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Colloquia: The Legacy of Bruno Pontecorvo

The beginning of a great adventure: Bruno Pontecorvo in Rome and Paris

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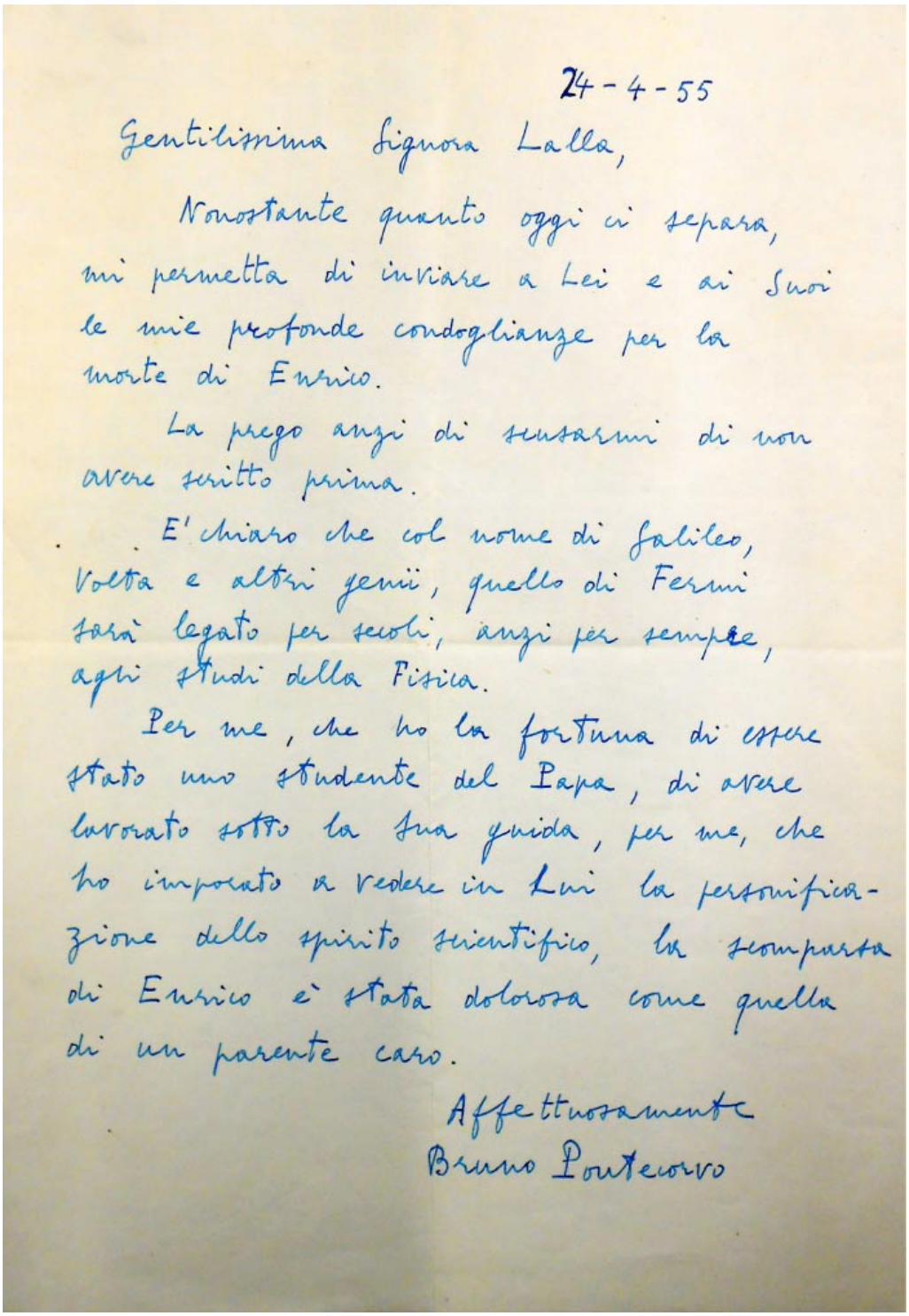
Summary. — By resorting to primary sources, *i.e.* scientific literature of the time and archive documents, we reconstruct the period spent by Bruno Pontecorvo in Rome, starting from the graduation in November 1933 up to the departure to Paris in April 1936, and give also some details on the period spent in France until his departure for the United States in 1940. The archive documents come mainly from Churchill Archive Center (Cambridge), Chicago University Library (Chicago), Joliot-Curie Archives (Paris), College de France (Paris), Préfecture de Paris, Sapienza University Archives (Rome), and Domus Galilaeana Archives (Pisa).

1. – A good start

On April 24, 1955, immediately after the granting of the long awaited permission to write abroad to the Western World, but many months after the departure of Enrico Fermi, Bruno Pontecorvo sends the following letter (fig. 1) from Soviet Union to Laura (friendly called Lalla), the widow of Fermi, here reported in literal translation:
"*24-5-55*
Very kind Signora Lalla,
notwithstanding all what is separating us nowadays, allow me to send to you and to your dear ones my deep condolence for the death of Enrico.
I beg you also to excuse me for not having written before.
It is clear that together with the name of Galileo, Volta and other geniuses, the name of Fermi will be bound for centuries, in fact for ever, to the studies in Physics.
For me who have the fortune of having been a student of the Pope, of having worked under his guidance, for me who have learned to see in Him the personification of the scientific spirit, the disappearance of Enrico has been so painful as for a dear relative.
Affectionately
Bruno Pontecorvo"



24-4-55

Gentilissima Signora Laura,

Nonostante quanto oggi ci separa, mi permetta di inviare a Lei e ai Suoi le mie profonde condoglianze per la morte di Enrico.

