, 2005, succeeding Will Happer, who has returned to full-time teaching and research after serving as the URB chair for 10 years.

"I am absolutely delighted that Stew Smith has agreed to become the next chair of the University Research Board," said Provost Christopher Eisgruber. "Professor Smith is a scientist of extraordinary distinction who is respected throughout the campus. He is also a nationally-known figure in science policy and a proven administrator."

Smith first came to Princeton as a graduate student, earning his Ph.D. in physics in 1966. He joined the faculty in 1967 and served as associate chair of the physics department from 1979 to 1982 and as chair from 1990 to 1998. Since 1992, he has been the Class of 1909 Professor of Physics. He also served as scientific team leader of an international collaboration of 600 scientists from 10 countries involved in a project based at the Stanford Linear Accelerator.

The chair of the University Research Board, whose rank is equivalent to that of dean, has administrative oversight of organized research activities throughout the University, is responsible for dealing with questions of policy in the acceptance and ad-

ministration of research grants and contracts, and supervises the application of established policy in this area. The chair also advises the president and provost about how best to sustain excellence in research at the University.

In 2003-04, researchers at Princeton conducted \$142 million in sponsored research, an increase of \$4 million from the previous year. The largest source of research funding at Princeton was the U.S. government, which provided \$105 million toward 686 projects. In addition, researchers at the Princeton Plasma Physics Lab that year conducted \$71.3 million in fusion energy research funded primarily by the U.S. Department of Energy.

(Excerpted from an article published in the June 13, 2005 Princeton Weekly Bulletin.)

William Happer, the Cyrus Fogg Brackett Professor of Physics, "has been a model chair for the research board, and he is a superb University citizen. We are grateful for his service, and we'll miss his leadership."

Happer retired in June 2005 as URB Chair after 10 years of service.



Professor William Happer

Chair's Message - continued from page 1

young to remember, a historical note is in order here. This is not the first physics newsletter, since a previous single issue appeared in 1989, spearheaded by the late Dave Wilkinson who was chair at the time. We hope that the next issue won't be so long in coming.

We are establishing an e-mail list to be used to announce special events and major developments within the department. Given our record, you needn't worry that we might cause your inbox to overflow, but we would like to mail things from time to time, perhaps including future issues of this newsletter. If you would like to be included, please send an e-mail to

Students' Field Trip-continued from page 1

During the 2005 fall break, 35 Princeton physics students flew to Southern California for a field trip that included stargazing in Joshua Tree National Park and visits to Palomar and Wilson Observatories.

Coordinated by physics professors Chiara Nappi and Ed Groth, the trip was cosponsored by the Princeton physics department and the Jet Propulsion Laboratory in Pasadena, California. Its goal was to allow students to make a direct connection between classroom material and exciting current research.

The group comprised mainly of sophomores enrolled

PHYnews@princeton.edu, or send a note to Physics Newsletter, P.O. Box 708, Princeton, NJ 08542.

We also hope to hear what you have been up to. Our faculty is interested in having more contact with alumni and friends, and many of our students, both graduate and undergraduate, are interested in learning about opportunities in the "real world," whether in or out of academia. For example, if you have a webpage, please tell us the URL, and let us know if you want us to share it with other alumni and friends. In the meantime, we wish you a great 2006!

Sincerely,

Dan Marlow

in PHY203 and PHY205, courses on classical mechanics that cover a significant amount of material on central force motion, with many applications to celestial mechanics. Caltech and the associated Jet Propulsion Lab (JPL), which is the NASA center for interplanetary exploration, were natural destinations for this trip. Students learned about interplanetary missions from leading scientist Adam Steltzner and about astrophysical research with the new Spitzer infrared telescope from astrophysicist Mike Werner.

While visiting the Caltech campus, the Princeton

Michael Hoffman, by physics department representative Ken Liebbrecht, and met with Caltech president David Baltimore.

Prizes & Honors in 2005

Peebles Awarded the 2005 Crafoord Prize



James Peebles

The Royal Swedish Academy of Sciences awarded the 2005 Crafoord Prize to Princeton physicist James Peebles, Einstein Professor of Physics Emeritus.

Peebles shared the prize with James Gunn of the Princeton Astrophysical Sciences Department and Martin Rees, of Cambridge University, England, “for contributions toward understanding the large-scale structure of the universe.” Peebles received his Ph.D. from Princeton in 1962. He has received many awards and honors, including the newly established \$1 million Shaw Prize in Astronomy in 2004.

