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Edoardo Amaldi
*Edited by*
Saverio Braccini
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Paola Scampoli

# The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966)

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ISSN 2191-5423 ISSN 2191-5431 (electronic)
ISBN 978-3-642-32854-1 ISBN 978-3-642-32855-8 (eBook)
DOI 10.1007/978-3-642-32855-8
Springer Heidelberg New York Dordrecht London

Library of Congress Control Number: 2012952006



Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

# Preface by the Editors

More than 20 years after having being written, a manuscript by Edoardo Amaldi comes to the publication. It is about the "adventurous life" of a colleague, Friedrich "Fritz" Georg Houtermans that shared with him a turbulent and dramatic time, starting in the first half of last century. A time, which has undoubtedly influenced the way physics developed, and even more dramatically the private life of men and scientists. Among them, Fritz Houtermans.

Why a manuscript Edoardo Amaldi was working on just before his sudden death in 1989 becomes public more than 20 years later? Indeed, recently some lucky circumstances met that came to a full circle within the Physics Institute of the University of Berne, and more particularly within the Laboratory for High Energy Physics (LHEP) and the Albert Einstein Center for Fundamental Physics (AEC).

Research activities on particle physics started in Berne, and in Switzerland, thanks to Fritz Houtermans, along with his predecessor, Heinrich Greinacher. Houtermans was an essential promoter and protagonist for the development of physics in Berne, with the introduction of a series of activities in the field of elementary particles and important contributions in applied physics. During the Bernese phase, Houtermans was especially devoted to the physics of cosmic rays, using an experimental activity carried out with nuclear emulsion detectors and particle accelerators.

Research with nuclear emulsion detectors and particle accelerators—what a coincidence!—have recently experienced a rebirth in Berne: among some consolidated research activities in physics, a renewed interest on nuclear emulsions characterizes the present time of the LHEP, together with the study of new particle detectors. All this and the recent installation of a cyclotron for medical applications the University Hospital in Berne (Inselspital) have naturally led to a new line of research: the application of particle physics to medicine.

Hence, the circumstances that recently met in Berne are: elementary particle physics, physics applied to medicine, Amaldi's family. In fact, to promote the new research field in Berne, Ugo Amaldi was invited to give a seminar on Physics and Medicine, namely "Hadrontherapy in the world and its recent developments".

And here we came to a full circle: Ugo Amaldi brought to the attention of one of us (AE, present director of LHEP and AEC) the existence of a manuscript on the life of the distinguished professor of physics of the University of Berne written by his father Edoardo. Hence, the idea to make public the testimony of a great scientist on a great colleague, being confident of the historical, human, and scientific importance of such a witness.

As a consequence of this meeting in Berne in 2010, Ugo Amaldi donated the manuscript to LHEP. The editors have decided to preserve as much as possible the original draft by Edoardo Amaldi, even if he only partially revised the text, originally written in English. In particular, the bibliography results incomplete, mainly on the short biographies that the author was used to write. We limited ourselves only in updating some biographical dates. Furthermore, the text has been supplemented with images and memories that physicists who had the chance to meet or work with Fritz Houtermans kindly provided us. In this way, we took the opportunity of the publication to remember more extensively a very interesting personality with an "adventurous life".

Our thanks go to Marcella Esposito for digitizing and re-editing the manuscript and to Olga Bobrowska-Braccini who kindly revised the text and provided the translation of a document in Ukranian. We would also like to acknowledge all the colleagues who contributed with their memories and pictures. In particular, Professor Yurij Ranyuk who provided us with unique information and documents of Fritz Houtermans' time in Kharkiv, Professor Johannes Geiss, who succeeded Fritz Houtermans as the director of the Physics Institute of the University of Berne, for the kind interview given to the editors to think back over his professional life close to our protagonist, and Professor Peter Grieder, who kindly wanted to share with us some memories of his warm and friendly relationship with Fritz Houtermans.

Above all, we feel deep gratitude to Ugo Amaldi for having given us a unique opportunity, through the donation of his father's unpublished work, to meet two outstanding physicists in an unusual way allowing us to know their human aspects often clouded by their fundamental and overwhelming contributions to Physics. These human aspects come out, in the case of Edoardo Amaldi, by his need to write on the adventurous life of a colleague who had to face tragic circumstances in his life, while the personality of Fritz Houtermans clearly emerge from the reading.

We hope that the reader will share the same interest we had in going along the revision of the manuscript.

Berne, August 2012

Saverio Braccini
Antonio Ereditato
Paola Scampoli

Citation style in this book: Normal references are cited by square brackets. Citations to Houtermans' papers are indicated as /1/ etc.

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# Preamble

It was during spring 1978, I believe, that the Italian Television transmitted, in three one hour instalments, the film "The Confession" directed by Costa Gavras, inspired by the book by Artur and Lise London "L'aveu"[1]. The book is an autobiographic account of the adventure passed by Artur London in Prague in 1957.

He was an authoritative member of the Czecho-Slovak Communist Party, put on trial initially because suspected of deviationism from the prevailing party-line, but later accused of connection with state enemies.

The film had been circulated at least two years before and I knew, more or less, its content from newspaper critics and friendly conversations. But when I saw it on the television screen, I was struck by the similarity of certain general aspects as well as many details of the trial with those that had been told me in the early fifties by a physicist who had gone through a similar adventure twenty years before in U.S.S.R.: Friedrich Georg Houtermans.

I knew his name in the thirties because of some important papers he had published in those years in scientific journals.

When in 1937 my friend Georg Placzek arrived in Rome from U.S.S.R., he had mentioned Houtermans as one of the young physicists gone to Kharkov to participate in the construction of a socialist society and recently in serious political troubles.

I received a letter from him, from Berlin in 1942, after, as I learned later, he had succeeded in getting out of a German prison to which he had been transferred from the Lubianka in Moscow.

I started to meet him rather frequently around 1950, on occasion of various scientific meetings taking place in France, Italy and Switzerland, where he had been appointed professor of physics at the University of Berne.

Stimulated by the adventures of Artur London, interpreted in the film with impressive realism by Yves Montand, I asked myself whether the adventures of Fritz Houtermans had been written or recorded by some of his colleagues and friends.

I knew, of course, a very nice but rather short biography published in Helvetica Physica Acta, shortly after his death, by his collaborator and friend Professor J. Geiss [2]. But only his more important scientific papers are mentioned there without any reference to or mention of his adventurous public as well as private life. These are very shortly mentioned in the "Obituary" published by Physics Today [3]. I found that another of his friends, Professor Martin Teuscher, on 20th October 1966, had given a "Gedenkrede" in front of the Deutsche Physikalische Gesellschaft [4] and prepared, a few years later, a short biography for the Neue Deutsche Biographie [5]. But also these notes are short and deal mainly with Houtermans' scientific work, except for a few very expressive lines on his imprisonment in Teuscher's speech.

On the occasion of some of my trips to Geneva, I mentioned the problem to Charles Peyrou, working at CERN since 1957, who had been Professor of Physics at the University of Berne from 1954 to1960 and a colleague and close friend of Houtermans.

In conversations with Peyrou and Geiss, whom I also met a few times in those years, the idea of an extended biography of Houtermans gradually grew in my mind. It was strengthened by a few exchanges of views with W. Gentner, W. Jentschke, W. Paul and V. Weisskopf.

On the occasion of a trip to the United States I visited Houtermans' first wife, Charlotte Riefenstahl, in her house in Bronxville, N.Y. the 3rd March 1979. Not only was her conversation of great help, but she even put at my disposal copies of a number of documents of extraordinary importance for the reconstruction of Houtermans' family background, youth and university period and for the years he passed in Russian and German prisons. The nature and content of these documents is explained in References [6–8].

Further information and more documents [9] were given me by Charlotte Riefenstahl and Paul Boschan [10] on occasion of a second visit I paid to Charlotte the 25–29th April 1980 in Bronxville.

Information on later periods of Houtermans' life have been given me on occasion of a trip to Bonn (5 to 9th May 1981) by Professors Wolfgang Paul and W. Walcher, Dr. Ilse Bartz Haxel and Professor Otto Haxel and of two trips to Berne (25–26th September 1984 and 20–21st March 1985) by Professor Joahnnes Geiss and Mrs. Lore Houtermans, the fourth and last wife of Fritz Houtermans. I had also repeated exchanges of views and letters with Professor Giuseppe Occhialini and Constance Dilworth Occhialini.

Towards the end of my work I came in contact with Professor David Holloway of the Center for International Security and Arms Control of Stanford University, who has written a book on the early Soviet nuclear program, from the development of nuclear physics in the 1930s to the testing of thermonuclear weapons in the mid-1950s [11]. He called my attention to a few sources of indirect information in U.S.S.R. in the 1940s [12] or 1950s [13].

At a still later stage of my work I was contacted by Dr. A. Kramish, author of a book on a Berlin friend of Houtermans, Dr. Paul Rosbaud, who appears only tangentially in Fritz's biography but apparently was the "British Master Spy in

Nazi Germany" [14]. I have used some of the information given on Fritz Houtermans by both these authors, Professor Holloway and Dr. Kramish.

I should express special thanks to Professor Holloway in consideration of the fact that his work has not yet been published.

My manuscript was read by a number of old friends or acquaintances of Fritz Houtermans listed below, many of whom were kind enough to communicate me their comments.[1]

I am particularly indebted to Doctor Charlotte Riefenstahl, Professor Wolfgang Paul, Professor W. Walcher, and Professor Johannes Geiss.

The pictures of Houtermans were given me by Charlotte Riefenstahl and Johannes Geiss.[2]

Rome, October 1987 Edoardo Amaldi

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2. J. Geiss: Professor Dr. Friedrich Georg Houtermans, Helv. Phys. Acta, 39 (1966) 169-171: Bericht über die Tagung der Schweizeirschen Physikalischen Gesellschaft, in Bern vom 29 und 30 April 1966.
3. Physics Today, April 1966, p. 126.
4. The scientific meeting, held on Tuesday 20th-21st October 1966 of the Deutsche Physikalische Gesellschaft, was opened with the "Gedenkrede" of Friedrich Georg Houtermans, presented by Professor Dr. Martin Teuscher.
5. Neue Deutsche Biographie, Band 9, 1972, edited by the Historische Kommission by der Bayerischen Akademie der Wissenschaften, Duncker & Humblot, Berlin.
6. Charlotte Riefenstahl (Fritz Houtermans' first wife) gave me copies of the following manuscripts she had written in various periods of her life for either her children (a, b, c) or close friends (d): (a) 26 pages manuscript she wrote for her children about the family background of Fritz Houtermans; (b)"And he was always right", the typewritten pages, dated September 1948; (c) 21 typewritten pages written after Fritz's death, during a vacation she took in July 1966 in Brione, high on the Lugano Lake. (d) 7 typewritten pages circulated among a few friends in 1981.

[1] The persons that have read the manuscript are: I. Bartz, C. Dilworth Occhialini, J. Geiss, O. Haxel, G. Occhialini, W. Paul, E. Picciotto, C. Riefenstahl, E. Tongiorgi, W. Walcher, V. Weisskopf, E. Weisskopf, and C.F. von Weizsäcker.

[2] The original pictures collected by Edoardo Amaldi have been lost. The photographs reproduced in this book have been collected by the Editors.

7. Two letters by Friedrich Houtermans from Berlin to his mother the first dated 1st August 1940, the second 28th September 1940.
8. Two letters by Friedrich Houtermans from Berlin to his mother the first dated 1st August 1940, the second 28th September 1940.
9. Copies of the following manuscripts by Aglaya Shteppa Corman have been given me by Charlotte Riefenstahl: (a) A 5 page letter by Aglaya Shteppa Corman to Charlotte, dated 27th February 1962, concerning the bad health of Fritz and his relations with Eric Kostantinovich Shteppa. (b) "In Memory of Professor Dr. F. Houtermans, 7 typewritten pages by Aglaya Shteppa Corman.
10. Paul Boschan, a classmate of Fritz Houtermans and later a mathematician, who emigrated to the U.S.A. where he worked for the Institute of Applied Econometrics. He gave me a number of useful information the 26th April 1980, when I visited him with Charlotte Riefenstahl in his house at 181 New Hamstead Road, New City, N.Y. 10956 and in later correspondence.
11. David Holloway.
12. Kharkov (1944).
13. Sergey Snegov (1910-1994, Soviet science fiction writer) Title of the book: "The Creators".
14. E. Amaldi, E. Fermi: "On the absorption and slowing down of neutrons", Phys. Rev. 50 (1936) 899-928; A. Kramish: "The Griffin, The Story of Paul Rosband, Britain's Master Spy in Nazi Germany", Houghton Mifflin Company, 52 Vanderbilt Avenue, New York, N. Y. 10017 (1986). Fragmentary information about Rosbauds' work for the British Intelligence Service is given in Chapter 16, Ref. [8].

# Chapter 1
# Friedrich's Birth and Family Background

Friedrich Georg Houtermans, or Fritz to his parents, Otto Houtermans and Elsa Waniek, was born in Danzig the 22nd January 1903 (Fig. 1.1).

The first name of Fritz's father was Oscar, but he did not like it and used, during all his life, the name Otto. He had inherited from his father, Joseph Cornelius Houtermans (1848–1921), a large estate with a beautiful house in Zoppot as well as other properties.

Charlotte, the first wife of Fritz, wrote for her children [1] the following information on Fritz grandfather. She had collected it from Fritz's mother Elsa, who «probably had embroidered it slightly. She must have met Joseph Houtermans in Vienna when he and his wife stopped there on their way to Italy where they spent months at a time in their villa in Capri».

«Joseph was of Dutch origin, being born in Voerendaal of a Catholic middle class family. He became an architect and must have been quite successful. He went to Germany and obtained a contract to build the military harbour in Bremerhaven. This work brought him not only fame and money but also honours bestowed on him by the Kaiser». Fritz' stepbrother Peter keeps a silver trowel on which are engraved his various contributions and the emperor's signature.

«At that time he was still a young man, unmarried, anxious to see the world. Once he went to Monte Carlo with a lot of money, gambled in the Casino and lost all his properties». This happened around 1869–1870 when in Italy the fourth and last independence war was raging. The kingdom of Piedmont, in three previous wars (1848, 1859 and 1866) had succeeded in unifying almost completely the territory of the Italian peninsula. Only the "Pontifical State", Trentino and Venezia Giulia were not yet a part of the Italian kingdom.

In 1870 king Vittorio Emanuele II had declared war on the Vatican State and his troops had started to enter its territory. Joseph Houtermans, enrolled in the Pope's Zuaven Battalion, went to Rome and took part in the defence of the pontifical State until 20th September 1870, when the Italians entered the Holy City. Fritz's stepbrother Peter kept a diary of their grandfather Joseph, which

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966),* SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8_1, © The Author(s) 2012

covers the period from 20th July 1869, when he left Voerendaal, to 2nd October 1870, when he was back at home [2]. He returned to work again, met Lotte Strathman, who lived near Bielefeld in Spenge, and married her. He constructed the Fort Toruń in Poznań, became a businessman and earned a fortune dealing in real estate. His residence finally was Danzig, where his only son Otto was born. He died in Toruń, West-Preussen, in 1921.

Otto Houtermans (1878–1936) had studied law but he did not practice it until rather late in his life when he became a bank director. He had inherited enough money to live in an opulent way without really being obliged to do any regular work.

He married Elsa Waniek (1878–1942) who was born and brought up in Vienna. She was half Jewish, since her mother belonged to the Karplus family, well known mainly because it owned the liberal Viennese daily journal "Das Wiener Tageblatt".

She was used to a rather sophisticated atmosphere and a high-level intellectual life, not available in Zoppot. Charlotte «gathered from her conversation many years later that she detested the luxuries in Zoppot, which might have been occasioned by the residence of the German Crown Prince, Friedrich Wilhelm von Hohenzollern, who was wild in the eyes of German citizens, spent a great deal of money and seemed to follow any whim [3]. Elsa did not care about eating food out of season, listening to what she considered flat jokes. She missed the music and the theater and the beautiful museums in Vienna. After three years of marriage she left Zoppot, took her young son back to her home town and was divorced from Otto Houtermans.

**Fig. 1.1** F.G. Houtermans with his parents and grandfather in Toruń in 1905 (Courtesy of the Physics Institute of the University of Berne)

Otto married again and with his second wife "Mimi" (Suzanne Helmhold) went on an adventurous trip in German South West Africa and became mayor of Windhuk. Their first son Peter was born during the year they spent there (1912). Otto visited also Buenos Aires but they must not have liked life in Argentina either because they were soon back in Zoppot. Otto became director of a bank and they had two more children: Rosemary (b. 1916) and Hans (1919–1980)».

Fritz only met his father when he was fifteen years old. Charlotte and Fritz accepted him because he had a sense of humour and also easily forgave the radical jokes or strange behaviour on Fritz's part. Otto understood nothing of Fritz's interests or his professional ambitions and Fritz disliked Otto's kind of life. In spite of the distance between them, Fritz had a sentimental attachment to his father's family, especially to Hänsi, whom he met again in 1945 in Göttingen where Hänsi studied physics.

## References

1. Charlotte Riefenstahl (Fritz Houtermans' first wife) gave me copies of the following manuscripts she had written in various periods of her life for either her children (a, b, c) or close friends (d): (a) 26 pages manuscript she wrote for her children about the family background of Fritz Houtermans; (b) "And he was always right", the typewritten pages, dated September 1948; (c) 21 typewritten pages written after Fritz's death, during a vacation she took in July 1966 in Brione, high on the Lugano Lake. (d) 7 typewritten pages circulated among a few friends in 1981.
2. Die Belagerung (1869-1870) Tagebuch des Joseph Houtermans, geb. am 10.2.1848 in Voerendaal, gest. am 12.8.1921 in Toruń: Zum 100 Jahrestag der Belagerung Roms herausgegeben von Albert Houtermans, Mönchengladbach, und aus dem Niederlandischen übersetzt von seinem Patenonkel Christian Henskens. Eggelshoven, Niederlande. Das Original stellte freundlicherweise zur Verfügung: Peter Houtermans, Düsselsdorf. Fussnoten von Arno Houtermans.
3. Kronprinz Friedrich Wilhelm of Hohenzollern.

# Chapter 2
# His Youth in Vienna

Back in Vienna in 1905 Elsa Waniek rented a large apartment which was next to that of her sister Lilli and her husband Rudolf Gmeyner, a well established Viennese lawyer. They had three daughters: Anni (Anna) about two years older than Fritz, Tully (Alice) about the same age and Kitty (Elisabeth), the baby, born shortly after the arrival of Elsa and Fritz in Vienna. Both flats comprised the whole second floor of the house.

Elsa was a very intelligent, self-possessed, intellectual person that in today's jargon would be called a "liberated woman".

