IN MEMORIAM

Gerson Goldhaber
Professor of Physics, Emeritus
UC Berkeley
1924 – 2010

Gerson Goldhaber, whose remarkable research achievements included major roles in the first observations of antiproton annihilation and the discoveries of charm hadrons and the acceleration of the universe's expansion, died at his Berkeley home on July 19, 2010, after a long bout with pneumonia. He was 86.

Gerson was born in Chemnitz, Germany, on February 20, 1924, the youngest child of Charles and Ethel Goldhaber. His siblings, in decreasing order of age, were Leo, Maurice, and Fredrika. Many years before, Charles had been a tour guide at the Egyptian museum in Cairo; and after the Nazis took power, he, with Ethel, Leo, and Gerson, moved to Cairo, where he set up a large- scale tour guide service. Maurice had been studying physics in Berlin since 1930 and, after the Nazi takeover, moved to Cambridge, England, to complete his graduate education. He subsequently moved to the United States and had a distinguished career, receiving the Wolf Prize and serving as director of Brookhaven National Laboratory. Fredrika left Chemnitz in the early 1930s and eventually moved to Palestine.

In 1942, Gerson left Egypt to attend the Hebrew University in Jerusalem, and, in 1947, was awarded an M.Sc. degree in physics. While in Jerusalem, Gerson met Sulamith Löw, a chemistry student at the Hebrew University, and they were married in 1947. They subsequently moved to the University of Wisconsin, Madison, for graduate work; and in 1950 both were awarded Ph.D. degrees, he in physics and she in nuclear chemistry.

In his thesis research at Wisconsin, Gerson developed a technique to measure gamma- ray spectra from excited nuclear states using photographic emulsion heavily loaded with D2O. This technique permitted observation of proton recoils from deuterium photodisintegration, and provided a measure of the gamma- ray energy.

Gerson became a physics instructor at Columbia University in 1950. Using pion beams in the ~100 MeV range, and working with George Homa and Leon M. Lederman, he studied pion- nucleon interactions, again using photographic emulsions for particle detection.

In 1953, Gerson became a U.S. citizen and joined the Department of Physics at the University of California, Berkeley, as acting assistant professor. He moved up through the ranks, becoming associate professor in 1958, and professor in 1964. He was also appointed faculty senior scientist at what is now the Lawrence Berkeley National Laboratory (LBNL). At Berkeley, Gerson's wife Sula shifted into physics research, and became his close collaborator.

Working at the Berkeley Bevatron, Gerson played a major role in establishing the antiproton identity of the negatively charged particles, of mass equal to that of the proton, first observed in the Nobel Prize experiment led by Berkeley professors Owen Chamberlain and Emilio Segrè. Using photographic emulsion, Gerson, working with Gosta Ekspong and colleagues, followed a negative antiproton candidate until it stopped, and determined conclusively that the energy released in the form of newly created pions and nuclear fragments

significantly exceeded its rest energy. These observations established the process of annihilation of an antiproton with a proton or neutron, demonstrating conclusively that the negative particles of mass equal to that of the proton, observed in the initial electronic experiment, were indeed antiprotons.

Further experiments by Gerson and collaborators, using emulsion and a propane bubble chamber, provided much more quantitative information on the antiproton annihilation process. One interesting result arose from the study of pion- pion angular correlations for annihilation pions: the distributions of angles between like-charge pions differed markedly from those between unlike- charge pions. This behavior was explained, with help from theorist Abraham Pais, as arising from the effect of the Bose- Einstein statistics obeyed by the pions.

Gerson, with Sula and others, also made numerous measurements of kaon properties, such as mass, lifetime, interaction behavior, etc. They initially used emulsions, and then, in collaboration with a University of California, Los Angeles, group led by Harold Ticho, moved to the use of the LBNL 15" hydrogen bubble chamber. Later, in collaboration with Berkeley professor William Chinowsky, they worked with higher energy kaon beams incident on the 20" Brookhaven bubble chamber. An important result from the latter work was the determination of the K* resonance spin 1.

In a 1963 LBNL reorganization, Gerson, Sula, and their postdoctoral fellows and students joined Berkeley faculty member George Trilling and his collaborators to form a new research group, the Trilling- Goldhaber group (TG) that collaborated until 1989. Its achievements during those 25 years were in large part due to Gerson's extraordinary insight into where to find important new science. Tragically, in 1965, in the course of a visit to India, Sula suddenly died from a previously undetected brain tumor. In 1969, Gerson married Judith Margoshes Golwyn, a science writer, playwright, and poet.

