

**Nuclear Physics Program Records, 1926-1963  
(Bulk 1933-1955)**



**Carnegie Institution of Washington  
Department of Terrestrial Magnetism Archives  
Washington, DC**

Finding aid written by:  
Ann Mulfort  
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**DTM-2004-05**

**Introduction**

*Abstract:* This collection contains the records of the Nuclear Physics Program of the Department of Terrestrial Magnetism at the Carnegie Institution of Washington, begun in the 1920s. Noteworthy activities included the construction of Van de Graaff generators and Cyclotron fixed frequency machines to conduct nuclear scientific experiments and contracted work up to, during, and after World War II. The program concluded in the 1970s.

*Microfilm Copies:* A microfilm copy of two laboratory notebooks filmed by the Smithsonian is in the DTM Microfilm Storage area. The High Voltage books 13 and 24 as well as the original drawing by Odd Dahl (1935) were loaned to the Smithsonian Institution from 1976-1982 for their exhibit: "Atom Smashers: Fifty Years."

*Extent:* 9.75 linear feet; 5 records center cartons, 4 document boxes, 1 flat box, 1 map drawer.

*Acquisition:* The bulk of the records were gathered in 1989 and 1994 from the files in the Cyclotron Building on the Broad Branch Campus of the Carnegie Institution of Washington, in preparation for the dismantling of the Cyclotron machine in 1994. An additional group of drawings was located in the Administrative files in 2004 and accessioned into the collection. In 2005, further materials were gathered from Dr. Brown's office and the Rock Crushing Room on the Broad Branch Campus, and were integrated.

*Access Restrictions:* There are no access restrictions to this collection.

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*Processing:* This collection was processed by Ann Mulfort, Library/Archives Intern through the generous support of the National Historical Publications and Records Commission.

**Administrative History**

The nuclear physics program of the Department of Terrestrial Magnetism (DTM) at the Carnegie Institution of Washington (CIW) began in the late 1920s and continued into the mid 1970s. This program was largely driven by Dr. Merle A. Tuve, who came to DTM in 1925 and became the director of the department in 1946. The earliest experiments, conducted by Tuve, Gregory Breit, L. R. Hafstad, and Odd Dahl, were done with the use of Tesla coils, but in the 1930s, the DTM group turned to Van de Graaff generators to provide the higher voltages necessary for their experiments. Three such accelerators were constructed in succession. Pioneering studies of proton-proton scattering were conducted in 1935 using a 2-meter Van de Graaff in the

Experiment Building, leading to an understanding of the strong nuclear force. Investigations of neutron-proton scattering followed.

The Atomic Physics Observatory was constructed in 1938 to house one million-volt pressure tank Van de Graaff generators that would subsequently host an historic event: a demonstration of uranium fission. This milestone was witnessed on January 28, 1939 by Tuve, Robert C. Meyer, Enrico Fermi, Richard Roberts, Leon Rosenfeld, Erik Bohr, Niels Bohr, Gregory Breit, and John Fleming, then DTM's director, and was reported by Robert Potter in *Science Service*, a Scripps' news service.

In 1940, DTM began construction of a 60" cyclotron, modeled after the Berkeley cyclotron, to produce isotopes for biomedical research. The estimated cost of the machine itself, completed by 1944, was \$500,000.

During the World War II years, Tuve served on Franklin Delano Roosevelt's Uranium Commission, while directing the Proximity Fuze project from DTM. In the post-war years, research using the Van de Graaffs resumed under N. P. Heydenburg. Studies of coulomb excitation and the discovery of deformed nuclei (1952-54) were noteworthy. The installation of a polarized proton source on the pressure-tank Van de Graaff by Louis Brown in 1962 opened the path to productive experimentation for another decade and a half. But extending the usefulness of the Atomic Physics Observatory beyond that would have required expensive modification and instrumentation, and the decision was made to terminate accelerator work around 1975.

The following is excerpted from Dr. Louis Brown's chapter on the cyclotron in the *Centennial History of the Carnegie Institution of Washington, Volume II, The Department of Terrestrial Magnetism*.

