

📖 Topic Page: [Fermi, Enrico \(1901 - 1954\)](#)

Definition: **Fermi, Enrico** from *Philip's Encyclopedia*

US physicist, b. Italy. He spent his early career in Italy developing, independently of Paul Dirac, a form of quantum statistics now known as **Fermi-Dirac statistics**. In 1940 Fermi produced the first synthetic transuranic element, neptunium. In 1942, he built the world's first nuclear reactor and produced the first controlled, self-sustaining nuclear chain reaction. At Los Alamos, Fermi worked on the Manhattan Project to develop the atomic bomb. Fermi received the 1938 Nobel Prize in physics for his work on the bombardment of uranium by neutrons. The element fermium was named after him.

Summary Article: **Fermi, Enrico (1901-1954)**

From *The Hutchinson Dictionary of Scientific Biography*

Place: Italy

Subject: biography, physics

Italian-born US physicist best known for bringing about the first controlled chain reaction (in a nuclear reactor) and for his part in the development of the atomic bomb. He also carried out early research using slow neutrons to produce new radioactive elements, for which work he was awarded the 1938 Nobel Prize for Physics.

Fermi was born in Rome on 19 September 1901, the son of a government official. He was educated at the select Reale Scuola Normale Superior in Pisa (which he attended from 1918) and went on to the University of Pisa, receiving his PhD in 1929 for a thesis on X-rays. He then travelled to Göttingen University, where he worked under Max Born, and to Leiden University, where he studied with P Ehrenfest. He became a mathematics lecturer at the University of Florence in 1924, and two years later he was appointed professor of theoretical physics at Rome University. Fermi married a Jewish woman in 1928 and during the 1930s became alarmed by increasing antisemitism in fascist Italy under Benito Mussolini. After the Nobel Prize ceremony in Stockholm in 1938 Fermi did not return to Italy but went with his wife and two children to the USA, where he took up an appointment in New York at Columbia University. In 1941 he and his team moved to Chicago University where he began building a nuclear reactor, which first went 'critical' at the end of 1942. He became involved in the Manhattan Project to construct an atomic bomb, working mainly at Los Alamos, New Mexico. At the end of World War II in 1945 Fermi became a US citizen and returned to Chicago to continue his researches as professor of physics. He died there, of cancer, on 28 November 1954.

Fermi first gained fame soon after his Rome appointment with his publication *Introduzione alla fisica atomica* (1928), the first textbook on modern physics to be published in Italy. His experimental work on beta decay in radioactive materials provided further evidence for the existence of the neutrino (as predicted by Wolfgang Pauli) and earned him an international reputation. The decay, which takes place in the unstable nuclei of radioactive elements, results from the conversion of a neutron into a proton, an electron (beta particle), and an antineutrino.

Following the work of Irène and Frédéric Joliot-Curie, who discovered artificial radioactivity in 1934 using alpha-particle bombardment, Fermi began producing new radioactive isotopes by neutron bombardment. He found that a block of paraffin wax or a jacket of water round the neutron source

produced slow, or 'thermal', neutrons that are more effective at producing such elements. This was the work that earned him the Nobel Prize. He did, however, misinterpret the results of experiments involving neutron bombardment of uranium, and it was left to Lise Meitner and Otto Frisch in Sweden to explain nuclear fission in 1938.

In the USA Fermi continued the work on the fission of uranium (initiated by neutrons) by building the first nuclear reactor, then called an atomic pile because it had a moderator consisting of a pile of purified graphite blocks (to slow the neutrons) with holes drilled in them to take rods of enriched uranium. Other neutron-absorbing rods of cadmium, called control rods, could be lowered into or withdrawn from the pile to limit the number of slow neutrons available to initiate the fission of uranium. The reactor was built on the squash court of Chicago University, and on the afternoon of 2 December 1942 the control rods were withdrawn for the first time and the reactor began to work, using a self-sustaining nuclear chain reaction. Two years later the USA, through a team led by Arthur Compton and Fermi, had constructed an atomic bomb, which used the same reaction but without control, resulting in a nuclear explosion.

Element number 100 - discovered in 1955, a year after Fermi died - was named fermium, and his name is also honoured in the fermi, a unit of length equal to 10^{-15} m.

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