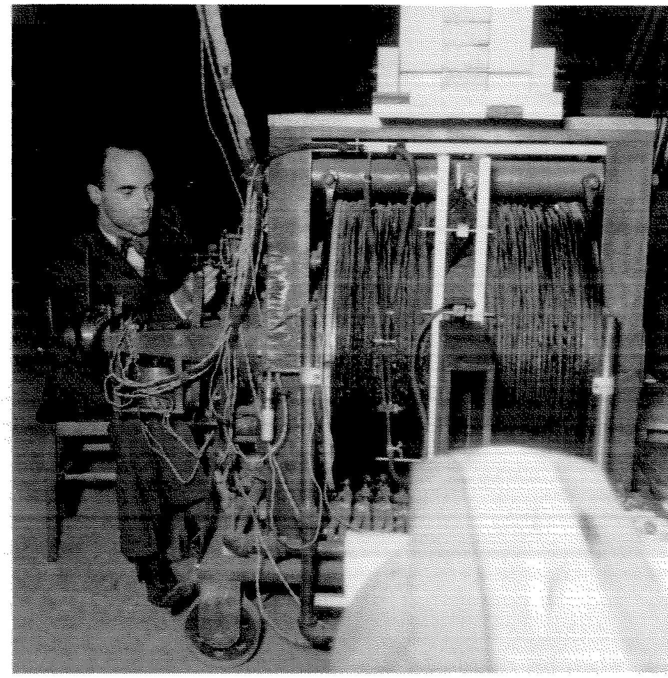
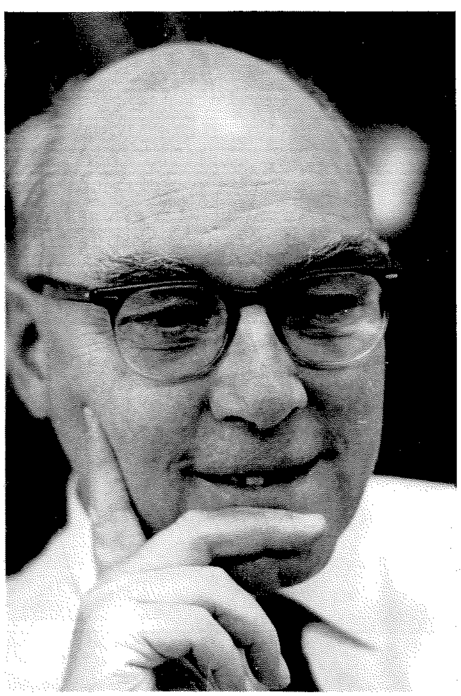
Obituaries



Carl Anderson and his cloud chamber.

Carl D. Anderson 1905–1991



Nobel Laureate Carl D. Anderson, Board of Trustees Professor of Physics, Emeritus, died January 11 after a short illness. He was 85. Discoverer of the positron, the first particle of antimatter shown to exist, Anderson was awarded the Nobel Prize in physics in 1936, when he was only 31 years old. "He lived during the heyday of modern physics," said Gerry Neugebauer, chairman of the Division of Physics, Mathematics and Astronomy, at the February 25 memorial service. "To many of us he epitomized the experimental physicist." He was also "someone whose career epitomized Caltech," added Robert Christy, Institute Professor of Theoretical Physics, Emeritus.

Anderson entered Caltech as an undergraduate in 1923, intending to become an electrical engineer. During the third term of his sophomore year, however, Anderson took Ira Bowen's class in modern physics, a course he found so inspiring that he changed his major to physics. At the memorial service Lee DuBridge, Caltech president emeritus, recalled meeting Anderson in 1926 when Anderson was a senior and DuBridge a young postdoc at Caltech on a National Research Council fellowship. It was Robert Millikan's policy to introduce promising young undergraduates to research by making them research assistants. Millikan offered Anderson to DuBridge. "I thought I'd really made it now that I had a research assistant to help me," said DuBridge, "even though I didn't really need one; the experiments I was doing were very simple indeed."

