To notify the community about a colleague's death, subscribers can visit http://www.physicstoday.org/obituaries, where they can submit obituaries (up to 750 words), comments, and reminiscences. Each month recently posted material will be summarized here, in print. Select online obituaries will later appear in print.

Samuel Frederick Edwards

Samuel Frederick Edwards, a leader in several fields of physics, died peacefully on 7 May 2015 in Cambridge, UK.

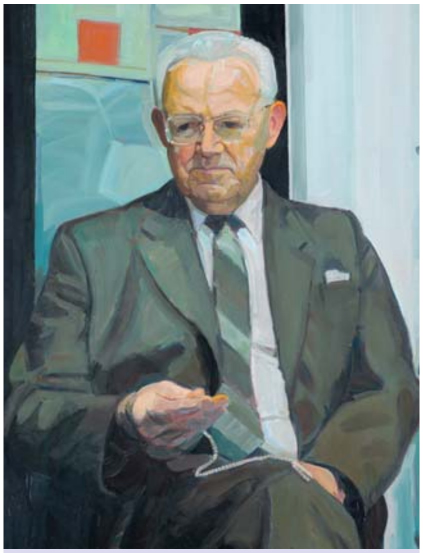
Born in Swansea, Wales, on 1 February 1928, Edwards studied at Cambridge University and earned his degree in mathematics in 1949. He joined Julian Schwinger at Harvard University and received his PhD on the structure of the electron in 1951. There he adopted the functional methods that he later used to transform many areas of physics and establish yet others.

After a year at Princeton University, Edwards returned to the UK and joined the Birmingham group of Rudolf Peierls. He then went to the University of Manchester, where he was a professor of theoretical physics and worked on turbulence, statistical mechanics, and quantum many-body theory of transport in metals.

An isolated polymer chain is a formidable, non-Markov problem—it is a self-avoiding, spatial random walk. Edwards used field theory to calculate Paul Flory's celebrated $3/5$ scaling exponent for chain extent. He was quick to recognize the universality of that and similar problems in which detailed molecular structure is irrelevant. He then showed that dense solutions and melts of chains are *less* difficult problems, just as metallic electrons are essentially free, with an effective mass subsuming all detail.

Edwards attacked the problems of chain dynamics and of cross-linked networks (rubber). He also saw that entanglement constraints effectively create a confining tube. Pierre-Gilles de Gennes then extended that concept to molten chains that can crawl, or "reptate," along the tube. So began a lifelong friendship and gentle rivalry between Edwards and de Gennes, who visited the Cambridge group often. His visits were an admirable excuse for the fabulous dinners Edwards hosted at the college and for more intimate dinners at home.

As Edwards observed, polymer networks contain locally mobile chains but with quenched connectivity and topology that create a solid from a liquid. Computing their free energy required averaging the logarithm of the partition function over quenched variables. Edwards solved that deep technical challenge by returning to field theory, this time with n components, each describing a different replica of the same system. Simple averaging over all variables and letting n tend to zero was equivalent to averaging the logarithm. Edwards's replica trick made both network and tube constraints tractable. Edwards, with collaborators, also used it to good effect in the random matrix problem and its generalizations.



COURTESY OF CAVENDISH LABORATORY

Samuel Frederick Edwards

In the early 1970s, Edwards was back in Cambridge, in the Cavendish theory group, alongside Philip Anderson. Together they applied the replica trick to the spin-glass problem, in which magnetic spins interact with each other via fixed random couplings. Their celebrated papers launched a field that took decades to reach maturity and remains active today. Edwards once said, "I may not have had the last word on that subject, but at least I had the first word." Considerable theory worldwide was directed toward more formal aspects of replica theory. Spin-glass theory now underpins simulated annealing, machine learning, fuzzy logic, and neural networks, all much exploited in our information age.