She settled down, organized her life and went back to school, finished the gymnasium and entered the University where she studied chemistry and biology, ending with a doctorate. The topic of her dissertation was: "Is pure water poisonous?" She had tremendous energy and enjoyed a very intense social life dominating the lives of her gentle sister, her three nieces and son. The preponderantly female environment in which Fritz grew up was only relieved by the presence of Lilli's husband. His position in the family was unique. He was adored by all as the best, the wisest, to whom everybody had to look up, if not to serve [1]. Charlotte adds in her notes: «I have never understood how Elsa, who thought herself intellectually equal to any man, could believe that men were so utterly superior, that women definitely were meant to serve them and play the part of, at best, beloved slaves»…

«During the summer months the whole family went to their country house in Baden, near Vienna. There was a large garden with fruit trees. The children loved to climb them, eat cherries, spitting the stones into the grass. Lilli discovered that soon enough, forbade it strictly and went back into the house. The children remained in the trees, went on eating cherries, but now swallowed the stones also. The result was a terrible tummy ache and, probably, some punishment too.

In the house there were frequent musical evenings. The enormous living room made the grand piano look small. Fritz and his cousins must have listened very often to chamber music, trios and string quartets.

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966)*, SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8_2, © The Author(s) 2012

Tully studied the piano and acquired a Ph.D in music. Fritz was not considered gifted enough, though he loved classical music all his life. Anni was the poet of the family and the baby sister was too young to be considered.

The emphasis in their education was literature and the classics. Fritz's mother had studied science. She had taught at the University during the First World War, when there was a scarcity of teachers, but later on devoted her life to the study of history of arts and philosophy. She studied Nietzsche and involved herself in Hindu philosophy. With her phenomenal memory she seemed to me (Charlotte) a living encyclopaedia. The small family estate was not large enough for her enterprising energy. She began to lecture for private groups on history of arts, combining this with tours through the museum. Her main thoughts, her main interests were Nietzsche and Goethe.

In Vienna there was a group of young women who sat at her feet and adored her. She herself was in turn fascinated and influenced by another dominating and very intellectual woman, Laura, who led a salon in Berlin, where she ruled supreme ».

Elsa was under Laura's spell for several years, but was very likely too intelligent to be dictated to. « What is still puzzling me as I write this story is the extraordinary philosophy on life which pervaded Elsa and her circle. They combined the loftiest ideals as outlined by the philosophers with the humblest notions of serenity they needed in daily life ». Charlotte remembers one tale where Laura and her disciples were in the mountains, found an empty shepherd's hut and began a thorough spring cleaning, washing the dirty shirts etc. The shepherd must have been tremendously annoyed when he returned; also he might have appreciated it.

Another "liberated woman" that had also an influence on the formation of Fritz and his cousins was Genia Schwarzwald, usually called "Tante Genia" or "Fraudoktor". She had created a circle of many people interested in music, literature, politics and economics and organized summer camps for the young people of the Viennese "elite schools" in different vacation resorts, such as Grundlsee, Ischl and so on. Karl Popper, Rudolf Serkin, the quadrefolium (Paul Lazarsfeld, Joseph Gluecksman, Ludwig Wagner and Alexander Weissberg-Cybulski) were used to participate in these summer colonies. Fritz Houtermans and his cousin Tully went to some of them.

« When Fritz was in his teens, life became difficult, in general, because of the First World War (1914–1918), and for him in particular, because of tensions at home between the group of the four children and the three grown-up people, who had developed rather complicated mutual relations among them. These were due in part to the presence of a single grown-up man with two women, in part to the dominating nature of Elsa, who, at one time or another, made all the others feel not to be up to the intellectual standards she had set for herself. Fritz started to show such a difficult behaviour that his mother, through her friend Anna Freud, arranged for Fritz to be taken care of by Anna's father, Sigmund Freud. The sessions, however, did not last long because when Fritz realized that he had to relate his

dreams to Freud, he and his imaginative cousin Anni began to invent dreams, which Freud soon discovered and stopped the psychoanalytic treatment [1] ».

Already at the age of 8 Fritz was fascinated by stars, minerals and butterflies and a few years later, by mathematics and also by history. The literary and musical atmosphere at home left its imprint on him but he never played an instrument or wrote.

« In a way he was somewhat of an outsider: since nobody took his interests seriously. His mother realized that he was very intelligent and somehow furthered his inclinations, but he was rather rebellious and challenged her authority but never succeeded to upset her Olympian calmness. Fritz went to the Akademische Gymnasium well known for counting among its graduates many young people that later became famous in one way or another: for example the poet Hugo von Hoffmannsthal (1874–1929), the mathematician Richard von Mises (1883–1953) and the physicist Erwin Schrödinger (1887–1961). Fritz became a close friend of his classmate Paul Boschan [2], and also of Rudolf Serkin and Alexander Weissberg-Cybulski. Years later Serkin became one of the greatest pianists of his time, and Weissberg a recognized physicist-chemist, whose life-line crossed that of Fritz Houtermans again in later periods. In those years Houtermans, Boschan and a few others of their schoolmates deepened the reading of "Plato Dialogues" and "Presocratics" and discussed thoroughly "Das ideal der inneren Freiheit bei den griechischen Philosophen" by Heinrich Gomperz [3], whose father, Theodor Gomperz was the well-known author of the "Greek Thinkers" [4]. A copy of the book "Aufruf zum Sozialismus" by Gustav Landauer [5], given by Fritz to Boschan, was inscribed by him with quotes from the "Novum Testamentum, Graece et Latine" [6] rendering of the sermon of the mountain and a quote from Friedrich Adler's "Vor dem Ausnahmegericht". Fritz used to cite Landauer's statement "Der Marxismus prophezeit aus dem Kaffeessatz" (Marxism makes predictions from the tea-leaves) ».

Around 1917 Fritz contributed, together with a few others of his friends, to the journal "Der sozialistische Mittelschüler". At the time of the assassination by Friedrich Adler of the Austrian Prime Minister, Count Stürck, both Fritz and Adler belonged to the "Verein für Sozialwissenschaften" and Fritz wrote an article on "Der sozialistische Mittelschüler" supporting violence as a necessary means to obtain political changes in connection with discussing the defence of Friedrich Adler before the extra-ordinary court [7].

This gave rise to a long and rather heated discussion with his friend Paul Boschan who insisted on the need for finding more gradual means for reaching radical changes, but the « stifling circumstances which had led to the emigration of many active intellects from Austria, were so horrible to make him (Fritz) impatient [2] ».

The difficult life conditions, after the First World War, but even more the family tensions, had started to make Fritz's life in Vienna not easy at all. Even forty years later, on various occasions Houtermans said: "Danke Gott wenn Du noch eine Mutter hast, aber ich hatte zwei" (Thank God if you have a mother, but I had two).

The final blow was his dismissal from the Akademische Gymnasium after he read inside the school, on occasion of the 1st May celebration, the "Communist Manifesto" in front of a crowd of schoolmates.

Thus Fritz went for the last year of school to the Landeserziehungsheim in Wickersdorf in Germany (Thüringen), which in those years was one of the best progressive schools in Central Europe [2]. Following the general scheme established by the director of this school Gustav Wyneken [8], pupils of different ages and sexes lived there in small groups under the care of a teacher who succeeded to create something of a family life for all of them.

The Landeserziehungsheim was one of the educational enterprises created in the course of the "deutsche Jugendbewegung" which appeared here and there in Germany and Austria in those years. Wyneken was involved in a dispute with the less progressive parts of the Youth Movement.

"Fraudoktor's" saloon and colonies, the intellectual students of the Akademische Gymnasium and the educational radicalism of the Wickersdorf School characterized the general background relevant to Fritz's life story.

At Wickersdorf, Fritz made lifelong friends, one being Irmine von Holten, the other one Heinrich Kurella. Irmine, later, married Robert d'Escourt Atkinson, an English physicist and astrophysicist who worked for his doctorate under James Franck at the same time as Fritz, and collaborated with Fritz in the late 20s. Heinrich Kurella later became Sitzredakteur (permanent editor) of the "Rote Fahne", the journal of a rather small group of communists which included Ernst Fischer and Manes Sperber [9]. In Austria, at that time, there was a strong socialist party supported by the working class. The communists were few and in great part "crazy intellectuals", at least in the opinion of the other leftist Austrians belonging to more or less the same circles. Weissberg most probably became a member of the communist party, at least later, but at the beginning he appeared to have a political orientation in some way in between the socialist party and the communist group.

Fritz Houtermans probably never became a member of the communist party, but at that time was extremely attracted by the "crazy intellectuals" who, in many respects, conformed to his anti-conformist views.

In 1933 the Nazi party was becoming more and more threatening and Kurella had to escape from Berlin [10]. He went to Zurich and became the chief editor of the illegal newspaper Inprecor (International Press Correspondence). About one year later, the Swiss Intelligence discovered his activity and expelled him from the country.

Kurella went to U.S.S.R. but, shortly later, was arrested and put on trial, condemned and finally executed as an anticommunist agent. He was one of the many victims of the massive and devastating political repressions that, at the end of the second "five-year plan" shook the U.S.S.R., which according to Stalin's official declarations was entering into the socialist era [11].

## References


1. Charlotte Riefenstahl (Fritz Houtermans' first wife) gave me copies of the following manuscripts she had written in various periods of her life for either her children (a, b, c) or close friends (d): (a) 26 pages manuscript she wrote for her children about the family background of Fritz Houtermans; (b) "And he was always right", the typewritten pages, dated September 1948; (c) 21 typewritten pages written after Fritz's death, during a vacation she took in July 1966 in Brione, high on the Lugano Lake. (d) 7 typewritten pages circulated among a few friends in 1981.
2. Paul Boschan, a classmate of Fritz Houtermans and later a mathematician, who emigrated to the U.S.A. where he worked for the Institute of Applied Econometrics. He gave me a number of useful information the 26th April 1980, when I visited him with Charlotte Riefenstahl in his house at 181 New Hamstead Road, New City, N.Y. 10956 and in later correspondence.
3. About H. Gomperz see in the "Michigan Quarterly Review", winter 1979, the article by Karl Popper "Three Worlds", footnote on p. 13.
4. Theodor Gomperz: "The Greek Thinkers".
5. Gustav Landauer: "Ausruf zum Sozialismus".
6. Novum Testamentum, Graece et Latine, Eberhard Nestle, United Bible Society, London.
7. Friedrich Wolfang Adler (Vienna 1879, Zurich 1960), Austrian politician, socialdemocratic, antimilitaristic, who, for protesting against the First World War, killed the Austrian Prime Minister Stürck. Condemned to death and amnestied after the fall of the monarchy, he became a member, after the revolution, of the Austrian National Council. Exiled in 1938, he became secretary of the International Union of the Socialist Workers until 1940. From 1940 to 1946 he was in New York as President of the Austrian Labour Committe.
8. Gustav Wyneken.
9. Manes Sperber from Yugoslavia is the author of the book "Der verbrannte Dornbusch".
10. In the book "Out of the Night" (Alliance Book, New York 1941) Jan Valtin presents the history of the communist party in Germany before and during Hitler time.
11. See, for example: (a) Roy A. Medvedev: "Let History Judge, the Origins and Consequences of Stalinism, Vintage Books, New York, 1973. (b) G. Boffa: "Storia dell'Unione Sovietica", Arnoldo Mondadori Editore, Milano, 1976.

# Chapter 3
# Student in Göttingen

These were the years of the Weimar Republic. Its constitution, approved by the National Assembly of Weimar on 11th August 1919, established that the German Reich was a republic, whose sovereignty derived from the people. It came to an end on 28th January 1933 when the 86 years old President of the Republic, Feldmarschall von Hindenburg, suddenly dismissed the chancellor, General Kurt von Schleicher and, two days later, nominated Adolf Hitler new chancellor of the German Reich [1]. Fritz Houtermans studied physics at the University of Göttingen from 1922 to 1927 under James Franck, who put him to work on the excitation of atoms by means of the mercury ultraviolet line of wavelength $\lambda = 2537$ Å /1/ (Fig. 3.1). In 1926 at the proseminar of Franck, Fritz met a girl from Bielefeld, who was also studying physics: Charlotte Riefenstahl. She was the daughter of G. Riefenstahl, journalist and magazine editor.

«During those years Fritz spent many vacations with Kurella exploring Switzerland and Northern Italy by bicycle. On one of these trips they ran out of money, Kurella went back home but Fritz befriended a test-driver of the FIAT company, who persuaded him to come along to Naples. The car had no body but in spite of its many inconveniences, the two young men had great fun. The Neapolitan family of the driver took Fritz in, asked what was his profession or trade and when he explained in his broken Italian that he was a physicist, they translated it to mean he was a plumber or electrician. Fritz stayed quite a while selling buttons to his only customer who was impressed that he knew who Cavour was, but nevertheless never paid him. His last job was at the harbour loading cargo. The other long-shore men liked him, and when they noticed that he could barely lift those heavy sacks, they let him keep track of counting the sacks and did the heavy work for him. Shortly before he was hired as a deck-hand to sail to New Zealand, Fritz's mother, frantic about his disappearance, succeeded in spotting his address in Naples and sent money and a laconic telegram asking him to return immediately to Germany. His return was urgent, since it would have been impossible for James Franck to reserve his research room any longer » [2].

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966),* SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8_3, © The Author(s) 2012

In those years the University of Göttingen was one of the three outstanding centres of German mathematical and physical tradition. Berlin and Munich were the two others. Among the Göttingen mathematicians the outstanding figure had been David Hilbert (1862–1943), who however was ill during much of the Weimar period. His interdisciplinary spirit was continued by his younger colleague Richard Courant (1888–1972) whose activity was oriented towards a tight collaboration with the physicists. The treatise, first appeared in 1924, on "Methoden der mathematischen Physik" by Courant and Hilbert was a clear manifestation of this attitude. It became in those years an important tool for the use of advanced mathematical methods by theoretical as well as experimental physicists. Even today it is one of the best books of this type. The Institutes of Mathematics and of Physics were on the Bunsenstrasse.

Among the mathematicians in Göttingen in the 1920s one should recall, besides Hilbert and Courant: Edmund Landau (1877–1938) prominent in number theory, Emmy Noether (1882–1935) [3] in algebra and Herman Weyl (1885–1955) in the theory of relativity, group theory and mathematical foundations of quantum theories.

At the Institute of Physics Max Born (1882–1970) had the chair of Theoretical Physics. He had been one of the founders of quantum mechanics. Among his many papers on this subject, the most outstanding one was his interpretation of the square of the modulus of a wave function at a certain instant and point of space as the probability for a particle (for example an electron) to be at that time at that

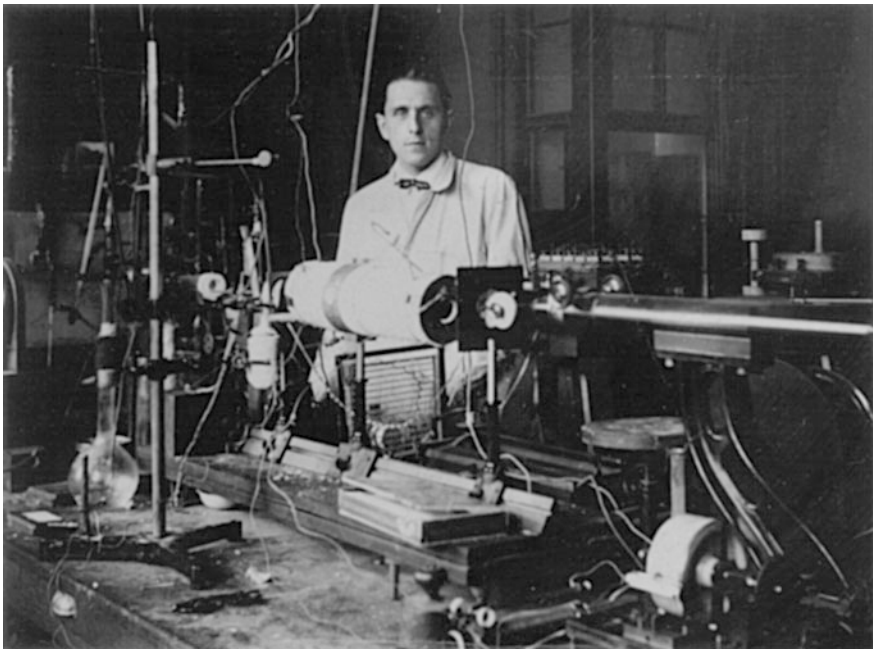

**Fig. 3.1** F.G. Houtermans in the laboratory during his Ph.D in Göttingen (Courtesy of the Physics Institute of the University of Berne)

point. He shared with W. Bothe the 1954 Nobel Prize for Physics. To Max Born the Prize was awarded "for his fundamental research in quantum mechanics, especially for his statistical interpretation of the wave function".

A number of younger theoreticians spent months or years working in Göttingen institute at that time. Let me recall among the German young people: Werner Heisenberg, Wolfgang Pauli, Friedrich Hund, Max Delbrück, W.M. Elsässer, Maria Göppert Mayer, and among the foreigners: Enrico Fermi and G.C. Wick from Italy, E.U. Condon, Robert Oppenheimer and H.P. Robertson from U.S.A., P.A.M. Dirac from Great Britain, E.A. Hylleraas from Norway, A. Fock from U.S.S.R., Victor Weisskopf from Austria and L. Rosenfeld from Belgium [4].

In the same building, but on different floors, there were two Institutes for Experimental Physics: the first Physical Institute, directed by Robert Pohl (1884–1976), the second Physical Institute directed by James Franck (1882–1964). Pohl was a distinguished experimenter, especially in optics. He was the author of a well-known university text book with a beautiful series of experimental demonstrations.

The interests of Franck were completely oriented towards the new atomic physics. His insight into fundamental problems complemented Born's tendency towards formalism [5]. He had shared the 1925 Nobel Prize in Physics with Gustav Hertz (Chap. 4) "for the discovery of the laws governing the impact of an electron upon an atom".

**Fig. 3.2** F.G. Houtermans with J.P. Maslakovez, G. Gamow, N.W. Lermotowa-Fok, J.A. Krutkov and N.N. Andreev in Göttingen in 1928 (V.J. Frenkel, Preprint 414, Max Planck Institute for the History of Science, 2011)

The young people of the Physics Institutes of the University of Göttingen got into the habit of discussing physics not only at the University but also at the "Café Cron & Lanz" where they were used to go all together. The marble tables were used for writing formulas or sketching experimental set-ups during the almost daily heated discussions. The resonant voice of Fritz, very often dominating all the others, could be heard all over the Café (Fig. 3.2).

All the students of the group were rather poor mostly because of the inflation. The only exceptions were Oppenheimer and Houtermans who received allowances from their parents. Almost always Fritz paid for everybody. They had also taken the habit of spending hours in the book-shop Peppmüller.

Fritz was a very witty man. He also possessed an almost inexhaustible store of Viennese Jewish stories and jokes that he used to tell in connection with the most different situations. Many years after, these stories were collected and published by a few of Fritz's pupils in Berne, who later became professors of physics in various German speaking Universities [6].

Once Fritz, with the permission of Franck, announced at the Colloquium the presence of a Russian professor in Göttingen and then introduced into the lecture room two dancing bears, whose owner he had met in the street just before.