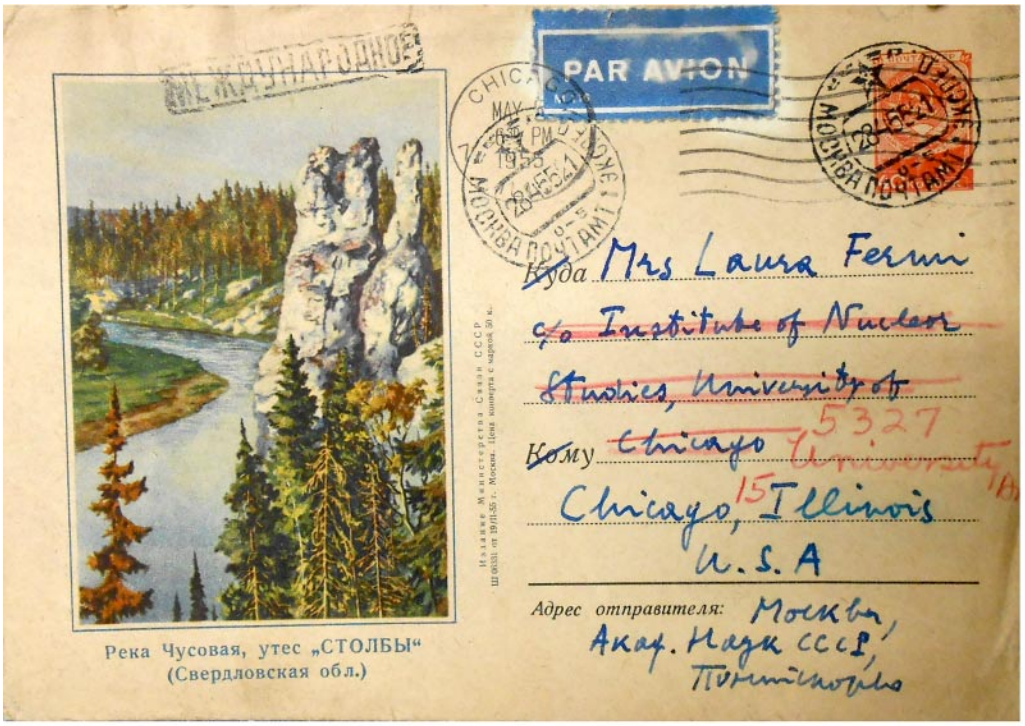
La prego anzi di scusarmi di non avere scritto prima.

E' chiaro che col nome di Galileo, Volta e altri geni, quello di Fermi sarà legato per secoli, anzi per sempre, agli studi della Fisica.

Per me, che ho la fortuna di essere stato uno studente del Papa, di avere lavorato sotto la sua guida, per me, che ho imparato a vedere in Lui la personificazione dello spirito scientifico, la scomparsa di Enrico è stata dolorosa come quella di un parente caro.

Affettuosamente
Bruno Pontecorvo

Fig. 1. – Bruno Pontecorvo to Laura Fermi, April 24, 1955 (Special Collection Research Center, University of Chicago Library).


PAR AVION
Река Чусовая, утес „СТОЛБЫ"
(Свердловская обл.)
Куда Mrs Laura Fermi
c/o Institute of Nuclear
Studies, University of
Chicago 5327
Кому
Chicago, 15 Illinois
U.S.A
Адрес отправителя: Москва,
Акад. Наук СССР,
Понтекорво

The connection of Pontecorvo with Fermi has been always very deep. In his 1988 autobiographic note [21], speaking about the period spent in Rome at the side of Enrico Fermi, Pontecorvo says: "*It was by far the most important event of my scientific life*".

The first contacts go back to 1932, when after the first two years of the School of Engineering in Pisa, willing to dedicate himself to Physics, Pontecorvo decides to move to the University of Rome, "*where there are Fermi and Rasetti*".

As Pontecorvo recalls [21], after an informal test by Fermi and Rasetti on May 12, 1932, ("*They improvised for me a nonofficial examination*"), he enrolls as a student of the third year of the Course for doctoral degree in Mathematics and Physics. He earns the degree on November 10, 1933, at the age of only 20 years. His doctoral Thesis is an experimental study on the "Geometric optics of the electron and the electron microscope". He gets the maximum mark of 110/110 *summa cum laude*.

After graduation, he immediately is engaged in scientific research activity at the Institute of Physics. His research is devoted to atomic spectroscopy, a topic with a well established tradition in Rome, and still an advanced argument at the time. The duty of Pontecorvo ("*chosen by Fermi and Segrè*") is to study, in the particular case of Mercury, a new phenomenon discovered by Amaldi and Segrè, and immediately explained theoretically by Fermi, *i.e.* "The displacement of high spectral lines of alkali vapors when these are immersed in the atmosphere of a foreign gas".

The experimental apparatus exploited by Pontecorvo is the same as that of Amaldi and Segrè. However in the case of Mercury the experiment is quite delicate, and data analysis is very complicated. In any case, Pontecorvo is able to conclude the experiment at the beginning of Summer 1934.

The results are presented at the seance of July 18 of the "Accademia dei Lincei" by the Member Orso Mario Corbino, the influential Director of the Institute of Physics, and immediately published in the Proceedings of the Academy [13]. This is the first scientific publication of Bruno Pontecorvo. It is published in a Journal of high reputation, under his name alone. At the time he is only 21 year old.

2. – The discovery of the slow neutron effects

While Pontecorvo is involved in his spectroscopic research, Enrico Fermi, working alone and guided by his theory of the beta decay, in the night of March 20, 1934, discovers that neutrons can induce artificial radioactivity on the nuclei of many elements [6] (for a complete analysis of the discovery see [1, 10, 11]).

