

PIERRE AUGER—A LIFE IN THE SERVICE OF SCIENCE

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A short biography of Pierre Auger, the discoverer of the atomic auger electron effect, is given. Professor Auger's outstanding professional career covered physics, nuclear power and space research, organization and administration of research, diplomatic services and pedagogics but also extended into modern biology, humanistic sciences, poetry and arts. Part of a speech in Paris of professor Auger held in 1989 on the theme 'Research and Creativity' at an international symposium on the auger effect is included in this biography as well as one of his poems.

Pierre Victor Auger was born on May 14, 1899 (1) and passed away on December 24, 1993 in Paris at an age of 94 years. His outstanding career extended over physics, nuclear power and space research, organization and administration of research, diplomatic services and pedagogics. He took the initiative to the Palais of Discovery in Paris. He led a popular program on modern science in the French radio every week for many years. In 1951, he published a book, *The microscopic human* where he described the modern molecular biology to the public and in 1961 the book *Main trends in Scientific Research*.

From the onset of his scientific work in 1922 Pierre Auger took an interest in the cloud chamber method discovered by Wilson and applied it to studying the photoelectric effect produced by x-rays on gas atoms. The Wilson method provided him with the most direct means of obtaining detailed information on the photoelectrons produced, since their trajectories could be followed when leaving the atom that had absorbed the quantum of radiation. He filled the chamber with hydrogen, which has a very low x-ray absorption coefficient, and a small proportion of highly absorbent and chemically neutral heavy gases, such as krypton and xenon. Auger observed some reabsorption in the gas, but most often found that the

expected electron trajectory started from the positive ion itself. Numerous experiments enabled Auger to show that the phenomenon is frequent and amounts to non-radiative transitions among the electrons of atoms ionized in

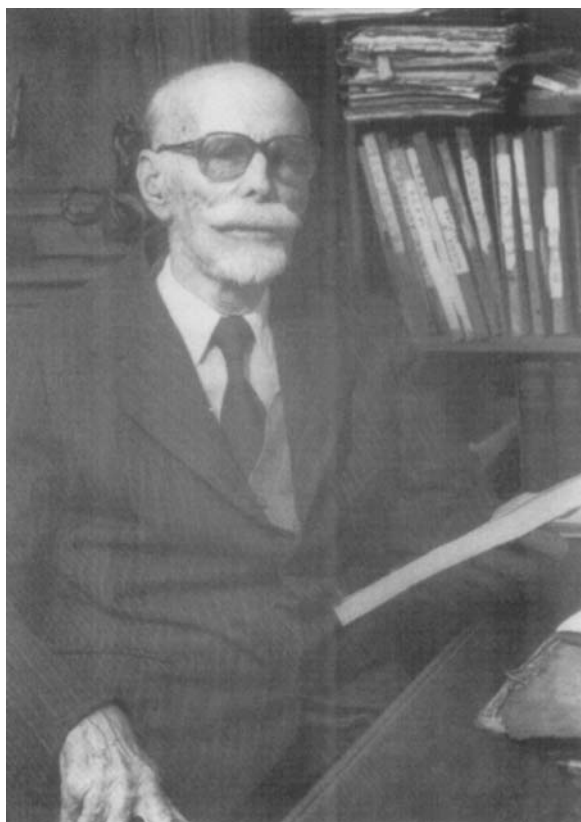


Figure. Pierre Victor Auger, May 14, 1899–December 24, 1993.

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depth. This phenomenon was named the Auger effect, and the corresponding electrons Auger electrons. His discovery was published in the French scientific journal *Comptes Rendus* as a note titled 'On secondary beta-rays produced in a gas by x-rays' (1925; 180: 65–8). He was awarded several scientific prizes and was also a nominee for the Nobel Prize in physics which however, he never received. He was a member of the French Academy of Science. Pierre Auger was certainly one of the great men who created the 20th century in science.

Research and creativity

In Paris, March 30–31, 1989 a symposium on the Auger effect was held in honour of professor Pierre Auger in celebration of his 90th birthday, organized by the University Pierre and Marie Curie and sponsored by the French Government. The author of this biography attended the symposium which dealt with surface, solid state, chemical, atomic and molecular physics. Professor Auger then spoke on the theme 'Research and Creativity'. In his speech he described his professional achievements as follows:

If I could characterize by a single word the principal trends of my activities in research and in the creation of national and international organizations, that word would be *novelty!*

Thus, after my university studies and admission as research scientist, I renounced teaching as a career in order to dedicate my efforts to scientific research, in particular the search for new effects. Upon joining Jean Perrin's laboratory in the 1920's I began by constructing, with my friend Francis Perrin, the first Wilson cloud chamber in France.