But the relationship was short-lived. Millikan reassigned Anderson to some work on cosmic rays using a cloud chamber. "So I regretfully said goodbye, and he moved two doors down the hall and started working with the cloud chamber. But I was proud to be at least a forerunner to the experiments that led to the Nobel Prize," said DuBridge. Their friendship resumed when DuBridge returned as president in 1948.

In the meantime Anderson received his BS in 1927 and stayed on as a graduate student, working with Millikan. Millikan was a pioneer in cosmic-ray research and had already measured their enormous penetrating power. What he wanted Anderson to do was to measure the energy of the electrons they produced, and the best way to do that at the time was in a cloud chamber. Anderson designed and built an apparatus consisting of a giant electromagnet wrapped around a cloud chamber. An arc-lighted camera was focused on the chamber's window to record the vapor trails of electrons or other charged particles passing through.

By 1930, when Anderson earned his PhD, scientists had identified only two elementary particles of matter—the electron and the proton. In 1932 Anderson realized that he had found something new when his cloud-chamber photographs showed what appeared to be a positively charged electron. This particle was eventually named the positron, and its discovery was the first confirmation of Paul Dirac's equation for the electron, which predicted its positively charged analog.

By the time he received the Nobel Prize for this work in 1936, Anderson and his first graduate student, Seth Neddermeyer, had identified two more of the fundamental particles of matter, which have variously been called the positive and negative mesons, the mu mesons, or the muons. According to Christy, "Carl was never as impressed by the discovery of the positron as he was by his work with Neddermeyer on the discovery of the mu meson. He felt that the positron discovery was kind of an accident, a stroke of luck, whereas the discovery of the mu meson followed several years of intense work trying to follow one lead after another." Anderson was promoted to assistant professor in 1933, and was named associate professor in 1937 and professor in 1939.

When Anderson discovered the positron, William Fowler (PhD '36), Institute Professor of Physics, Emeritus (and winner of the Nobel Prize for physics in 1983), was an undergraduate in Ohio. Anderson's discovery inspired him to apply for a graduate assistantship at Caltech. Fowler worked in the Kellogg Radiation Laboratory with Charles Lauritsen, who suggested that he talk to Anderson about using a cloud chamber to look at beta rays and gamma rays produced in an accelerator.

"Anderson showed me his cloud chamber and let me in on the secrets of how to make one operate successfully," recalled Fowler at the memorial service. "I followed his suggestions as well as I could. Although I obtained thousands of cloud chamber exposures, none were ever as clear of background droplets as were Anderson's." Fowler also spoke of his World War II experience with the Caltech group producing land and aircraft rockets, a group that included Lauritsen and Anderson (see story on page 2).

Two of Anderson's former students also spoke at the memorial service—Eugene Cowan, professor of physics, emeritus, who joined Anderson's group as a graduate student in 1945, and Donald Glaser, now professor of physics at UC Berkeley (and winner of the Nobel Prize in 1960), who had Anderson as a thesis adviser from 1947 to 1949. Glaser was measuring the energies of the mu meson. "Whenever I got stuck," said Glaser, "Carl would be more than happy to give me advice and help me, but otherwise he left me strictly alone. I've compared notes with others of his students, and that seems to have been his pattern. The consequence was that he stimulated a great independence in many of us, which I've always been grateful for."

Cowan also recalled "the way of Carl Anderson" with his students. During the early 1950s, when Anderson and his team were looking for new elementary particles, Cowan was scanning photographs of cloud-chamber tracks and discovered "the blob," which he concluded must be evidence of a new particle. When he communicated this to Anderson, "he came immediately to view the blob with an interest that turned to amazement as I showed him the second blob. With growing excitement, we began to see the heavy dark streak and the strange origin of the blob as the possible form of a much sought prize, the magnetic monopole. His next words remain as clear to me now as when he spoke. He said, 'I don't know what this is, but it does look like something new. I want to work with you on this, but I want you to know at the start that this is to be your discovery, and you are to publish it first.'" It was not the magnetic monopole, and though "the discovery was new and interesting, it was unimportant in the basic structure of science." But Cowan never forgot Anderson's generous gesture to a young postdoc.

