Fe Institute, where he served on the science board.

Anderson's many accomplishments constitute a triumph over the disease that he carried throughout his mature life. A combination of insight, ingenuity, sound design and determined execution characterized his scientific work. He leaves a large number of friends, colleagues and students, who will remember him as one of the great figures of the atomic era.

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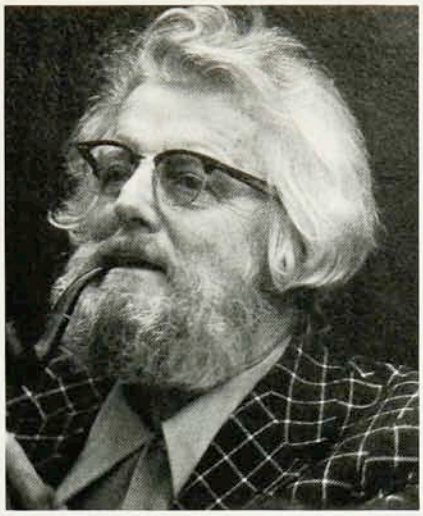
## Seth H. Neddermeyer

Seth Henry Neddermeyer died on 29 January 1988 after a long illness that drained his physical stamina but not his interest in physics or his concern for the problems facing our society.

Neddermeyer was born in Richmond, Michigan, in 1907. His first two years of undergraduate study were spent at Olivet College in Michigan. He then transferred to Stanford University, where he received an AB in 1929.

He pursued his graduate studies at Caltech under the supervision of Carl Anderson, who was engaged in cloud chamber studies of cosmic radiation. Neddermeyer's doctoral thesis contained the first study of collisions of fast charged particles with electrons. It established the qualitative correctness of Niels Bohr's theory for this process up to 100 MeV. It also confirmed the existence of large radiative losses by fast electrons in heavy materials (lead), and indicated approximate agreement with the Bethe–Heitler theory up to 50 MeV. During this period Neddermeyer made substantial contributions to the investigations that led to the discovery of the positron in 1932. He received his PhD in 1935.

Neddermeyer continued his association with Anderson as a research fellow. In 1936 they announced the discovery of a charged particle having a mass intermediate between those of the electron and the proton. Initially called the "mesotron," it is now known as the muon. Soon after, Anderson and Neddermeyer announced a rather precise value for its mass. The existence of such a particle had been suggested by Neddermeyer's demonstration that the majority of the more massive cosmic-ray particles at sea level are not protons. For these investigations Neddermeyer had proposed two important innovations: He suggested installing in the cloud chamber a thick, heavy platinum



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Seth H. Neddermeyer

absorber to distinguish electrons from heavier particles, and a Geiger counter to provide a trigger for particles stopping in the chamber. His earlier work on the absorption of fast particles was crucial for the determination of the muon mass. It is interesting to note that the experimental evidence for the muon preceded Hideki Yukawa's theory of a particle mediating the nuclear force.

Later, Anderson and Neddermeyer, in collaboration with Robert A. Millikan, made high-altitude studies at Pike's Peak of the composition of cosmic radiation. Their observations showed that the shower particles were electrons, and confirmed the description of showers proposed by J. Robert Oppenheimer.

The threat of war terminated this research, and in early 1941 Neddermeyer joined the group developing the photoelectric proximity fuse, initially at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington and later at the National Bureau of Standards. Following the successful completion of that project he went to the Los Alamos Laboratory of the Manhattan Project.

Almost immediately after joining the project early in 1943, he proposed the implosion method of assembly for the atomic bomb. His tenure at Los Alamos, where he was a group leader, was devoted principally to the development of this concept, which was vital for the production of a plutonium bomb. (For a time his proposal was strongly opposed, but Neddermeyer's stubbornness and Oppenheimer's support finally led to its acceptance. With some modification, based on an appreciation of the importance of compression, their work resulted in a successful weapon.) In later years Neddermeyer came to be deeply troubled by his part in the production of this instrument of destruction.

In 1946 Neddermeyer joined the department of physics at the University of Washington. Here he resumed the investigation of cosmic rays with a large magnetic cloud chamber. He also developed an apparatus, the chronotron, for measuring the velocity of a fast charged particle by racing it against an electromagnetic pulse in a transmission line. Although the chronotron did have some experimental application, it was soon superseded by more compact devices. He was, quite naturally, interested in delineating further the character of the muon, and he searched for evidence of its nonelectromagnetic interactions in muon–electron and muon–nucleus collisions. He was one of the first outsiders to conduct an experiment at SLAC, namely a further investigation of the muon–electron interaction.

Later in his career Neddermeyer decided that the time had come to indulge in some problems that physicists generally consider too difficult to confront—in particular, the nature of the mind and its connection to the domain of traditional physics—and to approach these problems with the tools and methods of science. He published some of his speculations on these matters and devised and executed experiments looking for effects of psychokinesis. It required a certain dedication and courage to undertake these investigations in the face of an understandable skepticism among his colleagues. Neddermeyer was a sincere and practicing advocate of the principle of the open mind in all fields of investigation.

In 1973 he became professor emeritus, but he continued his research activities as long as his health permitted. He provided valued advice to former students and to other groups, particularly in connection with projects involving the detection and measurement of cosmic neutrinos and an (inconclusive) attempt at Western Washington University to detect neutrinos generated at Fermilab. Neddermeyer participated in the early stages of the design of the large-scale deep underwater detectors of neutrinos for the DUMAND project.

Seth Neddermeyer's life was always governed by the highest principles. He was admired and will be fondly remembered by his students, colleagues and friends.

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