

David Kaiser

Viki Weisskopf: Searching for Simplicity in a Complicated World



IT and the scientific community lost a giant in 2002, when Victor Frederick Weisskopf passed away. Known by students and colleagues alike as “Viki,” he was among the most accomplished and admired physicists of the twentieth century. A beloved teacher, Weisskopf developed a sought-after style that emphasized conceptual understanding and qualitative description over rigorous mathematical derivation. He used to sum up his style by the slogan, “search for simplicity.”

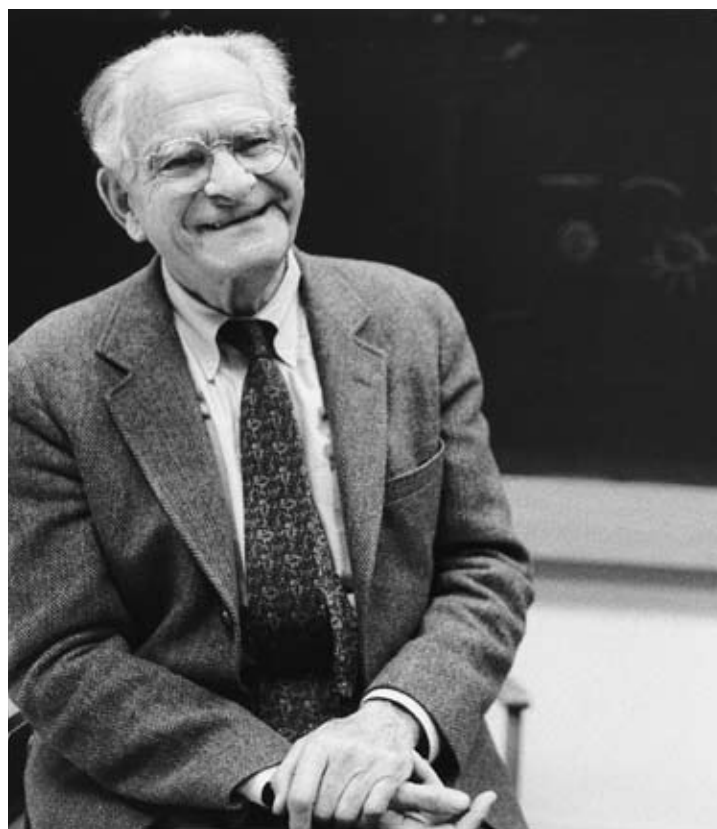
I WAS LUCKY ENOUGH TO WITNESS VIKI'S GREAT POWERS up close during his later years. He ventured from MIT to Dartmouth College (where I was a student) during the early 1990s to give a physics department colloquium, and I sat glued to my seat along with my fellow physics undergraduates. To this day I remember Viki's masterful performance: with the barest of algebra and no calculus in sight, he demonstrated why mountain peaks rarely rise higher than 10 kilometers; why water droplets from a leaky ceiling tend to form with radii of around a centimeter; and why the surface of a lake will retain its mirror-like smoothness until winds pick up above a speed of twenty centimeters per second. Each of these effects that Weisskopf displayed for us could be derived from the trade-offs between gravity and

surface tension. The numbers ultimately derived from simple properties of atoms and molecules—properties well within the grasp of undergraduates. We were mesmerized. Only later did I learn that Viki had published many of these insights in a monthly column, “Search for Simplicity,” that appeared in the *American Journal of Physics* during 1985 and 1986.

After Weisskopf’s colloquium, some students joined him for dinner. He and I got to talking—my interests in the history of science had already begun to take form, alongside my interests in physics—and he graciously continued our discussion by letter over the next few years. To those who did not know Viki, he and I might appear unlikely pen-pals: a world-renowned physicist and scientific statesman trading letters with an overeager undergraduate. But to the many physicists and students who benefited from Weisskopf’s tutelage over the years, such interactions would have seemed typical. Years later, when I was asked to write an entry on Weisskopf for the updated *DICTIONARY OF SCIENTIFIC BIOGRAPHY*, I leaped at the chance to delve more deeply into Viki’s life and work. Here are some of the things I learned.