By the late 1950s Anderson's kind of cosmic-ray studies was beginning to be supplanted by work done on huge high-energy accelerators. "Anderson was trained to be the kind of lone investigator working with a few students and postdocs, and he did not like the idea of becoming one member of a large team," said Christy. Anderson became division chairman in 1962, a position he held until 1970. He retired in 1976.

Fowler eloquently summed up Anderson's contribution: "He was a creative scientist, and he created a new world for all of us—the world of antimatter in the form of positive electrons. Later on, others produced antiprotons, antineutrons, and many other antiparticles, but it was Anderson who took the first step into an enhancement of our knowledge of the physical universe which few other discoveries can match. Anderson stands among the great scientists of all time."□

Longtime friends Milton Plesset (left) and Carl Anderson reminisce at Anderson's home in September 1989.

Milton S. Plesset 1908–1991

Milton S. Plesset, professor of engineering science, emeritus, and an expert on nuclear energy, died February 19 at the age of 83.

After earning his BS (1929) and MS (1930) from the University of Pittsburgh and PhD from Yale in 1932, Plesset came to Caltech as a National Research Council Fellow—just as the positron was in the process of being discovered by Carl Anderson. At that time Plesset was a theoretical elementary particle physicist and an expert on quantum electrodynamics. "The term 'elementary particle physicist' was not yet in vogue and quantum electrodynamics was brand new," said Murray Gell-Mann at the April 2 memorial service. "He was working right at the cutting edge of fundamental physical theory."

Gell-Mann, the Millikan Professor of Theoretical Physics and Nobel laureate, described some of Plesset's early work following Anderson's discovery—first with Robert Oppenheimer, using the Dirac equation and quantum electrodynamics to show how electron–positron pairs were produced. The next year Plesset went to the Bohr Institute in Copenhagen, where some of his important work—on the nature of cosmic rays in collaboration with E. J. Williams—remained unpublished, according to Gell-Mann. Plesset and Williams showed that cosmic-ray collisions took place at energies less than those at which quantum electrodynamics was assumed (wrongly, it turned out) to break down. Therefore, they said, if primary cosmic rays were indeed photons, as Robert Millikan believed, then they would have to behave like photons, which they notoriously failed to do. "Milton told me," said Gell-Mann, "that he and Williams even hinted that the explanation of cosmic-ray phenomena in the atmosphere might somehow involve a heavy version of the electron. If they really said that, then it was an anticipation of the next discovery by Carl Anderson—of the muon. Unfortunately this remarkable work was not published. They sent a version of it as a letter to the great man, Dr. Millikan, who ignored it, since it challenged his pet hypothesis. Perhaps researchers in the history of physics can find that letter in some musty file and see what it actually contains."

From 1935 to 1940 Plesset was an instructor in theoretical physics at the University of Rochester, lured there by none other than Lee DuBridge, future president of Caltech. DuBridge, who had been invited to start up a new physics department, knew of Plesset's work through Oppenheimer. At the memorial service DuBridge recalled Plesset's time there: "It was the early days of blossoming quantum physics, and Milton helped to put Rochester on the map as a place where modern theoretical physics was being done. Rochester has remained for a long time a leader in both experimental and theoretical physics due to the work that Milton helped start in those days."

His interests, however, gradually shifted to applied science and engineering. After returning to Caltech in 1941, Plesset left again soon afterward to spend the war years with Douglas Aircraft Company as head of the Analytical Group of the Douglas Research Laboratories. He came back to Caltech in 1948 as associate professor of applied mechanics and was named full professor in 1951. During this time his research centered on the theory of cavity flows and bubble dynamics. In 1963 he was appointed professor of engineering science and retired as emeritus professor in 1978. From 1976 he continued to serve as adjunct professor of nuclear engineering at UCLA.