As the 1950s progressed the value of the DTM Cyclotron began to diminish. National laboratories began to furnish isotopes, both stable and radioactive for modest sums, leaving the cyclotron for those of lifetimes too short to allow shipment...The machine made its last isotopes in 1957 and was shut down for modifications that were never completed. Modern spiral-ridge cyclotrons...have made the "classic" cyclotron hopelessly obsolete. Curiously, the older pressure-tank Van de Graaff continued to be a useful research instrument until the early 1970s.

DTM's cyclotron was dismantled in 1994; the cyclotron vault was completely renovated and currently houses DTM's ion microprobe laboratory. Nuclear physics thereby ceased to be a research area of the Department by the mid 1970s.

### **Scope and Contents**

This collection contains roughly 50 years of experimental nuclear physics work performed by the Department of Terrestrial Magnetism. It includes scientific laboratory notebooks, correspondence, extensive blueprints and drawings, and ephemera consisting of photographs, a scrapbook and a guest book. These materials are housed in five records center cartons, four document boxes, an entire map drawer and a large flat box.

## **Arrangement**

The collection is arranged in four series.

Series 1. Laboratory Notebooks, n.d., 1926-1963

Series 1, Subseries 1: Cyclotron Notebooks, 1944-1961

Series 1, Subseries 2: High Voltage Notebooks, 1926-1927, 1929-1938

Series 1, Subseries 3: General Notebooks, n.d., 1926-1963

Series 2. Correspondence, n.d., 1931-1959

Series 3. Blueprints and Drawings, n.d., 1931, 1934-1943, 1946, 1948-1949, 1951, 1958, 1961

Series 4. Ephemera, n.d., ca. 1927-1933, 1947-1955

### **Series 1: Laboratory Notebooks, n.d., 1926-1963**

This series contains the experimental laboratory notebooks of scientists conducting research for the Carnegie Institution of Washington. Many of the notebooks contain documentation of experiments, graphs and loose notes inserted by the scientists. To facilitate preservation and research, the loose notes were removed and placed behind the notebooks in the folder. They are numbered in pencil on the upper right side of image to match the pages from where they were removed.

#### **Series 1, Subseries 1: Cyclotron Notebooks, 1944-1961**

This subseries contains the logs of the cyclotron's usage, including the contracting party, the target result, the machine usage time and remarks. These could have been used for billing purposes. The logbooks are arranged in numerical and chronological order.

#### **Series 1, Subseries 2: High Voltage Notebooks, 1926-1927, 1929-1938**

This subseries contains data on high voltage work. The work detailed in these notebooks was the first work performed on the high-powered generators, beginning with the Tesla coils. These notebooks are arranged in numeric order.

#### **Series 1, Subseries 3: General Notebooks, n.d., 1926-1963**

There are many impressive notebooks in this subseries. Some include the Van Allen work conducted cooperatively with Norman F. Ramsey, who later received a Nobel Peace Prize in 1989 for his work in physics. Also included is the notebook used by Robert Potter, who was a science journalist, and conducted research at Carnegie Institution of Washington to inform his writing. S. J. Buynitzky was a Senior Technician for DTM and his notebook provides a log of Cyclotron Control Desk activities. A grouping of Buynitzky's electrical circuit drawings are found in Series 3. These notebooks are arranged in alphabetical order by title.

### **Series 2: Correspondence, n.d., 1931-1959**

This series contains correspondence to and from worldwide colleagues, clippings and scientific data that chronicle this program and its personnel. It includes annual supply purchases, Cyclotron specifications and quotation requests, and information from the U.S. Atomic Energy Commission. Throughout these folders, many copies of minor purchase orders were removed from the collection. The second Cyclotron 4 folder includes a seven page "Check list for DTM Cyclotron drawings," created in 1947, which was used to arrange the drawings found in Series 3.

The correspondence in this series is arranged first by the yearly departmental files; then, alphabetically by title of folder.

**Series 3: Blueprints and Drawings, n.d., 1931, 1934-1943, 1946, 1948-1949, 1951, 1958, 1961**

This series contains over 200 blueprints and drawings related to the construction of the Atomic Physics Observatory and the Cyclotron Building, as well as instrument schematics. They detail the enormity of these projects. A notebook titled "Cyclotron designs and instructions" contains additional cyclotron machine drawings. The cyclotron machine blueprints and drawings were used and housed in the Cyclotron Building while the other drawings were held in the Administrative Building.