A Physicist’s Grand Tour

Weisskopf was born into a cultured, upper-middle-class family of assimilated Jews in Vienna. His father Emil, originally from Czechoslovakia, was trained in law. His mother Martha hailed from one of the leading families of fin-de-siècle Vienna. They instilled in Viki and his siblings—an older brother named Walter and a younger sister named Edith—a strong appreciation for music and the arts, often taking the children to concerts, plays, and museums. Viki began studying music at an early age, and quickly developed into an accomplished pianist; he performed chamber music with friends and colleagues throughout his life. His family also supported his budding interest in socialism and political activism. He joined a socialist student group in high school, worked with the



MIT/Donna Coviery

FIGURE I
*Viki Weisskopf in his natural element:
an MIT classroom*

FIGURE 2

Heady times: Werner Heisenberg (seated, front right) with his disciples in Leipzig, 1931. Seated next to Heisenberg (front left) is Rudolf Peierls. Second row, left to right: George Placzek, G. Gentile, Giancarlo Wick, Felix Bloch, Victor Weisskopf, and F. Sauter.

Emilio Segre Visual Archives, American Institute of Physics



Social Democratic Party, and took part in the general progressive movement often dubbed “Red Vienna,” which aimed to improve education and housing for workers.

From his earliest days, Weisskopf also harbored a deep interest in science and nature. As a fifteen-year-old, he conducted a detailed astronomical study with a boyhood friend, staying up all night to catalog the shooting stars during the peak of the annual Perseid meteor showers. Their work appeared in the leading astronomical journal, *Astronomische Nachrichten* (Astronomical Notices), in 1924. He followed upon this success with avid studies of physics at the University of Vienna, where he quickly impressed physicist Hans Thirring. Thirring encouraged young Viki to continue his education beyond the confines of Austria. And so, at the age of twenty, Weisskopf moved to Göttingen, Germany, to study with the great Max Born. He completed his Ph.D. under Born’s direction in 1931, working on the application of quantum theory to the breadth of spectral lines, the thin beams of light emitted by atoms when excited by an outside source of energy.

Next came a string of postdoctoral fellowships. Weisskopf hit every major stop along the way, studying with all the principal inventors of the new theory of quantum mechanics, physicists’ description of matter and forces at the atomic scale. These leaders had only just finished cobbling together quantum mechanics—rife with bizarre departures from ordinary experience—during the mid-1920s, a few years before Weisskopf embarked on his postdoctoral tour. The new material, and the enduring sense that physics had undergone a major revolution, was still fresh.

Weisskopf’s first destination was Leipzig to study with Werner Heisenberg (fall 1931), before moving to Berlin to work with Erwin Schrödinger (spring

1932). A Rockefeller Foundation Fellowship allowed Weisskopf to spend the 1932–33 academic year studying with Niels Bohr in Copenhagen and Paul Dirac in Cambridge, England. Wolfgang Pauli hired Weisskopf as his assistant in Zurich beginning in autumn 1933, where he remained until the spring of 1936. Then it was back to Copenhagen for more work with Bohr. The novelist Henry James could scarcely have invented a more spectacular “grand tour” for a young physicist of Weisskopf’s generation (*Figure 2*). During his first stay in Copenhagen, Viki met and fell in love with a young Danish woman, Ellen Tvede. They married in 1934, and spent the next fifty-five years together, until her death in 1989.

Quantum Electrodynamics

Weisskopf had been surprised when Pauli offered him the assistantship position in 1933; Viki always harbored a certain lack of self-confidence when it came to his work. This was hardly helped when he arrived in Zurich and the imposing, acerbic Pauli asked who he was. Flummoxed, Weisskopf stammered something about the job offer. Pauli looked up from his desk and explained that he had really wanted to hire Hans Bethe, but Bethe’s interests had already shifted to solid-state physics (a topic Pauli famously dismissed as “squalid-state” physics), and so Weisskopf would have to do.