The experimental apparatus exploited by Fermi is very simple: a Radon-Berillium neutron source to irradiate the various materials and a Geiger-Müller counter to detect the induced radioactivity. The neutron source is provided by Giulio Cesare Trabacchi, director of the physical laboratory of the "Institute of Public Health", located on the premises of the Institute of Physics in via Panisperna. The Geiger-Müller counter is personally constructed by Fermi, by following some hints given by Bruno Rossi in Florence. Fermi discovery initially involves only two light elements (Aluminum and Fluorine). However, by taking into account that neutrons can easily penetrate also the nuclei of heavy elements, Fermi decides to start a systematic exploration of the entire table of elements. In this enterprise, he calls to participate firstly Oscar D'Agostino, a young Chemist of Rome, then Amaldi and Segrè and finally Rasetti. By the Summer of 1934, the well organized team is able to activate and study more than 40 elements, out of the 60 tested [7].

Bruno Pontecorvo is not involved in this first frenetic and exalting phase of research. He is invited to participate only at the end of the summer vacation, in September 1934, and he immediately succeeds to become one of the most important protagonists, after Fermi, of the discovery of the effects of slow neutrons, which together with that of the neutron induced radioactivity will motivate the Nobel Prize in Physics for Fermi in 1938.

The duty given to Pontecorvo, together with Amaldi, is to establish a quantitative scale of neutron induced activity, until then classified only qualitatively (as strong, medium, low). As a first step, Amaldi and Pontecorvo try to find optimal irradiating conditions by taking as sample a silver cylinder, and its 2.3 minutes induced activity. However, from the beginning, they realize that it is very difficult "to reproduce the results" (later it became clear that this was related to the influence of scattering and slowing down of neutrons by the surrounding objects).

For example, according to an account of Amaldi [4], Pontecorvo notices that there are some wooden tables which have miraculous properties: silver irradiated on those tables gains more activity than when it is irradiated on the usual marble table. Moreover, the induced activity seems to be strongly influenced by the position of the source with respect to a lead structure ("castelletto") built to study the anomalies. These observations are reported daily to Fermi, who gets interested in the problem. He immediately finds the way to explain the anomalies, and arrives to the discovery of the effects of the neutron slowing down.

In fact, on Saturday October 20, Fermi decides to study the effects of the irradiation on the induced radioactivity by interposing a paraffin block directly between the source and the silver sample and finds that the activity, in the presence of the paraffin "absorber", does not diminish but it is much more intense. Similar effects are obtained also in presence of large amounts of water, and with other samples.

The explanation given by Fermi is very simple and disconcerting. The slow neutrons, which are produced in the elastic collisions with hydrogen atoms in paraffin or other hydrogenated materials, more easily interact with the nuclei, and therefore are more effective in inducing radioactivity.

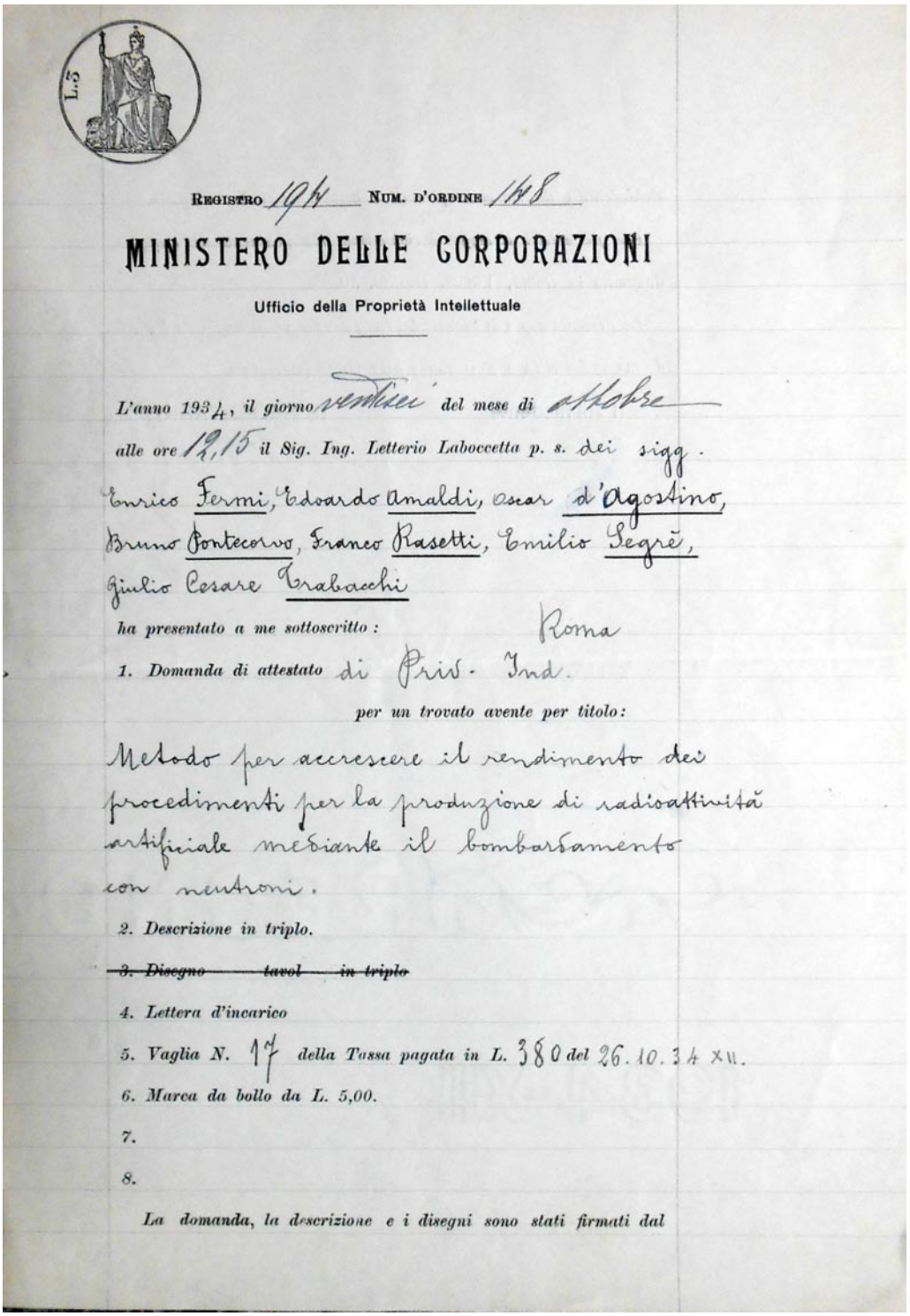
On Monday 22, Fermi communicates the discovery to his collaborators, and a Letter is written to *La Ricerca Scientifica*, signed by E. Fermi, E. Amaldi, B. Pontecorvo, F. Rasetti, E. Segrè [8]. The name of Fermi is at the first place, the others in strict alphabetic order, so as to say that the discovery was made by Fermi, but also thanks to the contribution of the others.

