

The multifaceted life of Pontecorvo

A symposium in Rome celebrated the centenary of Bruno Pontecorvo. Luciano Maiani was one of the speakers.

Résumé

Bruno Pontecorvo, physicien aux multiples facettes

Un colloque s'est tenu à Rome en septembre pour célébrer le centenaire de la naissance de Bruno Pontecorvo, qui faisait partie de la petite équipe de jeunes chercheurs d'exception ayant travaillé sous la supervision d'Enrico Fermi à Rome. Les conférences ont traité des nombreux aspects de la vie scientifique de Pontecorvo, marquée par la passion profonde et lucide du chercheur pour la science, ainsi que par sa contribution importante à de nombreux domaines de la physique nucléaire et de la physique des particules. Luciano Maiani, l'un des conférenciers, rappelle les points forts du colloque, notamment la découverte d'un journal de bord que Pontecorvo a rédigé peu après son arrivée à Doubna en 1950.



Fig. 1.

Bruno Pontecorvo (1913-1993) was born in Pisa but his scientific life began in Rome, when he was accepted into the group of physicists working at Sapienza University of Roma with Enrico Fermi. It was a small but exceptional group of young people attracted by the strong personality of Fermi, who were later known as "the boys of Via Panisperna" from the name of the street where the physics institute was located at that time. Pontecorvo arrived in Rome in time to participate in the discovery of radioactivity induced by slow neutrons, for which Fermi was to receive the Nobel Prize in Physics in 1938. A famous picture shows the group at the time of the discovery, with the notable absence of Bruno (figure 1). This was for good reason - he was behind the camera, taking the picture.

On 11-12 September 2013, Sapienza University of Rome celebrated Pontecorvo's centenary with an international scientific symposium - The Legacy of Bruno Pontecorvo: the Man and the Scientist. (Another was held later in Pisa.) Inaugurated in the presence of the president of the republic, Giorgio Napolitano (figure 2), it was

attended by distinguished physicists from Italy and other European countries, as well as Japan, Russia, the US and CERN. The talks revisited different sides of Pontecorvo's long and multifaceted scientific life, which was marked by his lucid and deep passion for science and his important contributions to several branches of nuclear and particle physics.

It was a life sharply divided in two parts by his sudden move to the Soviet Union in the summer of 1950, when he went from England via Italy and Sweden, to reappear five years later in Dubna as part of the Soviet scientific establishment. Presenting an historical perspective of Pontecorvo's life, Frank Close spoke of "a life of two halves". One could add a third life - the one lived during the decline and dissolution of the Soviet system, with periodic visits to Italy and disenchantment in the 1980s, which are well described in a book by Miriam Mafai, *Il lungo freddo (The Long Cold)*, published in 1990.



Fig. 2.

Jack Steinberger opened the meeting by speaking about when he was a student of Fermi and Pontecorvo came to Chicago from Canada to visit his old mentor. Pontecorvo had discovered that the capture of the muon by nuclei, measured by Marcello Conversi, Ettore Pancini and Oreste Piccioni in Rome, was consistent with having the same strength as electron capture - that is, that the muon and the electron, besides having the same electric charge, share the same coupling in the weak interaction. It was the start of the lepton family and the universality of the weak interaction, which would eventually evolve into the long story of electroweak unification. Steinberger was doing his thesis with Fermi on muon decay, which led him to discover the continuum character of the electron's spectrum, entirely analogous to nuclear beta decay.

Pontecorvo's research during his Canadian period was presented by Giuseppe Fidecaro, who delved into the development of the radiochemical method to detect neutrinos - later applied by Raymond Davis to detect solar neutrinos. Luigi Di Lella described the studies by Pontecorvo and Ted Hincks on muon decay, including the search for the decay $\mu \rightarrow e \gamma$ - a long saga, which also saw Steinberger as a protagonist and which continues today with the MEG experiment at PSI. Di Lella ended with the ideas that Pontecorvo developed in Dubna on high-energy neutrino interactions, somehow anticipating the independent line of research carried out at

Brookhaven by Leon Lederman, Melvin Schwarz and Steinberger, which eventually led to the discovery of the two kinds of neutrino in 1962 and the award of the Nobel prize in 1988.

An important part of the conference was dedicated to neutrino oscillations - Pontecorvo's other great intuition - with an update on solar and atmospheric neutrino oscillations by Till Kirsten and Yoichiro Suzuki, respectively. An overall view was given by Samoil Bilenky from Dubna, who was a collaborator and friend of Pontecorvo for a long time.



Fig. 3.

In Dubna, Pontecorvo became the reference figure for many Russian physicists and also for the physicists from Western Europe and CERN who visited countries in the East (figure 3). Ettore Fiorini brought his recollections of Pontecorvo at the Balaton School, in Hungary, at the time of the discovery of neutral currents, while Ugo Amaldi spoke of his relations with Pontecorvo at Dubna, when the Russian participation in the DELPHI experiment at the Large-Electron Positron collider was taking shape.

Two historical talks gave an idea of the depth of Bruno Pontecorvo's personality.

Nadia Robotti documented the path of Pontecorvo in the Panisperna group. From his initial position as the youngest and most inexperienced member of the group - he was called "the cub" - he went on to become in few years a respected researcher, signing one publication with Fermi and Rasetti alone, and owner of part of the slow-neutron technologies. Later, when the group in Rome started to split up, Pontecorvo moved independently from Fermi to find a position in Paris, in the laboratory of Frédéric Joliot and Irène Curie, where he arrived in spring 1936 as a fully formed and independent investigator in the most advanced fields of nuclear physics.

Precious testimony

In a second historical talk, Rino Castaldi brought a precious testimony from when Pontecorvo arrived in Dubna. It was a hand-written log book begun on 1 November 1950, which Gloria Spandre and Elena Volterrani obtained from Pontecorvo's eldest son, Gil. Page after page, written in minute but precise writing with remarkably few cancellations, reconstruct a picture of Pontecorvo building up his future activity in particle physics in the new laboratory where he had chosen to spend his life. From

issues in the life of an experimental physicist and ideas about new experiments, through glimpses about his thoughts on the mysterious strongly produced but long-lived particles (the strange particles), to a tantalizing formula for muon beta decay, with one neutrino encircled and the other in a box (figure 4) - could this be a hint that the two neutrinos might be different? We can leave the answer to Pontecorvo himself. Much later, he described his earlier activity on the weak interaction in a contribution to the International Colloquium on Particle Physics in Paris in July 1982:



Fig. 4.

"I have to come back a long way (1947-1950). Several groups, among which J Steinberger, E Hincks and I, and others were investigating the (cosmic) muon decay. The result of the investigations was that the decaying muon emits 3 particles: one electron...and two neutral particles, which were called by various people in different ways: two neutrinos, neutrino and neutretto, ν and ν' , etc. I am saying this to make clear that for people working on muons in the old times, the question about different types of neutrinos has always been present...for people like Bernardini, Steinberger, Hincks and me...the two neutrino question was never forgotten."

The centenary symposium took place in the Aula Magna of Sapienza University in Rome, where Fermi worked from 1935 to 1938, the year of his departure to Stockholm (for the Nobel prize) and then to the US. Organized with efficiency by the indefatigable Carlo Dionisi, professor of physics at Sapienza, it was an occasion for the larger Pontecorvo family - the Italian and Russian branches - to gather, cheer and greet friends and colleagues.

- For all of the presentations at the symposium, see <https://agenda.infn.it/conferenceOtherViews.py?view=standard&confId=6051>

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