
Descriptive Summary**Title:** Carl D. Anderson Papers,**Date (inclusive):** 1923-1987**Collection number:** 10053-MS**Creator:** Anderson, Carl D. (Carl David) 1905-1991**Extent:** 2.5 linear feet**Repository:** California Institute of Technology. Caltech Archives
Pasadena, California 91125**Abstract:** A selection of the course and teaching notes, correspondence, technical files, and photographs of Carl D. Anderson (1905-1991) form the collection known as the Carl D. Anderson Papers in the Archives of the California Institute of Technology. Working under Robert A. Millikan at Caltech, Anderson conducted experiments on the penetrating radiation known as cosmic rays with a magnet cloud chamber, and in 1936 he won the Nobel Prize in physics for his discovery of the positive electron, or positron. Anderson was professor of physics at Caltech until 1976 and chairman of the Division of Physics, Math and Astronomy from 1962-1970.**Physical location:** Archives, California Institute of Technology.**Language of Material:****Languages represented in the collection:**

EnglishGerman

Access

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Preferred Citation

[Identification of item], Carl D. Anderson Papers, 10053-MS, Caltech Archives, California Institute of Technology.

Acquisition Information

Carl D. Anderson donated selected papers to the Caltech Archives in 1987 and 1988.

Biography

Carl David Anderson was born September 3, 1905, in New York City. He was the only child of Swedish immigrants Carl David Anderson and Emma Adolffina Ajaxson. In 1912 the family moved to Los Angeles, where the elder Anderson managed a small restaurant business. Carl attended Los Angeles Polytechnic High School, from which he graduated in 1923. The following fall he entered the California Institute of Technology in Pasadena as a freshman, intending to study electrical engineering. In his sophomore year, during a course with Ira Bowen, he decided to change his major to physics. After receiving his BS in 1927, he stayed on at Caltech to do graduate work under Robert A. Millikan. His doctoral thesis, entitled "Space-Distribution of X-Ray Photoelectrons Ejected from the K and L Atomic Energy-Levels," involved a cloud-chamber study of photoelectrons (electrons exposed to radiation) scattered from various gases by X rays. He received his PhD in 1930.

Anderson was encouraged by Millikan to stay on at Caltech for a postdoctoral year to conduct experimental research on the penetrating radiation known as cosmic rays. Anderson designed and constructed an apparatus consisting of a giant electromagnet wrapped around a cloud chamber. He inserted a lead plate into the middle of the cloud chamber to lessen the particles' energy and to clarify the direction of their motion (negatively charged particles moved downward). An arc-lighted camera was focused on the chamber's window to record the vapor trails of electrons or other charged particles passing through. The magnet cloud chamber was put in operation in October 1931. At this time, scientists had only identified two elementary particles of matter--the electron and the proton. However, in 1928 Paul Dirac, in what came to be known as Dirac's equations, posited the existence of another particle, comparable in mass to the negatively charged electron, but

with a positive charge, an "anti-electron." On August 2, 1932, viewing a very clear photograph of an upward-moving particle with mass similar to the electron, Anderson knew he had discovered the "positive electron," later named the positron. This was the particle predicted by Dirac. In fact, Dirac's theory predicted that all elementary particles should have their own antiparticles. Thus the term "antimatter" emerged, and Anderson was hailed as its discoverer. Anderson published his research in *Science* magazine on September 9, 1932. At first his results were met with skepticism. Ultimately they were confirmed by experimenters, initially in 1933 at the Cavendish Laboratory in Cambridge, England, by Patrick M. S. Blackett and G. P. S. Occhialini.

Anderson's work garnered him the Nobel Prize in 1936, at the age of only 31. A year prior to this date, in 1935, Anderson and his first graduate student, Seth Neddermeyer, discovered another subatomic particle, which they named the mesotron (later called the μ -meson or muon). The muon discovery grew out of experimental work on cosmic rays done at high altitude (around 14,000 feet) on Pikes Peak in Colorado. In 1933 Anderson became assistant professor at Caltech. He was named associate professor in 1937 and professor in 1939. During World War II Anderson was closely associated with the Caltech rocket research and development effort, led by Charles C. Lauritsen and funded by the U. S. Office of Scientific Research and Development (OSRD). Anderson spent his time working on problems associated with the launching of rockets from airplanes. For his wartime work, he received the Presidential Certificate of Merit in 1945. In 1946 Anderson married Lorraine Bergman. They had two sons.