Blaine Parkin (BS '47, MS '48, PhD '52), professor of aerospace engineering, emeritus, at Pennsylvania State University, was one of Plesset's first graduate students after he returned to Caltech in 1948. Parkin stayed at Caltech as a research fellow in hydrodynamics for several years, and at the memorial service recalled his former professor as a man who had "a keen intellect, great generosity, and a wonderful sense of humor, although he could at times be a bit acerbic"—illustrated by calling his students "intellectual provincials" ("but in his smiling, gentle way") when they objected to his assigning a textbook in French for his class in tensor analysis.

Plesset's later reputation was as an authority on the problems and progress of nuclear power. He was a consultant to the Science Division of the RAND Corporation from 1948 to 1972 and to the energy and kinetics department at UCLA. From 1975 to 1982 he served on the Nuclear Regulatory Commission's Advisory Committee for Reactor Safeguards (ACRS) and was its chairman in 1980. Ivan Catton, professor of mechanical, aerospace and nuclear engineering at UCLA, who knew Plesset through his tour of duty with the ACRS, praised his ability to "summarize the most complex ideas in a simple way that all could understand. Although he was a physicist, Milton had more engineering sense than many of the engineers he had to deal with. And his common-sense guidance was invaluable; by example he demonstrated that one should do what is right rather than what is sometimes necessary to get research money."

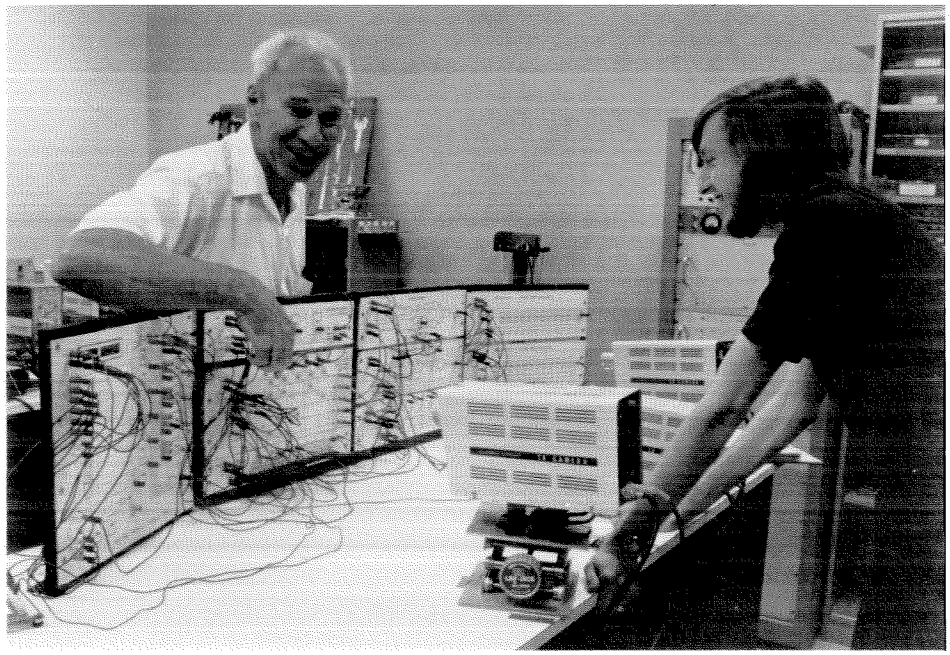
Victor Gilinsky, former commissioner of the U.S. Nuclear Regulatory Commission, noted Plesset's good humor and friendliness as well as his integrity: "He pressed for high standards in conducting nuclear-safety research, and he also pressed for making sure that research was directed at solving real problems and not just building scientific empires. . . . Overall his work for the government was characterized by common sense and a respect for realities. In fact, 'common sense and a respect for realities' describes a lot of what Milton was about. It is sometimes forgotten that these too are graces of the spirit."□

Charles H. Wilts 1920–1991

Charles H. Wilts, professor of electrical engineering and applied physics, emeritus, died March 12, at the age of 71. He was stricken by a heart attack while hiking, one of his favorite activities, along the Sam Merrill Trail in the San Gabriel Mountains.