In Göttingen the Proseminar, directed jointly by Born and Franck, was one of the stimulating gatherings of each week, where graduate students presented papers and where new ideas were discussed. Once, during 1926, Werner Heisenberg gave a lecture on the development of quantum mechanics which was one of the most awe-inspiring outlines of the state of this new field. At the end the audience applauded him with great enthusiasm. Pasqual Jordan (1902–1980) who was present in the lecture room took part in the following discussion. In spring 1927 the Annual Meeting of the Physical Society of Germany (Gauverein) was held in Hamburg, and many of the Göttingen young physicists, including Fritz and Charlotte, went there. At the meeting they had the opportunity of seeing and listening to P.A.M. Dirac from U.K. and W. Pauli from Austria. During spring and summer 1927 Robert Oppenheimer (1904–1967) already graduated at Harvard University, Fritz Houtermans, Walter Elsasser and Charlotte Riefenstahl passed Ph.D examinations in short succession. Their Committee was composed by Max Born, James Franck, Richard Courant and Gustav Tammann (1861–1938). Charlotte's thesis, under the physical chemist Tammann, was on the crystallization of gold and silver. Elsasser's and Oppenheimer's thesis, both under Max Born, dealt with the theory of collisions, and the quantum theory of the continuous spectrum. Finally Houtermans' thesis, under Franck, was "On the band fluorescence and the photoelectric ionization of mercury vapour". Divided into two parts, it appeared in Zeitschrift für Physik in 1927 /2/. During that academic year Fritz and Charlotte, or Fissel and Schnax, as they were called by their friends, had become great friends and had taken the habit of walking in the streets at night. The town, however, was so small that they always reached the open country pretty soon. The evening before Oppenheimer's departure from Göttingen they went to his house, where they met for the first time Georg Uhlenbeck (1900–1988) [7] who just arrived from Rome. Chatting about his Rome sojourn as a preceptor of the

son of the Dutch Ambassador in Italy and about the friendly relations he had established with Enrico Fermi and his colleagues in Rome, Uhlenbeck expressed his great admiration for the Divina Commedia of Dante Alighieri, in particular for the 5th Canto of the "Inferno", which had enchanted him. Upon which they all joined, enthusiastically, in reading it aloud to each other. Later on—not having enough copies—they borrowed a copy from the library, a priceless first edition. A few interesting remarks about Fritz and Charlotte can be found here and there in Elsässer's book [4].

In the meantime George Gamow (1904–1968) arrived in Göttingen from Berlin, where shortly before he had published his first paper on the theory of emission of alpha-particles from radioactive nuclei [8]. The discussions between Gamow and Houtermans brought a reformulation of the same ideas from a more phenomenological point of view, which allowed a better fit of the experimental data /3/. At about the same time Fritz Houtermans got a job at the Technische Hochschule in Berlin-Charlottenburg, and Charlotte went to the U.S.A. as an instructor at the Physics Department of Vassar College in Poughkeepsie, N.Y. Before her departure she received a bouquet of a hundred roses from Fritz.

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1. See, for example, Ref. [10] of Chapter 2.
2. Charlotte Riefenstahl (Fritz Houtermans' first wife) gave me copies of the following manuscripts she had written in various periods of her life for either her children (a, b, c) or close friends (d): (a) 26 pages manuscript she wrote for her children about the family background of Fritz Houtermans; (b) "And he was always right", the typewritten pages, dated September 1948; (c) 21 typewritten pages written after Fritz's death, during a vacation she took in July 1966 in Brione, high on the Lugano Lake. (d) 7 typewritten pages circulated among a few friends in 1981.
3. The brother of Emmy Noether, Fritz Noether, professor of applied mathematics at the Breslau University, left Germany and went to the U.S.S.R. with his wife and children, time before Fritz Houtermans and met him in the Butyrka prison as we can see in Chapter 10.
4. For more detail about the situation in Göttingen in those years see: (a) M. Born: "My Life, Recollections of a Nobel Laureate", Taylor & Francis Ltd (London, 1978); (b) W. M. Elsässer: "Memories of a Physicist in the Atomic Age", Science History Publications (New York, 1978).
5. Remarks in this sense were made independently by E. Fermi and V. Weisskopf.
6. "Leonium und andere Anekdoten um den Physikprofessor Dr. F.G. Houtermans Herausgeber: Haro von Buttlar, Bochum, 1982 Mitautoren: F. Begemann (Mainz), K. Hintermann (Hansen b. Brugg), H. Oeschger (Berne), I. Yandt (Hannover), W. Winkler (Würenlingen).
7. George Eugene Uhlenbeck (1900-1988). Professor of physics at Utrecht (1935-1939), Ann Arbor (Mich., 1939-1961), Rockefeller Centre (New York, 1961). Well known for the discovery, in 1925, in collaboration with S.A. Goudsmit, of the spin of the electron and for a number of important contributions to statistical mechanics.
8. G. Gamow: "Zur Quantentheorie des Atomkerns", Zeit. für Physik 51 (1928) 204-212. The same ideas were published independently at the same time by: R.W. Gurney, E.V. Condon: "Waves Mechanics and Radioactive Disintegration", Nature (London) 122 (1928) 439; Phys. Rev. 33 (1929) 127-140.

# Chapter 4
# Assistant in Berlin

In Berlin there was an impressive collection of scientific talents belonging to four or five different research institutions. Max Planck (1858–1947), the first to quantize the energy of the electromagnetic oscillator (1900), was professor of theoretical physics at the University of Berlin. He had been awarded the 1918 Nobel Prize for Physics "in recognition of the services he rendered to the advancement of physics by his discovery of energy quanta". His pupil, Max von Laue (1879–1960), had been awarded the 1914 Nobel Prize for Physics "for the discovery of the diffraction of X-rays by crystals". He was an outstanding figure not only as a scientist but also as a man, as we shall see later. When Max Planck retired in 1927, his successor was the Austrian physicist Erwin Schrödinger (1887–1961), founder of wave's mechanics. He shared with P.A.M. Dirac the 1933 Nobel Prize for Physics "for the discovery of new productive forms of atomic theory".

Albert Einstein (1879–1954) (Nobel Prize 1922) was in Berlin from 1913 to 1933, first (1913) with a chair of theoretical physics at the Prussian Academy of Science, and later (1914–1933) as director of the Kaiser Wilhelm Institute for Physics. His works on general relativity and on exchange of energy between molecules and radiation were produced in that period.

At the Technische Hochschule there was another outstanding group of physicists: Gustav Hertz (1887–1975), professor of experimental physics, who had been awarded the Nobel Prize for his work with James Franck, and Richard Becker (1887–1955) professor of theoretical physics and author of many papers and books on atomic physics, ferromagnetism and plasticity. For some time Becker's assistant was the Hungarian Eugene Wigner (1902–1995), who a few years later emigrated to the U.S.A. and, in 1944, was awarded the Noble Prize for Physics "for his contributions to the theory of the atomic nucleus and elementary particles".

The Kaiser Wilhelm Institute for Physical Chemistry and Electrochemistry was headed by Fritz Haber (1868–1934), winner of the 1918 Nobel Prize for Chemistry "for the synthesis of ammonia from its elements", while the Kaiser Wilhelm

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966),* SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8_4, © The Author(s) 2012

Institute for Chemistry was directed by Otto Hahn (1879–1968) and Lise Meitner (1878–1968). In 1963 Hahn received the Nobel Prize for Chemistry for the discovery of fission of heavy nuclei. A point of encounter of all physicists working in Berlin was the seminar lead by Max von Laue at the Institute of Physics of the University. For various reasons Berlin was also the organizational center of German physics, a leadership accepted by the majority of the other physicists but not by Wilhelm Wien (1864–1928), professor of experimental physics at the University of Munich, by Philipp Lenard (1862–1947) and Johannes Stark (1874–1957) who were also hostile to modern physics and anti-Semitic. All of them were very recognized experimenters and were awarded the Nobel Prize for Physics: Lenard in 1905, "for his work on cathode rays"; Wien, in 1911, "for his discoveries regarding the laws governing the radiation heat"; Stark in 1919, "for the discovery of the Doppler effect in "canal rays" and the splitting of spectral lines in electric fields". Both Lenard and Stark voiced their views about the deteriorating influence of Jewish scientists (in particular Albert Einstein) and in general of the Jewish way of thinking, in various meetings and in writing, gradually more explicitly, starting from the early 1920s and reaching, already in 1923, forms of expression very similar to those used by Hitler in the first volume of Mein Kampf, which appeared about one year later. The outstanding figure at the University of Munich was Arnold Sommerfeld (1868–1951), professor of theoretical physics, who unlike Wien, always closely collaborated with his colleagues in Berlin and had a number of Jewish students. He was the author of a number of fundamental papers and beautiful text books which have been studied by many generations of young physicists in Germany as well as abroad.

Werner Heisenberg (1901–1976) and Hans Bethe (1906–2005) had been two of his many talented students. Bethe was also his assistant for a few years. At the Technische Hochschule in Berlin Fritz Houtermans was first assistant of Gustav Hertz, but his main duty was to teach in the "Praktikum" managed by Professor W.H. Westphal. Robert d'Escourt Atkinson (1898–1982) had come with Fritz from Göttingen and was one of the many assistants conducting the advanced laboratory. Walter Elsässer and Alexander Weissberg joined this group for a while. In 1929 Atkinson and Houtermans published a more complete and systematic treatment of the theory of the alpha decay of heavy nuclei /4/ /5/ and used their formulas for computing from the experimental values of the energy of the emitted alpha-particle and of the decay constant the radius and height of the potential barrier for each single nucleus of the uranium-radium family. The smooth dependence of their results on the atomic mass represented a considerable progress with respect to all previous publications.

At about the same time they tackled a completely new problem: that of the formation of elements in stars with production of energy /6/ /7/. Already Max von Laue and Kudar independently [1] had suggested the possibility of formation of light elements through the inverse process of alpha-decay, but found values much low by orders of magnitude for the probability per unit time to occur even under

stellar conditions. Atkinson and Houtermans, however, computed the probability per unit time of nuclear capture in light nuclei not of alpha particles but of protons under the conditions expected at the centre of a star.

As typical conditions they used a density of at least $10^{23}$ protons/cm$^3$ and a temperature between 10 and 20 million Kelvin. For heavy nuclei the probability of proton capture turned out to be exceedingly small, but for light elements, assuming a collision radius of 4 $10^{-13}$ cm, they obtained half lives ranging from 8 s in $^4_2$He to $10^9$ years for $^{10}_{20}$Ne. Then they proceeded to estimate from phenomenological arguments the probability for a proton remaining bound in the nucleus through the emission of its excess energy by radiation.

From a detailed analysis of the capture of protons by light nuclei they concluded that processes of this kind can provide the mechanism not only for the formation of light elements, but also for supplying the energy required for maintaining over the ages the emission of radiation from the stars. The authors discussed their paper with Gamow before publication, during the Christmas holidays spent to do some skiing in Zürs am Arlberg. The results are very close to those given by modern calculations, as Gamow pointed out years later [2].

Gamow also noticed that the derivation by Atkinson and Houtermans involves two mistakes, which compensate each other and which, in 1929, were generally accepted by all physicists. For the proton-nucleus collision cross section the authors used the geometric cross section and not the square of the De Broglie wave length of thermal protons. Furthermore they attributed the emission of photons to dipole transitions while we learned during the 1930s that nuclei radiate quanta of higher angular momentum.

As a conclusion of this group of important papers Houtermans published in 1930 a comprehensive review article in the "Ergebnisse der exakten Naturwissenschaften"/8/, entitled "Recent works on the quantum theory of the atomic nucleus".

Shortly later, Houtermans started to work with M. Knoll and W. Schulze on the electron microscope with special regard to the construction of the magnetic lenses /9/ /10/. Houtermans and Knoll took a patent on the design of magnetic lenses and the first model of their microscope was kept for a rather long time in the living-room of the apartment of Fritz and Charlotte, who in the meantime had returned from the U.S.A. With his work on the electron microscope Houtermans became "Privatdozent" with Hertz. In a paper on the prehistory and early history of the electron microscope, presented by Ruska at an international conference held in Australia in 1974 [3], Houtermans and Knoll are quoted as the first to have introduced the De Broglie wave length of the electron as the important physical quantity that should be considered in connection with the resolving power of the electron microscope.

During the Berlin period Houtermans published two more papers, one on a light source particularly designed for the investigation of the fluorescence light of metal vapours /11/, the other on the experimental study of the absorption and other optical properties of fluorescent media by means of modulated light /12/.

From the beginning of this paper Houtermans stresses the interest of this method for measuring the absorption of spectral lines which start from excited states of atoms or molecules. The modulated light was produced by a periodic source emitting a continuous spectrum which was detected by means of a photocell connected to an alternating current amplifier tuned on the same frequency. The absorbing material, typically a tube filled with a gas crossed by a continuous electric discharge, and, possibly, the instruments necessary for the spectral analysis of the transmitted spectrum, were inserted between the source and the photocell which recorded the modulated light but was insensitive to the radiation emitted continuously by the absorber. The method was tested by Houtermans by measuring the absorption lines emitted by the caesium vapour present in an appropriate electric arc. The problem of the absorption of light from excited states of atoms or molecules is very closely connected with those taking place in the laser, which was discovered about 50 years later. According to what Houtermans was used to say years later, in the 30s he had even thought about the "Lichtlawine" (light avalanche), but I was not able to find these words in his writings although it is quite possible that he arrived rather close to this idea, which is essential for the discovery of the laser.

In Berlin Houtermans devoted part of his time also to help G. Hertz who, in those years, was the first to develop the diffusion method for separating isotopes and to apply it successfully to neon [4] and hydrogen [5]. Houtermans, making use of the remarkable experience as an atomic spectroscopist he had acquired at the Franck school, determined the relative abundance of the isotopes by photographing and measuring the spectra of the enriched samples. He was actually the first to measure the hyperfine structure of artificially separated isotopes [6].

In autumn 1931 a new brilliant young physicist from Vienna appeared in Berlin: Victor Weisskopf (1908–2002) who had been asked by Erwin Schrödinger to replace for one semester his assistant, F. London (1900–1954), who was spending a few months in the United States.

Weisskopf had studied in Vienna during the academic years 1926–1927 and 1927–1928, mainly under the guidance of Hans Thirring (1888–1976) and had completed his formation in Göttingen with Max Born and James Franck, passing his Ph.D examination at the end of spring 1931. His thesis on the theory of resonant fluorescence [7] was made under the supervision of Born, but the same choice of the problem clearly belonged to the area of interest of Franck, who exerted a considerable influence on the young Austrian. He was also influenced by Eugene Wigner who came often to Göttingen from Berlin, and with whom Victor Weisskopf published two important papers on the width of the spectral lines and the mean life of the atomic states [8].

From Göttingen Weisskopf went to Leipzig, where he stayed until March 1932, at the Institute of Werner Heisenberg, another of the great centres at that time. Besides Heisenberg there was Friedrich Hund (1896–1997), professor of spectroscopy, Felix Bloch (1908–1984), assistant of Heisenberg, C.F. von Weizsäcker (1912–2007) an exceptional student, and a number of other remarkable young physicists coming from all over the world.

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2. G. Gamow: “My Early Memories of Fritz Houtermans”, preface to the volume “Earth Science and Meteorities” dedicated to F. G. Houtermans on his sixtieth birthday, compiled by J. Geiss and F. D. Goldberg, North-Holland Publ. Co. Amsterdam, 1963.
3. E. Ruska: “Zur Vor- und Früh-geschichte des Elektronenmikroskops”, 8th International Congress on Electron Microscopy, Camberra 1974, Vol 1, 1-5.
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# Chapter 5
# Fritz's First Marriage

Charlotte came back from the United States in 1929 and went to live in Berlin. Actually her contact with Fritz had been maintained all the time by letters. In Berlin they lived in Halensee and saw each other constantly.

Late in 1929 or early in 1930 Fritz and Charlotte paid a visit to Fritz's father. Charlotte describes her first encounter with Otto as follows: « We went by train to Danzig and from there to Zoppot, where Otto Houtermans lived with his second wife and their three children Peter, Hänsi and Rosemarie, who, of course, were quite grown up, Peter studying in Munich or Bonn and only Hänsi, I believe, still in the "gymnasium". Not used to any opulence and more adjusted to a utilitarian way of life in the United States, I was impressed by the vastness of the house, the layers of oriental rugs, the lovely edged wine glasses with hunting scenes etched especially for Otto in Bohemia. It was a pleasant visit, but strangely enough the family impressed me less than the ancient city of Danzig. It may be that I was under Fritz's influence, who made fun of everything which was not strictly academic. Otto Houtermans was tall, jovial and easygoing. His main interests were photography and hunting. The house was filled with trophies, reminders of his many trips to the various hunting grounds in Europe » [1].

On occasion of a physics conference held in Odessa (Ukraine) during August 1931 Fritz and Charlotte went there by train. During the one-week trip some tension arose, from time to time, among them for completely futile reasons. The following little story is typical.

They had just passed the U.S.S.R. border, when they thought to practice their Russian but her two slim Russian grammars had been placed in the big suitcase. Fritz said: « All right, let's start with the first declination », and Charlotte answered too quickly with her suggestion: « Let's decline 'table'; we always started with "table" in all languages. Do you remember mensa, mensae,…? » « will not » Fritz answered in an unreasonably violent mood. « Why should I always, from now on all my life, in all languages, always start with: the table, of the table, to the table… It's absurd, utterly bourgeois and reactionary » [1].

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DOI: 10.1007/978-3-642-32855-8_5, © The Author(s) 2012

After a while he added: «I shall decline the elephant». They looked at each other, their faces were blank. They did not know how to stop it … and they both looked for a way back,… to regain their lost happiness, … but they only fumbled, trying to make him give up his absurd demands, to convince her of the despicable conservatism of her view-point. It continued for many miles… At last the train stopped: nothing outside but bare fields. They were in the next to last coach and had no way of seeing the station. Further ahead doors banged, feet tromped, voices, yelling, and calling. After a while Charlotte asked:

«What are they shouting?» «I told you so», said Fritz, «they shout elephants». Then Charlotte was really furious and of course did not believe it. The train restarted and just then they saw where all the people were running to. Just outside the station there was another train with unusually shaped cars, huge doors, some wide open and out of these looked tranquilly not less than four elephants. It was a circus train! [1]

Fritz felt this encounter to be a proof of the soundness of his views about how to learn languages and Charlotte, in this as well as in other circumstances of their life, remained with the impression that Fritz had a kind of divination capacity. But, apparently, this talent manifested itself only in unimportant circumstances.

In Odessa Fritz and Charlotte went to live in a hotel in the vicinity of the steps well known from the Russian film "Revolt of the Potemkin", directed by Sergei M. Eisenstein. At the end of the conference the participants were invited to a trip by boat on the Black Sea which lasted a few days with stops to Sebastopol, Yalta and Batumi in the Caucasus.

Fritz and Charlotte married in Batumi, where the documents were issued in Grusinian language. Their marriage witnesses were D. Iwanenko and W. Pauli who had recently divorced his first wife. Also Rudolf Peierls and his Russian wife, Eugeniia Kanegiesser, were present [2]. She was a Leningrad physicist and they had married less than one year before, after they had met in 1929 on the occasion of a trip of Rudolf to the U.S.S.R.