A seven page "Check list DTM Cyclotron drawings," created in 1947, is found in Series 2. The drawings are arranged according to the headings found in this checklist. The checklist uses the "common" name of the drawing which is often different than the formal drawing title. An annotated copy of the checklist used by the archivist to inventory the drawings is found in the control file. Following the drawings included in the checklist are the Atomic Physics Observatory blueprints, the cyclotron design notebook, the original drawing by Odd Dahl of the proton-proton scattering chamber. The series concludes with other drawings.

**Series 4: Ephemera, n.d., ca. 1927-1933, 1947-1955**

This series contains a scrapbook presumably created by M.A. Tuve containing photographs and scientific data relating to the Tesla apparatus and the Van de Graaff generator. The guest book lists names and institutions of visitors from around the world. The photographs detail the cyclotron, its control panel, and the laboratory that housed it.

## Folder Listing

	<u>Box</u>	<u>Folder</u>
<b>Series 1: Laboratory Notebooks, n.d., 1926-1963</b>		
<b>Series 1, Subseries 1: Cyclotron Notebooks, 1944-1961</b>		
Cyclotron, 1952-1961	1	1
Cyclotron Record, Index, 1944-1953		2
Cyclotron Record, v. 1, 1944-1945		3
Cyclotron Record, v. 2, 1945		4
Cyclotron Record, v. 3, 1945		5
Cyclotron Record, v. 4, 1945-1946		6
Cyclotron Record, v. 5, 1946		7
Cyclotron Record, v. 6, 1947		8
Cyclotron Record, v. 7, 1947-1948		9
Cyclotron Record, v. 8, 1948		10
Cyclotron Record, v. 9, 1948-1949		11
Cyclotron Record, v. 10, 1949-1950		12
Cyclotron Record, v. 11, 1950-1951		13
Cyclotron Record, v. 12, 1951		14
Cyclotron Record, v. 13, 1951-1952		15
Cyclotron Record, v. 14, 1952-1953		16
Cyclotron Record, v. 15, 1953-1954		17
Cyclotron Record, v. 16, 1955-1956		18
Cyclotron Record, v. 17, 1957-1961		19
<b>Series 1, Subseries 2: High Voltage Notebooks, 1926-1927, 1929-1938</b>		
Tesla Book 1, 1926-1927	8	1
Tesla Book 2, 1927		2
Tesla Book 3, 1929-1930		3
Tesla Book 4, 1930		4
Tesla Book 5, Protons etc., FP-54 – First BK, 1930-1931		5
Tesla Book 6; High Voltage Laboratory Notes, Calibration of H etc., 1930-1931		6
Tesla Book 7A, 1930-1931		7
Tesla Book 7B, Big Tank, 1931-1932		8
Tesla Book 8 High Voltage, 1932		9
BK 9, 1931-1933		10
BK 10 Miscellaneous experimental data related to high voltage work, 1932-1933		11
BK 11 Electrical Detection of H.V. particles; FP-54 – 2 <sup>nd</sup> Bk; Linear Amplification Counter LAC #2, 1931-1933		12
BK 12 High Voltage (2 <sup>nd</sup> Book), 1933		13
BK 13 Two Meter Generator Installation, 1933-1934	2	1
BK 13X Blood Counts, X-ray exposure of personnel, 1930-1933	8	14
BK 14 Two Meter Generator (2 <sup>nd</sup> Book), Con't from BK 13, 1934	2	2
BK 14-1 One Meter Generator (Capillary Ion Source Tube Focus), 1933-1935		3
BK 15 Nuclear Physics Results, 1933-1934	8	15

