David Todd Wilkinson FREE

Special Collection: Print Obituaries

John C. Mather; Lyman Page; P. James E. Peebles

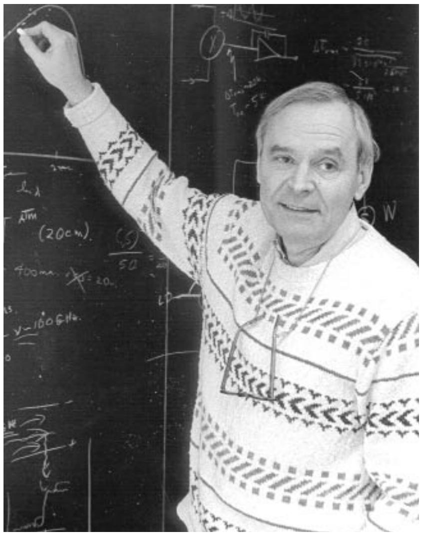
Physics Today **56** (5), 76–77 (2003);
https://doi.org/10.1063/1.1583543

David Todd Wilkinson

David Todd Wilkinson died on 5 September 2002 in Princeton, New Jersey, after having battled cancer for 17 years. His role in the measurements of the thermal cosmic background radiation (CMB) was key to the completion of the program of cosmological tests that began with Edwin Hubble's discovery of the expanding universe in 1929.

Dave was born on 13 May 1935 in Hillsdale, Michigan. From his father, a self-employed electronics specialist, Dave developed a strong interest in how things work. His mother was an elementary school math teacher who maintained high academic standards for her sons. An older brother was an aeronautical engineer. As a student at the University of Michigan, Dave played saxophone in a jazz band. He earned his BS (1957) and MS (1959) in engineering. Because a course on steam tables—those that describe the properties of steam as a working medium—had turned his interest to physics, he stayed at Michigan for further graduate work with Richard Crane. In 1962, Dave defended his thesis, a test of the quantum theory of electromagnetism entitled, "A Precision Measurement of the *g*-Factor of the Free Electron," and completed his PhD in physics. He remained at Michigan for another year as an instructor.

Dave joined Bob Dicke's research group at Princeton University in 1963. His first project at Princeton, with Dicke, was the design of optical retro reflectors that the Apollo astronauts placed on the Moon. Laser ranging with the retro reflectors continues to measure the distance of the Moon for precision tests of gravity physics. With Peter Roll and one of us (Peebles), Dave then set out to search for the faint CMB radiation that would fill the universe in a hot Big Bang cosmology. At the same time, Robert Wilson and Arno Penzias at Bell Laboratories were seeking diffuse emission from the outer parts of our galaxy. Their search required cooling their instrument to liquid helium temperatures. As it happened, that would make it sensitive to the CMB. News of the Princeton experiment led them to consider the possibility that the anomalous radiation they were detecting might be the thermal radiation Wilkinson and Roll were looking for. The Princeton and Bell Labs results, at different wavelengths, gave the first evidence that the CMB spectrum agrees with the hot Big Bang.



David Todd Wilkinson

Realizing that accurate measurements of the CMB would be an invaluable probe of the large-scale structure and evolution of the universe, Dave led pioneering studies of experimental cosmology from 1965 to the time of his death. Those experiments were aimed at checking whether the CMB spectrum really is close to thermal—as required of a remnant of the hot Big Bang—and whether tiny variations in the radiation temperature exist across the sky—as would be produced by the gravitational growth of the present clustering of matter in an expanding universe. His experiments include the first CMB balloon flight in 1970 (with Paul Henry), the first dedicated CMB polarimeter in 1973 (with Peter Nanos), and the first dedicated CMB interferometer in 1984 (with Peter Timbie). He set the learning curves on how to make those difficult measurements, and found the best places to do them: Princeton rooftops, deserts, mountains, balloons, and space. The results have driven the development of the standard model for cosmic structure formation and the new generation of cosmological tests. In the process of those experiments, Dave trained a large fraction of the scientists now engaged in this wonderfully productive field of experimental cosmology.

Dave significantly influenced the origin of the Cosmic Background Explorer (COBE) satellite. COBE demonstrated that the spectrum of the CMB is very close to thermal. The demonstration was compelling evidence that the universe expanded from a denser hotter state because space now is transparent and is incapable of thermalizing the radiation. NASA's Wilkinson Microwave Anisotropy Probe (WMAP) spacecraft, renamed in February 2003 to honor Dave, is now in orbit about the Sun at the second Lagrange point and is making accurate measurements of the angular distribution of the CMB temperature (see PHYSICS TODAY, April 2003, page 21). WMAP's design follows Dave's philosophy: Keep it simple, but build in abundant checks for systematic errors. He was delighted with the results; the community is witnessing yet another great advance in precision tests of the relativistic cosmological model.