After their marriage Fritz and Charlotte went via Tiflis and Kharkov to Moscow. They stayed near the Kremlin in the Grand Hotel and met there, by good luck, a very interesting group which accompanied the Indian poet Rabidranath Tagore. They knew his nephew Shomendranath, who acted as his uncle's guide and interpreter, and they were thus included in the magnificent tour prepared for the poet. Part of the group was also the daughter of Albert Einstein, Margaret, who was there with her husband Marianov, a Russian theater actor. Before going back to Berlin the Houtermans also spent a few days in Leningrad (Hotel Astor).

Not long after their marriage Fritz and Charlotte were visited by Otto Houtermans, who had taken the habit of stopping in Berlin to see his son and his daughter in law on his trips to Munich.

It was on the occasion of the first of these visits that Otto cut Fritz's allowance "because two can live cheaper than one", which astonished Charlotte and also made their life more complicated. An agreeable aspect of these visits was an

invitation to both of them to have dinner at the fashionable and expensive Kempinsky Restaurant, on the famous Kurfürstendamm.

According to Charlotte «these dinners were sumptuous. We usually-if it was the right month—ate oysters and we consumed as much as possible because we were always hungry. I remember that we occasionally went to Kempinsky by ourselves and usually ordered "kleine Zwischengerichte", cheese and coffee, which was the cheapest of all possible dinners and gave one the excellent feeling of having dined well. After dinner we often went to our apartment. Otto Houtermans trusted me to make good coffee, but he did not trust my cooking, and I believe he was quite right. He really was very amusing though his stories were on the heavy side, while our enthusiasm for exciting problems in modern physics did not produce any reaction in him». On the other hand, he was proud both of Fritz and his first wife Elsa, who had earned her doctorate degree in the meantime, and after Fritz had passed his Ph.D examination, he financed for both of them a trip to Spain which was a wonderful experience. Charlotte continued: «They could not speak Spanish, but were very successful speaking Latin with what they thought was a Spanish accent, hoping to be understood. And apparently it worked. While his father's visits were very nice in a way, they also depressed us because we had so little money, which did not bother us in the ordinary way, except when we saw the bill at Kempinsky's».

## References

1. Charlotte Riefenstahl (Fritz Houtermans' first wife) gave me copies of the following manuscripts she had written in various periods of her life for either her children (a, b, c) or close friends (d): (a) 26 pages manuscript she wrote for her children about the family background of Fritz Houtermans; (b) "And he was always right", the typewritten pages, dated September 1948; (c) 21 typewritten pages written after Fritz's death, during a vacation she took in July 1966 in Brione, high on the Lugano Lake. (d) 7 typewritten pages circulated among a few friends in 1981.
2. Sir Rudolf Peierls (Berlin, 1907 – Oxford, 1995) studied theoretical physics in Berlin, Munich, Leipzig, and at the ETH of Zurich, under Sommerfeld, Heisenberg, and Pauli. He was Professor of Applied Mathematics at the University of Birmingham (1937-63) and of Theoretical Physics at the University of Oxford (1963-74). In addition to many important papers on the theory of solids, nuclei, and fields, Peierls has published a few books: "Quantum theory of solids", (1955); "The laws of nature" (1955); "Surprises in theoretical physics" (1979). He is the editor of "A perspective of physics", Vol.1 (1977), Vo1.2 (1978). His autobiographic book ("Bird of Passage", Princeton University Press, 1985) is particularly interesting.

# Chapter 6
# Life in Berlin

After their marriage the Houtermans moved into an apartment across the road from the laboratory. It was one end of the long barracks built after World War I as living quarters for students. According to Charlotte [1]: "Life in Berlin between 1929 and 1933 was unforgettable. The city vibrated with new ideas in practically all fields. The Kurfürstendamm, Berlin's entertainment center, was alive with new plays, films, concerts. The numerous cafés were the meeting places for the intelligentsia. All social life was of extraordinary vigor, and the levels of conversations were higher than I ever experienced before and since. We had many friends-Fritz seemed to attract people. He was always full of ideas, he told stories, witty jokes; he was interested in a great number of different things, running the gamut from physics to music, to economy, to politics. Pauli came to visit one Christmas, Gamow and Landau were frequently in Berlin. Then there was Polanyi with his interest in economics and politics, his niece Eva Striker, a gifted ceramic designer, who later married Weissberg, Sperber, a writer who had been a student of Adler's. Weissberg-Cybulski was a physicist and engineer, and one of the most intelligent persons with an astonishing command and knowledge of history, politicism, Marxism, to which one should add his gift of quoting and reciting Rilke by the hour. The small house and the tiny garden were always bursting with guests. It was not unusual to have 35 people dropping in for tea".

One evening almost every week the Houtermans invited their colleagues and friends to what Fissel called "Eine kleine Nachtphysik" paraphrasing Mozart's "Eine kleine Nachtmusik". Their first child Giovanna was born in Berlin in 1932 and, as wrote Charlotte, "brought us great happiness" (Fig. 6.1).

«Parallel to all this high-pitched excitement ran the ever growing awareness of the slowly increasing power and influence of the National Socialist Party. People became more and more afraid to speak openly, to be linked rightly or wrongly with some political parties. Our apartment was raided by Nazi students, who in those early years though fanatics were poorly initiated in Nazi theories. When raiding bookcases, they did not know what was-in their own belief-controversial and what

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DOI: 10.1007/978-3-642-32855-8_6, © The Author(s) 2012

**Fig. 6.1** F.G. Houtermans with his wife Charlotte and their daughter Giovanna in Berlin in 1932 (Courtesy of the Physics Institute of the University of Berne)

was not. I remember a raid on an apartment building, where many actors and writers lived. Some were imprisoned on trumped-up charges, but were allowed visitors who brought food and books. The Nazi guard inspecting it all seized one of the books: Karl Marx 'Das Kapital'. Very pleased he exclaimed: You dumb communist, here is a good book for you to study.

After the raid on our apartment the Technische Hochschule forced the Nazi students to apologize, thus protecting us for a little time at least. Any liberal attitude was interpreted as anti-nazi or communistic. Since the police itself was under attack, they became gradually unable to help ordinary citizens, whether Jewish or not. Thus fear and uncertainty and anticipation of terrors to come were increasing every day.

After the raid we inspected our bookcases for incriminating material. Fritz had bought books, pamphlets, periodicals, representing the whole gamut of the political spectrum. Some books like Marx seemed to us to be classics, some liberal writings legitimate criticisms; others maybe doubtful or even dangerous. We began a private purge, destroying compromising papers by tearing them apart and flushing them down the toilet, since we had no facilities to burn them. We had to stop this soon, because the Nazi students next door might have become suspicious. Fritz then remembered that he had some relatives on his mother's side, an elderly Jewish couple, who, we hoped, might have a stove, and asked them whether he could burn the rest of the material in their kitchen. He was asked to come late in the evening, so they could be sure that their non-Jewish maid was asleep in her

upstairs room. Fritz left our house with his large package, very apprehensive whether he would manage to cross the dark Savigny Place unmolested. When he arrived at his uncle's flat, he felt very nervous and became suddenly conscious of the danger for these nice people. But his uncle did not allow him to apologize. Never mind, he said, it's nothing new. Father did it also in 1948.

As time went on, the Nazis got stronger and bolder. Then came the horrible day when Jewish homes were attacked and vandalized, pianos thrown out of the windows, people were arrested, the police was helpless. When they could not protect anybody any longer, when one day the Jewish faculty members were not allowed to enter the university, it was time to think of leaving. People began to emigrate, smuggling money and valuables if they were suspected to have no legitimate reason for going. It was easier for those who had relatives abroad or were invited to new jobs. Everybody who could help made connections to foreign universities, suggesting jobs. Fritz was involved in these projects, but the great pillar who helped so many people was Max von Laue. Fritz was only 1/4 Jewish on his mother's side and in no immediate danger. But since he did not look like the Nazi prototype, more like an Italian than a blond Nazi, and since he never would have said "Heil Hitler" his safety might not have been of long duration. When Weisskopf came through Berlin from Vienna on his way to Copenhagen, I asked him to do something for Fritz abroad because he was not taking any steps on his own behalf. Vicki made the connection with the Electrical and Musical Industries, His Masters Voice, in Hayes, England. The head of their research department was Shoenberg (1880–1963) who was born in Pinsk, in Russia, had moved with his family to Great Britain in 1914, where he made a brilliant career as an applied scientist and television pioneer [2]».

## References

1. Charlotte Riefenstahl (Fritz Houtermans' first wife) gave me copies of the following manuscripts she had written in various periods of her life for either her children (a, b, c) or close friends (d): (a) 26 pages manuscript she wrote for her children about the family background of Fritz Houtermans; (b) "And he was always right", the typewritten pages, dated September 1948; (c) 21 typewritten pages written after Fritz's death, during a vacation she took in July 1966 in Brione, high on the Lugano Lake. (d) 7 typewritten pages circulated among a few friends in 1981.
2. For more information see: "Shoenberg, Sir Isaac", in Dictionary of National Biography.

# Chapter 7
# Emigration to U.K. and U.R.R.S.

The dissolution and end of Weimar Republic took place mainly in the period from 1931 to 1933, while the period 1933 to 1934 is indicated by historians like Shirer [1] as that of the nazification of Germany. The complexity of this amazing tragedy, that occurred in Germany and involved pretty soon the whole of Europe and later the entire world, certainly cannot be reduced to a few names, dates and figures. But as a hint at some of the wings of the huge stage, in a little corner of which took place our story, I will recall very briefly a few emblematic events of those years.

In September 1930 on occasion of the national elections in Germany, the National-Socialist Party, led by Adolf Hitler, obtained six and one half million of votes, compared with slightly more than eight hundred thousand only 2 years before.

On 10th October 1931 Hitler was for the first time received by the President of the German Republic, the Feldmarshall Paul von Hindenburg.

At the beginning of 1932 Hitler ran for office at the elections for the presidency of the Republic and started to campaign against the about 85 years old von Hindenburg, who was at the end of his 7 year mandate. The result of the elections, that took place on 13th March 1932 are:

| | Votes | |
|---|---|---|
| Hindenburg | 18651497 | 49.6% |
| Hitler | 11339446 | 30.1% |
| Thälmann | 4983341 | 13.2% |
| Düstelberg | 2557729 | 6.8% |

At the end of a period of great confusion and instability, the last chancellor of the Weimar Republic, Schleicher, resigned his mandate on 28th January 1933, only 57 days after his appointment; two days later, on 30th January 1933, President von Hindenburg nominated Hitler chancellor. In his cabinet the National-Socialists represented a minority, while the most important departments fell to

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DOI: 10.1007/978-3-642-32855-8_7, © The Author(s) 2012

"conservatives" and those remaining to "independent experts". But that day the Weimar Republic came to an end after 14 years of unsuccessful attempts to create in Germany a working democracy.

On 27th February the Reichstag (i.e. the Parliament House) was set on fire by an insane communist incendiary who had followed an idea born in the minds of Göbels, Göring and other Nazi leaders. Immediately the Nazis accused the Communist Party of this crime against the new government. Taking advantage of the consternation of the public opinion, the next day, 28th February Hitler forced von Hindenburg to sign a decree "for the protection of the People and the State" by which the seven articles of the constitution regarding personal and civil rights were abolished. Furthermore it authorized the Reich's Government to assume full power in the Federal States, if necessary, and to apply capital punishment for a certain number of crimes, including that of "serious disturbance of the peace" by armed people.

The Communist Party was baned; about four thousand communist State employers and a great number of social democratic and liberal leaders were arrested, including members of the Reichstag who were supposed to enjoy parliamentary immunity.

On 5th March 1933 democratic elections took place for the last time during Hitler's time. The Nazis collected about 17.3 million votes, with an increase of 5.5 million and thus reaching 44% of the votes, their allied Nationalists guided by von Papen and Hugenberg, obtained only 3.1 million votes (8%), the Party of the Center 4.4 million votes; together with its allied, the Bavarian Catholic Party they realized 5.5 million votes (14%). The Social Democrats essentially maintained their position with 7.2 million votes (19%) and the Communists still collected 4.8 million votes (12%) with a loss of one million votes with respect to previous elections.

The solemn ceremony of the opening of the first Reichstag of the Third Reich took place on 21st March, and two days later Hitler presented to the Parliament the "Gesetz zur Behebung der Not von Volk und Reich" (Law for the elimination of the state of need of People and State) which gave full power to his cabinet. In five short articles this law took from the Parliament the legislative power, the control over the Reich's budget, the approval of treaties with foreign States and the initiative of amendments to the constitution, all of which were transferred for 4 years to the Reich's Cabinet.

On 2nd August 1934 von Hindenburg died and three hours later it was announced that the offices of Chancellor and President of the Reich were unified in the person of Adolf Hitler, who was also the supreme commander of the armed forces.

That's enough for sketching the general frame in which our story took place.

Thus during the winter 1932–1933 both Fritz and Charlotte started to realize that they also had to leave the country as soon as possible. Before doing so Fritz went once more to Zoppot, via the Danzig corridor [2], to say goodbye to his father. As Charlotte wrote [3]:

« This visit to Zoppot was a short one and ironically in a way his father's bourgeois tastes in living actually saved him from a possible imprisonment at that time. Fissel was a chain smoker and, what I used to call, a chain newspaper reader. Hence, when he left Zoppot, he was laden with a stock of the latest newspapers, which ranged from the very right to the very left, including some economical statistical surveys that were probably issued by either the social-democrat or communist party. Passing the Danzig corridor, during which time the train was sealed, a Nazi police detachment raided and searched the train and found Fissel's compromising newspapers and accused him of being a communist. Fritz's defense consisted in pointing out that well-informed persons ought to be familiar with all points of view, and gave the right wing papers as evidence. These arguments made no impression, but something else saved him. In his hurried and rather disorganized way he had picked up, together with his books, his father's leather bound cellar-book with his list of wines, when bought, when laid down, price etc. The police took this impressive document as his personal property, and concluded that the owner of such a cellar could not possibly be a communist. Fissel arrived in Berlin free, but rather shaken. He never saw his father again and we learned of his death in 1936 when we were in Kharkov. It was said that he died of a heart attack while on a hunt, aiming to shoot a deer ».

In spring 1933 Fritz went first to Copenhagen and from there to England. Charlotte followed him in June, packing and shipping their belongings and saying goodbye. The last person Charlotte saw was Professor von Laue who had messages to take abroad, as Charlotte wrote [3]:

« I went by train to Rotterdam, after having been seen off at "Bahnhof Zoo" by a large group of friends whom we might never see again. Crossing the border into Holland was nerve-wracking. I had to face the Nazi patrols and their inspections and questions. On the boat we were safe finally; it was peaceful in spite of the crying baby who was thoroughly upset and would not sleep ».

The Houtermans stayed in Cambridge for a few weeks, where they meet again the Blacketts [4] they had first seen years before in Göttingen, and became friends with Giuseppe Occhialini [5] who stayed in the same boarding house. As soon as they found a place to stay, they moved to Hayes, Middlesex, because Fritz wanted to be near his place of work.

« Settling down in this small town was rather an anticlimax after the high-pitched atmosphere of the last weeks in Berlin and the intellectual companionship with the friends in Cambridge. After the constant tension in Berlin with all its fears and pressures, Hayes presented us with quietness and peace. It was unfortunately the calmness of a suburb, a very tiny place with ugly little houses, semi-detached, with identical gardens in streets with pretentious names. Fritz had to contend with a well organized working day and its fixed hours. He was used if necessary to work all night if a research project required it. To stop exactly at 5 p.m. as well as to begin in the morning at a given time was a great burden for him.

We were not quite as isolated as we had feared during the first weeks. Our concerns for the refugees and the friends who were still in danger inside Germany kept us busy and brought all kinds of people from London to discuss ways of

helping. Fritz got a rather princely salary from "His Masters Voice" and was able to spend a great part of it on these financial projects. The Quakers in London had organized the Coordinating Committee and collected names and curricula vitae of scientific personnel. They tried to connect them with jobs abroad: in Turkey, India, Scotland, England Leo Szilard [6] worked with them and devoted all his time and energy to this task. Fritz made contacts with professors in Oxford and Cambridge, collecting signatures for letters pleading for the release of political prisoners. Our house was constantly full of guests, many of them refugees who stayed for days or weeks or even months. Hayes was quite far from London, but the stream of visitors kept on coming. Fritz seemed to attract people. He was very hospitable, generous, always full of ideas of how to help, how to organize whatever was needed. Fritz and Lange [7] equipped the upstairs kitchen as a darkroom, where they developed micro-photography and finally succeed to reproduce whole pages of the London Times in the size of a postage stamp. The idea was to send news and information into Germany to people who had no other means of learning what was going on abroad. These tiny films, often undeveloped, were pasted under the postage stamps or into cigarette packages.

But in spite of all these useful and important activities, in spite of the visits of so many friends, the isolation in Hayes became more and more oppressive. We went of course to London to parties, at the Blacketts where we met the French scientists: Auger [8], Perrin [9] and the Joliot-Curies [10]. Somehow this contributed only to Fritz's misery instead of alleviating it. He missed the scientific inspiration, the exchange of ideas, which is the essence of university life.

One day Alexander Leipunski (1903–1972) arrived from Kharkov. He had a two year stipend to work in Cambridge in the Rutherford laboratory. He spent all his weekends in Hayes. Sasha was loved by everybody. He was "simpatico", gentle, entertaining, pleasant and very intelligent. It was he who told Fritz about the scientific work in the Physics Institute in Kharkov. His interests were the same as Fritz's. Sasha painted the scientific possibilities in such rosy colors that Fritz began to anticipate a possible renaissance there for his scientific ambitions. Hayes did not look like a permanent solution for him, the U.S.A. were closed, and now Sasha was opening a new door. Sasha offered him a contract with half a salary paid in foreign currency, guaranteed vacations abroad, a house or an apartment. It all sounded so good, especially against the background of Hayes, and became more tempting as the months went by. In order to accommodate more refugees, the salary fund from which Fritz was paid, was now to be divided between more people, a curtailment which would have made the financial assistances he had promised to others impossible. So in spite of all the warnings of friends, of all the negative aspects of such a step, Fritz finally accepted.

When Pauli visited us and warned over and over again not to go, he did not listen any more. Our political instincts were dormant. What was alive was the hate of the Nazi regime, the danger and the terror of the Third Reich, the possible dangers and risks awaiting us in Russia were minimized by comparison. It was the time of the Kirov murder [11], and if nothing else this alone should have warned us and prevented us from leaving England » [3].

