Harvey L. Lynch (1939-2025), A Biographical Memoir[i]

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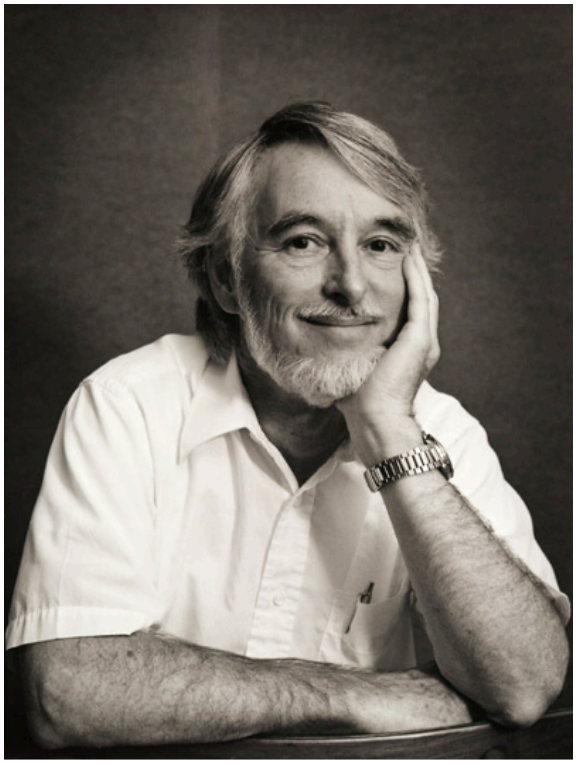
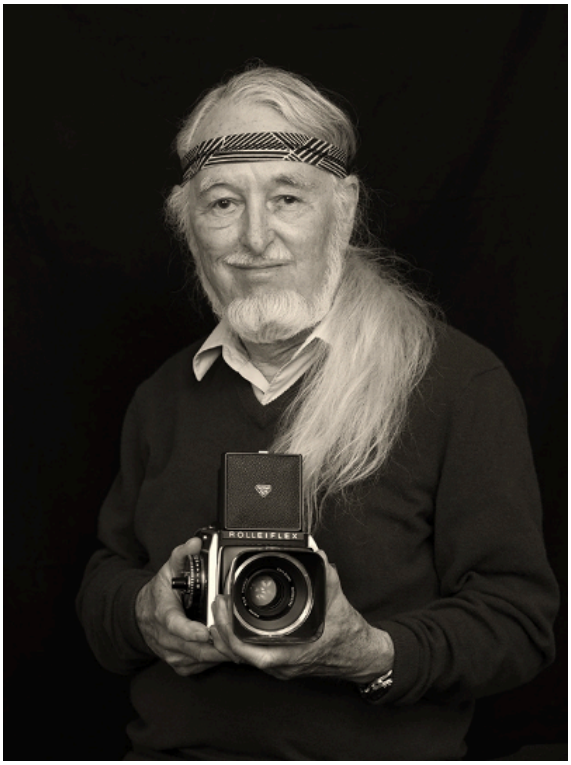


Harvey before retirement, circa 2012



Harvey before his second Paris show, circa Spring 2022

Harvey L. Lynch passed away on January 28, 2025. Many of you no doubt crossed paths with Harvey during his long career at SLAC from 1968-1976, and again from 1982 until he retired in 2012.

Harvey was one of the handful of very early physicists that helped “put SLAC on the map,” after Richard Taylor’s deep inelastic scattering experiments at End Station A first suggested the presence of quarks in the nucleus. On the scientific front Harvey was a major player in developing and supporting the scientific program and technical advances that led to the November Revolution by Mark I at Stanford Positron Electron Accelerating Ring (SPEAR) in 1974.

As well, he was a driver of other subsequent discoveries and measurements which cemented our picture of the Standard Model. These included his work leading to the precision electroweak measurements by the SLAC Large Detector (SLD) using polarized beams from the SLAC Linear Collider (SLC), and subsequently to the measurement of CP violation in the B-meson system in BABAR at PEP-II. In later years he helped promote the next-generation linear colliders for producing and studying the Higgs boson.

