THE POSITRON — ITS DISCOVERY

This photograph of Carl Anderson is one of a series of faculty portraits taken by physics staff member Tom Harvey.

AND IMPACT ON PARTICLE PHYSICS

An Introduction by Robert F. Bacher

THE YEAR 1982 marks the 50th anniversary of the discovery of the positron by Carl Anderson. This was the first antiparticle to be discovered, and it marked the beginning of a new era in particle physics. Robert Millikan, whose penetrating insight in physics was well known, suggested to Anderson that he use a cloud chamber in a magnetic field to study the nature of cosmic ray particles. Anderson's work produced many advances in techniques and led to the unambiguous identification of a positive particle with roughly electron mass on August 2, 1932.

During that same year, Chadwick announced the discovery of the neutron, which was to lead to major advances in nuclear physics and the whole field of nuclear energy. Also in 1932, Cockroft and Walton produced the first radioactivity initiated by protons accelerated in a machine. Moreover, it was the year in which Harold Urey discovered deuterium, which has played such an important role in nuclear physics. That year 1932, now 50 years ago, was indeed an outstanding one in the progress of science. The discoveries in those 12 months changed many of our concepts and led to great advances in our understanding of atomic nuclei. They also led to developments that had a major impact on our society.

This issue of *Engineering & Science* is devoted to a recall of Anderson's historic work and some of the findings that have followed. The introductory article by Eugene Cowan, who worked with Carl Anderson for many years, gives a careful account of the discovery of the positron and the events that led up to it. The discovery was so unexpected by most physicists that acceptance of the result, especially from Cambridge, came slowly.

Next is an excerpt from a paper by Anderson, prepared in 1980 to review the work that led to the discovery of the positron and later with Seth Neddermeyer to the discovery of the meson, now called the mu meson or muon.

Milton Plesset, who came to Caltech about the time of the first clear positron evidence, recounts his recollections of that time and his work with Robert Oppenheimer on this subject. Jacquelyn Bonner's biographical account of Anderson contains many interesting sidelights on his life not known to many because, as she points out, modesty is one of his strong characteristics.

Robert Leighton, who worked in cosmic rays with Anderson, has written a summary of the extensive cosmic ray work carried on that was not part of the early positron work. This includes the painstaking work with Seth Neddermeyer leading to the mu meson discovery. He also covers the period after 1945 in which, for about two decades until high-energy accelerators were developed and built, information about particle physics came predominantly from cosmic ray studies. Anderson and his colleagues played an important part in those studies.

John Schwarz has written a brief history of antimatter, which started with the positron discovery 50 years ago. He carries this along to the present when "positrons and antiprotons are the bread-and-butter tools of high-energy experimental physics." In the last article Robert McKeown discusses the current concept introduced by Murray Gell-Mann and George Zweig from Caltech of sub-proton and -neutron particles called quarks, which have fractional electronic charge ⅓ or ⅔ both plus and minus and which seem to be extremely reluctant to exist except in a group of three with charge $\pm e$. Experiments are now being carried out in several laboratories to determine whether fractionally charged particles really exist. So far the evidence is positive but not definitive, but the next 50 years will bring much that is new. □