On October 26, 1934, only four days after the submission of the Letter, the discovery becomes the subject of a patent (fig. 2). The owners are the authors of the Letter, with the addition of Oscar D'Agostino, the first and always present coworker of Fermi, and Giulio Cesare Trabacchi, the provider of the essential neutron sources.

The patent, registered in the main industrial countries, will prove very useful for the inventors. After the War, the patent owners are obliged to a long court trial with the American Authorities to defend their rights. An agreement is reached only in 1953, when Pontecorvo is already in URSS. Each owner receives 27.500 $, after expense deduction. Pontecorvo share is "deposited in a special account in the Treasury subject to claim by him at a later date" (Fermi Archive, Chicago Library).

Pontecorvo writes in his autobiography [21]: "A respectable amount of money was paid to the inventors since a long time (but not to me until now!)". May be that he was never informed of his right to the claim.

The participation as a protagonist to the discovery of the slow neutron effect, even though he is the last member to join the team, is surely a great success for the young



L. 5

REGISTRO 194 NUM. D'ORDINE 148

MINISTERO DELLE CORPORAZIONI

Ufficio della Proprietà Intellettuale

L'anno 1934, il giorno sedici del mese di ottobre

alle ore 12,15 il Sig. Ing. Letterio Laboccetta p. s. dei sigg.

Enrico Fermi, Edoardo Amaldi, Oscar d'Agostino,

Bruno Pontecorvo, Franco Rasetti, Emilio Segrè,

Giulio Cesare Trabacchi

ha presentato a me sottoscritto: Roma

1. Domanda di attestato di Priv. Ind.

per un trovato avente per titolo:

Metodo per accrescere il rendimento dei procedimenti per la produzione di radioattività artificiale mediante il bombardamento con neutroni.

2. Descrizione in triplo.

~~3. Disegno tavol in triplo~~

4. Lettera d'incarico

5. Vaglia N. 17 della Tassa pagata in L. 380 del 26.10.34 XII.

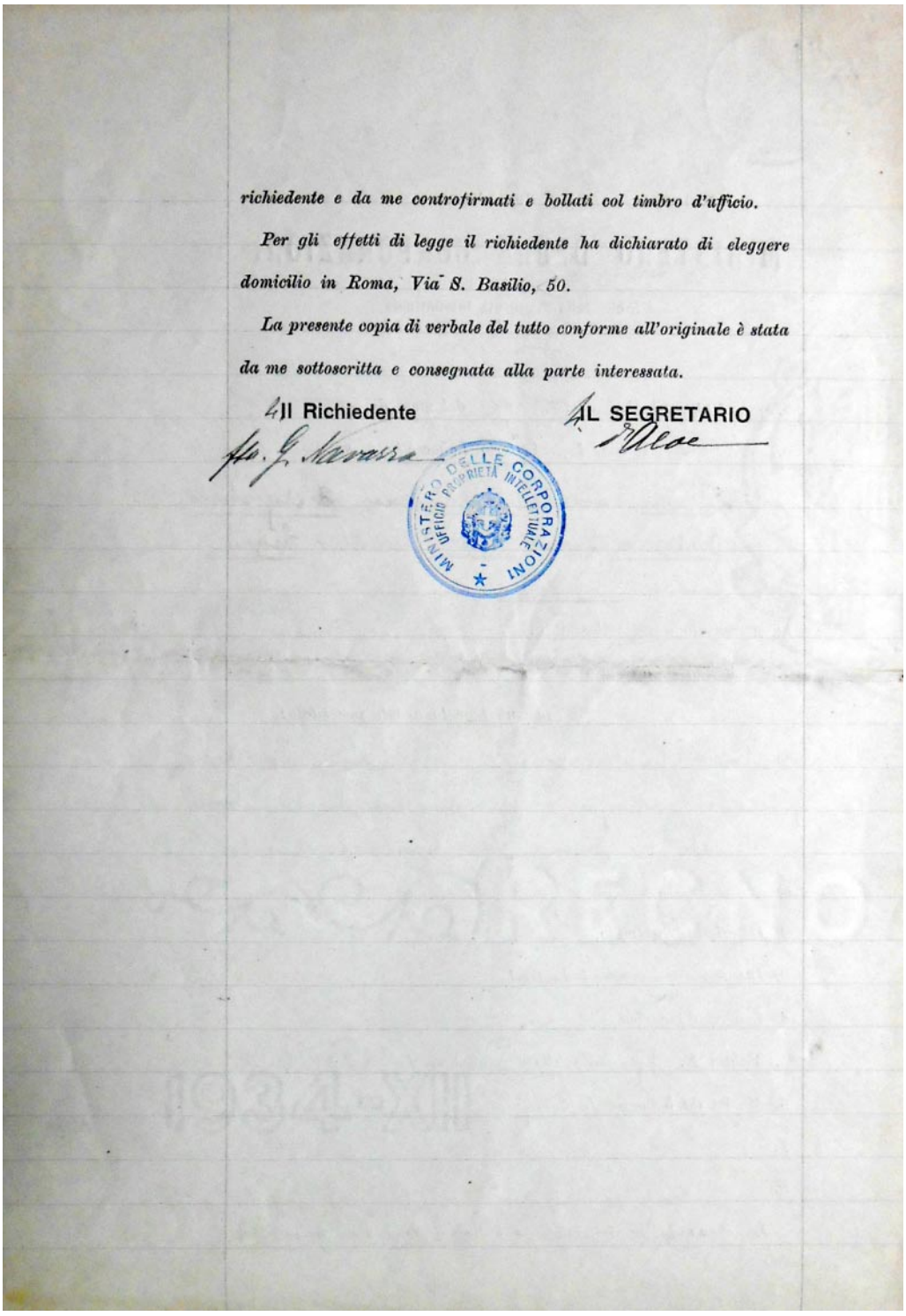
6. Marca da bollo da L. 5,00.