Edwards was head of the UK's Science Research Council from 1973 to 1977. His daily commute from Cambridge to London gave him time to carry out seminal work: Alongside spin glasses, he extended network and polymer dynamics to include the nonlinear effects of entanglements.

His groundbreaking work with Masao Doi, then a postdoc from Tokyo, would have a profound effect on a problem of huge industrial importance: high-polymer-melt rheology. When a polymer melt is sheared, chains respond elastically as if in rubber until they have had time to reptate out of their confining tube. Stress has then relaxed. The supreme achievement of the Doi–Edwards theory was to describe in detail such nonlinear viscoelasticity, which pervades all long-chain polymer response and all processing of molten plastics. A huge community of theoretical, experimental, and industrial researchers and technologists subsequently tested, extended, and applied those theories. In both the polymer and spin-glass communities, Edwards's work had an electrifying effect.

On returning full-time to Cambridge, Edwards's contact with industry grew because of his governmental experience, his judgment, and the extreme importance of his discoveries to the chemical and food industries. He gave industry invaluable guidance, and industry in return gave substantial support to academic research at Cambridge.

In 1984 Edwards became the eighth Cavendish Professor, a worthy successor to James Clerk Maxwell, Lord Rayleigh, J. J. Thomson, Ernest Rutherford, William Bragg, Nevill Mott, and Brian Pippard. He continued founding new fields and turning powerful methods to established fields not yet studied by physicists. For instance, with a colleague working in theoretical physics, he extended the scaling laws for the mechanical properties of dry, solid foams to cellular solids modified by filling liquids. Fluid flow, elasticity, and fluid-induced failure are coupled. Those models are used by industry for many foodstuffs. Another field—granular matter—preoccupied Edwards into old age. For granular materials, the equivalent to inverse temperature, in the statistical mechanical sense, is now called the Edwards compactivity. In his later years, he would bicycle so deep in thought and so slowly that colleagues would observe, "Here is Sam making an adiabatic transition from home to the lab!"

Edwards had a deep interest in music: Before his 70th birthday celebrations, de Gennes proposed that Edwards be offered a ride in a hot-air balloon, a gift he declined in favor of the complete works of Bach on CD! His knowledge of and generosity with fine wines were a pleasure shared with friends.

Edwards is remembered fondly for his insights, generosity with his wisdom, and his mercurial intellect.

Mark Warner
University of Cambridge
Cambridge, UK

Val Logsdon Fitch

"My mother always told me that if you do anything worth praise, let others praise you, don't praise yourself." To friends of Val Logsdon Fitch, who died in Princeton, New Jersey, on 2 February 2015, that quotation from him says it all. Fortunately, he has left several eloquent recollections over the years, which we quote or paraphrase to capture the spirit of this great scientist and human being.

Val Logsdon Fitch

Val "was born on a cattle ranch not far from the South Dakota border on March 10, 1923 . . . just 20 years after the battle of Wounded Knee, which occurred about 40 miles northwest. The Sioux were very much a part of our environment, and my father, while not fluent, spoke their language. They recognized his friendly interest on their behalf by making him an honorary chief, naming him 'Eagle Star.' " Soon after Val's birth, the family moved to Gordon, Nebraska, where Val loved to work in his basement "laboratory," which had a separate fuse box to prevent blackouts in the rest of the house. Graduating from Gordon High School in 1940 as valedictorian, he attended nearby Chadron State College until he was drafted into the US Army in March 1943.

While in basic training, Val was selected for the army's Specialized Training Program at the Carnegie Institute of Technology and then for the Manhattan Project. Given responsibilities far beyond his formal status, Val "observed that the most accomplished experimentalists were also the ones who knew most about electronics, and electronic techniques were the first I learned. But mainly I learned . . . not just to consider using existing apparatus but to allow the mind to wander freely and invent new ways of doing the job."