Following a suggestion of my boss Jean Perrin, I changed the experimental conditions to obtain, as he used to say in French, 'la région des truffes', and noticed, in the cloud chamber snapshots, that photoelectron trajectories created along a beam of x-rays contained a tiny group small droplets at the start of each trajectory. A group of ions which should not have been there! I replaced the gas in the chamber by wet hydrogen in order to lengthen the electron tracks, and observed in my photographs that the little group of drops lengthened into a new, very short trajectory, quite well visible, and which originated at the same point as that of the photoelectron. It was a new phenomenon, unexpected, in effect, the one that now bears my name.

By adding to the hydrogen atmosphere heavy atoms of such elements krypton or xenon, I saw the additional tracks lengthening, indicating that the new electron had an energy that was characteristic of the atom absorbing the x-ray, and increased with atomic mass. The exploitation of an initially unexpected result by changing the experimental conditions is certainly one of the most fruitful processes in research.

In the 1930's I used the same method in the course of a study of neutron energies emitted by a polonium-beryllium source. The energy spectrum observed was continuous and hence not of the type by then usually seen in radioactive decay. Neutrons were emitted from the beryllium nucleus in collision with the alpha particles without the latter being captured. It was the first examples of a phenomenon now known as spallation.

I then became interested in cosmic rays, and started with a measurement of the intensity of these rays, using a Geiger counter,

along the path crossing the equator between Le Havre and Buenos Aires. This work, done in collaboration with Louis Leprince-Ringuet, demonstrated clearly the effect of the earth's magnetic field on cosmic rays. It was later on that I wanted to evaluate the extent of these showers by studying cosmic ray showers created in a lead screen by the observation of coincidences in two or three counters as a function of their separation. It was a surprise to observe coincidences when the counters were separated by more than one meter. Suspecting a new phenomenon, I decided to go whole hog, if I may so express myself, and thanks to the technical help of Roland Maze, we placed one of the counters in another building, more than one hundred and fifty meters away on rue Pierre Curie where my laboratory was. And there were still coincidences! It was the discovery of 'cosmic ray showers'. By pursuing this work at high altitudes, in order to increase the cosmic ray intensity, I showed that the showers covered more than a hectare in extent, and hence the number of particles making up the showers was such that the energy of the primary particle which originated the 'giant shower' must have been more than a million billion electron-volts. That was nearly a billion times greater than the energies of particles accelerated by cyclotrons in these days. These showers are sometimes called 'extensive Auger showers'.

Professor Auger's speech, given without manuscript as he was now blind, was extremely well received by the audience of the symposium, including the representative of the French Government, Professor H. Curien, Minister of Research.

Organization of international collaboration

In 1940, professor Auger's work was interrupted by World War II. He succeeded in leaving the occupied France and went to Canada with his family. In Montreal he studied nuclear physics and energy as a member of the Franco-Anglo-Canadian Atomic Energy Research Group in order to prepare, after the war, the entry of France into the atomic age.

Upon his return to France in 1945, he was named Director General of the French Ministry of Education, and that was the beginning of his civil service career, at the national and international levels. During this period he was able to realize a number of innovations in this area.

Thus, from 1945 until 1948, he founded, in collaboration with teaching colleagues, the National Higher Schools for Engineers (ENSI). He also founded the sixth section of the Practical School of Higher Studies (EPHE) thanks to considerable support from the Rockefeller Foundation. The sixth section has now become an independent organization dedicated to sciences of man.

In 1945, Pierre Auger also created, together with Frédéric Joliot, the French Atomic Energy Commission (CEA). He also established the University Consulting Committee which allowed delegates from all French universities to come together and collaborate in the establishment of criteria for higher education, and introduced into the Sorbonne University the new sciences of genetics, electronics and biophysics.

In 1948 he joined UNESCO to direct its department of sciences, and presided, with the help and advice of the great physicists Rabi and Amaldi, over the establishment of the European Organization for Nuclear Research (CERN) in Geneva.

These promotions of international organizations was followed in molecular biology by the creation of European Molecular Biology Organization (EMBO), and in computer science by the International Center for Computation. After his retirement from UNESCO in 1959, he dedicated himself to the problems of space research, such as the establishment of the French National Space Study Center (CNES), and as director general of the European Space Research Organization (ESRO; now ESA). In all professor Auger could claim the establishment or promotion of nine national or international organizations related to scientific research.

After his final retirement in 1970, he dedicated time and energy to scientific and cultural matters. He continued with radio broadcasts on the popularization of different scientific topics. He also published a collection of poems, two volumes of dialogues between an imaginary scientist and a humanist, and, finally, he sculptured some twenty small cast bronze statues.

A poem

The following poem of Pierre Auger (2) reflects his searching mind:

The palm tree waves a handkerchief
At me a passer-by,
Is it for happiness or grief?
A welcome or goodbye?
You may ask why I am so keen
In following up that line
But I should know just what they mean.
The trees are friends of mine
And when I touch and kiss their bark,
Warm on the sunny side,
I close my eyes and do embark
On a fantastic ride.
The wings of the palm beat the air
Out of the world we fly
A single being though a pair
We are welcome in the sky.

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