In the postwar period Anderson returned to his work on cosmic rays. He and his graduate students continued to take cloud chamber photographs at high altitudes, now using a B-29 aircraft, and also measuring variations in cosmic-ray effects at selected latitudes on the Earth's surface. They painstakingly accumulated further evidence of the existence of more subatomic particles, thus confirming the underlying complexity in the structure of matter and leading the way to a new branch of study, particle physics.

By the late 1950s, Anderson's kind of cosmic-ray investigation was beginning to be supplanted by work done on huge high-energy accelerators, both at Caltech and around the world. Anderson became chairman of the Caltech's Division of Physics, Mathematics and Astronomy in 1962, a position which he held until 1970. He retired from Caltech in 1976 with the title Board of Trustees Professor of Physics, Emeritus.

In addition to the Nobel Prize, Anderson was the recipient of many awards: the Gold Medal of the American Institute of the City of New York (1935), the Elliott Cresson Medal of the Franklin Institute (1937), the John Erikson Medal of the American Society of Swedish Engineers (1960), in addition to three honorary doctorates from Colgate University (1937), Temple University (1949) and Gustavus Adolphus College (1963). He was elected to the National Academy of Sciences in 1936 and to the American Academy of Arts and Sciences in 1954. Anderson died in San Marino, California, at the age of 85.

Scope and Content

The Carl D. Anderson papers represent only a small piece of Anderson's scientific legacy. The collection is divided into four series. The first, Course Notes and Teaching Files, 1920s-1940s, includes both notes taken by Anderson during his student years at Caltech and his own lecture notes. The former group is of interest for the prominent professors who taught at Caltech in this era, notably J. Robert Oppenheimer (quantum theory), but also Robert A. Millikan (electron theory) and the distinguished visiting physicist from Munich, Arnold Sommerfeld (problems in wave mechanics). The second series contains files from the period of Anderson's chairmanship of the Division of Physics, Math and Astronomy (PMA) at Caltech, from 1964-1970, and a few items past those dates. Series 3 contains a small set of correspondence which includes letters with scientific collaborators such as Seth Neddermeyer, H. Victor Neher, and Bruno Rossi. Also included here are two substantial files on William Shockley (Caltech B.S., physics, 1932; later inventor of the transistor and Nobel laureate) from the period of Shockley's notoriety over his controversial, inherently racist views on population genetics, 1962-1970.

Series 4 is a mix of technical notes, photos, World War II material, and some biographical papers. Of special interest are the historic cloud-chamber photos taken by Anderson that record the discovery of new subatomic particles. (Most of these photos have been scanned to the Caltech Archives online database, [PhotoNet](#).) The World War II material, though of small scope, provides some interesting documentation of the Holy Moses aircraft rocket, also known as the HVAR 5.0", engineered at Caltech towards the end of the war and first deployed in France following D-Day (1944). Anderson's war work centered on aircraft rockets and torpedoes; this work is documented in the 1970 interview by A. B. Christman of the Naval Weapons Center, China Lake, a copy of which is filed here. The assorted photos in this series were examined and described by Anderson's colleague, Professor Eugene W. Cowan, in a short, recorded interview which is filed following the photos in series 4.

The collection is organized into the following series:

- Series 1. Course Notes and Teaching Files, 1920s-1940s
- Series 2. Administrative files
- Series 3. Correspondence
- Series 4. Technical files and biographical

Related Material

Scientific apparatus related to Carl D. Anderson, now in the Caltech Archives' collections, includes the cloud chamber with which his important particle discoveries were made; some of his Geiger counters, including the one used in the muon experiment; and a fragment of the Holy Moses rocket, returned to Anderson from France where it knocked out a German tank following the D-Day invasion.

Indexing Terms

The following terms have been used to index the description of this collection in the library's online public access catalog.