7.

8.

La domanda, la descrizione e i disegni sono stati firmati dal

Fig. 2. – The application for the slow neutron patent, October 26, 1934 (Amaldi Archive, Department of Physics, Sapienza University, Rome).



richiedente e da me controfirmati e bollati col timbro d'ufficio.

Per gli effetti di legge il richiedente ha dichiarato di eleggere domicilio in Roma, Via S. Basilio, 50.

La presente copia di verbale del tutto conforme all'originale è stata da me sottoscritta e consegnata alla parte interessata.

Il Richiedente

IL SEGRETARIO

MINISTERO DELLE CORPORAZIONI
UFFICIO PROPRIETÀ INTELLETTUALE

Fig. 3. – Second page of the application for the slow neutrons patent, October 26, 1934 (Amaldi Archive, Department of Physics, Sapienza University, Rome).

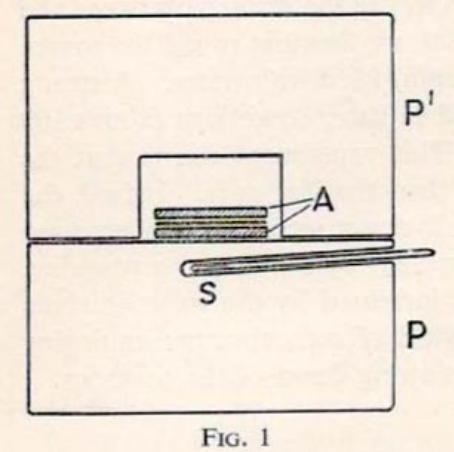


Fig. 4. – Apparatus for studying neutron absorption (Nuovo Cimento 12 (1935) p. 204).

Pontecorvo. From November 1, 1934, up to June 30, 1935, he is appointed as "temporary assistant at the Royal Institute of Physics of the University of Rome".

3. – Bruno Pontecorvo more and more active

After the discovery of the slow neutron effect, the role of Pontecorvo in the team becomes more and more relevant. On November 7, 1934, a second Letter is sent to *La Ricerca Scientifica* on the subject of slow neutrons [9]. This time there are only three names: E. Fermi, B. Pontecorvo, F. Rasetti. It is an outstanding achievement for the "temporary assistant" Pontecorvo, who finds his name alone between the two Professors of the team.

In this second Letter, (explicitly marked as -II.), the results of some experiments are reported, devised to systematically verify two important open questions, all confirmed. The first is whether the action of the hydrogenated substance is really due to the diffusion and consequent slowing down of neutrons. A positive answer is found by using the customary "silver cylinder", and comparing the induced activities under different irradiation conditions, with the source immersed in water, or without water. The second question is to verify that the slow neutrons, so effective for activation, are also "strongly absorbed". The apparatus used to study the absorption properties is reproduced in fig. 4.

PP' is a paraffin block, S a neutron source and A the substance under investigation. A small plate of Rhodium is put in a cavity of the paraffin cylinder block, which can be opened horizontally (P',P). The Rhodium plate is activated by a neutron source (S), firstly without any screen, and then by surrounding it with plates of different substances (A,A). Rhodium is chosen because it is a "very active" material, with a mean life of 44 seconds, very convenient for the measures.

Immediately after the publication of this second Letter, a systematic and comprehensive investigation is started on the effect of hydrogenated substances. All members of the team are involved, but with different duties. In particular, Pontecorvo is involved in the study of the behavior of slow neutrons, and publishes alone in April 1935, a paper ("Sulle

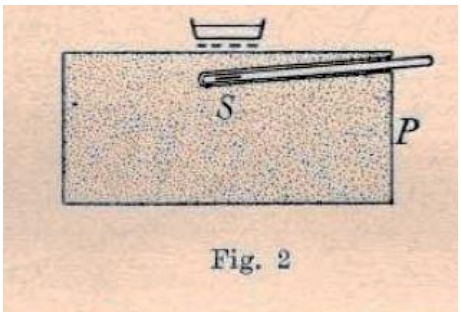


Fig. 5. – Apparatus for studying neutron diffusion (Nuovo Cimento 12 (1935) p. 216).

proprietà dei neutroni lenti") on *Il Nuovo Cimento* [14]. It is impressive to recognize how he has been able to conquest his own scientific territory, in few months.

Pontecorvo research aims to extend some questions, already present in the Letter with Fermi and Rasetti, concerning the efficacy of slow neutrons, their diffusion in various substances, and their energy. He studies also the effect of non-hydrogenated substances. Of high importance is the study of slow neutron diffusion, never attacked before. For this study he realizes a new experimental set up (fig. 5), where measurements are done on the exterior of the paraffin block (P) containing the neutron source (S).

Rhodium plate is put on the upper surface of the paraffin block. The induced activity is compared with that obtained by covering the plate with various substances acting as neutron reflectors in the back direction. In particular, he finds that a Carbon layer, many centimeter thick, increases the activity by a factor five. While Boron, with its enormous absorption for slow neutrons, does not give an appreciable increase of the activity.