A native of Los Angeles, Wilts received his BS (1940), MS (1941), and PhD (1948) from Caltech. Like many other Caltech graduate students during World War II, he joined the Navy's rocket project and was assistant supervisor in Aircraft Ballistics, where he worked on retrorockets and on fuses for igniting solid propellant. He joined the faculty as assistant professor of electrical engineering in 1947, and became associate professor in 1952 and professor in 1957. From 1974 until his retirement in 1984, he was professor of electrical engineering and applied physics. In 1970-71 Wilts was vice chairman of the faculty, and from 1972 to 1975 he served as executive officer for electrical engineering.

At a memorial service on April 17, several of his colleagues and former students spoke of Wilts's influence in his field and on their lives. Carver Mead (BS '56, MS '57, PhD '60), the Gordon and Betty Moore Professor of Computer Science, took his first course from Wilts when he was a junior. "Chuck was a wonderful teacher, and he started



Chuck Wilts in his lab in 1977.

me on my way as an electrical engineer," said Mead. When Mead first met him Wilts was working in the Analysis Lab in the basement of Throop Hall, which "had developed a giant analog computer to analyze flutter in aircraft structures. Chuck was amazing because he understood not only all the details of analog computation but also how it applied to this very complex aerodynamic and structural problem. Up till very nearly the present time that kind of analog computation has still outrun our most powerful digital computers in analyzing things like those dynamic problems in aircraft. . . . When I think back on the things I learned from Chuck—the principles behind that kind of computing haven't changed very much. Chuck's insights are still very much with us."

Chris Bajorek (BS '67, MS '68, PhD '72), also first met Wilts as an undergraduate and was persuaded to stay on as a graduate student, the beginning of a long friendship. "He was known as one of the toughest thesis advisers at Caltech," said Bajorek at the memorial service. "But students who had the courage to join him, rapidly found he was very warm, very human but exceptionally demanding of first-class research—research that would advance the understanding of any topic he dealt with in a very basic and unambiguous way." Bajorek noted Wilts's work on ferromagnetic thin films, which are used in memory-storage devices. "He did some of the best work in the world in ferromagnetic films—their synthesis, their structure, their static and dynamic properties, and in instrumentation to characterize such properties."

"In those days Charlie was working on magnetic thin films for computer memories," recalled Thomas McGill (MS '65, PhD '69), the Fletcher Jones Professor of Applied Physics, "but I always felt that he realized that the real memory in the system was in humans." Like Mead, McGill was first a student and then a colleague of Wilts. "Over the last 20 years as a faculty member, I found Charlie to be the colleague I sought out for critical reading of my thoughts on various subjects. With Charlie it was easy to grow accustomed to his absolutely uncompromising sense of fairness and self-discipline, which was wonderfully complemented by a compassionate, sensitive understanding of the human condition."

One of McGill's first recollections of Wilts was "of hearing someone walking along the hall and hitting his hands along the walls of Spalding. I was told that this was Professor Wilts toughening up his hands for his rock climbing." Besides skiing, hiking, and folk dancing, rock climbing was Wilts's avocation, and he claimed considerable fame among California climbers. According to James Campbell, senior electronics engineer at Caltech, "In the golden age of climbing, Chuck was one of the magic names." He had a number of first ascents in Yosemite, and developed a climbing-difficulty classification system, first known as the Sierra-Wilts classification system and later as the Yosemite climbing system. He was the author of the *Climber's Guide to Tahquitz Rock and Suicide Rock*. "He influenced the style and safety of the climbers of his era," said Campbell. "He brought his technological skill to the climbing family and wrote several papers on the strength of ropes, an article on the safety of expansion bolts used for climbing and another on a knife-blade piton that he invented." Campbell learned to climb in the rock-climbing course that Wilts began teaching at Caltech in 1973, which others have taken over in recent years. "He was my best friend, mentor, role model, father figure, my boss (twice), backpacking companion, and rock-climbing partner," said Campbell. "He influenced me more than anyone else in my life."□