## References

1. See, for example: W.L. Shirer: "The Rise and Fall of the Third Reich".
2. After the First World War Poland was reconstituted as an independent state with a way out to the Baltic Sea obtained by transferring to it the German Länder of Poznań and Pomerelia. This strip of Polish territory, about 50 kilometers wide, was called Polish Corridor or Danzig Corridor. It separated the Republic of Danzig and the German Land of East Prussia from the main parts of Germany. During Hitler period the trains connecting Germany to Danzig and East Prussia were closed and kept under strict watch by the Nazi police while travelling along the Danzig Corridor.
3. Charlotte Riefenstahl (Fritz Houtermans' first wife) gave me copies of the following manuscripts she had written in various periods of her life for either her children (a, b, c) or close friends (d): (a) 26 pages manuscript she wrote for her children about the family background of Fritz Houtermans; (b) "And he was always right", the typewritten pages, dated September 1948; (c) 21 typewritten pages written after Fritz's death, during a vacation she took in July 1966 in Brione, high on the Lugano Lake. (d) 7 typewritten pages circulated among a few friends in 1981.
4. P.M.S. Blackett (1897-1974) was awarded the 1948 Nobel Prize for physics for his development of the Wilson cloud chamber method and his discoveries therewith in the field of nuclear physics and cosmic rays. For a detailed biography, see: Bernard Lowell, "Biographical Memoires of Fellows of the Royal Society", Vol.1 (1975) pp.1-115.
5. Giuseppe P.S. Occhialini (Fossombrone (Pesaro), 1907 – Paris, 1993) studied physics at the University of Florence passing his laurea examination in 1929. In 1930 he became assistant at the University of Florence and the successive year with a fellowship of the Italian Consiglio Nazionale delle Ricerche (CNR) went to Cambridge where he started to work with P.M.S. Blackett, with whom he developed the technique of triggering a cloud chamber by means of two or more counters in coincidence. In 1937 he became associate professor at the University of S. Paulo in Brasil. When, in 1942 Brasil entered the Second World War, he was obliged to give up his academic position until 1945 when Italy became cobelligerent. At the end of that war, Occhialini went to England where, after abortive attempts to serve the Allied cause, he moved to Bristol as DSIR fellow of the laboratory directed by C.F. Powell. He worked at this University until 1948, when he was offered a research position at the Centre de Physique Nucléaire in Bruxelles. In 1949 he was appointed professor at the University of Genoa and in 1952 he moved to the same chair at the University of Milan. His remarkable experimental work was devoted to particle physics, cosmic rays and, in later time, space research. His most outstanding contributions are the works with Blackett on the positron and electromagnetic showers and those with C.F. Powel1 which led, among others, to the discovery of pions.
6. L. Szilard (1898-1964), a very brilliant physicist, and later biophysicist, of Hungarian origin, who emigrated from Germany to Great Britain and later to U.S.A. For a detailed biography see: E.P. Wigner: Biographical Memories, National Academy of Sciences 40 (1969) pp.337-347.
7. Fritz Lange, physicist and engineer worked at the AEG (Berlin) on high voltage production. Under Hitler pressure he emigrated to Great Britain and later to the U.S.S.R.
8. P. Auger.
9. J. Perrin.
10. Frederic Joliot and Iréne Joliot-Curie were awarded the 1935 Nobel Prize for chemistry in recognition of their synthesis of new radioactive elements. For their biographies see: P.M.S. Blackett: Jean Frederic Joliot (1900-1958) Biographical Memories of Fellows of the Royal Society Vol. 6 (1960) pp.87-105; J. Teillac: Irène Joliot Curie (1897-1956) Nucl. Phys. Vol. 4 (1957) pp. 497-502.
11. Kirov, pseudonym of Sergej Mironovich Kostrikov, was member of the Politbüro, Secretary of the Central Committee and the first Secretary of the Leningrad oblom (regional committee). He gave great contributions in solving complex problems of industrial development and collectivization of agriculture. He represented the tendency towards an internal "detente"

after the great successes obtained in the industrial development. At the beginning of the XVII Party Congress, early in 1934, a group of Party officials had a talk with Kirov, touching on the need to replace Stalin. But Kirov would not agree either to get rid of Stalin or to be elected Secretary General on 1st December 1934, a shot in the back killed Kirov in front of the door of his office. The shot was fired by a young Party member, Leonid Nikolaev, but immediately the rumor went around, in the U.S.S.R. and abroad, that the murder had been prepared by Stalin. This hypothesis seems to be backed by a few rather transparent hints given by Nikita Khrushchev. The assassination of Kirov marks the beginning of the great political purges in the U.S.S.R.

# Chapter 8
# Professor in Kharkov

The director of the Ukrainian Physics-Technical Institute in Kharkov, Professor Sinielnikov, had obtained for the Houtermans a rather large apartment with rooms on two different floors where they lived with Charlotte Schlesinger, with the nickname "Bimbus" (Fig. 8.1). She was a distinguished pianist emigrated not long before from Germany. Shortly after their arrival she got a very serious form of dysentery that kept the Houtermans in great anxiety.

Apart from this episode their life at the beginning was rather pleasant. They had a maid, Marussya, who helped in keeping the house, and when on 4th November 1935 their second child Jan was born, they also got a nurse to feed him. They were, however, surprised to see that the campus of the Ukrainian Institute was under control of guards carrying guns with mounted bayonets.

At a census they were asked to fill some form containing a number of questions, such as date and place of birth, names of parents, previous addresses and jobs and so on. To one of the question about religion, Fritz answered by writing in the appropriate space "Jewish".

Charlotte was rather astonished at such an answer since Fritz only had a quarter of "Jewish blood" and anyhow both of them did not practice any religion. An argument followed between the two, that was closed by Fritz with the sentence: "Ich wollte mich herausmendeln!", where the verb is derived from the name of Gregor Mendel, the man who around 1860 discovered the fundamental laws of biological heredity.

Shortly after their arrival at Kharkov, the Houtermans received the luggage they had shipped from London through Arcangel. It consisted of a single large box, about 3 m long 1.5 m wide and 1.5 high, which contained everything: mattresses, pottery, books etc. An inspector sent by the local police searched very carefully all their belongings, in particular their books. The man was rather puzzled by the seven Bibles, of different types and in different languages and by Rilke's "Geschichten vom lieben Gott". It took them some time to persuade the inspector that these books were not brought in by them for doing religious propaganda.

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DOI: 10.1007/978-3-642-32855-8_8, © The Author(s) 2012

Fritz also got an assistant, V. Fomin with whom he started to work on slow neutrons, as it appears from the names of the authors of a few papers published between 1936 and 1937 /13–18/.

The first of these papers /13/ reports on the observation of a new weak longlived activity observed in tantalum bombarded with slow neutrons, while the others /14/ – /18/ deal with the influence of the temperature of the moderator on the absorption of thermal neutrons (or better the so called group C neutrons) detected by means either of the activity induced in silver with 2.2 min half-life, or by a boron lined ionization chamber coupled to a linear amplifier. From their experimental results the authors conclude that: (a) in the thermal region the capture cross section for neutrons follows the l/v-law in boron and silver while cadmium should have a resonance; (b) in a hydrogenous moderator, like paraffin or water, the neutron spectrum should be (roughly) Maxwellian at room and higher temperatures, while at liquid hydrogen it does not reach thermal equilibrium.

Besides Houtermans there were many other young physicists who under the pressure of Hitler in Germany had started to visit the U.S.S.R., looking for better living and working conditions. As I said before Rudolf Peierls had visited the U.S.S.R. in 1929, and even found his wife over there.

Alexander Weissberg-Cybulski had moved to Kharkov in 1932 with the idea of remaining there for good. He was a man of very wide culture, a marxist of very strong convictions and apparently the man with the better political formation and stronger dialectic capacity than all the others of the group. He had sent invitations to move to Kharkov to many other German speaking young physicists, now in trouble because of the nazification of Germany and Austria. He was "managing director" of the Physics-Technical Institute.

Among the people invited by Weissberg there was Vicki Weisskopf who went over there for the first time in 1932 and stayed about 8 months. He had got a professorship offer from Kiev and therefore went back to the U.S.S.R. in 1936 and revisited Kharkov for a few weeks after there had been a considerable accumulation of other physicists who had left fascist Germany and were eager to find a place to work.

Among these was George Placzek [1] who had already passed the academic year 1933–1934 in Kharkov and had started to work with Landau on the scattering of light [2]. He returned to Kharkov in 1935–1936 after having spent the academic year 1934–1935 as professor of physics at the new University of Jerusalem. He had in mind to write a second paper with Landau which would have concluded their work, but this plan was never completed because of his sudden departure from Kharkov as I will tell below. George Placzek has been one of my dearest friends. I had met him in Leipzig, where I spent 10 months in 1931 at the "Physikalisches Institut der Universität", directed by Peter Debye (1884–1966), working on X-ray diffraction by liquids and where I had the opportunity of becoming acquainted with many of the young people appearing in this story. In particular I became immediately a great friend of Placzek's who spent the successive academic year 1931–1932 in Rome working with me on the Raman effect of the ammonia molecule. He was born in Brnò, the capitol city of Moravia, then a part of the

Austrian Empire. After the First World War he had become a citizen of the new state Czechoslovakia. He had studied physics in Prague and Vienna where he had passed his Ph.D examination in 1928. He spent the following years 1928–1931 in Utrecht. George spoke fluently about ten languages and had a fairly extensive knowledge of the corresponding literatures. For example, he had learned Italian by reading the "Decameron", and was used to quote Dante, Petrarca or Ariosto or discuss current politics in the very language of Boccaccio. After his first visit to the Istituto di Fisica di Via Panisperna [3] in 1931–1932, he had taken the habit to stop in Rome for a few weeks, or even months, on occasion of any of his frequent displacements from North to South or East to West or vice versa. On each of these visits he told us facts about what was going on in the various places which could not be learned from Italian newspapers because of the fascist censorship.

In 1936 one of the subjects of passionate discussion everywhere in the U.S.S.R. was abortion. The revolution had granted free abortion and the Great Soviet had encouraged people to discuss the problem deeply, in particular of how to limit the number of abortions per year. But in 1937 the Soviets passed an abortion law with rather strong limitations which had become a matter of dissatisfaction especially for the intelligentsia. Weisskopf tells me that the following joke was going around in Kharkov: "In U.S.S.R. abortion is always free but there is such a red tape that it takes at least 9 months before it can take place".

Life conditions, however, were not easy in the U.S.S.R. in those years. In particular food supplies were very scarce. In Kharkov wives had to go around almost every day trying to buy from the black market, i.e. directly from farmers, eggs, chicken or something else, to add to the small rations. The bachelors, among the foreign physicists lived all together in a single large apartment house. One of them in turn, almost every day, did not work, but went around looking for extra food for all of them. In practice only one satisfactory meal per day was possible for almost all grown-up people.

This unsatisfactory food supply was mainly due to the failure of the "integral collectivization" of agriculture. While the First (1928–1932) and Second (1933–1937) Five Years Plan for the development of heavy industry (oil, carbon, electricity, etc.) were successful, the "collectivization" was a failure, and, "after the revolution, the most terrible and stormy internal process" [4 (a)]. The production of cereals between 1926 and 1932 decreased from 77 to 70 million tons, the number of heads of cattle decreased between 1928 and 1933 from 277 to 177 million and so on. Furthermore the Kulaks, i.e. the farmers rich enough to have other people for working their estate, were destroyed as a social class and the effort of organizing the farmers' families almost completely in kolchozes, i.e. collective country concerns, was rather unsuccessful. For example, between 1933 and 1935 the individual working private farms were reduced by 4.8 millions but only 2.1 millions entered in kolchozes. The others disappeared from the villages. Before the collectivization there were about 25 millions of dvorez, i.e. family units in the country. At the beginning of 1933 there were still 24 millions but these were reduced to 21 millions in 1935 and to slightly less than 20 at the end of 1937 [4 (b)].

From conversations I had with Placzek in those years I heard the following story, which was confirmed and enriched by some further details by Vicki Weisskopf many years later (in 1976).

Once Martin Ruhemann, a German physicist working in low temperature, who like Houtermans had emigrated from Germany to the U.S.S.R., gave a reception for all physicists present in Kharkov, Russian as well as foreigners.

Not long before, Placzek had received the offer of a permanent chair and a few of the people present asked him what was his decision. Placzek, in his typical joking mood, answered that he was ready to accept provided five conditions were fulfilled. But what are these conditions? His friends asked.

The first one was that his salary should not be inferior to a certain satisfactory value, the second one that about one third of the salary had to be paid in dollars or pounds because he wanted to spend every year two or three months abroad in order not to lose contact with the international scientific community. The third condition was that at least two young people who could work with him had to be paid in some form. The fourth condition was that the economic treatment of these young people had also to be decent. Finally, the fifth condition was that the "Chasain must go"

**Fig. 8.1** The Physics institute in Kharkov in 1932 where F.G. Houtermans worked and lived in an apartment at the ground floor. He was a heavy smoker and, to avoid disturbing his wife Charlotte and his child, he was used to smoking in a balcony for the pleasure of his neighbours living in the second floor who could enjoy the smell of good tobacco (Y. Ranyuk, The secrets of Houtermans, Природа n. 5, p. 88, 2000 – in Russian)

-"Chasain" in Russian means "boss" and at that time was the name used to indicate Stalin. Everybody laughed and commented humorously.

The wife of Ruhemann, who was a very rigid party member, reported this little story to the Communist Party in Kharkov with the result that shortly later the local newspaper started to attack the foreign physicists with gradually heavier and more explicit accusations of being German spies.

Weisskopf, Placzek and most of the others understood immediately the general trend taken by the situation and rapidly left the U.S.S.R. Weisskopf went to Zurich where he stayed three years, married Ellen Tvede in 1934, and after a short return to Copenhagen went to the U.S.A. in 1937.

George Placzek suddenly reappeared in Rome and told all of us of the Istituto di Fisica that in the U.S.S.R. a period of collective insaneness had begun. But in Italy also the atmosphere was deteriorating rapidly. The precursory signs of the racial laws were already noticeable. Placzek left Italy, went to the great safe harbour of Copenhagen and from there, in 1938, to the Collège de France in Paris. About one year later he moved to Cornell University (Ithaca, N.Y.) where he could enjoy once more the collaboration with Bethe [5]. They had published together, already in 1936, an important paper on the neutron resonances.

During the Second World War George Placzek was entrusted with an important directive position in the Theoretical Division of the Anglo-Canadian group, organized by the British Authorities in Montreal (Canada) for the development of Applied Nuclear Physics. In 1945 he was transferred to Los Alamos. After the war he worked, for about two years, at the Research Laboratories of the General Electric Company in Schenectady and from 1948 onwards at the Institute for Advanced Studies in Princeton, N.J. But let me go back to Kharkov and to what happened to Fritz and Charlotte Houtermans and their two children.

## References

1. Amaldi: "G. Placzek (1905-1955)", Ric. Scient. 26 (1956) 2037-2041; L. Van Hove: "George Placzek (1905-1955)", Nuclear Phys. 1 (1956) 623-626.
2. L.D. Landau, G. Placzek: "Struktur der Unverschobenen Streulinie", Phys. Zeit. Soviet union 5 (1934) 172-173.
3. The Institute of Physics of the University of Rome was located in the building, constructed between 1877-1880, in Via Panisperna 89A, and remained there until autumn 1936, when it was transferred to a new building at the Città Universitaria. All or almost all the work of Fermi and his collaborators and pupils was carried on in the building of Via Panisperna.
4. See, for example: (a) Roy A. Medvedev: "Let History Judge, the Origins and Consequences of Stalinism, Vintage Books, New York, 1973. (b) G. Boffa: "Storia dell'Unione Sovietica", Arnoldo Mondadori Editore, Milano, 1976.
5. H.A. Bethe, born in 1906 in Strasbourg, has been a pupil and assistant to A. Sommerfeld in Munich. He emigrated to Great Britain in 1933 (Manchester and Bristol) and to U.S.A. in 1935 (Cornell University). He received the 1967 Nobel Prize for physics for his contribution to the theory of nuclear reactions, especially for his discoveries concerning the energy production in stars.

# Chapter 9
# The Beginning of the Great Trials

The story I have reported above should be seen as the trigger that determined the events that during 1937, in Kharkov, involved the physicists of the Ukrainian Physics-Technical Institute. What happened, there and at that moment, however, was only a part of a much wider stream of events that passed through the U.S.S.R., alarmed everybody and caused great anxiety in the small group of the Ukrainian Institute.

A few among Houtermans' friends were arrested already at the beginning of 1937. The first was Eva Striker, wife of Alexander Weissberg.

She was the niece of the physicist Polanie and was a ceramic pattern designer. Alex and Eva had met and married in Berlin, where Alexander most probably was mainly working for the German communist party. A few months after they had moved to Kharkov they were divorced, and she had gone to live in Moscow, where the Secret Police (NKWD[1]) get hold of her at the beginning of 1937. A few days later Konrad Weisselberg, who had married an Ukrainian girl, was arrested in Kharkov. He was sentenced to 10 years and later was found dead in his prison cell.

The third to be arrested was Weissberg on 1st March 1937. He had tried to get Eva out of prison. As we shall see later, for a few years his adventures were not too dissimilar from those of Fissel.

Those tragic events alarmed Fritz and Charlotte, who were extremely disturbed by the rapidity with which the situation in U.S.S.R. was deteriorating. A way had to be found, as quickly as possible, to get out of the country. With this secret program in mind at the beginning of summer 1937, Charlotte with Giovanna went by boat from Leningrad via the Kiel channel to London, where they learned of the bombing of Guernica in the Spanish civil war. Officially the trip was for a vacation, but its real goal was to ask their British friends to invite Fritz to go to England to give a course or at least a few lectures.

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[1] The NKWD, the People's Commissariat for Internal Affairs, was the public and secret police organization of the Soviet Union during Stalin time (Note of the editors).

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966),* SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8_9, © The Author(s) 2012

The friends of the Houtermans, however, did not believe what she was saying, or at least did not take it seriously enough. In the meantime Fritz in Kharkov noticed signs of impatience by local authorities about Charlotte's trip abroad and sent a telegram asking her to come back as soon as possible, and she returned immediately.

Shortly later two policemen came to the Ukrainian Physics-Technical Institute in Kharkov looking for the assistant of Fritz Houtermans, V. Fomin. They informed Fomin that his brother, a ski instructor in Caucasus, had been arrested and asked him to follow them to the quarter of the "Secret Police" for a few questions. Fomin obtained permission to go upstairs for a few minutes in order to collect a few personal things and books, drank a good deal of sulphuric acid from a bottle they had in the laboratory and then jumped from the window and died.[2]

Fritz Houtermans was terribly disturbed. He talked without interruption all the successive night in a state of complete madness. Charlotte did not know what to do to calm him and she also was in a state of great desperation. Finally Charlotte called Leipunski, who was then Institute director. During the beginning of the purges he had become rather distant, because he was probably afraid for his own safety. But now he came to assure Fritz that nothing would happen to him, that Fomin's death would not involve him.

A few days later three policemen came to Houtermans' house during the night. Fritz was convinced they had come to arrest him, but it was not so. The policemen asked only the address of Fomin's apartment. Fritz must have been so frightened, that waking up the next morning he imagined to be in prison and could hardly believe to be still at home.

Many people in the group had the impression that in Moscow the political pressure could be less strong, especially if they were allowed to continue their work in one of the research institutes of the Academy of Sciences. Lev D. Landau had already moved there.