Despite the inauspicious beginning, Weisskopf’s stay in Zurich proved to be remarkably productive. With Pauli, he delved into quantum electrodynamics (QED), a topic recently spearheaded by Pauli, Heisenberg, Dirac, and others. The goal was to describe electromagnetic phenomena—the motion of charged particles, the behavior of electric and magnetic fields—in a manner consistent with the still-new quantum mechanics. Only a few years old, the subject was already mired in difficulties; Weisskopf would soon produce several major breakthroughs.

In Dirac’s earliest efforts with QED in the late 1920s and early 1930s, he had found unexpected solutions to his equations. Though baffling at first, in time physicists came to interpret these solutions to mean that every type of ordinary particle has an antimatter cousin carrying the same mass but opposite electric charge. Electrons, for example, should have companion particles (dubbed “positrons”) that each carry one unit of positive electric charge. His explanation remained quite controversial, even after the first experimental evidence for positrons was found in 1932.

Further conceptual problems marred QED. As the early architects of QED had found to their dismay, straightforward application of their new equations yielded nonsensical results. Whenever they posed simple questions, such as the probability for two electrons to scatter, their formalism returned “infinity” rather than some finite number. Electrons might have a high probability to scatter (say, 75%), or a low one (10%), but whatever it was, it simply couldn’t be

infinite! Yet try as they might, none of these physicists had found any way to complete meaningful calculations in QED.

Weisskopf re-analyzed one of these stubborn calculations, regarding how an electron would interact with its own electric field. Charged objects serve as the source for electric and magnetic fields; and their behavior is affected, in turn, by the presence of electric and magnetic fields. So how would an electron behave in its own self-field? The problem seemed intractable because the strength of an object's electric field grows the closer one approaches that object. This is rarely a problem for macroscopic objects, which always have some finite spatial extension. But physicists believed that electrons were point-like objects, with virtually no spatial extension at all. Indeed, the first attempts to calculate an electron's self-energy found it to diverge—that is, blow up to infinity—as $\frac{1}{r_e^2}$, where r_e was the radius of the electron. A point particle, with $r_e = 0$, would have an infinite self-energy.

These early calculations had ignored possible effects from the still-controversial positrons. By the time Weisskopf took up the problem, however, early evidence seemed to indicate that positrons might really exist after all. He reworked the self-energy calculation, taking into account the behavior of both electrons and positrons. Weisskopf's calculation (with a little help from Wendell Furry, one of Oppenheimer's postdocs, who'd corrected Viki's sign error) showed a much more gradual breakdown of the equations than anyone had found previously: the electron's self-energy diverged as the logarithm of the electron radius. Such a function would still become infinite in the limit of a genuine point particle (with $r_e = 0$), but this gentle divergence seemed far less threatening to the entire QED edifice than the earlier results. Indeed, Weisskopf's revised calculation, published in 1934, gave many physicists hope that the problems of QED might be conquered after all.

That same year, Weisskopf teamed up with Pauli to scrutinize the behavior of antiparticles. They showed that even charged particles with zero spin—as yet entirely hypothetical, since no such spinless particles were known—would necessarily have antiparticle partners. Their conclusion, published in 1934, followed from the mathematical structure of quantized fields, and put Dirac's conjectures about antiparticles on a more solid physical foundation.