Under Ernest Titterton's supervision, Val designed and built the apparatus to generate the signal that detonated the first atomic bomb on 16 July 1945. At the Trinity test he encountered a guard who had not been told what to expect: "He was absolutely pale and a look of incredible alarm was on his face. I simply said what was on my mind, 'The war will soon be over.' "

After graduating from McGill University in electrical engineering, Val entered Columbia University in 1948. He worked with James Rainwater, who handed him a paper by John Wheeler on determining nuclear radii via x rays from captured muons and said it might make a good thesis topic. Val "took it and ran"; he built scintillation counters, trigger circuits, sodium iodide photon detectors, and a pioneering multichannel analyzer. "Every piece of electronics was home-designed and constructed. Nothing was available commercially." The 1953 results were auspicious: Val and Rainwater found that nuclei were twice as dense as and far smaller than previously measured and showed that the muon had spin-½. They shared the front page of the *New York Times* with Edmund Hillary and his ascent of Mount Everest, and a pithy headline in the *New York Daily News* proclaimed, "A bad day for fission, the nucleus is just a shrimp."

"Changing allegiance" to Princeton University in 1954, Val focused on the K mesons and first attacked the "$\tau - \theta$ puzzle": Two K-like particles had been found with the same mass but opposite parity, as evidenced by their decays $\tau^+ \to 3\pi$ and $\theta^+ \to 2\pi$. Using the new Cosmotron at Brookhaven National Laboratory, Val found that the τ^+ and θ^+ lifetimes were equal within a few percent; that finding motivated T. D. Lee and C. N. Yang in their famous 1956 proposal that parity was not conserved—that the τ^+ and θ^+ are the same particle, the K^+. Val's key innovation, the velocity-selecting Cherenkov counter, cleanly separated K^+ from protons and pions in the beam. Appropriately named the Fitch counter, it has been a workhorse ever since.

Val next turned to the neutral kaons, coherent mixtures of K^0 and its antiparticle $\overline{K^0}$. The mass eigenstates $K_1 = (K^0 - \overline{K^0})/\sqrt{2}$ and $K_2 = (K^0 + \overline{K^0})/\sqrt{2}$ were opposite eigenstates of charge conjugation–parity (*CP*), with different allowed decay modes and hence different lifetimes. In a kaon beam, the short-lived K_1 component would quickly decay via $K_1 \to 2\pi$ and leave a "pure" K_2 beam in which 2π decays were forbidden by *CP* conservation. However, matter placed into a K_2 beam preferentially absorbed the $\overline{K^0}$ component, "regenerating" short-lived K_1s and hence 2π decays.

In 1958 one of us (Cronin) joined Princeton and developed a spark-chamber spectrometer that had far better resolution than previous detectors. In spring 1963 Val suggested moving Cronin's apparatus to the Alternating Gradient Synchrotron (AGS) at Brookhaven to pursue Robert Adair's recent observation of large, "anomalous" K_1 regeneration and search for $K_2 \to \pi^+\pi^-$. By July the experiment was running, and by Christmas postdoc René Turlay with student James Christenson had found 45 ± 10 $K_2 \to \pi^+\pi^-$ candidate events. Efforts to find other explanations were unsuccessful, and the discovery published in the 27 July 1964 *Physical Review Letters* created a sensation.

But to prove *CP* violation, Val went further and showed that the pions from the K_L decay (neutral kaons were now called K_L and K_S) are coherent with those from K_S decay, and in 1980 he and Cronin received the Nobel Prize. Val went on to exploit the interference between incident and coherently regenerated amplitudes to measure the $K_L - K_S$ mass difference and invented the very precise "gap" method that became the standard in the field and a source of great pride.

The *CP* discovery led Andrei Sakharov to pose a scenario that could explain the evolution from the Big Bang to a matter-dominated universe, a profound question unanswered to this day.

Val left the study of kaons in 1972 and went first to Fermilab to search for *C* violation in proton–antiproton interactions, then to a cliff in Montana to search for short-distance gravitational forces, and back to the AGS to look for strange dibaryons. Though no signals