

## Washington University Physics Department

### HISTORICAL MILESTONES

- 1853 Washington University is founded by Wayman Crow and William Greenleaf Eliot. The infant university is housed in buildings in downtown St. Louis.
- 1857 Funds are acquired to build a "superior telescope." The 6-inch refractor, made by Fitz & Co. and later refigured by Alvan Clark & Sons, is still in service, providing accessible astronomical viewing to the St. Louis Community.
- 1875 Francis Nipher becomes Chair of Physics and the first Wayman Crow Professor. His nationally recognized research is diverse and includes electromagnetism, weather forecasting, and early psychophysical experiments on short-term memory. He introduces one of the nation's first laboratory courses in physics.
- 1880s Washington University's observatory provides a source of standard time for the region and the coordination of railroad schedules.
- 1904 The Hilltop Campus is established to the west of the grounds of the 1904 World's Fair, and serves as the venue for intellectual activities of the 1904 World's Fair, including public lectures by Boltzmann, Poincare, and Rutherford. The fairgrounds ultimately become Forest Park, which now separates the Hilltop and Medical campuses.
- 1904-1934 Physics resides in Eads Hall, one of the original structures of the Hilltop campus adjoining the main quadrangle.
- 1920 Arthur Holly Compton is appointed Wayman Crow Professor and Chair of Physics.
- 1921 The Compton Experiment is performed in a basement laboratory of Eads Hall, demonstrating the particulate behavior of  $X$ -radiation. The results are published in the May, 1923, issue of *Physical Review*, and led to his Nobel Prize a few years later.
- 1923 Compton departs for Chicago and Arthur Hughes becomes Wayman Crow Professor and Chair. Hughes is noted for definitive experiments on the photoelectric effect, confirming Einstein's theory. In subsequent years, he mentors Lee DuBridge, who later became a presidential Science Advisor.
- 1927 Compton is awarded the Nobel Prize for fundamental research in quantum physics carried out at Washington University.
- 1934 Construction of Crow Hall. Designed by Arthur Hughes to accommodate a modern physics department, it features specialized facilities for research and laboratory instruction. Costing only \$257,000, it was the cheapest physics building in the country on a square-foot basis, yet was widely regarded as the best of its time.
- 1940 Arthur Hughes' recruitment of support in the Medical School and from Edward Mallinckrodt leads to the acquisition of a cyclotron, to be employed in basic nuclear research and in the generation of radionuclides for clinical use.
- 1942 The Manhattan Project commandeers the WU cyclotron to produce the first significant samples of plutonium.
- 1945 Compton returns to Washington University as Chancellor.

- 1945-1949 Under the leadership of Compton, Hughes, and Joyce Stearns, Washington University experiences a vigorous expansion in the sciences, particularly physics and chemistry.
- Theory: Feenberg & Primakoff (nuclear shell theory; inverse Compton effect)
  - Cosmic Rays: Sard
  - Magnetic resonance: Pake, later Norberg
- 1947-1948 Physics is the most heavily funded department in university, with sponsored research support almost twice that of Internal Medicine.
- 1953 George Pake succeeds Arthur Hughes as Chair.
- 1956 Following Pake's departure for Stanford, Chancellor Ethan A. H. Shepley hires Edward Uhler Condon as Chair of Physics and (in 1958) Wayman Crow Professor, defying the smear campaign against him by the House Un-American Activities Committee.
- 1956 Michael Friedlander joins the faculty and establishes the cosmic ray group that uses high altitude balloons.
- 1956-1957 Richard Norberg and Irving Lowe invent magic-angle spinning to narrow nuclear magnetic resonance (NMR) lines and study free-induction decay in solids, providing the groundwork for Fourier-transform NMR.
- 1957 Sputnik orbital flight spurs science education and research funding.
- 1962 Michael Friedlander receives a Guggenheim Fellowship.
- 1962-1963 Richard Norberg becomes Chair, succeeding Edward Condon. Norberg chairs the department for the next 29 years, falling short of Hughes' record by one year.
- 1963 Appointment of Daniel Bolef to the faculty brings ultrasonics to WU.
- 1964 Construction of Compton Laboratory, designed by Richard Norberg and Franklin Shull so as to mirror the efficient modular structure of Crow Hall. The project is funded by an NSF Science Development Grant and local benefactors. Compton Laboratory also houses the Pfeiffer Physics Library, which has remained a central asset of the department.
- 1964 Eugene Feenberg is named Wayman Crow Professor, succeeding Condon.
- 1966 James S. McDonnell gives a gift for establishment of the Laboratory of Space Physics, with Robert Walker as the first McDonnell Professor of the Space Sciences, and for support of three graduate fellowships in memory of the late astronauts, Chaffee, Grissom, and White.
- 1969 The Laboratory for Space Physics receives for analysis some of the first samples of material returned from the moon by the Apollo astronauts.
- 1974 WU Physics alumnus Michael Ter Pogossian develops Positron Emission Tomography at WU Medical School. Active in the French resistance during WWII, he had immigrated to the U.S. and St. Louis to study under Compton.
- 1974 A major gift from the McDonnell Aerospace Foundation establishes the McDonnell Center for the Space Sciences, endowing eight faculty positions, half in Physics and half in the Department of Earth and Planetary Sciences, and endowing support for graduate fellowships in the space sciences, and other support for research in the space sciences. Robert Walker was named the first Director of the Center, a leadership position he held until 1999.