In 1936 Weisskopf completed another major article on QED. He returned to the behavior of an electron's self-field. As many physicists knew by that time, the self-field was complicated because of Heisenberg's uncertainty principle and the presence of “virtual” particles. In 1927, capping off years of work on quantum mechanics, Heisenberg had deduced that certain pairs of quantities, such as a particle's position and its simultaneous momentum, could no longer be specified with unlimited precision in the quantum realm. The same held for the energy involved in a physical process, E , and the time

over which the process unfolded, t : residual uncertainties, ΔE and Δt , would remain, subject to $\Delta E \Delta t \sim \hbar$, where \hbar was Planck's constant. In the context of QED, Heisenberg and others realized, the uncertainty relation meant that even empty space would not be truly empty. Particles could “borrow” energy all the time, popping into existence, as long as they paid that energy back sufficiently quickly. Physicists dubbed these strange, ghost-like particles “virtual particles.”

Quantum-mechanically, the electron's self-field thus could be pictured as a cloud of virtual pairs of electrons and positrons. Because opposite charges attract while like charges repel, Weisskopf realized that these virtual particles would arrange themselves like the petals of a daisy around the original electron (*Figure 3*).

The effect would be to polarize the vacuum—that is, even “empty” space would have a definite electrical directionality or orientation. Moreover, the virtual pairs would screen the original electron's charge, so that an observer would only measure the combined charge of the original electron plus the cloud. Because the virtual particles could borrow any amount of energy whatsoever—even infinite energy—so long as they paid it back quickly enough, the quantum-mechanical contribution to the electron's charge would be infinitely large. It appeared as if one more infinity had marred QED.

Weisskopf turned this particular infinity into a triumph. He reminded his colleagues that there was no way to turn off the uncertainty principle; virtual particles would always be popping into and out of existence. Thus physicists could never measure the “bare” charge of an electron apart from this virtual cloud. Since the observed charge of an electron was small, it must be that the “bare” charge—never measurable even in principle—was offset by the (infinite) contribution from the virtual particles. The virtual cloud “renormalized” the electron's charge, leaving a finite overall charge.

Weisskopf completed this last work in Copenhagen rather than Zurich. Although Viki and his wife Ellen had enjoyed their time in Zurich, dangerous reminders about the changing state of Europe intruded. The city's rich cultural life had been infused by a steady flow of German refugees fleeing Hitler, including many avant-garde artists and actors. Weisskopf himself was hauled before the Swiss *Fremdenpolizei* (special police force in charge of foreigners) in 1935 and told he would have to leave Switzerland, never to return, as soon as his fellowship with Pauli was over. As far as the authorities were concerned, Weisskopf had too many acquaintances who were Communists or otherwise suspicious. When his appointment ended, he and Ellen returned to Niels Bohr's institute in Copenhagen. (Twenty-five years later, Weisskopf moved back to Switzerland as a leading scientific statesman; by that time, the earlier, frightening run-in with the authorities could be laughed off.)

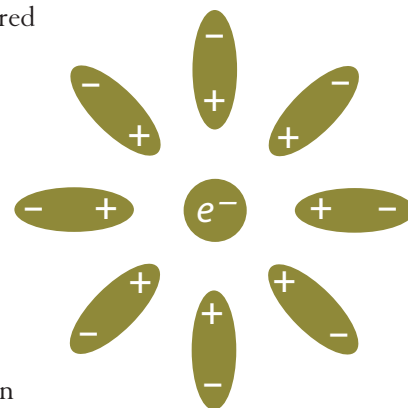


FIGURE 3

Vacuum polarization. A cloud of virtual electron-positron pairs surrounds an electron. (Source: David Kaiser, *Drawing Theories Apart: The Dispersion of Feynman Diagrams in Postwar Physics* [Chicago: University of Chicago Press, 2005], 33.)

War Work

Weisskopf had difficulty finding work in the 1930s because of the worldwide economic depression; his Jewish background only made things harder once the Nazis assumed power. He visited the Soviet Union late in 1936 and considered job offers in both Kiev and Moscow, but decided against moving there: the purge trials that would unleash Stalin's great terror had already begun. The possibility of a position in the United States seemed much more enticing. Knowing of the budding interest in nuclear physics that many American physics departments harbored—galvanized by Ernest Lawrence's famous work with cyclotrons at Berkeley—Weisskopf began shifting his research focus while in Copenhagen. He turned his attention to nuclear physics and began publishing for the first time in English, in the American journal, the *Physical Review*. This strategy, combined with Bohr's active lobbying on his behalf, led to an offer of a low-level instructorship at the University of Rochester in upstate New York. Weisskopf accepted the job and moved there in 1937.