Dave had many other scientific interests. With Princeton students and colleagues, he studied precision optical pulsar timing in our galaxy and placed bounds on pulsars in nearby galaxies, pioneered the use of charge-coupled device detectors for cosmology, and introduced the search for the young galaxies at high redshift that now are teaching us so much about how galaxies formed. He also developed methods for measuring the energy density in starlight that is integrated back to the edge of the observable universe, a critical datum for cosmology.

In 1998, a freshman seminar on extraterrestrial life led him to take part in a Harvard University project to detect fast optical pulses that an advanced civilization might send our way. Dave organized a volunteer group to revitalize Princeton's Fitz–Randolph Observatory and recruited amateur astronomers to run the project.

Teaching was Dave's passion: He gave demonstrations of giant bubbles at elementary schools, and he lectured to Princeton alumni groups and to state and federal judges. He was a member of working groups on undergraduate education at the National Academy of Sciences and the American Physical Society. He helped develop an intensive sophomore course in experimental physics and a three-semester introductory physics course that has engaged students who might have been turned off by the pace of the standard introductory physics course. And when he taught the standard course, it was among the highest rated at the university. He preferred to teach graduate students in the laboratory; they learned from him to be mentors as well as physicists.

Elected to the NAS in 1983, Dave was further honored by the award of the academy's James Craig Watson Medal in 2001. He was named a fellow of the American Academy of Arts and Sciences in 1984. The University of Chicago conferred an honorary PhD on Dave in 1996.

Dave was devoted to his children and five grandchildren. His family remembers him for his love of fishing, hiking, and family vacations, and as an ardent fan of the New York Yankees.

Dave's science often took the path less traveled, with results that have seeded large and active fields. He showed, by example, that the experimenter's conscience can be the best defense against bad science. In all his collaborations, Dave was always the arch-skeptic. He embodied so much of what we aspire to as scientists and as people. His effortless charm and natural affinity for people, his generosity with time, and his total absence of self-promotion brought out the best in all who were privileged to know him.

John C. Mather
NASA's Goddard Space Flight Center
Greenbelt, Maryland
Lyman Page
P. James E. Peebles
Princeton University
Princeton, New Jersey

Robert Wilson

Robert Wilson, whose conception of a UV observatory led to the development of the International Ultraviolet Explorer (IUE), died from complications related to cancer on 2 September 2002 in Chelmsford, England. He made major contributions to both laboratory plasma spectroscopy and astrophysical spectroscopy. For those and other contributions, he was knighted in 1989.

Born on 16 April 1927 in South Shields, England, Robert took his BS in physics from Kings College, Durham, in 1948. He received a PhD in astronomy from Edinburgh University in 1952. His doctoral thesis, carried out under W. M. H. Greaves, concerned optical spectroscopy of O stars.

Robert's first significant paper presented spectroscopic observations of the Sun made on 26 September 1950, when atmospheric conditions made it appear blue in Edinburgh. On that day, while other students displayed a modern sense for public relations by running to answer telephone inquiries, Robert concerned himself with the scientific phenomenon and dashed to the telescope. He concluded that the selective extinction responsible for the blueness resulted due to dielectric particles of a very uniform size. Those particles were probably submicron globules of oil produced three days earlier by a forest fire in Alberta, Canada.

As a member of the staff at the Royal Observatory, Edinburgh, which he joined in 1952, Robert continued his investigations of O stars. He discovered that such stars have winds and that the wind luminosity correlates with the radiative luminosity. In 1957, he submitted the paper on those findings. In that year, he went to the Dominion Astrophysical Observatory in Victoria, British Columbia, Canada, where he worked primarily on the diffuse interstellar bands.

He returned to England the following year after receiving a letter from John Crockcroft, who said that his team in the UK government laboratory Harwell in Oxfordshire was on the verge of attaining controlled fusion with the Zero Energy Toroidal Assembly (ZETA) device. Although he had worked only in optical astronomical spectroscopy, Robert recognized that he would have to develop UV spectroscopic diagnostics to infer the ZETA plasma's conditions. He measured the UV features of ions of neon, argon, and krypton injected in trace amounts into the plasma to deduce thermal and turbulent contributions to their linewidths. He also developed an analytically tractable model, which included plasma losses, of the time-dependent ionization structure of a rapidly heated plasma. Robert concluded that the ZETA plasma reached temperatures of only roughly 1 million kelvin and escaped in about 100 microseconds. He also realized the diagnostic utility of coherent scattering of laser radiation by plasma fluctuations and established an effort to exploit it.


Robert Wilson

In 1962, the entire fusion team moved to Culham. There, Robert began using the ZETA device for astrophysical experiments, in which he showed that many extreme UV solar lines that had previously been unidentified were due to iron. Robert turned increasingly to solar plasmas and, during much of the rest of the 1960s, oversaw the development of