2004 NOBEL PRIZE WINNERS RETURN TO JADWIN FOR CELEBRATION

Past Princeton faculty members David Gross and Frank Wilczek ('73) returned to Jadwin Hall in May 2005 for a celebration of their 2004 Nobel Prize in Physics which included special lectures and a formal dinner party.

David and Frank, along with David Politzer, were awarded the 2004 Nobel Prize in Physics for their 1973 discovery of asymptotic freedom,

one of the cornerstones of modern particle physics. At the time, Gross was a professor in the physics department and Wilczek was his thesis student. The problem in the early '70s was to describe what goes on inside the proton, and to explain how protons behave in experiments carried out at particle accelerators. Protons are made of quarks and, since the forces binding quarks together are much stronger than the familiar electric forces responsible for atomic physics, reliable theoretical investigation of such strong interactions had proven to be difficult. Asymptotic

freedom is the insight that a certain quantum field theory, known as non-abelian gauge theory, predicts that the strength of forces inside the proton decreases when energies increase, so that in experiments where protons and electrons are slammed together near the speed of light, the quarks behave almost like free particles during the collision. Gross, Wilczek, and Politzer showed that a version of non-abelian gauge theory, soon to be known as quantum chromodynamics, or QCD, possessed asymptotic freedom. They derived precise predictions for the behavior of electron-proton cross-sections at high energies. Gross and Wilczek further realized that the weakening of interactions at high energies (short distances) naturally led to their strengthening at low

energies (long distances), thus providing a dynamical mechanism for the celebrated hypothesis of “quark confinement” to explain the puzzling fact that free quarks are never observed in nature. QCD has become a highly successful theory of quark interactions in diverse contexts and is a cornerstone of the Standard Model of fundamental particles and their interactions.



David Gross, Princeton President Shirley Tilghman and Frank Wilczek

MYHRVOLD WINS 2005 MADISON MEDAL

At 23, Nathan Myhrvold received his Ph. D. at Princeton with a thesis on quantum theory in curved space-time. He continued his research as a



Nathan Myhrvold

post-doc with Steven Hawking in Cambridge, England. After founding a software firm, Dynamical Systems, which was later bought by Microsoft, he worked for 14 years as Microsoft's chief technology officer before retiring. His new company, Intellectual Ventures, specializes in invention and intellectual property.

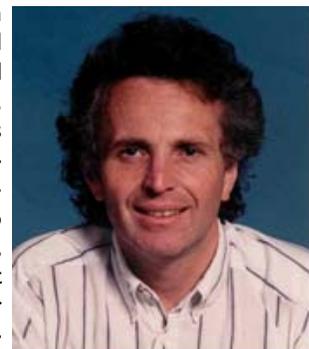
Dr. Myhrvold has conducted research on dinosaurs, has published photography books, and is a gourmet chef. Appropriately, the inscription on his Madison Medal reads:

*“Physicist,
champion of research
and invention,
and Renaissance man . . .
Society is richer for the
generosity with which
he shares his vision.”*

POLYAKOV INDUCTED INTO THE NATIONAL ACADEMY OF SCIENCES

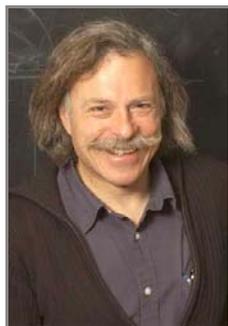
In May 2005, Professor Alexander Polyakov, Joseph Henry Professor of Physics, was inducted into the National Academy of Sciences.

On the occasion of his 60th birthday, a special Symposium was held on November 5 and 6, 2005 in the Physics Department. The topics ranged from quantum field theory to strings to turbulence, reflecting the vast range of Professor Polyakov's contributions to theoretical physics.



Alexander Polyakov

PEOPLE & NEWS



Paul Chaikin

Paul Chaikin, the Henry DeWolf Smyth Professor of Physics, transferred to emeritus status on September 1, 2005. He joined the Princeton faculty in 1988. His research focuses on colloids — fine particles dispersed in a fluid — and other areas of condensed matter physics. He is a member of the National Academy of Sciences, a fellow of the American Physical Society and former editor of the *Journal of Molecular Electronics*. He has written 300+ scientific papers and is the co-author of *Principles of Condensed Matter Physics*. Chaikin is now a faculty member at New York University.

N a d i a Azmy retired in November 2005 after 27 years as Academic Assistant for the High Energy Theory and Condensed Matter Groups. Pictured here at her Palmer House retirement party are (left to right): **Laurel Lerner**, Graduate Administrator since 1982; **Kathy Patterson**, Assistant to the Department Manager since 1973; **Dick Boscarino**, Department Manager from 1974-1994; and **Nadia**.