	<u>Box</u>	<u>Folder</u>
BK 16 Capillary Ion Source and Focussing, 1934	2	4
BK 17 Wells Cloud Chamber, 1933-1934	8	16
BK 19 Be-no Negative Protons, Resonance by Protons, 1934-1935	2	5
BK 20 Calibration Data, Con't from BK 19, 1934-1935		6
BK 21 Cloud Chamber Work, 1935		7
BK 22, 1935	8	17
BK 23 Voltmeter Porcelains, Herb, etc., 1935-1938	2	8
BK 23 Pressure Tests, etc./Wave Front Method, 1935-1936		9
BK 24 Proton Scattering, 1934-1935		10
BK 25 Proton Scattering, Con't., 1936		11
BK 27 Neutron Scattering, etc. [Amaldi], 1936		12
<b>Series 1, Subseries 3: General Notebooks, n.d., 1926-1963</b>		
1,000,000 Volt Generator, 1939-1947	3	1
5,000,000 Volt Generator, 1939-1940		2
5MV Generator/4MV Statitron, 1940-1942, 1946		3
Alpha Alpha Scattering, Book I, 1951-1952		4
Alpha Alpha Scattering, Book II, 1952-1953		5
Alpha Reactions, Book I [Heydenburg], 1951-1952		6
Alpha Reactions, Book I [Trumble], 1953		7
Alpha Reactions, 1953		8
Angular Distribution #1, 1942-1943		9
Angular Distribution #2, 1946-1947		10
Angular Distribution #3, 1947		11
[Atomic Physics Observatory] APO-2, 1939		12
Be <sup>7</sup> + Slow Neutron Scattering, 1938		13
Calculated Nuclear Scattering/Summary and Tables, 1932-1934		14
Calculations of Nuclear Scattering, 1931-1933	9	1
[Coulomb] Electric Excitation of Nuclei, I, 1953	3	15
Coulomb Excitation, II, 1953-1954		16
Coulomb Excitation, III, 1954		17
Coulomb Excitation, VI, 1955		18
Coulomb Excitation, VII, 1955		19
Coulomb Excitation, VIII, 1955-1956		20
FP-54 Counts – Sources – Foils, 1934		21
FP-54 Hopkins DTM, 1927, 1931		22
Geiger-Müller Tube-Counters 1930-1932		23
Geiger-Müller Zählrohr Book I, 1926, 1929-1930	9	2
Lab Orders, 1929-1934		3
[Linear Amplifier Counter] LAC-I 1932-1934	4	1
Neutron Scattering, 1937	9	4
NP Scattering and n-c Scattering, 1947	4	2
Proton-Helium Scattering, 1940		3
Proton-Proton Scattering, 1938-1940		4
Proton-Proton Scattering, I [Heydenburg], 1948-1949		5



	<u>Box</u>	<u>Folder</u>
Proton-Proton Scattering, 2 [Heydenburg], 1949-1950	4	6
Proton Scattering, 1937		7
Proton Scattering, 1937-1938		8
Proton Scattering, 1938		9
Proton Scattering, #3, 1951-1953		10
Proton Scattering Groups, n.d.		11
Proton Scattering in H <sub>2</sub> , He + Argon, #2, 1950-1951		12
Red Shift Experiments, 1950-1951, 1963		13
Robert Potter 1939-1940		14
S. J. Buynitzky, 1941-1948		15
Salant-Ramsey 1939		16
Seidenspinner; Ionization Chamber, 1931-1933	9	5
Van Allen, 1940	4	17
Van Allen-Ramsey, 1939-1940		18
Voltage Stabilizer 1937-1938		19
Wang C+D Neutron Scattering, etc, 1938-1939		20

	<u>Box</u>	<u>Folder</u>
<b>Series 2: Correspondence, n.d., 1931-1959</b>		
1946	5	1
1947		2
1948		3
1949		4
1950		5
1951		6
1952		7
1953		8
1954		9
1955		10
1956		11
1957		12
1958		13
1959		14
American Rolling Mill Co., 1939-1940		15
Amplifier I & II, 1931-1939		16
Cascade Branching Revised [Temmer?], 1955-1956, n.d.	9	6
Coulomb Excitation of enriched Xe samples, 1957		7
[Coulomb Excitation studies], 1957, n.d.	10	1
Coulomb Excitation Theory Calculations [Temmer?], 1954, n.d.		2
Cyclotron 1, 1939	5	17
Cyclotron 2, 1939	6	1
Cyclotron 3, 1939-1940		2
Cyclotron 4, (1 of 2), 1940-1941		3
Cyclotron 4, (2 of 2), 1942-1953		4
Cyclotron: Signal Engineering Relays, 1938-1939		5