While at Rochester, Weisskopf continued to pursue his interest in QED while also spending more and more time on nuclear theory. By the time World War II broke out, he was already recognized as one of the most accomplished theorists working in the United States. Not surprisingly, Oppenheimer tapped him to join the budding laboratory at Los Alamos, New Mexico, part of the fast-growing Manhattan Project to design and build nuclear weapons. Weisskopf was among the first to arrive at the laboratory in the spring of 1943; he became second-in-command of the theoretical physics division, serving as deputy division leader under Hans Bethe.

Part of Weisskopf's task was trying to understand the basic physics of nuclear fission, the process by which certain large nuclei break apart into smaller pieces, releasing energy. Weisskopf focused on how neutrons—tiny nuclear particles that carry no electric charge but interact strongly with other nuclear matter—would behave in and around fissionable material. He developed a keen intuitive sense for these interactions. At one point early in the project, he guessed that the fission cross section (that is, the probability that a neutron would cause a large nucleus to split in two) would rise sharply for neutrons in a particular energy range, even though data for a nearby energy range seemed to indicate otherwise. When newer experimental data vindicated Weisskopf's hunch, his office was nicknamed the seat of "the oracle"; others teased that it was the "cave of hot air."

His other main tasks were decidedly more of an applied nature. He aimed to calculate the effects of a nuclear bomb's detonation: the explosive yield (that is, the force of the bomb's blast as compared to so many tons of conventional explosives), the shape and force of the shock wave, the extent of radioactivity, and so on. Like his work on fission cross sections, Weisskopf's approach belied a characteristic trait: he aimed for qualitative description rather than formal

mathematical derivation. Meanwhile, he served for several terms on the Los Alamos town council, including one term as chair or “mayor.” Even in the midst of the world’s largest military-technical project, Weisskopf remained true to his roots. Just as in his “Red Vienna” days, he championed the cause of the low-paid workers and technicians at the laboratory, negotiating on their behalf with the military authorities to improve housing and other features of daily life.

Because of his work on blast effects, Weisskopf was one of the first scientists to relocate late in the war from Los Alamos to the Trinity test site at Alamogordo, New Mexico, two hundred miles south of Los Alamos. (Oppenheimer had dubbed the first test of a nuclear bomb the “Trinity” test, taking the name from a John Donne poem.) For weeks in advance of the July 16, 1945, test, Weisskopf helped set up measuring devices and diagnostic tools at various check-points. He was among the handful of theoretical physicists who witnessed the explosion, seeing the characteristic mushroom cloud rise above the desert.

Weisskopf and some colleagues had calculated that thirty-six hours after the detonation, residual levels of radioactivity at “ground zero” should fall low enough to allow brief inspections. And so Hans Bethe, Enrico Fermi, and he strapped on radiation-measuring tags and drove a Jeep down to the blast site a day and a half after the test. What they saw amazed them. Not only had the scaffolding and other equipment in the immediate vicinity of the bomb been vaporized, but the force and heat of the blast had even fused the desert’s sand into glass (later dubbed “trinitite”). This physical transformation gave Weisskopf a visceral sense of the bomb’s power. To his chagrin, the presence of trinitite seemed to hold little special meaning for the military officials, including General Leslie Groves, overseer of the entire Manhattan Project.

Postwar Research

Immediately after the war, Jerrold Zacharias recruited Weisskopf to move to the Massachusetts Institute of Technology. By 1946, Weisskopf had joined MIT’s physics department.