- 1975 Edwin Jaynes succeeds Eugene Feenberg as Wayman Crow Professor (information theory & statistical mechanics; maximum-entropy principle; Bayesian probability theory as the logic of science).
- 1977 The department hires mathematical physicist Carl Bender, who in succeeding years will build the particle-theory group. He trains generations of winners in the undergraduate Putnam Math competition.
- 1979 The Heavy Nuclei Experiment, the largest cosmic-ray detector ever flown in space, is launched on the third High Energy Astronomy Observatory satellite. Washington University professor Martin Israel serves as co-principal investigator, along with co-principals at Caltech and University of Minnesota.
- 1980- James Miller's Laboratory for Ultrasonics increases in international prominence as its association with Medical School cardiologists produces breakthroughs in ultrasound characterization of the beating heart.
- 1980-1983 John Clark and his engineering-school colleague T. J. Tarn establish the theoretical foundations of quantum control.
- 1986 The first high-pressure NMR experiment in a diamond-anvil cell is performed by Sam-Hyeon Lee, K. Luszczynski, R. E. Norberg, and Mark Conradi.
- 1987 Robert Walker's Laboratory of Space Physics pioneers a new field of laboratory astrophysics, based on the revolutionary SIMS ion probe, employed to analyze presolar grains (literally stardust) isolated from meteorites. (SIMS = Secondary Ion Mass Spectrometry)
- 1988 Two new icosahedral quasicrystals in titanium are discovered by Kenneth Kelton and Patrick Gibbons.
- 1991 Clifford Will, noted gravitational theorist, becomes Chair.
- 1992 Washington University hosts the 4th International Conference on Quasicrystals, organized by Kenneth Kelton and Patrick Gibbons.
- 1992 A symposium is held at Washington University to present results from the first year of observing from the Compton Gamma Ray Observatory. The conference also celebrates the centenary of the birth of Arthur H. Compton.
- 1992-1993 In a collaborative effort, members of the Physics and Earth & Planetary Sciences Departments and the Tata Institute of Fundamental Research confirm the double beta decay of Tellurium and determine the Tellurium lifetime, the longest-lived radioactive substance.
- 1994- The Saturday Science lecture series is started. The series offers four lectures each semester, and draws an audience of 150-200 people to each lecture.
- 1996 Lattice '96, the 14<sup>th</sup> International Symposium on Lattice Field Theory, is held at Washington University.
- 1997 The Cosmic Ray Isotope Spectrometer is launched aboard the NASA Advanced Composition Explorer satellite. Robert Binns, Martin Israel, and Joseph Klarmann are coinvestigators along with scientists from other institutions. This instrument continues to make key measurements relevant to the origin of cosmic rays.

