

Arthur H. Compton – Biography



Arthur Holly Compton was born at Wooster, Ohio, on September 10th, 1892, the son of Elias Compton, Professor of Philosophy and Dean of the College of Wooster. He was educated at the College, graduating Bachelor of Science in 1913, and he spent three years in postgraduate study at [Princeton University](http://www.princeton.edu) <<http://www.princeton.edu>> receiving his M.A. degree in 1914 and his Ph.D. in 1916. After spending a year as instructor of physics at the [University of Minnesota](http://www.umn.edu) <<http://www.umn.edu>>, he took a position as a research engineer with the Westinghouse Lamp Company at Pittsburgh until 1919 when he studied at [Cambridge University](http://www.cam.ac.uk) <<http://www.cam.ac.uk>> as a National Research Council Fellow. In 1920, he was appointed Wayman Crow Professor of Physics, and Head of the Department of Physics at the [Washington University, St. Louis](http://www.wustl.edu) <<http://www.wustl.edu>>; and in 1923 he moved to the [University of Chicago](http://www.uchicago.edu) <<http://www.uchicago.edu>> as Professor of Physics. Compton returned to St. Louis as Chancellor in 1945 and from 1954 until his retirement in 1961 he was Distinguished Service Professor of Natural Philosophy at the Washington University.

In his early days at Princeton, Compton devised an elegant method for demonstrating the Earth's rotation, but he was soon to begin his studies in the field of X-rays. He developed a theory of the intensity of X-ray reflection from crystals as a means of studying the arrangement of electrons and atoms, and in 1918 he started a study of X-ray scattering. This led, in 1922, to his discovery of the increase of wavelength of X-rays due to scattering of the incident radiation by free electrons, which implies that the scattered quanta have less energy than the quanta of the original beam. This effect, nowadays known as the *Compton effect*, which clearly illustrates the particle concept of electromagnetic radiation, was afterwards substantiated by C. T. R. Wilson who, in his cloud chamber, could show the presence of the tracks of the recoil electrons. Another proof of the reality of this phenomenon was supplied by the coincidence method (developed by Compton and A.W. Simon, and independently in Germany by W. Bothe and H. Geiger), by which it could be established that individual scattered X-ray photons and recoil electrons appear at the same instant, contradicting the views then being developed by some investigators in an attempt to reconcile quantum views with the continuous waves of electromagnetic theory. For this discovery, Compton was awarded the Nobel Prize in Physics for 1927 (sharing this with C. T. R. Wilson who received the Prize for his discovery of the cloud chamber method).

In addition, Compton discovered (with C. F. Hagenow) the phenomenon of total reflection of X-rays and their complete polarization, which led to a more accurate determination of the number of electrons in an atom. He was also the first (with R. L. Doan) who obtained X-ray spectra from ruled gratings,

which offers a direct method of measuring the wavelength of X-rays. By comparing these spectra with those obtained when using a crystal, the absolute value of the grating space of the crystal can be determined. The Avogadro number found by combining above value with the measured crystal density, led to a new value for the electronic charge. This outcome necessitated the revision of the [Millikan <./1923/index.html>](#) oil-drop value from 4.774 to 4.803×10^{-10} e.s.u. (revealing that systematic errors had been made in the measurement of the viscosity of air, a quantity entering into the oil-drop method).

During 1930-1940, Compton led a world-wide study of the geographic variations of the intensity of cosmic rays, thereby fully confirming the observations made in 1927 by J. Clay from Amsterdam of the influence of latitude on cosmic ray intensity. He could, however, show that the intensity was correlated with geomagnetic rather than geographic latitude. This gave rise to extensive studies of the interaction of the Earth's magnetic field with the incoming isotropic stream of primary charged particles.

Compton has numerous papers on scientific record and he is the author of *Secondary Radiations Produced by X-rays* (1922), *X-Rays and Electrons* (1926, second edition 1928), *X-Rays in Theory and Experiment* (with S. K. Allison, 1935, this being the revised edition of *X-rays and Electrons*), *The Freedom of Man* (1935, third edition 1939), *On Going to College* (with others, 1940), and *Human Meaning of Science* (1940).

Dr. Compton was awarded numerous honorary degrees and other distinctions including the Rumford Gold Medal ([American Academy of Arts and Sciences <http://www.amacad.org>](#)), 1927; Gold Medal of Radiological Society of North America, 1928; Hughes Medal (Royal Society) and Franklin Medal (Franklin Institute), 1940.

He served as President of the [American Physical Society <http://www.aps.org>](#) (1934), of the American Association of Scientific Workers (1939-1940), and of the [American Association for the Advancement of Science <http://www.aaas.org/>](#) (1942).

In 1941 Compton was appointed Chairman of the [National Academy of Sciences <http://www.nas.edu>](#) Committee to Evaluate Use of Atomic Energy in War. His investigations, carried out in cooperation with [E. Fermi <./1938/index.html>](#), L. Szilard, [E. P. Wigner </physics/laureates/1963/index.html>](#) and others, led to the establishment of the first controlled uranium fission reactors, and, ultimately, to the large plutonium-producing reactors in Hanford, Washington, which produced the plutonium for the Nagasaki bomb, in August 1945. (He also played a role in the Government's decision to use the bomb; a personal account of these matters may be found in his book, *Atomic Quest - a Personal Narrative*, 1956.)

In 1916, he married Betty Charity McCloskey. The eldest of their two sons, Arthur Allen, is in the American Foreign Service and the youngest, John Joseph, is Professor of Philosophy at the [Vanderbilt University <http://www.vanderbilt.edu/>](#) (Nashville, Tennessee). His brother Wilson is a former President of the [Washington State University <http://www.wsu.edu/>](#), and his brother Karl Taylor was formerly President of the [Massachusetts Institute of Technology <http://web.mit.edu/>](#).

Compton's chief recreations were tennis, astronomy, photography and music.

He died on March 15th, 1962, in Berkeley, California.

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This autobiography/biography was written at the time of the award and later published in the book series [Les Prix Nobel](http://nobel/nobel-foundation/publications/lesprix.html) [/Nobel Lectures](http://nobel/nobel-foundation/publications/lectures/index.html)

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