	<u>Box</u>	<u>Folder</u>
Expired Isotope Loans, 1954-1955	6	6
Fe <sup>57</sup> [Heydenburg correspondence], 1956	10	3
Inelastic Proton Scattering, June July, 1951, n.d.		4
Isotopes on Order, 1954-1955	6	7
Latest Edition, 1938-1939		8
Letter Copies [Heydenburg], 1936-1943, 1948		9
Log Plots of Gamma Ray Distributions, 1954, 1956, n.d.	10	5
Miscellaneous – [Drawings, Calculations], Blueprints & etc., 1935, 1939, n.d.		6
Na <sup>22</sup> levels, 1958, n.d.		7
Report of radiation cataract survey; Preliminary draft, n.d.		8
Revised B & B values (calculations), ca. 1954, n.d.		9
Scattering experimentsw, 1935-1936, 1938, n.d.		10
Specifications for Cyclotron Laboratory, 1939	7	1
Ta & W data and analysis, 1955-1956, n.d.	10	11
[Tuve's publications], 1936-1938		12

	<u>Box</u>	<u>Folder</u>
<b>Series 3: Blueprints and Drawings, n.d., 1931, 1934-1943, 1946, 1948-1949, 1951, 1958, 1961</b>		
Cyclotron Drawings, (1 of 3), C14B-C70, n.d., 1939-1943	Map Drawer 7	1
Cyclotron Drawings, (2 of 3), C71-C118, n.d., 1939-1943		2
Cyclotron Drawings, (3 of 3), C119-C171, n.d., 1939-1943		3
S.J.B. Drawing Index for Electrical Circuits, n.d., 1942-1943, 1948-1949, 1951, 1961		4
Archives Drawings, 1939		5
Architects Drawings, 1939		6
Architects Drawings Revised, 1939		7
Electrical Layout, 1939		8
Plumbing and Heating, 1939		9
Not Classified, 1939-1940		10
General Electric Co. Drawings, 1939-1940		11
American Rolling Mill Co. Drawings, 1939		12
Westinghouse Electric and Mfg. Company Drawings, 1941		13
A.F. Jorss Iron Works, Inc., 1942		14
Drawings in Book II, 1940		15
Atomic Physics Observatory: Building Plans, 1936-1938, n.d.		16
Atomic Physics Observatory: Plans for Equipment, 1935-1938, n.d.		17
Atomic Physics Visual Aids, n.d.		18
Cyclotron Designs & Instructions Notebook, n.d.	7	2
Original Drawing of Proton-Proton Scattering Chamber [Dahl], 1935	Map Drawer 7	19
Other Drawings, n.d., 1931, 1934, 1936, 1938-1941, 1946, 1948, 1958		20

	<u>Box</u>	<u>Folder</u>
<b>Series 4: Ephemera, n.d., ca. 1927-1933, 1947-1955</b>		
Photographs of cyclotron and laboratory, n.d.	6	10
Guest book, n.d., 1947-1955	7	
Scrapbook, ca. 1927-1933	7	

### Subject Terms

Topics:       Coulomb excitation  
                   Cyclotrons  
                   Nuclear physics  
                   Protons—Scattering  
                   Tesla coils  
                   Van de Graaff generator

Corporate Names:    Carnegie Institution of Washington. Dept. of Terrestrial Magnetism.

Personal Names:     Heydenburg, Norman Paulson, 1908-  
                             Tuve, Merle Antony, 1901-1982.

Forms:            Albums  
                       Blueprints  
                       Correspondence  
                       Laboratory Notebooks  
                       Photographs  
                       Plans (drawings)

### Bibliography

Brown, L., *Centennial History of the Carnegie Institution of Washington, Volume II, The Department of Terrestrial Magnetism*. Cambridge University Press. In press, 2004

Cornell, T. D., Merle Antony Tuve: Pioneer Nuclear Physicist, *Physics Today* 41 (no. 1), 1-8, 1988.

## **Related Collections**

Small caps denote series names.

*Department of Terrestrial Magnetism General Files, 1904-Present.* Department of Terrestrial Magnetism, Carnegie Institution of Washington. See the following folder titles in this collection:

- Atomic Physics
- Cyclotron
- Cyclotron Contracts
- Cyclotron Laboratory
- High Voltage
- Nuclear
- Proximity Fuze
- Van de Graaff generator

ARCHIVES for these folder titles:

- Atom. Phys. Obs.
- Blood Count Reports
- Correspondence re: Radioactive Exposure
- Cyclotron
- Cyclotron Utilization
- Exposure Reports, Film Badges
- Nuclear Physics
- Personnel Protection
- Radiation Protection
- Radiological Safety
- Uranium

PRESS CLIPPINGS.