Thus Fritz Houtermans left Kharkov for Moscow, while Charlotte remained in Kharkov with the children for a few weeks more. Then she went to Moscow and went to live in Landau's house, while he had moved to the house of a Russian friend.

Fritz Houtermans had already asked for permission to leave the U.S.S.R. and go abroad with the whole family and their personal goods and books. They were told that this was possible but they had to present a detailed list of their belongings. In order to overcome the red tape Fritz went every day to the Custom House in Moscow, hoping for some progress in clearing their papers.

It was the 1st December 1937 when he was arrested while at the Custom House waiting for some news about his request. He was brought to the Lubianka, the famous Moscow prison.

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[2] According to Y. Ranyuk, physicist at Kharhov, Fomin got severely injured but did not die. He was arrested and died in prison a few days later (Note of the editors).

The same day Anja, the wife of Pjotr Kapitza, went to visit Charlotte and had to give her a sedative. The Russian (Jewish) mathematician Rubin asked Charlotte immediately to leave the apartment of Landau because her presence was a danger to Landau himself. She left the children to Anja Kapitza and kept the key to Landau's house for a few days while trying to locate Fritz. She had no passport because Fritz had it when arrested. Helped by Pjotr Kapitza, she managed to ricover it in an office of the Lubianka. After that Kapitza found her a hotel room, where she now easily could stay with her children.

She decided to leave for Riga as soon as possible. The evening before her departure Charlotte, with Bimbus, who at that time was also in Moscow, went to visit the sister of Grisha Weller, a musician who was in charge of the Kharkov Radio Station. He had been sent to Siberia some time before.

The trip was all right but when they arrived not far from the Latvian border, Charlotte was asked to get out of the train and was housed with her two children in a building normally used for housing the railroad employees. They were kept there for about 10 days without receiving any explanation about the interruption of their trip, but were asked continuously about the whereabouts of Fritz and the reason for Charlotte's travelling alone. Had she admitted that she knew Fritz had been arrested, they would immediately have arrested her too. It was the presence of the small children, who according to a Russian law could not be arrested, that saved them all.

On 16th December the authorization arrived from Moscow, she was permitted to get into the train again and arrived in Riga the same day with the two children in good health and one hundred Swiss Francs plus one hundred Belgian Francs, sewn in the linings of their fur caps.

The nightmare was not yet over but she felt very much relieved, in spite of the anxiety for Fritz in a Moscow prison. Immediately she sent a telegram to the Bohr Institute in Copenhagen asking for an invitation to go there. She got a positive answer and some money, obtained a permit to enter Denmark through the help of Niels Bohr and took the boat for the new destination.

On Christmas Eve Charlotte arrived in Copenhagen where Christian Möller [1] met her at the boat. She was invited by him to a dinner in an elegant Danish restaurant, was overwhelmed by it and the friendly and warm reception since her arrival. It was almost unbelievable after the drabness of their lives in the U.S.S.R. The next morning at the Institute for Theoretical Physics, Charlotte met with Niels Bohr [2] and a great many other physicists; Gamow [3], Rosenfeld [4], and many others were there and eagerly asked about the fate of Fritz, Landau, Weissberg and others. She remained in Copenhagen for some time more and then went to London, after having planned with Bohr how to help the people still in trouble in the U.S.S.R. In April 1939 Charlotte with the two children went to the United States on an immigrant visa to meet Fritz's mother, who had immigrated in 1936 on invitation by one of her pupils. Through friends, Edna Carter and Monica Heaba, Charlotte obtained a small research scholarship at Vassar College.

Though continuously writing to Fritz in various prisons, Charlotte and Elsa never got an answer and did not know whether he was alive. At that time Charlotte

got in contact with Eleanor Roosevelt, who via the ambassador Steinberg found out that Fritz was alive. Constant letters and questions were the only things to prevent a prisoner from being forgotten.

In the U.S.A. Charlotte succeeded in making a career as a physics teacher in various women's colleges: from Vassar College (1939–1942) she went to Radcliffe College (1944–1945) in Cambridge Mass., where she also worked at the research laboratory of the Polaroid Company, but went back pretty soon to teach at Wells College (1945–1946). She finally succeeded, in 1946, to Maria Göppert Mayer [5] at the Sarah Lawrence College in Bronxville, N.Y., when Maria moved to the University of Chicago (1946). Charlotte taught physics in Bronxville for 22 years and even after her retirement, in 1968, she continued to give courses at the Manhattan Ville College (1968–1972), combined with some teaching at the Summer School Course at Sarah Lawrence College (1972–1976). Attempts to get Houtermans and Weissberg out of prison were made also from Europe. Irène Curie, Frédéric Joliot-Curie [6] and Jean Perrin (1879–1942) [7] sent in June 1938 a telegram and a letter to Stalin and the State Attorney General of the U.S.S.R. Vishinsky, the texts of which are given below [8].

Telegram: State Attorney General of U.S.S.R., Moscow. Same text to: Stalin, Kremlin, Moscow. Please send information on the fate of well-known physicists Alexander Weissberg, arrested in Kharkov on 1st March 1937, and Friedrich Houtermans arrested in Moscow on 1st December 1937. Stop. Their detention threat to provoke a political campaign from the enemies of U.S.S.R. and at the same time is incomprehensible to the friends of U.S.S.R. since they are convinced that Weissberg and Houtermans are unable of actions hostile to the Socialist Construction and that their arrest is a serious mistake of subordinated organs. Stop. Please pay attention to this case, we underline its political meaning, and urge a prompt answer. Signed by: Irène Joliot-Curie, previous undersecretary of State, Nobel Prize; Jean Perrin: previous undersecretary of State, Nobel Prize; Frédéric Joliot-Curie, Professor at the Collège de France, Nobel Prize.

Letter to the State Attorney General of U.S.S.R. (Vishinsky), Moscow Paris, 15th June, 1938

Very estimable Mr. Attorney General! The undersigned, friends of the Soviet Union, believe it to be their duty to bring the following facts to your attention: The imprisonment of two well-known foreign physicists, Dr. Friedrich Houtermans, who was arrested on December 1st, 1937, in Moscow, and Alexander Weissberg, who was arrested on March 1st of the same year in Kharkov, has shocked scientific circles in Europe and the United States. The names of Houtermans and Weissberg are so well-known in these circles that it is to be feared that their long imprisonment may provoke a new political campaign of the sort which has recently done such damage to the prestige of the country of socialism and to the collaboration of the U.S.S.R. with the great Western democracies. The situation has been made more serious by the fact that these scientific men, friends of the U.S.S.R. who have

always defended it against the attacks of its enemies, have not been able to obtain any news from Soviet authorities on the cases of Houtermans and Weissberg in spite of the time which has gone by since their arrest, and thus find themselves unable to explain the step that has been taken.

Mrs. Houtermans and Mrs. Weissberg have many friends among the most important scientists such as Professor Einstein of Princeton, Professor Blackett of Manchester, Professor Niels Bohr of Copenhagen, who are interested in their fate and will not abandon this interest. Mr. Weissberg, one of the founders and editor of the journal "Zeitschrift für Physik" in U.S.S.R., has been invited by Professor Einstein to the University of Princeton; because of his arrest he could not accept the invitation. Similarly, Dr. Houtermans has been invited for scientific work by a London Institute and at the moment of his arrest at the Custom House of the Moscow Station, was just on the point of leaving.

The only official information available on the reasons that have lead to the arrest of Mr. Weissberg, is a communication from the Soviet authorities of March 1937 to the Austrian Embassy in Moscow, according to which Weissberg is accused of having act as a spy for Germany, and to have participated in the preparation of an armed insurrection in Ukraine. No official information is given on Houtermans' case.

All those who know personally Weissberg and Houtermans are sincerely convinced that they are faithful friends of the U.S.S.R., incapable of any hostile action. They are deeply convinced that the accusations against Mr.Weissberg are absurd and should be attributed to a serious misunderstanding which requires an immediate clarification from both the political and human point of view.

Responsible personalities of the U.S.S.R. have recently indicated, in official declarations, that in the course of the purge campaign, necessary in a country so heavily threatened from the inside as well as from outside, some errors—inevitable in such critical times have been committed by subordinated units. The same personalities have underlined the urgent necessity of eliminating the errors and occasional abuses.

The undersigned and all friends of both these accused people are convinced that the case at hand is of a misunderstanding of this kind.

Therefore they address the State Attorney General, calling his attention on Mrs. Weissberg and Houtermans and ask him, for the reputation of U.S.S.R. in the foreign scientific circles, to undertake all steps necessary for the immediate release of these two gentlemen. The political meaning of this question authorizes us to transmit to Mr. Stalin a copy of this letter by means of the Soviet Embassy in Paris.

In consideration of the urgency of the matter, we ask you the courtesy of providing us with a prompt answer. With the expressions of our most sincere consideration, honorable State Attorney General, we remain

Irène Joliot-Curie: previous undersecretary of State, Nobel Prize
Jean Perrin: previous undersecretary of State, Nobel Prize
Frédéric Joliot-Curie, Professor at the Collège de France, Nobel Prize.

## References

1. Christian Möller (1904-1980), a pupil of Niels Bohr, studied the interaction between two relativistic electrons before the presently accepted methods of quantum electrodynamics, deriving the formula which bears his name. Subsequently he has played an important role in the development of both nuclear theory and quantum electrodynamics. He gave also important contributions to the theory of General Relativity.
2. Niels Bohr (1885-1962), one of the greatest physicists and scientists of our century, not only was the first to quantize the energy states of the atom, but also inspired, for years, the work of many other first class physicists who contributed to develop the quantum mechanical description of atoms and nuclei. Among the many books devoted to Niels Bohr as man and scientist, see, for example: "Niels Bohr, a centenary volume" edited by A.P. French and P.J. Kennedy.
3. George Gamow (Odessa, 1904-Bulder, Colorado, 1968) immediately after his Ph.D at the University of Leningrad (summer 1928) travelled to Göttingen, where he made his first major contribution to physics: the theory of nuclear alpha decay. During all his life he produced many other first class contributions to nuclear physics, astrophysics, cosmology and biology. He is also the author of many very brilliant popular books on science. His autobiography ("My world line", Viking Press, New York, 1952) is fascinating.
4. Leon Rosenfeld (1904-1974), born in Belgium, studied at many of the leading theoretical centers in Europe. He has been professor in Liege, Utrecht (1940), Manchester (1947-57) and Copenhagen (since 1958) at the newly established Nordic Institute for Theoretical Physics (Nordita). Rosenfeld has been active in many fields of physics, including nuclear physics, field theory, statistical mechanics and history of science. He has been one of the closest collaborators of Niels Bohr.
5. Maria Göppert Mayer (1906-1972).
6. Frederic Joliot and Iréne Joliot-Curie were awarded the 1935 Nobel Prize for chemistry in recognition of their synthesis of new radioactive elements. For their biographies see: P.M.S. Blackett: Jean Frederic Joliot (1900-1958) Biographical Memories of Fellows of the Royal Society Vol. 6 (1960) pp.87-105; J. Teillac: Irène Joliot Curie (1897-1956) Nucl. Phys. Vol. 4 (1957) pp. 497-502.
7. J. Perrin (1870-1942).
8. These texts can be found in Chapter 13, Ref. [1].

# Chapter 10
# The Years of Prison

All the information we have about Fritz Houtermans' years of prison are the two letters he wrote shortly after liberation to his mother on 1st August and 28th September 1940 [1], the "Chronological Report" on "My Life in Russian Prisons" [2] that he wrote in spring 1945, and a book published in London in 1950 under the title: "Russian Purge and the Extraction of Confessions" by F. Beck and W. Godin [3]. This book was translated into other languages. It was recommended to me by Fritz himself in the late fifties, when I asked about his experience in Russian and German prisons. The false names Beck and Godin stand for Friedrich G. Houtermans and Konstantin Feodossovitch Shteppa (1896–1958) who had spent one and a half years in the same cell of the Kiev prison.

In their book the two authors try to give a general view of the events that took place in those years in Russian prisons, but they avoid giving any precise date or name so that the whole story becomes in some way detached from their personal adventures and inevitably loses vividness and human touch.

To make up for this to some extent, the authors devote Chap. 7 to "Three Cases" which are described in somewhat greater detail. The first of the three cases is that of Konstantin Shteppa himself and I will come back to it later on (Chaps. 12 and 15).

No detailed information about the "Houtermans' case" can be found in the book and, therefore, after much deliberation, I decided to reproduce here the "Chronological Report" in spite of the fact that in its "Post Scriptum" Fritz Houtermans recommends not to use it for publication. Many years, however, have passed since Houtermans' death and all, or almost all, the other people mentioned in this document have died. With the vividness of Houtermans' case the "Chronological Report" adds substantially to the picture we already have from accounts published by other people that went through similar adventures in the U.S.S.R.

"Chronological Report" of "My Life in Russian Prisons"[2].

« On 1st December 1937 I was arrested at the Custom House in Moscow, where I was preparing my property to get looked through for my departure from Russia. I

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966),* SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8_10, © The Author(s) 2012

was immediately brought to the Lubianka prison where I was shown the order of arrest, dated from Kharkov from November 27th, on account of Paragraph 28 (political reasons). After a quarter of an hour I was brought to the big Butyrka prison into a cell for 24 men. Gradually this cell was filled until it held 140 men, sleeping on and under wooden boards, about 2–3 men per $m^2$.

While still in Moscow, eleven days after my arrest I was called by an officer of the NKWD to give a full confession of my alleged counterrevolutionary activities on behalf of the German fascist government, but no concrete charge was brought against me; only the names of a number of my Russian and foreign colleagues from the Kharkov Physics-Technical Institute were mentioned as being members of a counterrevolutionary organization, as Shubnikov, Landau, Ruhemann, Weissberg, Fomin, etc. I was told that if I gave a full confession I would immediately be sent abroad. Of course I did not make a false confession and denied any activity against the U.S.S.R.

On 4th January 1938 I was brought up in a prisoner car by railway to Kharkov and put into the prison Kholodnaja Gora in Kharkov, in a cell which was still more overcrowded than that in Moscow, but without any sleeping accommodation so that we all had to lie on the floor. I remained there till 10th January when I was brought to the central Kharkov prison of the NKWD, into a cell perfectly clean and not too overcrowded. Here many fellow prisoners tried to persuade me to make a false confession of things of my own invention as they had done themselves, which I would have to do anyhow sooner or later in order to save a lot of trouble. The same day I was asked to make a confession again by an interrogator, named Drescher, who threatened to beat me and to get anything out of me.

On the evening of 11th January began an uninterrupted questioning of 11 days, with only a short break of five hours the first day and about two hours the second day. No concrete charge was brought against me, as in nearly all cases of people I have seen in Russian prisons, and I was told to give all "facts" myself. The only two questions that were asked were: "Who induced you to join the counterrevolutionary organization" and "whom did you induce yourself?"

Three officials questioned me in turn, for about eight hours each, the first two days I was allowed to sit on a chair, later only on the edge of a chair and from the 4th day on I was forced to stand nearly all day, I was always kept awake, and when I fell from lack of sleep I was brought to by means of fainted cold water that was poured on my face. The chief official who led the questioning was named Pogrebnoi.

The night of 22nd January, shortly after midnight, Pogrebnoi showed me an order of arrest for my wife and another order to bring my children into a home "besprisornis"[1] under a false name so that I would not be able to find them ever again. I was of the opinion that they were all still in Moscow. I have learned since that they had left shortly after my arrest so all I was told was bluffing, but in my state of weakness after nearly ten days without sleep I fell for it.

[1] "Besprizorniki": So were called the hundred thousand of kids without family or home who roamed the roads after the Russian Revolution (Note of the editors).

In this state I fell unconscious nearly every 20–30 min but I was awaked every time and my feet were so swollen that my shoes had to be cut off. I was beaten little, only occasionally, and not with instruments as many other prisoners I have seen, and I was told by them that the treatment I had to undergo myself was very mild indeed compared with what they had to endure. At the end I declared, I was ready to sign any statement they wanted on condition that my family was to be sent abroad immediately and I would be shown a letter from abroad by my wife telling me her whereabouts, after three months. In case I would not get such a letter I would revoke any statement I had made. I signed a short statement as they asked me, admitting that I was sent to the U.S.S.R. by the German Gestapo for espionage. Then I was able to eat luxuriously and got tea and was sent to sleep to my cell where I slept for about thirtysix hours. Then I was asked upstairs again and there I wrote a long confession of about 20 pages in German and I was very careful to give only names of people whom I knew to be abroad, or whose evidence against me- of course forced by 3rd degree methods- was shown to me. I had to write about espionage, sabotage and counterrevolutionary agitation and I was absolutely free to invent anything I liked, no corroboration by facts or by evidence being needed. I made nuclear physics the theme of my espionage, though at that time no technical applications of nuclear physics were known, since fission was not yet discovered, but I wrote a lot of phrases that nuclear energy is existent and that it needed only the right way to start a chain reaction as described in popular novels on this matter. Another instrument I wrote I had spied on was an instrument for measuring absolute velocities of airplanes by the number of magnetic lines of force which went through a coil, a device contradicting the law of conservation of energy, and being obviously a perpetual mobile. I intentionally made my confession as stupid as possible in order to be able to testify that it is nonsense in case of a trial, and I put in a short statement in English in ciphered form that I was under third degree torture and that all I wrote was pure invention.

During the last year of my stay in Kharkov many acquaintances I knew perfectly well as being innocent had been arrested already and it was said that they all had given evidence of being guilty. I did not know then about the methods how these statements were forced from people but I had told my wife in case a signature should ever be forced from me, I would leave out the full stop after my signature, and in case my signature were given by my free will I would always put a full stop after my name. I had the opportunity to do so and I left out the full stop in the written confession. My written confession was translated into Russian and I was left alone and was not troubled anymore till August 1938, living till March in a clean prison cell not too overcrowded in the central Kharkov prison.

On 17th March I was called again and a letter from my wife dated from Copenhagen was given to me. The same day I was transferred to the Kholodnaya Gora prison in Kharkov, to a small cell, rather dirty and very overcrowded, where I remained till 2nd August. Food was very scarce and we suffered from hunger. The daily rations consisted of 600 grams of black bread containing more water than ordinary bread (equivalent to about 500–550 grams of ordinary bread), about 15–20 grams of sugar, a mug of soup containing little nourishing value and 1–2 spoons of

porridge of some kind a day, from fair estimates made by physicians I met and by myself about 500–1000 kcal per day. Food was always given regularly and I don't know of any cases that prisoners were not given their rations. Treatment by prison officials was hard but not sadistic, but there existed cells where conditions were much worse for people who had not given the confession of evidence wanted. I remained there till 2nd August when I was sent to Kiev in a "Stolypin car", a special sort of railway car for prisoners. I remained in Kiev till 31st October 1938 when I was asked to give more evidence especially against a friend of mine, Professor Leipunski, a member of the party and an absolutely sincere man. From prisoners in my cell I learned that he was arrested in another cell in Kiev and a man in my cell tried to persuade me to give evidence against him and told me what I should say. No especially hard pressure was used against me then and therefore I did not give any evidence against him or against Professor Obreimov, another member of our institute that I was asked to accuse. Prison conditions in Kiev were much better than in Kharkov, the rooms being very clean and food a little bit better. It was hard though because it was not allowed to sleep during the day time.