Gerson and collaborators from the TG group continued the study of K +- nucleon interactions with K + beams of momenta between 800 and 1600 MeV/ c incident on the new LBNL 25" bubble chamber, filled with hydrogen or deuterium. Results included rates and mass spectra for resonant states produced in these collisions, measured with excellent precision. Higher- energy studies used the 72" bubble chamber at LBNL, and later, its reincarnation as the Stanford Linear Accelerator Center (SLAC) 82" chamber. An important result from the Berkeley experiments was the first observation of destructive interference between omega and neutral rho- meson decays. The SLAC experiments, with 12 GeV/ c K + incident on the deuterium- filled 82" chamber led to the first observation of an anti- omega baryon.

In the early 1970s, in a move toward a new direction pushed largely by Gerson, a collaboration of the TG group, William Chinowsky, and the SLAC groups led by Burton Richter and Martin Perl was formed to study high- energy electron- positron collisions produced by the new storage- ring/ collider SPEAR at SLAC. This SLAC- LBNL collaboration built the Mark I detector to study these collisions, and analyzed the resulting data. Gerson played a leading role in that effort. The next few years saw numerous discoveries from that collaboration: the J/ psi and its excited states, the charm (c) quark, the tau lepton, and the observation of jet structure in collision products. Gerson's major achievement came in 1976 when he, in collaboration with François Pierre, demonstrated unequivocally the existence of charm particles, namely particles with a non-zero value of the charm quantum number. In 1977, Gerson was elected to the National Academy of Sciences and chosen California Scientist of the Year. In 1983, he was elected to membership in the Royal Swedish Academy of Sciences; and, in 1991, to fellowship in the American Academy of Arts and Sciences. Also in 1991, François Pierre and Gerson were jointly awarded the Panofsky Prize of the American Physical Society "for the discovery of charmed particles."

Gerson retired in 1991 but, as Professor in the Graduate School, he remained very active in research until he became ill with pneumonia in 2008. In 1989, the TG group broke up, and Gerson joined the Supernova Cosmology Project (SCP), led by Berkeley physicist Saul Perlmutter. Using techniques mostly developed by Perlmutter, the SCP group made observations of distant exploding stars known as supernovae, motivated by the fact that so- called type Ia supernovae could, with appropriate corrections, be treated as "standard candles" with fixed intrinsic luminosity. By studying the relation between the supernova red shifts (z) and their actually observed luminosities, one could derive information on the expansion history of the universe. In an analysis of 38 (soon after, 42) supernovae, in which Gerson had a major role, the SCP team obtained the extraordinary result that the universe's expansion was accelerating rather than slowing down as expected from gravitational attraction. This conclusion, hailed by Science magazine as the Breakthrough of the Year 1998, has stood the test of time.

In his University activities, Gerson taught mostly graduate and upper division courses. Quoting from the department chair, "his lectures are clear, and though they are not scintillating, they are apparently very effective". He originated the course, Introduction to Graduate Research in Physics. In the 1980s, Gerson and LBNL senior physicist Robert Cahn wrote the very useful textbook, The Experimental Foundations of Particle Physics. Gerson mentored 23 Ph.D. students, many of whom later had distinguished careers. Adrian Lee, the son of his Ph.D. student Wonyong Lee, is now a faculty member in the Berkeley physics department. Gerson served on numerous departmental and professional committees and held Miller professorships in 1958, 1975, and 1984.

Gerson's outstanding research accomplishments place him among the most productive experimental physicists of the twentieth century. His great strength was his ability to recognize, even in very preliminary experimental data, the hints of potentially new science, which he then relentlessly pursued until these hints were well understood. That pursuit sometimes led to important discoveries. His "nose for discovery" also influenced very wisely his choices of the best scientific directions to pursue.

In the lonely time that followed Sula's death, Gerson got interested in art, and became a very talented watercolorist. He illustrated two books of poems written by Judith, Sonnets from Aesop and Sarah Laughed, with a separate watercolor for each of about 100 poems in each book. They were published in 2004 and 2007, respectively.

Gerson is survived by his wife Judith, his son Amos Nathaniel, his daughters Michaela and Shaya, his grandsons Sam, Ben, and Charles, and his brother Maurice.

George H. Trilling
2011