Subjects

California Institute of Technology

Cosmic rays

Particles (Nuclear physics)

Physics

World War, 1939-1945 Equipment and supplies

Occupations

Nobel Prize winners

Physicists

Series 1. Course Notes and Teaching Files, 1920s-1940s

Subseries 1. Course notes (courses taken by Carl Anderson)

- Box 1, Folder 1 **Complex variable 1927-1930**
- Note**
- Ma 114, taught by Professor Morgan Ward.
- Box 1, Folder 2 **Complex variable, part 2 1927-1930**
- Note**
- Ma 114, taught by Professor Morgan Ward.
- Box 1, Folder 3 **Electricity and magnetism 1927-1930**
- Note**
- Probably Ph 122, taught by Professor Paul Epstein.
- Box 1, Folder 4 **Electromagnetic waves 1928-1930**
- Note**
- Ph 123, taught by Professor Paul Epstein.
- Box 1, Folder 5 **Electron theory 1927**
- Note**
- Ph 114, taught by Professor Robert A. Millikan.
- Box 1, Folder 6 **Heat radiation and quantum mechanics 1930**
- Note**
- Ph 126, taught by Professor Paul Epstein.
- Box 1, Folder 7 **Math analysis, parts 1 and 2 1927-1930**
- Note**
- Ma 119, taught by Professor E. T. Bell.
- Box 1, Folder 8 **Math analysis, part 3 1927-1930**
- Note**
- Ma 119, taught by Professor E. T. Bell.
- Box 1, Folder 9 **Problems in wave mechanics 1928-1929**
- Note**
- Ph 129; note from original file indicates taught by Arnold Sommerfeld (visiting from Munich).

Series 1. **Course Notes and Teaching Files, 1920s-1940s**

Subseries 1. **Course notes (courses taken by Carl Anderson)**

Box 1, Folder 10 **Quantum theory, part 2 1930**

Note

Ph 134, taught by Professor J. Robert Oppenheimer.

Box 1, Folder 11 **Relativity 1927-1929**

Note

Probably Ph 136, taught by Professor Richard C. Tolman.

Box 2, Folder 1 **Theory of Relativity undated, 1941**

Note

Unclear what course these notes pertain to.

Box 2, Folder 2 **Thermodynamics 1927-1930**

Note

Ph 111, taught by both Professors Fritz Zwicky and Paul Epstein.

Subseries 2. **Teaching notes (courses taught by Carl Anderson)**

Box 2, Folder 3 **Modern physics (Ph 3) 1934-1937**
Box 2, Folder 4 **Modern physics (Ph 3) 1938, undated**
Box 2, Folder 5 **Modern physics (Ph 3): exams and problems 1928, 1935-1935**

Note

Includes exam on special theory of relativity, 1928.

Box 2, Folder 6 **Sophomore physics (Ph 3) undated**

Series 2. Administrative files

Subseries 1. Chairmanship files, Physics, Math and Astronomy Division

- Box 2, Folder 7 **Planning, Division of Physics, Math and Astronomy (PMA) 1964-1970**
Box 2, Folder 8 **Division Chairmen's meetings, Administrative Council meetings 1965-1970**
Physical Description: Spiral-bound notebook.
- Box 2, Folder 9 **Provost, physics faculty meetings, new appointments, executive officer, executive officers' meetings 1967-1970**
Physical Description: Spiral-bound notebook.
- Box 2, Folder 10 **Instruction (teaching assignments) 1966-1970**
Physical Description: Spiral-bound notebook.
- Box 2, Folder 11 **High Energy Physics 1965-1970**
Physical Description: Spiral-bound notebook.
- Box 2, Folder 12 **Kellogg-Sloan (laboratories) 1966-1969**
Physical Description: Spiral-bound notebook.
- Box 2, Folder 13 **Solid state (physics) 1964-1969**
Physical Description: Spiral-bound notebook.
- Box 3, Folder 1 **Nuclear spectroscopy 1965-1967**
Physical Description: Spiral-bound notebook.
- Box 3, Folder 2 **Space physics 1965-1966**
Physical Description: Spiral-bound notebook.
- Box 3, Folder 3 **Astronomy 1965-1967**
Physical Description: Spiral-bound notebook.
- Box 3, Folder 4 **Radio astronomy 1965-1970**
Physical Description: Spiral-bound notebook.
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Subseries 2. Miscellaneous memos

- Box 3, Folder 5 **Memos: Robert Leighton: Divisional Activities on a Per Professor Basis 1971**
Box 3, Folder 6 **Memos: Robert F. Christy: Research involving Human Subjects; Faculty Growth at Caltech 1972-1973**
Box 3, Folder 7 **Memo: Jon Mathews: Courses and Teaching in 1973-1974 1973**
Box 3, Folder 8 **Memo: Robert A. Huttenback: Graduate and undergraduate degree programs in social science 1971**
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Series 3. Correspondence

Box 3, Folder 9 **A - L 1949-1958**
Box 3, Folder 10 **M - P 1944-1961**
Box 3, Folder 11 **R 1951-1960**
Box 3, Folder 12 **S 1951-1961**
Box 3, Folder 13 **T - V 1944-1961**
Box 3, Folder 14 **W - Z 1951-1961**
Box 4, Folder 1 **Butler, C. C. 1950-1953**
Box 4, Folder 2 **Continental Classroom 1959**

Note

Television course.