Many of you may also remember him as the guy who always had a 35mm single lens reflex camera hanging from his neck, or perhaps the one who helped organize lunchtime concerts at SLAC.

Harvey was born in Nebraska in 1939 to farming parents who suffered through the Great Depression. The family moved when he was just 6 months old, first to Colorado and then finally settling in California. Harvey's life also spanned tumultuous political times in the world. He grew up during the Second World War, and later as a young man witnessed multiple international conflicts, the onset of the Cold War, and finally the fall of the Berlin Wall. In later years, through Stanford's Center for International Security and Arms Control, The National Academies, and the American Institute of Physics, he and many of his early SLAC colleagues provided scientific guidance to the leaders of the U.S. who were struggling with nuclear arms control and proliferation.

Even as a 7-year-old child Harvey had a developing interest in science encouraged in part by his father. The two built vacuum tube Heathkits (remember those?) and eventually shortwave radios. For college he chose to move far from home, going east to MIT where from 1957-1961 he studied physics. There he was exposed in his senior year to particle physics, working with David Frisch on a pion-proton scattering proposal to be centered at the new 30GeV Alternating Gradient Synchrotron at Brookhaven. When this did not pan out he worked on detector development. All this seemed to resonate with him, and he applied to Stanford for graduate school. While Frisch wanted him to stay at MIT, the day he had to make the decision – east or west – a large snowstorm in Boston persuaded him to head to Stanford.

At Stanford, Harvey reconnected with Prof. David Ritson, another former MIT physicist who soon became his thesis advisor. In his first year at Stanford, he crossed paths with SLAC's first director Wolfgang ("Pief") Panofsky at an informal physics department event, perhaps portending his future. Harvey also met Burton Richter, the lab's second director, when he was a teaching assistant in his lab during his second year in graduate school. For his thesis he worked on campus at the 1 GeV MARK III linear accelerator, studying inelastic electron-proton scattering. Harvey defended his thesis in 1966, still a year or two from the time when the new SLAC linac was starting to produce physics. After receiving his PhD, he like many physicists at the time was encouraged to "go away awhile" and then "come back." CERN was often called the "finishing school for physicists" and that was where he decided to go, using a two-year NSF fellowship he had won.

At CERN Harvey worked closely with the young Carlo Rubbia on a CP-violation experiment that measured K^0_S-K^0_L mixing. Rubbia subsequently shared the Nobel Prize in Physics in 1984 with Simon van der Meer for work leading to the discovery of the W and Z particles at CERN. Rubbia later served as the Director of CERN from 1989 to 1994.

Around the end of his fellowship in 1968, Harvey was recruited by Richter to return to SLAC as a postdoc and work with Richter, Dave Ritson, and others on what would become SPEAR (Stanford Positron Electron Accelerating Ring). Arriving at SLAC in 1968, Harvey started out working with Fatin Bulos on hardware for another experiment of Burt's to measure vector dominance. However, he quickly changed gears around 1969 to work on SPEAR, as it moved rapidly through design, lab approval and completion in 1972.

The storage ring concept itself was initially developed by a small group (Burt, Dave Ritson, Ewan Paterson, John Rees and Martin Lee) and expanded rapidly over time. By 1972 the list expanded to over 20 people, including several visitors from Europe.[ii] The SPEAR detector group involved several dozen scientists and students from the lab (Burt's Group C and Martin Perl's Group E), Stanford, LBL (now LBNL), UC Berkeley, and visitors from Italy and France.

Harvey worked closely with Roy Schwitters and Dave Fryberger on the cylindrical spark chamber readout (using a novel magnetostrictive readout) that made up the central tracking chamber of what was first referred to as "MAD" for Magnetic Detector but was soon to be known as the Mark I, probably the first quasi-4p magnetic detector. Harvey was responsible for designing the electronics for the chamber, and also the trigger logic of the Mark I, which would become a critical piece of the detector.