Soon he was back into the thickets of QED. He began working with MIT graduate student Bruce French to calculate the energy levels within hydrogen, taking into account effects from virtual particles. They received extra impetus to plow through their laborious calculation in 1947, when Columbia University’s Willis Lamb announced that he had measured a miniscule—but



Emilio Segrè Visual Archives, American Institute of Physics

FIGURE 4
Taking a skiing break at Los Alamos, mid-1940s. Enrico Fermi, Hans Bethe, Hans Staub, Victor Weisskopf, and unknown others. Seated, left to right: Erika Staub, Elfriede Segrè, and unknown.



FIGURE 5
Working on nuclear theory at MIT, ca. 1949. From left to right: John Blatt, Bruce French, Herman Feshbach, and Victor Weisskopf.

non-zero—energy difference between two particular states of hydrogen, even though quantum mechanics predicted they should have precisely the same energy. Weisskopf compared his calculated value for the “Lamb shift” with both Richard Feynman and Julian Schwinger—two young guns of theoretical physics who had separately worked out new ways to calculate the effects of virtual particles in QED. To Weisskopf’s disappointment, Feynman’s and Schwinger’s calculations matched each other but differed from that of Weisskopf and French. Congenitally unsure of himself, Weisskopf held his paper back until he and French could find their error. In the

meantime, Lamb himself published a theoretical study of the energy-level shift, along with his graduate student Norman Kroll. Lamb and Kroll had arrived (independently) at the same result as Weisskopf and French. Six months later, Feynman sheepishly called Weisskopf to apologize: he and Schwinger had been the ones in error, and Weisskopf and French had been correct all along!

The mix-up marked one of Weisskopf’s last active encounters with QED. Beyond this tragi-comic snafu, however, several of Weisskopf’s earlier insights finally bore fruit. Building on Weisskopf’s work on self-energy, vacuum polarization, and charge renormalization, Schwinger, Feynman, Sin-itiro Tomonaga, and Freeman Dyson pieced together a successful renormalization program between 1947 and 1949. At long last, the infinities that had long plagued QED had been banished, leaving behind finite numbers that stood in remarkably good agreement with the latest experimental results.

By this time, Weisskopf’s own interests had turned squarely to nuclear theory. Working closely with fellow MIT theorist Herman Feshbach, as well as several graduate students (especially David Peaslee and Charles Porter), Weisskopf developed a string of successful models of nuclear behavior. Like the best of his wartime work, these models featured intuitive approaches and clever rules-of-thumb rather than mathematical rigor. Weisskopf’s particular brand of nuclear theory also infused his major textbook, written with MIT postdoctoral fellow John Blatt, *THEORETICAL NUCLEAR PHYSICS* (1952). Quickly considered the “bible” for the subject, this influential textbook had the distinction for several years of being the most frequently stolen book from the MIT libraries!

During this period, Weisskopf trained twenty-one MIT Ph.D. students, including such accomplished theorists as J. David Jackson, Kurt Gottfried,

Kerson Huang, J. Dirk Walecka, and Nobel laureate Murray Gell-Mann. He also stepped up his activities beyond the classroom. He was among the original eight members of the “Emergency Committee of Atomic Scientists,” founded in 1946. The brainchild of Leo Szilard and chaired by Albert Einstein, the Emergency Committee sought to educate the public and politicians about the dangers of a run-away nuclear arms race. At the same time, Weisskopf also helped to found the Federation of Atomic Scientists (FAS, later changed to Federation of American Scientists), which likewise lobbied for civilian rather than military control of atomic energy. Soon the FAS’s mandate widened to combat the excesses of McCarthyism. Weisskopf served for many years on the FAS executive council, and also chaired its committee on visas. During the late 1940s and early 1950s, the U. S. State Department frequently denied visas to foreign scientists deemed to be politically suspect; Weisskopf testified before the U. S. Congress in 1952 to argue for a reform of the system. A few years later, he joined the budding Pugwash movement (founded in 1957), devoted to halting the nuclear arms race.