On 1st October 1938 I was sent back to Kharkov and put into a clean cell in the central prison. Prisons were not so overcrowded any more at that time, but still there were 1–2 prisoners per $m^2$ of room. I was not questioned again till January 1939 when I was asked to sign an application for Soviet citizenship. For that case they promised me the chair of a big institute for my research, to be built by the NKWD itself, but I did not consider that offer to be sincere, having met foreigners in prison cells who had agreed to such an offer without having been released, and therefore I said I could talk about this matter only after release and after communicating with my family. This was the only time I got some of the things that were sent to me by my wife and by Mrs. Cohn-Vossen, a friend of mine in Moscow.

I got a blanket and a few pieces of underwear. I did not get any letters nor any money that was sent to me from abroad, as I have learned since. This was rather bad because all the time there was the possibility to buy some additional food supply and smoking material for about 20 rubles a fortnight, and this helped a great deal but since I had less than l00 rubles on me when I was arrested I nearly never could make use of this possibility and therefore I had lost about 18 kg in weight and became more and more feeble.[2] I could not consider a revocation of my confession of the year before and when I was asked to give more evidence against persons like Obreimov whom I knew to be in the U.S.S.R, I declined but I confirmed my former confession, not wanting to have all the trouble over again. On the new evidence they were not pressing very hard.

In February 1939 I was sent again to Kiev where I was put again in the central prison but in an underground cell without any daylight (artificial light was in all

[2] Houtermans note: I have to acknowledge though that I got a lot of help from prisoners in my cells and occasionally also from kind prison officials who risked a lot being kind to an "enemy of the State".

cells during the night) which was very humid. I was asked again by a new official to give evidence against Obreimov and Leipunski and I was threatened to be beaten in case I refused and shown written evidence of both men against me in their own handwriting. I was very weak by then, I could hardly walk about and so I decided to confirm their statements on counterrevolutionary activity about myself and that I knew about theirs. I put in some slight discrepancies concerning dates etc. with their evidence and my evidence was accepted. Again I was told I would be sent abroad.

In May 1939 I was asked by the People's Commissar of the Interior of Ukraina himself to give evidence against Professor Fritz Lange, a good physicist and friend of mine who was working in the Ukrainian Physics-Technical Institute, and also against Professor Landau, Professor Ioffe [4] and Professor Kapitza, all of them prominent physicists of the U.S.S.R. He told me he knew well that all of these people were active spies and members of a counterrevolutionary organization and he only wanted me to confirm this. I said I knew nothing about it but did not try to revoke my own statements given earlier. This confirms the fact I had often heard about in prison cells, especially by men who once had been officials of the NKWD themselves, that it is quite usual to collect evidence about counterrevolutionary activity of prominent people in case their arrest should be effectuated later on. Neither Lange, nor Joffe or Kapitza have ever been arrested as far as I learned since.

No paper or books were allowed in prison cells and therefore it was nearly impossible to do any work. Yet from the very beginning of my prison-time, I decided to work under all conditions and, since it was the only field I could do, I started already at the end of 1937 to think about problems of the theory of numbers. All I knew was Euclid's proof about the existence of an infinite number of primes [5] and I started thinking on the problem whether there exists an infinite number of the type $6x + 1$ and $4x + 1$ also, while for the $6x-1$ and $4x-1$ I could find Euclid's proof to hold with a slight alteration off hand.

I had no writing materials, so I tried to write some numbers with matches on a piece of soap or on places of the wall where it could not be seen, but I had to erase it all every day before leaving the cell for the toilet.

I thought about that problem for more than a year and finally in Kiev in the first days of March I found that any form $x^2 + xy + y^2$ with $x, y$ being relative primes cannot contain any other factor than primes of $6x + 1$ type or 3, and the sum of the squares of relative primes contains only primes $4x + l$ or 2.

After solving this problem I discovered Fermat's theorem (I only learned its name after I left the prison, as with all theorems I found) and quite a number of theorems in the elementary theory of numbers.

When I found on 6th August an elementary proof for Fermat's famous problem for $n = 3$, which as I have learned since is essentially the same as Euler's, by "descent infinite", I got very excited about it, because I did not know Euler's elementary proof to exist, and I applied to the People's Commissar of the Ukraine to get paper and pencil. (I said I wanted to work out an idea of mine on a method in radioactivity which might be of economic importance). When my petition was not

granted, I went on hunger strike (only declining food, not water). I was alone in a cell then and succeeded in getting paper and pencil after 8 days of hunger strike, by which time I was very much weakened since I had been in a bad state when I started. I wrote a number of theorems: I had found the so-called indices of theory of numbers, a theorem of Lucas and a new proof of a theorem of Sylvester which is in course of publication at the Jahresbericht upon the advice of Professor van der Waerden [6] whom I told about my prison studies in the theory of numbers.

I could even keep my writing materials when Professor Melamet (a philosophy Professor from Odessa) was put into my cell, so that I could make steady progress in the theory of numbers.

In August all the evidence I had given one and one half year earlier was rewritten and I was summoned up together with Professor Obreimov for a so-called "double questioning" in which he-of course it was all pure invention-stated before my eyes that I had induced him while still in Berlin to do espionage work for the Nazis, though at the time of his visit to Berlin the Nazis were not in power and a quite small party. I affirmed all his statements because I did not want and, in the state of health I was in, could not afford to suffer all the tortures by which I was threatened.

Suddenly on 30th September 1939 I was called out and brought to the station in a closed car and sent to Moscow. I did not know about the war till January 1940. The isolation of prisoners is extreme in Russia, the only source of information being what is told by newly arrested prisoners and I had not seen such people for a considerable time.

In the train I saw that the official, who had questioned me before, travelled with me in the same train and in Moscow I was brought immediately to the central prison of the NKWD on the Lubianka. While I was still in the shower bath that everybody arriving there has to go through, I was already called for questioning. I was brought into a luxuriously furnished room in which a man in the uniform of a general of the NKWD sat and beside him in civilian clothes a very intelligent looking man who presided and who asked me politely to sit down. Then he asked me what I felt guilty of. I asked: "Do you want to hear what confession I signed or do you want facts?" "Of course facts" he replied. "This is the first time I am asked this question within these walls" I said. "But since you want to know, the only thing I feel guilty of is that I stole a pair of underwear in the Kharkov prison a year ago, removing the prison stamp on them by calcium chloride in the toilet. That's all". "And what about your confession?" He asked. "That's all pure invention!" Then he asked who had forced me to give a confession and by what means I was forced. I gave all the names as far as I knew them and all details. "We are going to get it all cleared up", he said shortly and I was brought back to my cell, a good cell, where I was alone.

I liked it better that way, since I could work. Everything was extremely clean and I got books, very good ones, too, special food in quite sufficient quantity and a package of cigarettes every day.

Though my Kiev manuscript had been taken away from me when I entered the Lubianka, I got writing materials again without any effort and I went on to occupy

myself with what I have learned since to be "Pell's problem" and other things in theory of numbers. In this cell I remained without being called a single time until the beginning of December 1939, being all the time alone. After all I had gone through it was a treat.

In the first part of December I was called up again by another official who asked me absolutely correctly about everything and I answered all questions truthfully. When I asked to write or to cable to my family (I supposed them to be in England, from where I had last heard from them in August 1938) he said I would soon be sent out. I then asked especially not to be sent to Germany and he made a note of it.

About a week later I got new clothes and was sent to Butyrka prison, into one of the big cells where I had been 2 years previously, but now it was not overcrowded there. All people in the room were Germans, not all of them foreigners, some had taken the Soviet citizenship. Among them I was glad to meet another Professor, Professor Fritz Noether [7], former Professor at the Breslau University for applied mathematics and later a refugee living in Tomsk. He had been arrested as a German-though being a Jew-and was forced to invent an espionage story, also. But in contrast to my case a sentence of 25 years of imprisonment had been passed on him. Shortly after my arrival he was removed from the cell and I have never heard about him since. In this cell we all got special food in sufficient quantity and cigarettes and we had the impression that we were kept there because most of us were in a very bad state of health and they did not want to send us abroad like that. Most of the people were German workers, skilled workers, or engineers, specialists and many of them former communists. Among them was Hugo Eberlein [8], friend of Lenin and Liebknecht and former member of the executive control committee of the Komintern, president of the communist fraction of the Prussian Landtag for many years. He had been beaten severely, like nearly all of them. Some were called out and presumably sent abroad, some arrived directly from camps in Siberia and the far North.

In March I was called out alone and asked to sign a paper, agreeing that I would not tell about what I had seen in Russian prisons and that I would agree to do secret work for the U.S.S.R. abroad. This I signed because I had learned from many people that most of them were asked to sign such a paper, otherwise one would be kept indefinitively.

I again asked as a condition not to be sent to Germany and this was promised me by the official who made me sign the paper.

On 17th April 1940 some of us were gathered into another cell in the same building and on 30th April we all were called out, a sentence was read to each of us, that we were condemned to be exiled from the U.S.S.R. by a special court of the NKWD, and we were transported in a prison car to Brest-Litovsk where we all were taken over by the officials from of the Gestapo.

We were not set free, but taken to a German prison in Biała Podlaska, a small town near the frontier line and after some days we were all transferred to the citadel of Lublin.

Isolation was not as strong as in Russian prisons, the regime was more military and food and accommodation conditions much worse than the last time in

Moscow. Every day we heard the songs and the noise of drunken Gestapo officers below our windows, while we learned that every day about a hundred Poles and Jews were executed in the prison court.

We had passed the frontier on 2nd May 1940 and were transported to Berlin on 25th May Some of us were brought to "Nazi-Rückwandererheim" where they were set free after a few days, but some of us, among them also I, were brought to the police prison on Alexanderplatz. By the way the only prison in my experience where there were lice. Here I met people from concentration camps who told me about German camps and a well experienced communist who advised me how to behave in front of the Gestapo.

A week later I was brought to a small prison at the Gestapo headquarters in the Prinz-Albrecht-Strasse where I was asked about my Russian experiences, why I had left Germany and gone to Russia, and about some communist friends of mine in Germany before 1933. I told them I had known those people but I did not know about any illegal activity of theirs, confirming my information nevertheless on such people I knew to be abroad. I was asked to give an account of my Russian experiences, which I did, also mentioning by precaution the paper I had been made to sign but not the fact that I had asked not to be sent to Germany.

On 16th July finally I was set free. A few days later I met Professor von Laue from whom I learned the whereabouts of my family. As soon as he had heard that I was in Germany in a Gestapo prison he went there himself, brought me some money and did all he could to accelerate my liberation".

19th May, 1945 F. G. Houtermans


**Fig. 10.1** Photographs from the NKWD dossier of F.G. Houtermans in 1937 (V.J. Frenkel, Preprint 414, Max Planck Institute for the History of Science, 2011). Figure translation: 2766, Houtermans Fritz Ottovich, 1903

P. S. I have been asked several times by many people to publish something on my Russian experiences since the war between Germany and Russia began. I always declined strictly because I do not want any propagandistic conclusions to be drawn from my experiences. I also do not want this information to be used for publication. I want to emphasize again that apart from the treatment by which false confessions were forced from people in Russian prisons by the questioning officials under special order from the government, nearly no facts have been brought to my knowledge indicating sadistic or even incorrect treatment in prisons by prison officials in the execution of their duties. It is my opinion that most of the atrocity stories being told by prisoners about the executions are incorrect. I don't know any case in which a prisoner has seen the execution of another one though I have frequently met people who had been sentenced to death and had sat in a so-called "death cell" after revision of their sentences» (Fig. 10.1).

## References

1. Two letters by Friedrich Houtermans from Berlin to his mother the first dated 1th August 1940, the second 28th September 1940.
2. A "Chronological Report of my Life in Russian Prisons", consisting of 6 typed pages by F.G. Houtermans and dated 19th May, 1945.
3. F. Beck, W. Godin: "Russian Purge and the Extraction of Confession", Hurst and Blackett Ltd (London, 1951). This book was written during the second Göttingen period (Chapter 18) with the help of Höxter, an American journalist of German origin.
4. A "Chronological Report of my Life in Russian Prisons", consisting of 6 typed pages by F.G. Houtermans and dated 19th May, 1945.
5. A "prime number" is a natural number, other than 1, having no divisors except itself and the integer 1.
6. Van der Waerden.
7. The brother of Emmy Noether, Fritz Noether, professor of applied mathematics at the Breslau University, left Germany and went to the U.S.S.R. with his wife and children, time before Fritz Houtermans and met him in the Butyrka prison as we can see in Chapter 10.
8. Hugo Eberlein.

# Chapter 11
# An Overview of the Situation in Central Europe

Following the adventures of Fritz Houtermans we have lost the overall view of the general political scene in Europe. Which had been the most important changes that took place during the six years between Fritz's departure from Berlin just fallen under Hitler's power, and Fritz's liberation from the Gestapo prison in Berlin? Only a few of the most dramatic events of that period can be mentioned here.

On 25th July 1934 the Federal Chancellor of Austria, Dollfuss, leader of the Christian-Socialists, in reality clerical-fascists, was murdered in his office in Vienna by a group of 154 members of the dissolved Austrian National-Socialist Party.

The immediate annexation of Austria by Germany was prevented by the international reaction, in particular that of Mussolini's Government, which promptly sent four Divisions to the Brenner Pass.

Dollfuss was succeeded by his party companion Kurt von Schuschnigg, who tried to save Austria's independence by following a policy of détente with Hitler's Germany. But the Austro-German agreement, signed on 11th July 1936, contained concessions that spelt disaster for Schuschnigg and his country. The Austrian National-Socialist-Party was reconstituted, with a strong renewal of anti-Semitism, the roots of which in Austria dated back to the years 1880–1890 [1].

Around the end of February 1938, Vienna entered a period when Schuschnigg government was engaged in a death-struggle, which ended on 13th March 1938 with the proclamation of the "Anschluss" of Austria's annexation by German troops.

This occurred without Great Britain and France taking any measures, and with the consent of Mussolini, who first with the Abyssinian war (1935–1936) and later through participation in the Spanish civil war (1936–1939) had once and for all espoused Hitler's cause.

On 29th–30th September, 1938 at an encounter in Munich, Great Britain and France accepted the dismemberment of Czechoslovakia, with the transfer of a few of its border provinces to Germany, Poland and Hungary.

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966),* SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8_11, © The Author(s) 2012

Under Hitler's pressure on 15th March 1939 Czechoslovakia ceased to exist, without the slightest initiative from France and Great Britain which had solemnly promised in the Munich Pact to safeguard the threatened Czechoslovakia from any aggression.

On 23rd August, 1939 a "non-aggression pact" was signed in Moscow by Hitler's Foreign Affairs Minister von Ribbentrop and his colleague from U.S.S.R., Molotov. This Hitler-Stalin, or Ribbentrop-Molotov Pact was in reality an agreement on the partition of Poland, while Hitler gave to Stalin free hand in the Baltic states, a situation rather familiar in the times of German kings and Russian tsars. At the dawn of 1st September 1939, a date fixed by Hitler since 3rd April of the same year (!) [2], the German troops crossed the Polish border at many points in the direction of Warsaw. Stalin's troops entered Poland[1] from the western Russian border. A few days later Great Britain and France declared war on Germany in spite of their inadequate military preparation. It was the beginning of the Second World War and at the same time the climax of tensions in the left oriented part of the public opinion of the "free world".

The natural and most general reaction was that a pact of agreement between Hitler and Stalin was incredible, almost impossible. But common sense pretty soon won: opposite extremes, quite often, are much closer than suggested by reason.

A variety of judgments were expressed on Stalin's behaviour under these circumstances. Many people thought that the signing by Stalin of a Pact with Hitler was an intolerably unmoral deed. A smaller fraction tried to defend Stalin's position as an unpleasant but necessary procedure for giving the U.S.S.R. some time for military mobilization to resist a most probable attack of Hitler in the future.

Still others felt that the Hitler-Stalin pact was fully justified because, after all, the real enemy number one of the new socialist societies were the capitalistic countries and therefore any action which increased forces against them was a good thing.

That's enough as a general overview. I would only add a small reflection on the transfer from the U.S.S.R. to German prisons of many German people like Houtermans.

Most of them were communists or very close to the communist party and all of them asked the U.S.S.R. authorities to send them to any other place but to Hitler's Germany. But this understandable desire was not taken into account: following the von Ribbentrop-Molotov Pact they were all handed over to the German Gestapo. The only exception was made for those among them that were Jewish: they were all sent to concentration or annihilation camps.

[1] Stalin's troops entered Poland on 17th September 1939 (Note of the editors).

## References

1. Hellmut Andics: “50 Jahre unseres lebens-österreichs Schicksal zeit 1918”, Verlag Fritz Molden (Vienna) 1968.
2. See, for example: W.L. Schierer: “The Rise and Fall of the Third Reich”.

# Chapter 12
# More About Fritz and Konstantin

The name of Konstantin Shteppa does not appear in the "Chronological Report" of "My Life in Russian Prisons", because each of the authors, for years, even when it was no longer necessary, kept the habit they had adopted during the purges in U.S.S.R. of not giving any information about their friends.

We have, however, plenty of information about Shteppa's origin and life [1, 2]. Son of an Orthodox priest who had married the descendent of an Ukrainian family of noblemen, Konstantin had interrupted his studies at the University of Petrograd for military service, first in the tsar's armies during the war (1914–1916), and then in the civil war with the "Whites" [3].

After the war he completed his studies and in 1927 was awarded a Doctorate of Philosophy in History. In 1930 he was appointed professor of ancient and medieval history at Kiev University. At the same time Shteppa was senior Research Associate of the Academy of Science of the Ukrainian S.S.R., where he became chairman of the Committee for Byzantine Studies.

Shortly after 1930, having concentrated on demonology and ancient legend, Shteppa shifted his attention to social revolts in ancient Rome and especially in Roman Africa. This subject was to remain his special interest for the rest of his life. At the same time he reviewed the whole analysis of antiquity. Politics inescapably crept into his professional and personal life.

Shteppa was arrested in February 1938, at the height of the purges. His troubles with the authorities had started in 1937 with a comment about Joan of Arc. As Shteppa wrote years later [1]: « In a lecture on the Hundred Years' War I had described the famous French heroine as nervous and highly strung. Dimitrov, secretary general of the Komintern [4], had announced at the last congress that the French Communists had denied the Fascist's right to claim Joan of Arc, the French national heroine, as a champion of their fascist philosophy. In other words the French Communists wished to appear to be good patriots, for Joan of Arc had shared in the people's struggle for liberation from a foreign oppressor.

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DOI: 10.1007/978-3-642-32855-8_12, © The Author(s) 2012

That was the line of Dimitrov's argument. But I, by calling Joan of Arc highly strung in my lecture, had detracted from her significance as champion and representative of the struggling people, and had thereby also failed to respect the statement of a party leader. Thus I had deviated from the general party line in the matter of national movements and had exposed myself as a bourgeois scholar. That is what I was accused of in an article in the University wall-newspaper.