In any case, the involvement of Pontecorvo in the team does not concern only the behavior of slow neutrons, but is total. In fact, he participates also to the research on the activation of the whole periodic table, resumed after the discovery of the slow neutron effect. His name is present in the last four Letters on the subject, sent to *La Ricerca Scientifica* between December 6, 1934, and June 14, 1935, and signed in alphabetic order by E. Amaldi, O. D'Agostino, E. Fermi, B. Pontecorvo, F. Rasetti, E. Segrè, and also in the conclusive paper [2] sent to the *Proceedings of the Royal Society* on February 15, 1935.

4. – Bruno Pontecorvo more and more independent

On March 11, 1935, while Pontecorvo is in full activity, the Ministry of the National Education announces a competition for 16 fellowships at some foreign Institute, and also 8 fellowships at some national Institute, for the a.y. 1935-36. The application deadline is April 30, 1935. Pontecorvo holds in Rome a position of temporary assistant, valid up to June 30, 1935, but surely bound to be renewed for the next academic year. However, he decides to participate to both competitions ("Churchill Archive Centre").

In Summer 1935, the research team, organized around Fermi on the neutron induced radioactivity, begins to dissolve. Rasetti goes to the United States, at Columbia University, to stay there for at least one year. Segrè, after a visit in the U.S., moves to the University of Palermo in Sicily, where he is appointed as Professor of Experimental Physics. Therefore, by the end of the Summer, only Fermi, Amaldi and Pontecorvo

remain in Rome, together with D'Agostino, who will find soon a stable position at the Institute of Chemistry of C.N.R., to work on completely different subjects.

Pontecorvo in Rome continues alone his research on slow neutrons, and publishes, under his name alone, a paper on *La Ricerca Scientifica* in the second half of September 1935 [15]. The argument of this research is of great interest at the time, and concerns the selective absorption of slow neutrons on various nuclei, recently discovered by J.R. Tillman and P.B. Moon (July 13, 1935). He changes the geometry of the experiment. According to his well known strategy, he measures the absorption on the exterior of the paraffin block, by putting the absorber and the detector directly on the top of the block. With the new set up, he measures the slow neutron absorption cross section for various substances. His results are very interesting, in full agreement with those obtained by Tillman and Moon in different conditions, and confirm "beyond any doubt the selective absorption for slow neutrons".

After the Pontecorvo pioneering work, also Fermi and Amaldi start a systematic research on the selective absorption of slow neutrons, then extended also to their diffusion and slowing down. A conclusive paper by Fermi and Amaldi [3] is published in *Physical Review* on November 15, 1936. The experimental setup exploited for the selective absorption of slow neutrons is identical to that designed by Pontecorvo.

It is peculiar that Pontecorvo does not collaborate with Fermi and Amaldi in these researches, not even in the initial phase. In any case, his work is cited by Fermi and Amaldi, together with those of Tillman and Moon, and others.

After the work on the selective absorption of September 1935, the name of Pontecorvo seems to disappear from the official scientific literature. However, it reappears at the end of February 1936, with a research on slow neutron diffusion in intermediate and heavy nuclei, done in collaboration with Gian Carlo Wick, then a young theoretical physicist and Fermi assistant. This research is in parallel to that of Fermi and Amaldi, and develops in full autonomy. The experimental set up is the same as exploited by Pontecorvo in his previous work for similar measurements The results are reported in two Letters sent to *La Ricerca Scientifica*, on February 29, 1936, and March 15, 1936, signed by Pontecorvo and Wick [16, 17]. In these papers, in the frame of a systematic investigation with neutrons belonging to different "groups", it is shown that the scattering cross section, on various nuclei, does not vary much with neutron velocity. Moreover, the results give a new proof that the "groups" of neutrons differ by their velocities.

5. – An irreversible decision

In the meantime, during the period when Pontecorvo seems to be scientifically absent (October 1935) the Minister of National Education, communicates to him that he is in the first place with mark 30/30 in the two competitions, for the requested fellowships abroad and in the Kingdom. He is given thirty days to choose between the two fellowships, and to communicate the name of the Institute where he has the intention to exploit the chosen fellowship ("Churchill Archive Centre").

In agreement with the strict deadline, on November 18, 1935, Pontecorvo informs the Minister of his option for the foreign fellowship, and boldly communicates that he will go to the "Institute du Radium" in Paris. It can be reasonably conjectured that he had already some contacts with the host Institution in Paris, in order to be sure that he will be accepted. Probably some political or cultural affinity is involved, my be through the presence of the Pontecorvo cousin Emilio Sereni (a strong opponent of fascism) in Paris.

On February 13, 1936, the Minister officially confers to Pontecorvo the foreign fellowship at the Institut du Radium in Paris. He is also ordered to reach the French Institution in thirty days, therefore before March 12, 1936, otherwise he will loose all rights.

The arrival of Pontecorvo in Paris is preceded by an "urgent" and very formal letter of Fermi (February 26, 1936) to Joliot, in which he asks Joliot to accept Pontecorvo in his laboratory "to learn some new technique". This letter is written after that the Minister has officially approved the decision of Pontecorvo to go to Paris. Bruno Pontecorvo is very firm and independent, indeed. Joliot replays to Fermi, saying that "Pontecorvo is gladly accepted in the Laboratory", and that during his stay in Paris "he will be shown some techniques, Wilson apparatuses, High Tension..."

On March 7, 1936, with a letter to the Rector, Pontecorvo offers his "voluntary resignation" from his position of temporary assistant at the University of Rome. On April 15, 1936, he is on duty at the "Laboratoire Curie, Institut du Radium de Paris" with his six month Italian foreign fellowship.

6. – Pontecorvo in Paris and in America

In Paris he continues his research on the absorption of slow neutrons, initiated in Rome, with the Geiger-Müller counter as detector, a well familiar instrument. In particular, he undertakes a very interesting experimental research on the gamma rays emitted in the capture of slow neutrons by Gold nuclei. The results of this research are published in two papers. The first [18], already in July 22, 1936, on an Italian journal (*La Ricerca Scientifica*), the second [19] on a prestigious French journal (*Journal de Physique*, submitted on October 30). He thanks "F. Joliot for his continued interest in this work", and also "Madame Joliot for the benevolent interest".