Leading CERN

Fifteen years after moving to MIT, Weisskopf took an extended leave of absence. He had been invited to serve as director general for CERN (the European Organization for Nuclear Research), a new multinational laboratory for high-energy physics in Geneva, Switzerland. First proposed in 1950, the laboratory was operating by 1954. It achieved its first beam of accelerated protons in 1959; Weisskopf became director general in 1961.

Part of the attraction for Weisskopf was the opportunity to learn more about particle physics, which by this time had separated into a distinct specialty from nuclear physics. In addition to immersing himself in the day-to-day activities at the laboratory—he took inspiration from Oppenheimer’s leadership style at wartime Los Alamos—he also began to deliver popular lectures on the state of the field for students and new arrivals at the laboratory. The lectures became a long-running tradition, featuring Weisskopf’s famously conceptual, intuitive approach. He later wrote up the lectures with his former graduate student, Kurt Gottfried, as the two-volume textbook, *CONCEPTS OF PARTICLE PHYSICS* (1984, 1986).

Weisskopf served as director general for nearly four and a half years (August 1961—December 1965), and left two principal legacies. First was his strong backing of the controversial decision that the next major accelerator at the laboratory should be a colliding beam machine rather than a fixed-target accelerator. Until that time, particle accelerators worked by speeding up a beam of particles and smashing them into a stationary target, so that physicists could study the debris that came out. Weisskopf insisted instead on forging ahead with an “intersecting storage ring” (ISR) design, in which two beams

of protons were separately accelerated and then made to collide head-on. Although more difficult to build, the interaction energies achieved by such a machine promised to rise much higher than conventional accelerators had achieved; and in high-energy physics, higher energies was the name of the game. (The interaction energy in a colliding beam machine scaled roughly as the square of the energy of an ordinary fixed-target device.) Plans took shape during Weisskopf's tenure, and the ISR came on-line in 1971.

Second, Weisskopf concluded negotiations with the French government to expand the laboratory beyond Swiss soil. The new real estate proved crucial to the ISR and to later developments at the laboratory. Thanks to Weisskopf's diplomacy, protons now cross the Swiss-French border billions of times each second as they get whipped around to higher and higher energies. Weisskopf thus planted the seeds for the Large Hadron Collider (LHC), which should achieve the highest interaction energies of any accelerator on earth.

Later Work

Weisskopf returned to MIT early in 1966. He continued to work with younger theorists on nuclear and particle theory. His role increasingly became that of a wise sounding board, offering counsel to graduate students, postdocs, and young faculty alike. He excelled in this role, as in the mid-1970s, when he and several younger colleagues developed a new model for the structure of nuclear particles. Dubbed the "MIT Bag model," their work built upon the latest discoveries in particle theory. The paper appeared in 1974.

Just a few months earlier, theorists at Harvard (H. David Politzer) and at Princeton (David Gross and Frank Wilczek) separately found that the strength of the strong nuclear force becomes weaker the closer one approaches the sub-nuclear particles, or "quarks," within protons and neutrons. Conversely, the strong force becomes stronger with increasing distance. This is exactly the opposite of how more familiar forces behave, such as electromagnetism, which led to the self-energy divergences that Weisskopf first tackled in the 1930s.

Until the mid-1970s, no one had made much progress in trying to calculate the effects of the strong nuclear force from first principles, precisely because its strength ruled out perturbative approaches. (The same stumbling block had led Weisskopf, Feshbach, and their students to try phenomenological approaches, such as the "clouded crystal ball" model, twenty years earlier.) Armed with the news that the strong force actually became weak at short distances, several young MIT theorists—Alan Chodos, Robert Jaffe, Kenneth Johnson, and Charles Thorn—together with Weisskopf, introduced a new way to study the behavior of neutrons and protons. In a typical Weisskopfian move, they simplified the problem, honing in on the essentials without getting bogged down in mathematical details.