The first phase of the experiment focused on the total e+e- cross section measurement while the second phase, for which Harvey and Roy were co-spokespersons, was to extend the running to higher energies. In September 1973 Harvey was promoted to be an assistant professor.

It was of course in that first phase, in November 1974, the J/psi was discovered, in part because of pressure on Burt from Marty Breidenbach, Ewan, and Roy to go back to energies around 3.1 GeV, where seemingly anomalous cross-section values were first seen. Harvey was the first to admit that he was skeptical of this approach but suggested starting back at 3.0 GeV to establish a baseline and be sure the detector hardware was working, and then to proceed upwards in small energy steps.

It is hard to believe nowadays how primitively the measurement was made. Scientists on shift looked in real time at a simple "event display" on a CRT each time the detector triggered. They classified the events as "hadronic," Bhabha scattering, or muon-pairs, literally tallying the events with paper and pencil. Harvey was on the early shift in the combined SPEAR/Mark I control room when the first evidence of a ~50% rise in the cross section was observed at one beam energy. Convinced that the detector was working, he remembered uttering the simple words that "if this holds up we are onto something…." It was later that night, after a repeat scan by the next shift, that a huge narrow peak 100 times the background was observed, signaling the New Physics of the J/Psi. Within a day, a Physical Review Letter was drafted for submission.

Immediately following the discovery, the scientists had to figure out what it was they saw, amongst competing theories. It was Harvey's idea to measure interference below the peak, and together with Adam Boyarski and Vera Lüth they quickly demonstrated that it had the same quantum numbers as the photon. To make this higher resolution scan, Harvey is credited with writing in the logbook about using the ring frequency to fine tune the beam energy before hardware changes to the DAC, to do so, could be implemented.

Many important discoveries followed on at SPEAR with the Mark I, the Lead Glass Wall upgrade (pushed by Perl) which proved the existence of the third-generation lepton, the Tau, the spectroscopy of bound charmed quarks (psi, psi-prime, eta_c, etc.), mesons carrying the charmed quarks (D^0 and D^+), and the unexpected difference in charmed meson lifetimes. Some

came in the late 70's when Mark II, the next-generation detector, was in checkout mode at SPEAR.

In 1976 Harvey chose to leave SLAC for a position at the DESY laboratory in Hamburg to work on the next large e+e- storage ring, PETRA, and the TASSO detector. The PETRA ring was in competition with SLAC's PEP ring, with experimenters hoping to find the Higgs particle in these higher energy rings. Harvey's decision to leave was based on his expectations of the tenure process for assistant professor positions at Stanford, in which he was in competition for one allotted faculty position, and did not think he would "win."

Harvey worked at DESY and on TASSO, but fearing his connections with the U.S. particle physics community would fade, he returned to the U.S. in 1980 and took a visiting professor position at UC Santa Barbara, teaching and doing research at PEP. While he enjoyed teaching, in 1982 he was offered a Staff Scientist position at SLAC, where he would spend the rest of his scientific career.

His work after 1982 involved a mix of ongoing PEP experimental research on the MAC detector working again with Dave Ritson. On MAC, he led the group working on the total e^+e^- cross section measurement. Shortly afterward he got involved in Burt's plan to build the SLAC Linear Collider (SLC). Burt became SLAC Director in 1984, and the focus of the lab switched rapidly to building the SLC, which was a large ~$100M accelerator upgrade project.

Harvey's early work on the project was to develop the magnetic flux concentrator, which was the first stage of the positron source for SLC. In the first phase of SLC running, the Mark II PEP detector would be used, after some upgrades, and then be replaced by a completely new detector. In 1982, a large international group formed around Martin Breidenbach to develop a proposal for this state-of-the-art detector, nicknamed "SLD" for SLAC Large Detector, and Harvey was a key player in the SLAC SLD group.

