Karl Berkelman

June 7, 1933 — February 26, 2009

Karl Berkelman, the Goldwin Smith Professor Emeritus of Physics and an internationally recognized leader in elementary particle physics, died in Robert Packer Hospital in Sayre, Pennsylvania, after a brief illness. He was director of Cornell's Laboratory of Nuclear Studies (now the Laboratory for Elementary-Particle Physics) from 1985 to 2000. Under his leadership, the laboratory prospered and maintained a prominent position at the frontiers of elementary particle physics that was exceptional for the size of the laboratory and its financial resources.

Karl was born in Lewiston, Maine, the son of Robert and Yvonne Langlois Berkelman. After graduating from Lewiston High School, he obtained a B.S. degree in Physics from the University of Rochester in 1955. He began his Cornell career as a graduate student in the physics department, earning his Ph.D. degree in 1959. Karl joined the Cornell physics faculty following a year as a NSF Postdoctoral Fellow at the Instituto Superiore di Santa in Rome, Italy. He rose rapidly through the professorial ranks, becoming a full professor in 1967 and the Goldwin Smith Professor of Physics in 1995. On sabbatical leaves from Cornell, he conducted research at the CERN laboratory in Geneva, Switzerland, and the DESY laboratory in Hamburg, Germany. Although he retired in 2006, he remained active in research until his death.

Karl came to international attention in 1965 when he made the first significant measurement of the size of an elementary particle called the charged pi meson, a measurement at the frontier of elementary particle physics. The experiment was a tour de force because it was not at all clear to the physics community how to turn a theoretical suggestion into a realistic experiment. Karl was exceptionally able to identify what was most important in complex mathematical expressions, and to utilize that insight to obtain the best results possible with available technical resources. Furthermore, he always focused on getting the job done. These techniques and this ability to concentrate his effort served him well throughout his career.

Over the years, Karl contributed significantly to the design and construction of a sequence of electron accelerators at Cornell and the associated experiments and he exploited the new physics opportunities that they provided. His first experiment at the Cornell 10 GeV electron synchrotron was a study of the production of very high energy x-rays by electrons in this new energy regime. This was a crucial and very sensitive test of the theory developed by Bethe and Heitler in the 1930s, and indeed the theory survived this stringent test. During the 1970s, Karl was a leader in a series of experiments on the production of other particles by beams of photons and electrons incident on hydrogen targets, again topics that were on the frontier of elementary particle physics. A world leader in this

field, he was frequently invited to review progress at the major international scientific conferences. He also served on the most important committees that advised the National Science Foundation, the Department of Energy, and the other principal international laboratories for elementary particle physics. He was elected to Fellowship in the American Physical Society.

In the late 1970s, the laboratory constructed CESR, an accelerator that stores electrons and their antiparticles, positrons, and collides them in a detector called CLEO. During this period, Karl was responsible for the design and construction of the complex system that extracted electron and positron beams from the 10 GeV synchrotron and injected them into CESR. Simultaneously, Karl developed a track-finding program the momenta of charged particles in the CLEO detector based on their paths. The results of Karl's effort were the basis for all physics results produced by the CLEO collaboration; nothing could be discovered or measured without these momenta. Karl had identified a task that was absolutely necessary, realized that nobody else was doing it, and focused his effort so that his computer program was ready and working as soon as data were available.

CESR was the best facility at which to explore the new field of elementary particle physics called heavy flavor physics, particularly the physics of an elementary particle called the B meson. The early 1980s were an exciting time, with the CLEO collaboration leading the discoveries and measurements in this field. However, the collaboration soon recognized that further progress required substantial upgrades of the CLEO I detector, and CESR luminosity, the rate at which CESR provided the events that CLEO collaboration was studying. Just before Karl became director of the laboratory in 1985, the NSF approved a proposal for the CLEO II detector and a substantial upgrade of CESR. The CLEO II detector broke new ground in detector technology and capability, and has served as the model for later detectors in the field. In his role as laboratory director, Karl oversaw the construction and operation of the CLEO II detector, the luminosity upgrades of CESR, and the exploitation of the two to produce a host of important discoveries in heavy flavor physics. Members of the CLEO collaboration fondly remember Karl's 15 years as director of the laboratory as a golden age. Younger colleagues particularly appreciated the attention that Karl paid to the development of their careers and to their sense of belonging to the laboratory. Furthermore, Karl accomplished all of this in the frugal style of operation that he inherited from the previous directors, Bob Wilson and Boyce McDaniel. Cornell and CLEO were recognized internationally as being especially efficient in utilizing relatively modest financial resources to obtain the most scientific productivity per dollar spent and per member of the collaboration. Without question, Karl's scientific leadership of the laboratory during that period was crucial for the success of the program.

While most of the effort of the laboratory was concentrated on CESR and CLEO, Karl also ensured that other programs thrived. Perhaps the most notable of these is the Superconducting Radio Frequency program, called SRF. This research program develops devices that accelerate particle beams very efficiently, minimizing the electrical energy used and the operating costs. The laboratory had been involved in SRF research and development since the early 1970s. By the mid 1980s, the Cornell program had been so successful that a large fraction of the SRF group left to build an accelerator in Virginia based on that technology. At that time, termination of the program and employment of the resources elsewhere would have been relatively easy. However, Karl made a very wise decision to rebuild the Cornell effort with the core group that remained, and to concentrate on advanced research and development for the future. The result is continuing international leadership in the field. Accelerators around the world, including CESR, utilize technology developed by this group.

While he was the laboratory director, Karl remained heavily involved in the CLEO physics program. He continued to be the thesis advisor for graduate students, and he contributed his physics insight, his clarity of thought, and his wisdom to many of the most significant discoveries and measurements made by the CLEO collaboration. Karl's participation in the laboratory and CLEO did not end with his retirement as director, or his later retirement as the Goldwin Smith Professor of Physics. He remained involved in CLEO, and even participated actively in a monthly CLEO collaboration meeting only three weeks before his untimely death.

One of Karl's significant legacies is his book, *A Personal History of CESR and CLEO*. In it, he describes the history of the CESR/CLEO program from its beginning in the 1970s until 2002, when he finished the book. The book is a fitting tribute to CESR and CLEO to which he contributed so much, and to Karl's style as a scientist, as a leader of scientists, and as an expositor of science. In accord with his style in research and leadership, his description is succinct and accurate: not too much, not too little, just right. Karl's wisdom and scientific leadership are sorely missed as the collaboration completes the final stages of the CESR/CLEO program, and members of the CESR/CLEO community wish that he were able to write a final chapter for his book.

Karl is survived by his wife of 49 years, Mary; his sister, Ann Berkelman of New York; sons, Tom Berkelman and his partner, Nathan Waldon, of Oakland, California; Jim Berkelman and his wife, Elisabeth, of Madison, Wisconsin; Peter Berkelman of Honolulu, Hawaii; and two grandsons, Felix and Frederick Berkelman.

Karl's scientific accomplishments and leadership left an indelible impression on scientific research at Cornell and on the broader elementary particle physics community. We greatly miss his calm wisdom and insightful leadership.

David G. Cassel, Chairperson; J. Ritchie Patterson, Maury Tigner