After the expiration of the Italian foreign fellowship (October 15, 1936), he is awarded a six month French fellowship by the "Fondation Curie-Carnegie", under proposal of Joliot, always at the Institut du Radium.

On May 15, 1937 finally the University of Rome opens a competition for a stable assistant position, transforming the temporary position already held by Pontecorvo into a stable one. At this point Pontecorvo has the possibility to go back to Rome, with a solid permanent position. He asks the Rector in Rome all documents relative to his previous position, but at the end he does not participate. He decides to stay in Paris. He will never be back again.

The Curie-Carnegie fellowship is renewed six months by six months, until December 1939, when he is finally appointed as Chargé de Recherches de la Caisse National de la Recherche Scientifique.

There is a strong analogy between his move from Italy to France in 1936 and the move from the West to Soviet Union in 1950. These moves are irreversible, and strongly motivated by deep scientific, political, cultural reasons.

The scientific activity performed in France, firstly at the Institut du Radium, then at the Collège de France, earns him international recognition. Starting from the study on the inhomogeneity of the γ radiation for slow neutron capture, the interests of Pontecorvo grow toward nuclear isomerism, intended as a new way to study the nuclear structure. With this, the idea comes that nuclear β stable nuclear isomers may possibly exist. This idea is pursued with great tenacity, and at the end it will lead him (with M. Dodé) to the discovery of the first β stable isomer (fast neutron excitation on Cadmium) in 1939 [5], and then, in the same year (with A. Lazard) to the production of the first β stable isomers (Indium and others), through hard X-ray nuclear bombardment [20].

Concerning this last result, Fermi writes from New York, on February 4, 1939: "*Dear Pontecorvo, ... I highly congratulate with you for the excellent results of the research*".

The expertise and interest of Pontecorvo toward slow neutrons find a natural outlet not only in his research in Paris, but also in his successive activity in the United States and Canada.

In the United States, where he emigrates in 1940 (when the German army invades Paris), hired by a private petrol society in Oklahoma, he invents a very brilliant technique for the survey of oil fields, "the neutron well-logging", based on the absorption of slow neutrons, still up to date.

In 1943 he moves to Canada (Montreal and Chalk River), where he is called to contribute to the nuclear Anglo-Canadian project. In particular he participates to the planning and construction of a research reactor (NRX) based on Uranium and heavy water. His expertise on slow neutrons, developed in so many years of hard work, will play a fundamental role, by leading him to a forefront position in the frame of the Anglo-Canadian project.

7. – Conclusion

This analysis on the early Pontecorvo activity shows a very strong scientific personality, sharing great autonomy and independence. Already in his first investigation on atomic spectroscopy, he exhibits his great capabilities as a scientist, which will become more and more evident during his participation, initiated with some delay with respect to the other "Panisperna boys", to the program of neutron induced radioactivity. Along this program, Pontecorvo plays a great role, not only in the discovery of the slow neutron effect, but also in the start of an autonomous research line on the diffusion and absorption of slow neutrons.

This line developed by Pontecorvo in Paris, and then expanded toward the nuclear isomerism, at the end of the Thirties will lead Pontecorvo to a relevant international position in nuclear physics.

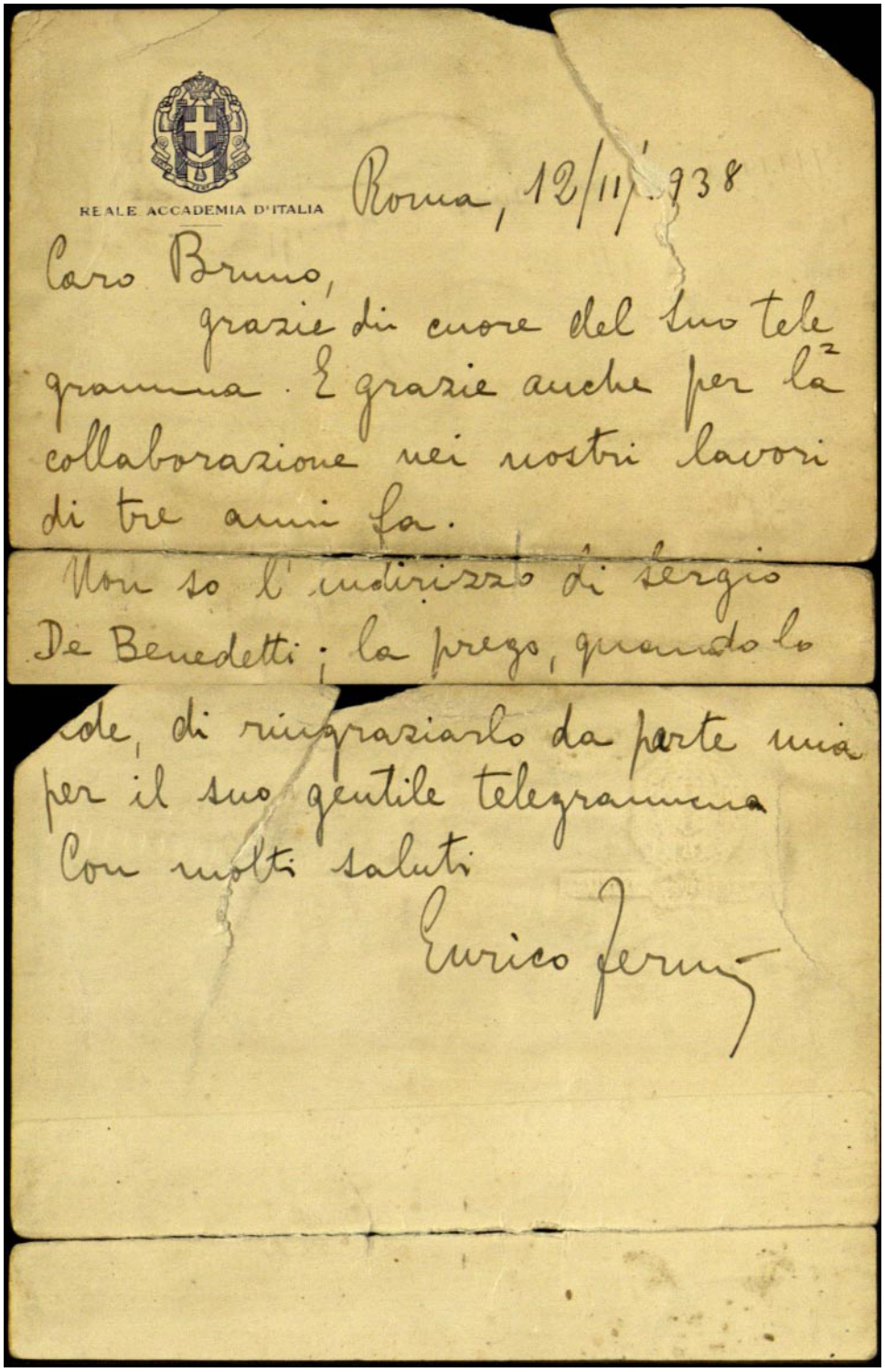
As a matter of fact, in contrast to what is frequently asserted, when Pontecorvo arrives in Paris in 1936, he is not a young naive researcher, but he is a well formed mature researcher, importing his expertise, already at high level, and succeeds in conquering his own scientific territory, where he operates with great success.