In 1983, Stanford's Center for International Security and Arms Control (CISAC) was established. The interest in teaching and studying arms control first grew out of discussions between SLAC's Panofsky, with professors John Barton and John Lewis on campus. SLAC Deputy Director Sidney Drell became one of the first co-directors (with Lewis) after the Ford Foundation and the university provided support. CISAC had funded fellowships and Sid wanted there to be science fellows, so in 1983, Sid recruited Harvey (having known each other from graduate school in the 60s) to be one of the first such fellows. The 1980s were the time of Reagan's Strategic Defense Initiative (SDI) which proposed the development of defensive weapons based on space-based infrared and ultraviolet lasers. During Harvey's six-month leave he worked on analyzing and writing a report on the scientific and technical viability of these ideas for offensive use as well. This ultimately provided him a conduit into many other arms-control studies and adventures. He often recalled how he was invited to join a group for collaborative work between the Soviet Academy of Science (then USSR) and the Natural Resources Defense Council (USA) to study means of inspecting ships to detect nuclear weapons in 1989.

Returning full time to SLAC he continued work on SLD construction and SLC operations. In 1991, Harvey was recruited by some of his old colleagues from SPEAR to the new Superconducting Supercollider (SSC) being built in Texas. Roy Schwitters was director of the

project, and Fred Gilman was associate director of the Physics Research Division. Both Vera Lüth and Harvey were recruited to be deputy associate directors to Fred. Harvey took a two-year leave of absence to help on SSC, and started in January of 1992; he stayed until the project's cancellation in late 1993, eventually returning to SLAC in March 1994. At that point, the SLC and the SLD were up and running and starting to produce very competitive physics with LEP at CERN.

The next project at SLAC, called the Asymmetric B-Factory, was led by Johnathan Dorfan. It was the rebuilding of the PEP storage ring infrastructure to generate high luminosity asymmetric collisions at the Upsilon 4S. This produced very clean B-meson pairs in a moving center of mass- from which a precision study of CP violation in B mesons could be performed. Promoted by David Hitlin from Caltech, a new collaboration formed to build a detector (BABAR, a take-off on B anti-B in physics jargon) to do the physics. It held its inaugural meeting a few months before Harvey's return. Harvey became the integration physicist for the detector, following his promotion to permanent staff. Running in close competition with a similar machine and detector at KEK in Japan, BABAR produced its first physics results in the summer of 1999, just five years later.

As is always the case at SLAC, the next generation machine (a Higgs Factory) was already on people's minds, and in this case, it was the Next Linear Collider (NLC, eventually the ILC). This was an extension of the SLC concept but focused on studying the Higgs particle. By 2002, Jonathan Dorfan, now Lab Director, asked Harvey to participate on the ILC/NLC steering committee.

A few years later, Harvey (who had experience heading the Radiation Safety Committee for many years) helped in the investigations following SLAC's 2004 electrical accident, during which time he felt compelled to turn down an offer to work in the DOE's HEP office to help with NLC planning, and stayed instead to help Persis Drell, who at the time was Associate Director of the Research Division.

Harvey associated this transition with the end of his "scientific career" and the start of his "paper pusher" career, albeit doing important administrative work, and he continued until his retirement in 2012, eight years later. During this time Persis rose in 2007 to be the laboratory director, and Harvey continued his role under David McFarlane, who took over the Research Division leadership. When Harvey retired, he was a permanent staff scientist and assistant director in the now renamed Particle and Particle Astrophysics Directorate under David MacFarlane. In 2024 Harvey became one of the first staff emeritus, after David promoted his case to the lab management.

During this last period at SLAC, Harvey took great joy in helping with the DOE – INFN exchange program which brought talented students from Italy to SLAC. There were a half dozen or so students each year, and Harvey helped place them in research groups while remaining their primary point of contact.

Harvey also maintained his interest in arms control during the years right up to retirement. In 2001 he was invited by the American Physical Society to join a high level study group investigating boost-phase missile defense. This group had knowledgeable people from industry

as well as academics and it proved to be a valuable means of making contacts between the two communities. The report, published in 2004, was largely written by Harvey himself, along with David Montague who was the former president of Lockheed Missile Division. It became a handbook for officials in the Missile Defense Agency. For this work the committee received the Leo Szilard award for the use of physics for the benefit of society (2005).