GEORGE T. REYNOLDS (1917–2005)

Below are excerpts from the Memorial Resolution presented by Professor Pierre Piroué to the Princeton Faculty in November 2005.

George T. Reynolds was born on May 27, 1917 in Trenton, N.J. The son of a trainmaster for the Pennsylvania Railroad, he never strayed far from his central New Jersey roots. He received his physics bachelor's degree from Rutgers University in 1939 and his Ph.D in physics from Princeton University in 1943. George's thesis work was on shock waves, and it was no accident that he was quickly sought out for the Manhattan Project.

In 1946, George accepted a faculty position at Princeton University where he remained through the end of his life. Under the influence of John Wheeler, he soon became interested in cosmic ray research and started the Cosmic Ray Group.

Later on, while this group increasingly focused on the recently-discovered "strange particles," George tried to grow organic scintillation crystals as detectors of ionizing particles. In the process, he came up with the idea of a liquid scintillator counter, which soon became one of the most used particle detectors in high energy physics experiments.

In his '50s he changed career directions. From his work on particle track detection, he realized that image intensifiers and CCD detectors could be used to record very weak sources of light, and hence could be useful in biological observations, includ-

ing protein structure detection and bioluminescence. In his last decade, he focused on luminescent phenomena pertaining to mid-ocean ridge hydrothermal vents, and he spent his summers working at the Oceanographic Institution in Woods Hole, MA as an Adjunct Scientist.

George was blessed with a remarkable ability to foresee scientific opportunities far before others and worked tirelessly to bring these into being. In the late 1960s, when environmental consciousness began sweeping the world's campuses, he helped convince the university to establish the Center for Environmental Studies, of which he served as the first director (1971–1973). Recruiting promising scientists was something George did with great success. Among his recruits were Sam Treiman, Jack Keuffel, Georgio Salvini, Riccardo Giacconi, Val Fitch and Jim Cronin, the last three of whom were to win Nobel prizes.

George Reynolds played the violin and viola and was one of the first performers in the annual physics department spring recital. He is survived by Virginia, his wife of 61 years, four sons and six grandchildren.



George T. Reynolds

ROBERT A. WINTERS (1912-2006)



Robert Alonzo Winters

Robert Alonzo Winters Ph.D., who worked in the physics department from 1955 to 1969 as assistant to the chairman, died on January 12, 2006 in Hightstown, NJ. He was 93 years old.

Dr. Winters graduated from Princeton

University in 1935 and later received a Ph.D. in economics from Harvard University. From 1969 to 1978 Dr. Winters served as assistant university librarian at Princeton University and secretary of the Princeton-Pennsylvania Accelerator. He was cofounder, first president, and director of the Princeton University Employees Federal Credit Union. He was also a founding member of the Meadow Lakes Community in Hightstown, a favorite retirement community among physics department retirees.

In 1985, Dr. Winters received both the Service Award from Princeton's Class of 1935 as well as the Alumni Council Award for Service to Princeton.

UPDATE ON JOHN ARCHIBALD WHEELER

Since his times in Los Alamos, John Wheeler started using bound record books—either because of security requirements at Los Alamos or because he was following Enrico Fermi's lead, as he occasionally claimed.

By now he has filled dozens of them. He brings one with him every Tuesday and Thursday morning when he comes to his office in Jadwin Hall. These books, containing calculations, drawings, musings, clippings and photos, provide revealing insights on John's current thoughts.

John is much taken with the idea that evolution may not be just a feature of biology. He wonders whether physical laws and physical constants evolve, too, through a process of natural selection—whether what we see around us and the rules that govern our world have not been here “from everlasting to everlasting” but have been shaped by evolution.

Why $3 + 1$ dimensions? he asks. Why not more? There is no law against more. Is the dimensionality of space and time itself a product of natural selection? And even more importantly: How does something arise from nothing? He is still fascinated with quantum mechanics and its interpretation. He ponders the question whether we humans actually create the laws by our observations, in the way that a magician creates illusion—that what we observe around us is no more real than what we observe at a magic show. On his wall

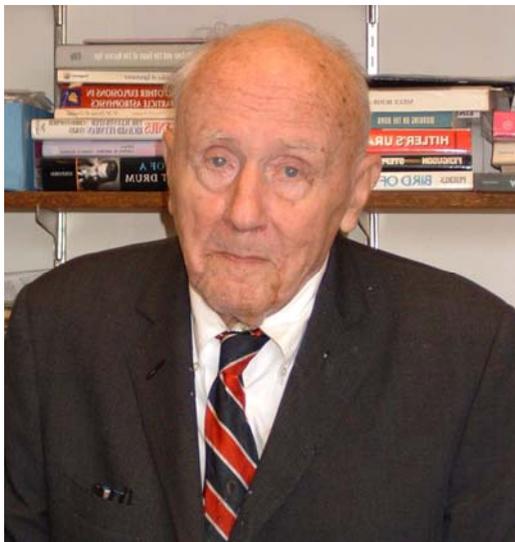
hangs a sweatshirt with the logo: What part of quantum theory don't you understand? He never fails to point it out to his visitors, while asking with a laugh: How do you like my sweatshirt?

