= Seth Neddermeyer =

Seth Henry Neddermeyer (September 16 , 1907 ? January 29 , 1988) was an American physicist who co @-@ discovered the muon , and later championed the Implosion @-@ type nuclear weapon while working on the Manhattan Project at the Los Alamos Laboratory during World War II .

= = Early life = =

Seth Henry Neddermeyer was born in Richmond , Michigan , on September 16 , 1907 . He attended Olivet College , a small college that his mother , older sister , and uncle had also attended , for two years before his family moved to California . He transferred to Stanford University , from which received his Bachelor of Arts (A.B.) degree in 1929 . His interest in physics was inspired by the work of Robert A. Millikan , and he enrolled in graduate school at California Institute of Technology (Caltech) , where he wrote his 1935 Ph.D. thesis on " The absorption of high energy electrons " , under the supervision of Carl D. Anderson . He confirmed the theory espoused by Niels Bohr for this process . He also noted large radiative energy losses of electrons in lead , in agreement with the theory propounded by Hans Bethe and Walter Heitler .

Neddermeyer contributed to the research which led to the 1932 discovery of the positron , for which Anderson was awarded the Nobel Prize in Physics in 1936 . That year , Neddermeyer and Anderson discovered the muon , using cloud chamber measurements of cosmic rays . Their discovery predated Hideki Yukawa 's 1935 theory of mesons that postulated the particle as mediating the nuclear force . Anderson and Neddermeyer collaborated with Millikan in high altitude studies of cosmic rays , which confirmed Robert Oppenheimer 's theory that the air showers produced in the atmosphere by cosmic rays contained electrons . They also obtained the first evidence that gamma rays can generate positrons .

= = Manhattan Project work = =

In early 1941 , with World War II raging in Europe but the United States not yet a belligerent , Neddermeyer joined a team led by Charles C. Lauritsen and William A. Fowler at the Department of Terrestrial Magnetism at the Carnegie Institution of Washington , and then at the National Bureau of Standards in Washington , D.C. , that worked on the photoelectric proximity fuze . After this work was successfully completed , Neddermeyer was recruited by Oppenheimer to work at the Manhattan Project 's Los Alamos Laboratory . Neddermeyer was an early advocate for the development of an implosion technique for assembling a critical mass In an atomic bomb . Although implosion was suggested by Richard Tolman as early as 1942 , and discussed in the introductory lectures given to Los Alamos scientists by Robert Serber , Neddermeyer was one of the first to urge its full development . Unable to find much initial enthusiasm for the concept among his fellow Los Alamos scientists , Neddermeyer presented the first substantial technical analysis of implosion in late April 1943 . Oppenheimer considered this to be the beginning of implosion research at Los Alamos .

Though many remained unimpressed , Oppenheimer appointed Neddermeyer the head of a new group to test implosion . His group became the E @-@ 5 (Implosion) Group , which was part of Captain William S. Parsons ' E Division . A gun @-@ type nuclear weapon was the preferred method , but implosion research constituted a backup . Neddermeyer embarked on an intensive series of experiments testing cylindrical implosions . The result was a series of distorted shapes . Progress was made ; Neddermeyer and a member of his team , Hugh Bradner , along with James L. Tuck from the British Mission , conceived the idea of explosive lenses , in which shaped charges are used to focus the force of an explosion . Nevertheless , seemingly unsolvable problems with shock wave uniformity brought progress on implosion to a crawl .

By September 1943 , Neddermeyer 's team had grown from five people to fifty . That month , John von Neumann came to Los Alamos at Oppenheimer 's request . Von Neumann was impressed by the implosion concept and , working with Edward Teller , an old friend , made a series of suggestions . Von Neumann was able to create a sound mathematical model of implosion , enabling

Neddermeyer to present a proposal for a greatly expanded research program . Edwin McMillan and Isidor Isaac Rabi recommended that George Kistiakowsky , who had a specialized knowledge in the precision use of explosives , be brought in to help the program . In February 1944 , Kistiakowsky became Parsons ' deputy for implosion .

In April 1944 , tests on the first sample of plutonium that had been produced with neutrons in a nuclear reactor revealed that reactor @-@ bred plutonium contained five times more plutonium @-@ 240 than that hitherto produced in a cyclotrons . This unwanted isotope that spontaneously decayed and produced neutrons promised to cause a predetonation without sufficiently quick critical mass assembly . It now became apparent that only implosion would work for practical plutonium bombs ; a powerful enough gun could not be constructed small enough to be carried in an aircraft , and plutonium @-@ 240 was even more difficult to separate from plutonium @-@ 239 than the isotopes of uranium that were giving the rest of the Manhattan Project such difficulties . Plutonium was unusable unless implosion worked , but only plutonium could be produced in quantities that would allow regular production of atomic bombs . Thus , the implosion technique now suddenly stood as the key to production of nuclear weapons .

In mid @-@ June 1944 , a report from Kistiakowsky to Oppenheimer detailing dysfunctionality within the implosion team led to the ousting of Neddermeyer . He was replaced as the head of the E @-@ 5 Group by Kistiakowsky on June 15 , 1944 , but remained a technical adviser to the implosion program , with group leader status . Neddermeyer was said to have been much embittered by this episode . In Oppenheimer 's August 1944 reorganization of the Los Alamos Laboratory , Neddermeyer 's group was renamed X @-@ 1 , with Norris Bradbury as group leader . The implosion method championed by Neddermeyer was used in the first atom bomb exploded (in the Trinity test) , the Fat Man bomb dropped on Nagasaki , and almost all modern nuclear weapons . Kistiakowsky later insisted that " the real invention should be given full credit to [Seth] Neddermeyer . "

= = Later years = =

In 1946 , after World War II ended , Neddermeyer left Los Alamos to become an associate professor at the University of Washington , where he would spend the rest of his career . In due course he became a full professor . He resumed his studies of cosmic rays using a cloud chamber and a new device that he invented to measure the speed of charged particles known as a " chronotron " . He was particularly interested in the properties of the muon , and conducted experiments with muons at SLAC . He participated in the DUMAND Project , for which he helped design large @-@ scale underwater neutrino detectors . Neddermeyer became interested in parapsychology , insisting , in spite of the skepticism of many colleagues , that it warranted proper scientific investigation . He retired in 1973 , becoming a professor emeritus , but he continued his research activities for as long as his health permitted . He was afflicted with Parkinson 's disease .

In 1982 , he was presented with the Department of Energy 's Enrico Fermi award . His citation read :

For participating in the discovery of the positron , for his share in the discovery of the muon , the first of the subatomic particles ; for his invention of the implosion technique for assembling nuclear explosives ; and for his ingenuity , foresight , and perseverance in finding solutions for what at first seemed to be unsolvable engineering difficulties .

In later life , Neddermeyer was sometimes troubled by the nuclear weapons he had helped to invent . He told an interviewer in 1983 :

I get so overwhelmed by a feeling of terrible guilt when I think about the history of the bomb . I 'm terribly worried now about the current world situation . What the hell can we do about it ?

Neddermeyer died in Seattle on January 29 , 1988 , from complications of Parkinson 's disease .