In 2010 the U.S. Congress charged the National Academy to reopen the question of missile defense. Harvey was invited to join the group by Montague who was a co-chair. The committee was even more filled out with technology experts than the previous APS study. Harvey obtained permission to be away one week a month for meetings and tours over the course of about a year. The final 300-page report emerged in 2012, both in a classified and unclassified version, and was entitled *Making Sense of Missile Defense* (National Academies Press).

Harvey felt that these last two contributions in arms control actually had a real impact on the direction the U.S. went, bringing some scientific and technological sanity toward the development of defensive systems.

Outside of the lab Harvey was a different person entirely, possessing a vast array of interests and pursuits that few of us were aware of. As with his scientific work, he pursued each of these with a passion. Indeed, many have said that he approached the arts with the same methodical and thoughtful rigor and analysis as he did his science, to achieve the most profound and meaningful effect he could. His passion for classical music, dance and photography filled his later years.

From early in his life, Harvey was an audiophile and a lover of classical music. Often with SLAC friends and colleagues, he enjoyed concerts by artists performing at Stanford, as well as Philharmonia Baroque, and others. He was a regular attendee at the Carmel Bach Festival held each summer. And he played a key role in bringing the St. Lawrence String Quartet to SLAC for an annual lunchtime performance that fellow music lovers at SLAC always enjoyed.

Over the last 20 years or so, Harvey was devoted avidly to ballet, especially the Smuin Ballet. An enthusiastic and generous supporter of Smuin, he often arrived at performances wearing his trademark beret. He loved how the creative process mirrored the scientific one, believing that through experimentation and risk, we would arrive at innovation. As a result, he sponsored countless world premiere ballets at Smuin, primarily championing emerging choreographers and women.

He approached his view of the ballet as a scientist, often attending multiple performances, each with different casts of a given set, while studying each from every angle, enjoying the geography of the choreography–the effect of the lighting from various vantage points. When Harvey was moved by a performance, he would yell a hearty “Bravi!” The dancers always said they could hear him from the balcony. Later, he enjoyed discussing his assessments with the dancers, and greatly enjoyed getting to know them and the artistic directors at Smuin over the years. In a recent performance honoring Harvey’s memory, all members of the company wore berets behind the stage.

Photography was another of Harvey’s passions, perhaps better known to us. He said he got his first camera in1945 at the age of 6. He developed an affinity for capturing people and places as

moments in time. He loved creating in black and white using classic photographic equipment and darkroom techniques, which yielded silver-gelatin prints that were of modern archival quality. Harvey chose monochrome instead of color because a monochrome image is more abstract, which he felt aided in the extraction of the essence of the subject. The viewer can more easily concentrate on shapes and subtle nuance without the distraction of color.

At SLAC, he was always the guy with the 35mm Leica hanging around his neck, documenting many important events in SLAC's history. The Leica was a camera he chose for its discreet size and the quietness of its shutter. Over many years he photographed people at physics conferences and meetings. Since he knew many of them well, he could put on film their characteristic expressions or gestures and, knowing him, they remained relaxed. In this way he photographed many of the prominent people in the physics community of that era, including about 20 Nobel Prize winners.

Beyond this passion to document history was his appreciation for the beauty of the natural world. His landscape and still-life photography captured his celebration of nature. The California coast provided a great venue for him – his favorite spots included Yosemite, Point Lobos and Garrapata Beach. For this kind of work, he generally used a medium format Rolleiflex camera (6x6 cm) or even larger format (4x5 inch and 8x10 inch) view cameras.

He often combined his photographic skills and his love of ballet to capture dancers on the stage as well as surprisingly beautiful still lifes of their used ballet shoes.