They pictured protons, neutrons, and similar nuclear particles as “bags” filled with quarks. Because the strong force grew in strength with increasing distance, they simply hypothesized that the quarks remain rigidly contained within some volume (the “bag”); but at shorter distances (within the bag), the force between quarks fell rapidly, and so it could essentially be ignored altogether. Treating protons and neutrons as bags filled with free (that is, noninteracting) quarks sidestepped most of the horrendously complicated dynamics, allowing the theorists to make rapid progress in estimating how real nuclear particles behave. Although Weisskopf often joked that all he had contributed to the study was the “don’t-know-how,” his younger colleagues insisted that his name appear with theirs as an author. In fact, explained Jaffe, Weisskopf had supplied some of the crucial statistical arguments that the group employed, hearkening back to some of Weisskopf’s own work from the 1930s and 1940s.

Weisskopf reached the mandatory retirement age in 1974, after which he spent even more time in leadership roles around the world. He continued his decades-long work on nuclear policy, encouraging Pope John Paul II to speak out against the horrors of nuclear war and the importance of arms control, a topic the pope championed during the early 1980s. Weisskopf also built upon his earlier success as a popular-science author, publishing *THE PRIVILEGE OF BEING A PHYSICIST* (1989) and his scientific autobiography, *THE JOY OF INSIGHT* (1991), to complement his acclaimed *KNOWLEDGE AND WONDER* (1962) and *PHYSICS IN THE TWENTIETH CENTURY* (1972).

Weisskopf died in 2002 at the age of 93. During his long career, he published nearly four hundred scientific articles, technical reports, textbooks, and popular books about science. He often remarked that he had “lived a happy life in a dreadful century.” He was survived by his second wife, Duscha Scott, his two children, Thomas and Karen, and several grandchildren.

TO LEARN MORE ABOUT VICTOR WEISSKOPF

English translations of Weisskopf’s most important articles on quantum electrodynamics are available in *EARLY QUANTUM ELECTRODYNAMICS: A SOURCE BOOK*, edited by Arthur I. Miller (New York: Cambridge University Press, 1994). His textbooks, popular writings, and autobiography all make excellent reading as well:

Blatt, J. M. and V. F. Weisskopf. 1952. *THEORETICAL NUCLEAR PHYSICS*. New York: John Wiley.

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Works about Weisskopf include:

Jackson, J. David and Kurt Gottfried. 2003. "Victor Frederick Weisskopf, 1908–2002." Biographical Memoirs of Fellows of the National Academy of Sciences 84: 3-27.

Schweber, Silvan S. 1994. QED AND THE MEN WHO MADE IT: DYSON, FEYNMAN, SCHWINGER, AND TOMONAGA. Princeton: Princeton University Press. Describes Weisskopf's and others' work on quantum electrodynamics, including the successful postwar renormalization program.

Stefan, V., ed. 1998. PHYSICS AND SOCIETY: ESSAYS IN HONOR OF VICTOR FREDERICK WEISSKOPF BY THE INTERNATIONAL COMMUNITY OF PHYSICISTS. New York: Springer. Collection of reminiscences by students and colleagues. Includes a complete list of Weisskopf's publications.

DAVID KAISER is an Associate Professor of the History of Science in the MIT Program in Science, Technology & Society, and a Lecturer in the Department of Physics. He received his Ph.D. in Physics and History of Science from Harvard University in 2000, and an A.B. in Physics with Highest Honors from Dartmouth College in 1993. Kaiser's many awards and honors include MIT's 2006 Harold E. Edgerton Faculty Achievement Award and the 2001 Levitan Prize in the Humanities, as well as the 1993 Apker Prize from the American Physical Society. He has published several books and edited volumes, of which his first book, *Drawing Theories Apart: The Dispersion of Feynman Diagrams in Postwar Physics* (University of Chicago Press, 2005), received critical praise for being 'the definitive study of one of the great ubiquitous tools of modern quantum field theory.' Kaiser's upcoming book, *American Physics and the Cold War Bubble*, will be published by the University of Chicago Press.