In a letter (fig. 6) dated November 12, 1938, Fermi thanks Pontecorvo for the congratulations received about the Nobel Prize, calling him by name (Bruno): "*Dear Bruno, I heartily thank you for your telegram. And thanks also for our collaboration in the work of three year ago...*".

Knowing the parsimony in all verbal expressions by Fermi, the very special thanking sentence in this letter is really impressive.

Perhaps the role of Pontecorvo in Rome has been greater than we think. It would be necessary to dedicate a detailed study to the complex of all documents kept at the Domus Galilaeana in Pisa, concerning the research on neutrons performed in the days before October 20, amounting to many pages of laboratory notebooks, and experimental recording sheets, in order to specify the real role played by Pontecorvo in the discovery of the slow neutron effects.

In an official report, written in 1951, to the Senator Brian McMahon, after Pontecorvo disappearance, (Fermi Archive, Chicago Library) Fermi writes on the scientific and strategic relevance of Pontecorvo decision to go away in Russia:



REALE ACCADEMIA D'ITALIA

Roma, 12/11/1938

Caro Bruno,

grazie di cuore del tuo telegramma. E grazie anche per la collaborazione nei nostri lavori di tre anni fa.

Non so l'indirizzo di Sergio De Benedetti; la prego, quando lo vede, di ringraziarlo da parte mia per il suo gentile telegramma.

Con molti saluti

Enrico Fermi

Fig. 6. – Enrico Fermi to Bruno Pontecorvo, November 12, 1938 (Churchill Archives Centre, Cambridge).

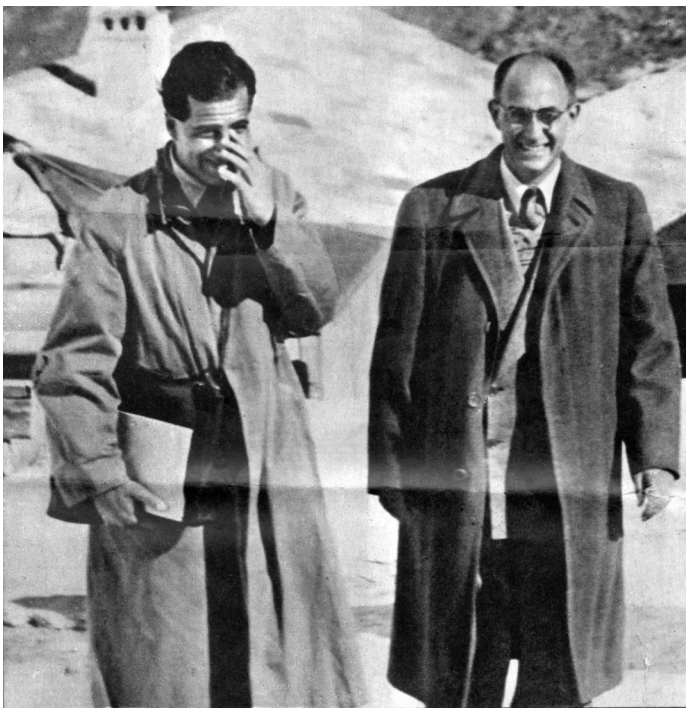


Fig. 7. – Their last encounter: visit to Olivetti factory, 1949 (Pontecorvo Family Archive).

"*I do not know of course what are the reasons that prompted his alleged escape to Russia. My personal impression of his research activities has been that he did not have much interest in the atomic developments except as a tool for scientific research. In particular I do not remember any instances in which he took up with me any subject connected with atomic technology and he did not seem to have any special interest in atomic weapons. For these reasons my impression is that if he went to Russia he may not be able to contribute to their work by the things that he has learned during his connection with the Canadian and the English projects but rather through his general scientific competence.*"

In the same report to the Senator McMahon, Fermi writes about Pontecorvo:

"*Scientifically he is one of the brightest men with whom I have come in contact in my scientific career.*"

This document was kept buried in the American Archives for decades. Pontecorvo could never know its content. Surely he would have been very happy. In fig. 7 we see a picture of their last encounter.

A preliminary account of the Pontecorvo activity in Italy and France appears in [12], where one can find also the list of all papers produced by Pontecorvo during this period. A more complete treatment will be published elsewhere.

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