Around the time of his retirement, he became interested in photographing the small neighborhood of Montagne Ste Geneviève in the heart of Paris, close to the Pantheon, the Sorbonne University and the Cathedral Notre-Dame de Paris. The neighborhood was historic - going back to a 5th century village in Roman times which was slowly enveloped by the city. The village is to be found along a street named Rue de la Montagne Sainte-Geneviève, for the patron saint. Harvey described the street as having "… an intimacy as well as a warmth of a place where people still live and thrive. Along the street there are many small shops and restaurants, each of which having a distinct character that has developed over many years." It was home to many small family-run restaurants and shops, which Harvey immortalized in a portfolio of prints. Harvey wrote, "These photos attempt to capture and preserve in our time the charm and character of the village within the city and some of the people who are part of it." It was his motivation to eternalize it on film.

One of Harvey's BABAR colleagues (and longtime friend), Gerard Bonneaud, helped to organize an exhibition of his photos, which Harvey titled La Montagne Sainte-Geneviève in Our Time. This took place in Paris in late 2015. There was a lively and successful opening night, featuring accordion music by local musician Hugues Bouchindomme. Numerous Parisians and American traveling friends attended as did the mayor of the 5th Arrondissement. And Harvey, a cat lover himself, was enamored with the large orange tabby that supervised the gallery.

In October 2022 Gerard helped organize a second Paris exhibition, also in the Quartier Latin. This last exhibition was titled California 2022. The photographs emphasized the natural beauty of both Yosemite and Point Lobos and included the complex abstract shapes and history of coastal trees and roots. Some prints were included from his music and ballet photography as well.

After his retirement from SLAC, Harvey volunteered as an aide in a film photography class at La Entrada Middle School in Menlo Park. Right up the road from SLAC, he often passed by the lab after classes to say hi. Like his early exposure to teaching at UCSB, he enjoyed passing on his wisdom to the kids about classic darkroom techniques, from developing roll film to making prints. He was touched by his popularity with the students, many of whom would call out "Harvey! Harvey!" when they saw him arriving on campus.

Unfortunately, just a couple of months after the first Paris opening in 2015, Harvey was diagnosed with late-stage cancer. Those who knew him well said that he didn't talk much about his illness, preferring to carry on with his active life and enjoy it as fully as he possibly could. Indeed, they say he was quite matter-of-fact about it all, showing enormous courage and grace throughout the nine years that elapsed before he passed away.

About the author: *Rafe H. Schindler is a professor of particle and particle astrophysics at SLAC, since 1985. He started his graduate school career at Stanford/SLAC in 1974, when he first met Harvey Lynch working on the Mark I detector at SPEAR. Save for a few years at CERN, he has focused his career on projects at SLAC, such as Mark I, Mark II, Mark III, Tau-Charm, SLC, SLD, BABAR, and since 2004 the camera for the Legacy Survey of Space and Time (LSST).*

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[i] This biographical memoir is based in part on the transcript of an oral history interview that Harvey Lynch did with David Zierler of the American Institute of Physics in September 2020. It is available on their website. A similar AIP interview in August 1996 of John Abbadessa by Elizabeth Paris is available, where Abbadessa discusses politics, budget and funding structure at the United States Atomic Energy Commission (AEC) as well as the specifics of funding the Stanford Positron-Electron Asymmetric Ring (SPEAR). To round out his story, I have collected information from a number of people - both inside and outside the laboratory – who knew him well over his many years. In particular, I would like to thank Marie Becker, Gerard Bonneaud, Martin Breidenbach, Celia Fushille, David MacFarlane, Amy Seiwert, and Kathleen Thompson for their many suggestions and interesting recollections that have helped in assembling this memoir.

Also, thanks go to SLAC's Strategic Communications & External Affairs team for helping bring it to the whole SLAC community in an expeditious fashion.

[ii] The list included P. Morton, R. McConnell, A. Sabersky, R. Scholl, J. Voss, H. Wiedemann (visitor from DESY), M. Allen, J. -E. Augustin (visitor from U. of Paris, Orsay), Adam Boyarski, W. Davies-White, N. Dean, G. Fischer, J. Haissinski (visitor from U. of Paris, Orsay), J. L. Harris, L. Karvonen, Rudy R. Larsen.