Box 4, Folder 3 **Lauritsen Memorial Lectures 1971-1975**
Box 4, Folder 4 **Neher, H. Victor 1951-1956**
Box 4, Folder 5 **Rossi, Bruno 1952-1954, 1980**
Box 4, Folder 6 **Shockley, William (1) 1962-1970**
Box 4, Folder 7 **Shockley, William (2) 1962-1970**
Box 4, Folder 8 **Sigma Xi (1) 1938-1940, 1957-1958**
Box 4, Folder 9 **Sigma Xi (2) 1938-1940, 1957-1958**
Box 4, Folder 10 **Sorrels, John D. 1973**
Box 4, Folder 11 **Thompson, R. W. 1954-1979**

Note

Includes 1 letter to E. W. Cowan, 1 letter to R. B. Leighton, and 1 letter from Isao Kita.

Box 4, Folder 12 **Wald, Edwin 1956-1957, 1961**
Box 4, Folder 13 **York, Carl 1952-1959**
Box 4, Folder 14 **Correspondence, miscellaneous 1970-1973**

Series 4. Technical files and biographical

- Box 5, Folder 1 **Student notebook, untitled 1929**
- Box 5, Folder 2 **Summaries and transcripts of articles by Kolhörster, Kolhörster and Bothe, and Skobelzyn 1923, 1927, 1929, 1932, undated**
- Box 5, Folder 3 **Magnetic field calculations undated (ca. 1930s)**
- Box 5, Folder 4 **Notes for talk, probably on cosmic rays undated (after 1939)**
- Physical Description:** Two sets of 3 x 5 cards.
- Box 5, Folder 5 **Notebook, Cosmic Rays, Vol. I 1942 Jun-Aug**
- Box 5, Folder 6 **Notebook, Cosmic Ray Data, B-29 flights 1947 Jul 2**
- Box 5, Folder 7 **Notebook, untitled, with loose papers 1970-1971**
- Box 5, Folder 8 **Reprints by Anderson and others 1934-1971**
- Note**
- Includes Reviews of Modern Physics special issue, Symposium on Cosmic Rays, U. of Chicago, June 1939.
- Box 5, Folder 9 **Reprint, Anderson and Neddermeyer, "Cosmic Ray Particles of Intermediate Mass," Physical Review 54 (1938); with note concerning discovery of muon and photograph 1938, 1987**
- Physical Description:** Photocopy of original article.
- Note**
- Includes cloud chamber photograph and 1987 MS note by Anderson with explanation of photo: a muon passing through a Geiger counter and stopping in a cloud chamber.
- Box 5, Folder 10 **Photographs of cosmic-ray research and World War II rocket project (See also: E. W. Cowan, description of Carl Anderson's photos) 1930s-1940s**
- Physical Description:** Prints and negatives made from original glass slides. Includes Carl Anderson's original captions.
- Note**
- Includes cloud chamber photos of positron, muon (μ -meson), and other particles; cosmic-ray apparatus; expedition to Pikes Peak, Colorado, summer 1935; and Holy Moses rocket damage to German tank.
- Box 5, Folder 11 **E. W. Cowan, description of Carl Anderson's photographs (See also: Photographs of cosmic-ray research and World War II rocket project) 1987 Dec 9**
- Physical Description:** Cassette tape and interview transcript.
- Box 5, Folder 12 **Project Moses (Holy Moses aircraft rocket) 1944, undated**
- Note**
- This rocket also known as HVAR 5.0" (high-velocity aircraft rocket).
- Box 5, Folder 13 **Interview with Carl Anderson on Caltech aircraft rocket program, World War II, by A. B. Christman, Naval Weapons Center, China Lake, California 1970 Oct 5**
- Physical Description:** Photocopy of interview transcript.
- Box 5, Folder 14 **Biographical sketch 1975**