- 1998 Carl Bender and graduate student Stefan Boettcher publishes a paper in PRL that opens a new field in physics, PT-symmetric quantum theory. Recent experiments have verified predictions of the theory.
- 1998- Developments in the Conradi lab lead to novel clinical applications of NMR to lung imaging on the WU medical campus.
- 1999 Department launches new thrust in biological physics.
- 1999 John Clark succeeds Edwin Jaynes as Wayman Crow Professor; James Miller is named the first Albert Gordon Hill Professor.
- 2000 Center for Parallel Scientific Computing established as a university-wide resource with funding from the NSF and WU Arts & Sciences, with Wai-Mo Suen as Director. Its 128 CPU SGI Origin 3000 supercomputer allows state-of-the-art simulation of black hole collisions and resultant gravitational radiation.
- 2001 Cameca NanoSIMS 50 ion probe, developed by Cameca engineers in collaboration with WU scientists, begins operation in the Laboratory for Space Physics. This remarkable instrument provides unprecedented sensitivity along with submicron resolution, opening a new domain for laboratory study of stellar materials.
- 2001 The Laboratory for Experimental High-Energy Astrophysics achieves a record-breaking cosmic-ray balloon flight at the South Pole, in an experiment to record trans-iron elements in galactic cosmic rays. Robert Binns is principal investigator of the NASA-sponsored project.
- 2002 John Clark succeeds Clifford Will as Chair.
- 2002 Stuart Solin joins the department as the first Charles M. Hohenberg Professor of Experimental Physics.
- 2002 Experiments performed by Kenneth Kelton's group vindicate a 50-year-old explanation of how liquid metals resist solidification: Diffracted X-rays reveal a sequence of structural changes as a levitated drop cools and freezes.
- 2003 Creation of the multidisciplinary Center for Materials Innovation is announced by the WU Board of Trustees. Stuart Solin appointed Director.
- 2003 Carl Bender receives a Guggenheim Fellowship.
- 2004 The Physics Department becomes a world leader in the physics of natural fission reactors with the publication in Physical Review Letters (and later in Scientific American) of research by Alex Meshik, Charles Hohenberg and Olga Pravdivtseva revealing the operational mode of the ancient natural nuclear reactor in Oklo, Gabon.
- 2004 Ramanath Cowsik is elected to the U.S. National Academy of Sciences.
- 2005 Clifford Will is appointed as the James S. McDonnell Professor of Space Sciences.
- 2006 Kenneth Kelton is appointed as the first Arthur Holly Compton Professor in Arts & Sciences.
- 2006 The Cliff Will Birthday Symposium on Gravitational Theory and Experiment is held at Washington University featuring Luc Blanchet, Francis Everitt, Bernard Schutz, Joe Taylor, and Kip Thorne.

- 2007 Kenneth Kelton succeeds John Clark as Chair.
- 2007 Carl Bender receives the Washington University Compton Faculty Achievement Award and becomes the Wilfred R. and Ann Lee Konneker Distinguished Professor of Physics.
- 2007 Clifford Will is elected to the U.S. National Academy of Sciences.
- 2008 Ramanath Cowsik succeeds Roger Phillips of the Department of Earth & Planetary Sciences as Director of the McDonnell Center for the Space Sciences.
- 2009 Quantum Mechanics in the Complex Domain conference is held at Washington University on March 27-28, honoring Carl Bender for his 60th birthday.
- 2012 Mark Alford succeeds Kenneth Kelton as Chair.
- Dec. 2012 – Jan. 2013 The longest ever high-altitude scientific balloon flight floats for 55 days over Antarctica, led by Robert Binns, and Martin Israel (WU PI institution), with co-Is at Caltech and NASA Goddard Space Flight Center. This instrument measured the abundances of galactic cosmic rays from iron to zinc to test theories of the origin of galactic cosmic rays.
- 2013 Ramanath Cowsik is appointed as the James S. McDonnell Professor of Space Sciences.
- July 2013 A new Institute of Materials Science and Engineering (IMSE) is established. The IMSE brings together more than thirty research groups in Arts & Sciences, the School of Engineering and Applied Science, and the Medical School. Kenneth Kelton is appointed as the first Director.
- 2015 Kater Murch wins a Sloan Fellowship.