John and Janette, his wife of more than 70 years (they were married in 1935), live at Meadow Lakes in Hightstown, where they have been since they returned from Texas in 1986.

John is now 94, Janette, 97. John's secretary, Jackie Fuschini, serves as the twice-a-week chauffeur and valued assistant, doing what she can to help them both.

John is physically frail, has great difficulty hearing, and sometimes seems lost in reverie. Yet he clings to the belief that he may come up with yet another important idea. He has lost none of his persistence, nor any of his courtliness. Any colleague or student stopping by to say hello in Room 394 will be rewarded with a big smile, a warm handshake, and perhaps a penetrating question.

Ken Ford, who received his Ph.D. from Princeton in 1953 and collaborated with John Wheeler on Wheeler's autobiography, *Geons, Black Holes, and Quantum Foam: A Life in Physics* (1998), is the contributor of this article. He is a frequent visitor to Jadwin Hall, driving up from his Philadelphia home at least two or three times each month to visit with Wheeler and assist with correspondence.



Professor John Wheeler

THE NEW PRINCETON CENTER FOR THEORETICAL PHYSICS

In the 21st century, the rapid expansion of the scope of theoretical physics beyond its traditional boundaries calls for new approaches to nurturing excellence in theory. The Center for Theoretical Physics (PCTP), a cooperative venture of theoretical physicists at Princeton University across several departments, is an innovative response to this challenge.

The mission of the Center will be to promote and support the exploration at Princeton of the most exciting frontiers of theoretical natural science. The Center will engage faculty, post-doctoral fellows and students in research and educational activities that cross the boundaries between Princeton's traditional areas of strength in fundamental theory: particle and string theory, condensed matter and materials theory, cosmology and astrophysics, theoretical biophysics and mathematical physics. Cooperation between faculty members from a range of theoretical disciplines will be needed to exploit many of the most important scientific opportunities of the coming decades and the Center is designed to encourage and facilitate such cooperation.

The mission of the Center will be to promote and support the exploration at Princeton of the most exciting frontiers of theoretical natural science.

The Center will be associated with the Physics Department and will be housed in newly-renovated space in Jadwin Hall. The Center will have a Director, responsible for the overall intellectual direction of the enterprise, and a corps of Center Faculty Fellows from Physics and other departments, whose responsibilities will include choosing the programs and overseeing the selection and mentoring of Center Postdoctoral Fellows. The first director will be Professor Curtis Callan, who will work with Associate Director Paul Steinhardt. Every year, three Center Postdoctoral Fellows will be selected competitively, with the aim of identifying the most outstanding and promising young theorists. Fellows will be appointed for three-year terms, will have complete freedom to pursue their own research interests, and will be encouraged to participate in, and help organize Center programs.

The latter are thematic programs focused on forefront issues in theoretical physics. The topics of the first two will be “The Beginning of the Universe,” and “Frontiers in Quantum Computations.” More information can be found at: <http://www.pctp.princeton.edu/pctp>

FACULTY, RESEARCHERS AND POST-DOCS



Top row: J. Olsen, L. Page, S. Staggs, C. Callan, P. Steinhardt, S. Warzel, C. Galbiati, Steve Smith, W. Happer, W. Brinkman, M. Aizenmann, H-C Jeong
2nd row: H. Xia, R. Seiringer, D. Haldane, T. Rothman, N. Beisert, Z. Hasan, L. McAllister, H. Verlinde, S. Gubser, I. Klebanov, M. Kruczenski, S. Franco, P. Meyers
3rd row: K. Ishikawa, C.Tully, A. Giuliani, L. Rastelli, C. Nappi, O. DeWolfe, J. Fowler, A. Yazdani, S. Smullin, Y. Jau
Bottom row: K. McDonald, J. Taylor, V. Fitch, R. Sherr, D. Marlow, J. Peebles, A. Wightman, E. Lieb, E. Groth, Stew Smith