Joan of Arc was followed by Midas. To illustrate a point in one of my lectures I had mentioned the legend of Midas, I think in connection with the invention of money. The legend had no particular importance in the context, and I had merely mentioned it in passing, so it may be that I did not sufficiently emphasize some minor aspect of it. Probably, however, I told an unfamiliar version of it.

Meanwhile Stalin, in one of his speeches on the gap between officials and the party masses, had mentioned the legend of Antaeus. It was now suggested by my critics, among them my own assistants, the "representatives of the younger generation", that only a bourgeois professor—and my name was mentioned—would neglect these myths and distort their context, thus setting his students a bad example, while Stalin, the wisest and most brilliant leader of the party and of the workers of the whole world, showed the greatest respect for ancient mythology and even quoted it in confirmation of his conclusions. The political significance of my mistake, in the opinion of my critics, lays in the fact that I had insufficient respect for the party leader's authority and did not accept his statements as my guiding principle. It sounds like a joke, but it was a joke with serious consequences.

The Midas incident was followed by more and more accusations, though the attacks on me were still isolated and individual. I felt more and more clearly that these were merely the preparations for the big offensive that was still to come, and sure enough this began in the late autumn of 1937, when the whole country was in the grip of an unprecedented purge. Eventually my turn came. For many days and nights I was the object of a "checking-up process" at meetings and sessions in the university attended by my colleagues, assistants and students. At the same time essays and articles violently criticizing my work appeared in the most varied periodicals and newspapers » [5].

Arrested in February 1938, Shteppa was held as a political prisoner until after the outbreak of World War II in September 1939. His first encounter with Fritz in Kiev prison was described by Konstantin Shteppa and written down by his daughter Aglaya [6].

« I entered the cell of the Soviet prison which contained a single piece of furniture 'a wooden bunk-bed'. Immediately I was shocked. On the top bed laid a corpse. The man's face was grey and the skin was so thin that one could see every bone under it. I was terrified. Is it possible that they got to be so cruel? That the degree of their mockery went to the point of putting the dead and alive together? » It was my first thought after I looked at his face.

In a while he opened his eyes. He stared at me with a look of expectation that I would bring him all kinds of news which he needed desperately.

« Are you new? I can tell by the way you walk, you move and you look », he said in his broken Russian. He lifted himself up and offered his thin hand for a

handshake. « My name is Fritz Houtermans, a German… a physicist… a former member of the socialist party… former emigrant from fascist Germany… former director of the Institute of Science in Kharkov… former human being and who are you?».

Those were my first weeks in prison, so I hadn't forgotten how to smile. I shook his hand and introduced myself properly, « Professor Konstantin Feodossovitch Shteppa, professor of History of the University of Kiev ».

«I am pleased to meet you »-Fritz Houtermans replied-« I think we will have much in common ». « Do you smoke? » « No, sorry, I don't ». « This is a pity. If you did I would hope to occasionally smoke your stubs. You know that I don't get any money from the outside. My family is abroad. I tried several times a hunger strike but they don't care, so I gave up, and you can see the only results, as he pointed out, his emaciated limbs. I also used to exchange rations for cigarettes »-He added with sorrow in his voice-I answered-« My wife is allowed to send money every month, I don't know for how long, but as long as I will have money we shall share ».

«You are a lunatic »-he said frankly-« nobody does this here. Everyone cares only for one thing, to survive. And one cannot survive on what they give you… Forget about this; just tell me all the news… When did they arrest you? What are the news from the West? ».

Aglaya Konstantinova Shteppa goes on as follows [1]: « This was the atmosphere under which my father and… Fritz Ottonowich met. They stayed in one cell for several months. They became great friends. By turns they hated or loved one another. They told one another everything about themselves, about their families, their experiences, their knowledge. They just had to talk. They remembered the books they had read and the letters they received. They talked about good and bad, beautiful and ugly, about wonders and terrors. For that period of time they became one being, one soul. They had the same fears, the same agonies, the same distress and hopelessness. They both were in the hands of fate or at the mercy of the NKWD. Either one was completely sure that the other would never come out alive.

My father kept his word and shared his small allowance with Fritz Houtermans. This made him feel sore, but there was no other solution, so he accepted.

When one was called out for interrogation, the other one prayed. They prayed together. One Catholic, the other Orthodox, but the cell made them compromise. They shared their sorrows, they swore that if someone came out alive, he would take care of the other's family. Both had a wife and two children left behind. And there was very little hope for either one.

Fate brought them together and fate separated them. When they said good-bye it was meant forever. But the will of God is not ours to know. They both came out of prison at different times and under different circumstances. They met again in a free world and stayed friends. They wrote a book which they started in their thoughts while still over there, in a cell of the NKWD building on Korolenko 33 in Kiev ».

## References

1. See "The Forward" by Alexander Dallin of Konstantin Shteppa book Ref. [3] of Chapter 17.
2. Ref. [3] of Chapter 10: the first of the three cases discussed there, is that of Konstantin Shteppa.
3. "Whites" and "White army" were expressions used in contrapposition to "Reds" and "Red army" for indicating the Russian troops that during 1918-1919 fought on the Russian territory a desperate and unsuccessful war against the communist government.
4. In 1919 the Bolshevik Party, which one year before had adopted the name Communist Party, promoted the constitution of Komintern, or Third International, i.e. an unitary organization of all Communist Parties which were represented in proportion to the number of their members and strictly bound to follow the decisions taken by its organs.
5. F. Beck, W. Godin: "Russian Purge and the Extraction of Confession", Hurst and Blackett Ltd (London, 1951). This book was written during the second Göttingen period (Chapter 18) with the help of Höxter, an American journalist of German origin.
6. Copies of the following manuscripts by Aglaya Shteppa Corman have been given me by Charlotte Riefenstahl: (a) A 5 page letter by Aglaya Shteppa Corman to Charlotte, dated 27$^{th}$ February 1962, concerning the bad health of Fritz and his relations with Eric Kostantinovich Shteppa. (b) "In Memory of Professor Dr. F. Houtermans", 7 typewritten pages by Aglaya Shteppa Corman.

# Chapter 13
# A Few Other Physicists' Political Troubles

It would be very interesting indeed to find out what happened to all scientists gathered from 1933 to 1937 at the Ukrainian Physics Technical Institute in Kharkov. The information available, however, is fragmentary and therefore it is difficult to reconstruct a picture as complete as it would be desirable.

Besides a few cases already mentioned above (Chaps. 10 and 12), I have found that Obreimov, one of Ioffe's earliest students, a specialist in crystal physics and first director of the Ukrainian Physics-Technical Institute, served 10 years in prison, while his successor, Sinielnikov, in charge during Houtermans times, was condemned to death and executed in 1937 or 1938.

Almost all other leading scientists of the Physics-Technical Institute in Kharkov were also in trouble in that period: Shubnikov, head of the low temperature laboratory, Leipunski, head of the nuclear disintegration laboratory, Gorsky, head of the X-ray department, Weissberg, head of the experimental low temperature station, and Landau, head of the department of theoretical physics, were all arrested, while Ruhemann, head of the second low temperature laboratory, was deported.

Within a year about half of them were released except Shubnikov and Gorsky, who died in imprisonment [1]. Leipunski was soon back at work in the Institute while Alex Weissberg, who had been arrested months before Fissel (Chap. 10), was also handed over to the Nazis by the Russians after the Ribbentrop-Molotov treaty. Being Jewish, he was put into a concentration camp in Poland, from which he escaped and joined the Polish underground. He survived the war and lived in Paris later on. He published a book on his adventures: "Hexensabbat" [2] which has been translated into other languages.

The adventures of Lev Davydovich Landau, one of the greatest Soviet theoretical physicists of the 20th century, appear to be of the greatest interest. It is not proved that his arrest on 28th April, 1938 was directly related to the purge of the scientists moved to Kharkov during the early thirties. What is sure, however, is that this short but dramatic interlude belongs to the same great stream of events.

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966),* SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8_13, © The Author(s) 2012

Many biographies of Landau have been published in Russian. A beautiful one, in English, is due to Kapitza and Lifshitz [3], who give us, respectively, a general outline of his life and work and a short but substantial survey of his scientific production. Additional information about his way of working, relationships with other scientists and little amusing stories, which throw light on Landau's nature, can be found in the lecture given at CERN by Janouch in June 1978 [4].

Landau was born in Baku in 1908 and being an "enfant prodige", entered the University of Baku in 1922. In 1924 he moved to the Department of Physics of the University of Leningrad, where he completed his course the day before his 19th birthday in 1927.

He became a post-graduate student at the Leningrad Physics Technical Institute of the Academy of Science of the U.S.S.R., founded immediately after the revolution by Ioffe (1880–1960) [5], who had been a student of Röntgen (1845–1923) and became well known for his work on solid state physics. In Leningrad at that time there was no senior scientist of note to set up a theoretical school. Ehrenfest (1880–1933) [6] had lived and worked in Leningrad, but later had been invited to the University of Leiden to take the chair which had become vacant on Lorentz's retirement. He left behind in Russia several talented students and some of them led the teaching of theoretical physics while Landau was at the University of Leningrad.

When 18 years old, Landau published his first paper on quantum mechanics, which was just emerging. In 1928 he went abroad for the first time and passed one and a half years in various centers such as Göttingen (Max Born), Leipzig (Heisenberg), Berlin (Laue etc.), Cambridge (Dirac) and Copenhagen (Bohr). Everywhere he impressed everybody with his originality and talent and established lasting friendships.

In 1931 he returned to the Physics Technical Institute in Leningrad which was the chief physical institute in the U.S.S.R. and had grown considerably. Not long before it had branched out into other scientific centers all over the Soviet Union. The more important of these were three, in Tomsk, Sverdlovsk and Kharkov, the capital of Ukraine.[1] The Ukrainian Physics-Technical Institute in Kharkov, directed by Obreimov, was mainly devoted to solid state and low temperature physics.

Landau went to Kharkov in 1932. He was already famous as theoretical physicist and represented the main scientific attraction for the young German speaking physicists looking for a place to live and work outside Hitler's political sphere.

Some of Landau's main works belong to his time in Kharkov: on the theory of second-order phase transition, the kinetic equations for particles with a Coulomb interaction, and the theory of the intermediate state in superconductivity.

[1] Kharkov-now Kharkiv-became the most important city in Ukraine in December 1917 and later the capital of the Ukrainian Soviet Socialist Republic. In 1934 the capital was moved to Kiev (Note of the editors).

In 1937 he left Kharkov to go to the Institute of Physical Problems created in Moscow in 1935 to allow Kapitza to continue research he had begun in Cambridge. A year later Landau was joined by Lifshitz (1915–1985), his closest student and friend, and his co-author of the many volumes "Course of Theoretical Physics" [7]. According to Janouch [4], the main reason for Landau to leave Kharkov for Moscow was a difference with the rector of the Kharkov University about Landau's method for testing physics students. According to some of the people present in Kharkov in those years, the heavy political atmosphere prevailing in the Ukrainian capital also had a weight on his decision.

The day after Landau's arrest, Pjotr Kapitza wrote a letter to Stalin asking for the reason of the imprisonment of a scientist, member of the Institute for Physical Problems of the Academy of Science, placed under his directorship. Such an arrest, Kapitza added in his letter, had the effect of increasing the already existing "gap" between the scientists and the Country. Since this letter remained without answer, 6 months later Pjotr Kapitza wrote again, but this time the letter was addressed to Prime Minister Molotov. He wrote that the reasons for Landau's arrest were still unknown and that in the meantime, he, Kapitza, had discovered helium super-fluidity and the only man who could explain the new phenomenon was Lev Landau, still kept in prison. A few days later Molotov let Kapitza know that the Minister of the Interior, Beria, had entrusted his deputy with receiving him. At the Ministry Kapitza was received by a group of three people: Beria's deputy and two generals who had on the table in front of them a very thick dossier. They showed it to Kapitza, told him that it contained the documents proving all crimes committed by Landau, and invited him to have a look at them in order to become aware of the kind of person he was taking into such consideration. They asked him also what were his reasons for trying to protect such a criminal.

Kapitza thought that in order to avoid to be beaten, Landau, as most other people in the same circumstances, had signed any possible declaration of guilt presented to him. Therefore he declined to look at the dossier, saying that it was not his but their business to judge Landau's behavior. He added that he wished to discuss with them which could be the reasons that had induced a scientist like Landau to commit all those crimes. His speech, interrupted here and there by discussions with the examining judges, went on for about three hours, during which he also declared himself ready to assume responsibility for Landau's behavior if he were released.

Later Kapitza was called again and required to sign a declaration agreeing to take on himself the responsibility for Landau's behavior. As a result Landau was released at the end of April 1939, just one year after his arrest.

Since then Landau used to say to his close friends that Kapitza had saved his life and that what he had done for him required more courage than entering a tiger's cage.

Landau's achievements in science are very well known and cover an exceptionally wide range of problems. The acknowledgement of his scientific merits was shown by a number of academic awards in the U.S.S.R. and abroad. He was elected Member of the Academy of Science of the U.S.S.R. in 1946; awarded State Prizes

on three occasions (1946, 1949 and 1953), the Lenin Prize in 1962; given the title of Hero of the Socialist Effort in 1953 for his scientific activity and for fulfilling government projects, twice awarded the Order of Lenin and several other medals. In 1962 he was awarded the Nobel Prize for his pioneering research in the theory of condensed state, especially liquid helium. This interlude in Landau's life was not the only circumstance in which Kapitza gave proof of extraordinary civil courage.

When, in 1948, Stalin placed Beria at the head of the U.S.S.R. Atomic Energy Organization, Pjotr Leonidovich Kapitza prepared a letter to Stalin containing a number of considerations, all indicating that such an appointment was a wrong decision. In the country, pointed out Kapitza, there were a number of scientists with all the scientific, technical and human qualities desirable for such an important position. He added, as an example, that such an appointment was a mistake similar to that of nominating director of the Bolshoi Theater a man that did not know musical notes.

Before sending the letter, he called to his home three of his closest friends [7] and read it to them. All of them said that to send such a letter was suicidal and tried to convince him to desist from his intention. Pjotr Leonidovich answered that it was his civic duty to intervene at the highest level. He did, however, accept a few minor changes and sent his letter to Stalin.

About one week later he received an answer from Stalin, thanking him for the criticism and asking for further information. Kapitza was very happy, showed Stalin's letter to his friends pointing out that this was a clear sign that times were changing and criticism could be made when necessary. Stalin, however, had passed Kapitza's letter to Beria, who started a well-planned attack on what Kapitza had done as chairman of the National Committee in charge of applied research on production and use of compressed gases. Later Kapitza was openly accused of having led the Committee to take wrong decisions which had brought considerable economic damages to the U.S.S.R. He was removed not only from the Committee but also from the direction of the Institute of Physics Problems of the Academy and compelled to live in a private house (dacha) he had on the periphery of Moscow. When, seven years later, in 1955, Beria was executed, Pjotr Kapitza went back to his activity and previous work.

Pjotr Leonidovich Kapitza (1894–1984) was born in Kronstadt, close to Leningrad. He had started his scientific career in Ioffe's section of the Electromagnetic Department of the Petrograd Polytechnic Institute, completing his studies in 1918. Here, jointly with Semenov, he prepared a method for determining the magnetic momentum of an atom interacting with an inhomogeneous magnetic field, later used in the Stern-Gerlach experiments that brought the discovery of the spin space quantization.

At the suggestion of Ioffe, in 1921, Kapitza went to the Cavendish Laboratory to work with Rutherford. In 1928 he discovered the linear dependence of resistivity on magnetic field for various metals placed in very strong magnetic fields. The importance of these results was fully appreciated in Cambridge in general and in particular by Lord Rutherford.

Kapitza was nominated Clerk Maxwell Student of Cambridge University in 1923–1926 and one year later Assistant Director of Magnetic Research at the Cavendish Laboratory (1924–1932).

By the use of a special alternator, Kapitza was able to produce fields up to 300,000 gauss, and to carry out experiments showing the existence of new phenomena in conduction and magneto-striction. Since most of these phenomena are more pronounced at low temperatures, a hydrogen liquefaction plant was added in 1929 and in 1930 the Royal Society made a special donation of £1500 to enable a new laboratory to be built to house the original apparatus, together with a helium liquefaction plant. Kapitza was nominated at the same time Messel Research Professor of the Royal Society (1930–1934) and Director of the new Royal Society Mond Laboratory (1930–1934), which later was partially financed also by the Department of Scientific and Industrial Research.

It was characteristic of Kapitza that in 1930 he was not satisfied to take over existing designs of helium liquefiers but began immediately to work on the construction of a new type of liquefier which required no liquid hydrogen. This liquefier is an illustration of Kapitza special technical gift, for it incorporates a piston type engine, which works down to the temperature of liquid helium. In summer 1934 Kapitza was able to start preliminary experiments using strong magnetic fields combined with liquid helium temperatures.

It was just at that time that I had the great pleasure to meet him for the first time. At the beginning of July 1934, Emilio Segrè and I went to the Cavendish Laboratory and remained there for almost two months. During our visit, mainly devoted to talking to people working at the Cavendish on nuclear reactions and in particular to those working on neutron physics, we visited the Mond Laboratory where we were received and shown around by Pjotr Kapitza. We still remember the great impression we had of his preparation, brightness and human kindness. Only many years later did I have the pleasure of seeing him again on occasion of the Pugwash Conference, held in Nice in 1968 [8].

In September 1934, i.e. less than one month after our visit to Cavendish and Mond Laboratories Kapitza left Cambridge for the U.S.S.R. to attend the Mendeleff's Congress.

He had visited his country almost every summer since he had started his research activity in Cambridge. During these visits he gave lectures and advises on the construction of new institutes.

It came, therefore, as a shock to his colleagues to learn, in October 1934, that Kapitza's return passport had been refused and that he had been ordered to begin the construction of a new laboratory in Russia. Such news made an enormous impression not only in Great Britain but everywhere in Europe and the United States.

The reasons underlying this action were given in the News Chronicle by the Soviet Embassy in London: "Pjotr Kapitza is a citizen of the U.S.S.R., educated and trained at the expense of his country. He was sent to England to continue his studies … Now the time has arrived when the Soviet Union urgently needs all her scientists. So when Professor Kapitza came last summer, he was appointed as director of an important new research station which is now being built in Moscow" [9].

Lord Rutherford, in a letter to The Times of 29th April 1935, expressed his concern about the whole story but shortly later he contributed to prepare an agreement concerning the sale, to the Government of the U.S.S.R., of a large generator for the production of strong magnetic fields, together with the associated apparatus and a duplicate of the helium liquefier, to allow the continuation of Kapitza's work in Moscow. With the sum received, new equipment was bought for the continuation of the work in Mond Laboratory [10].

When, in 1978, Leonidovich Kapitza was awarded the Nobel Prize for his discovery of super-fluidity, physicists throughout the world were very happy to see the recognition of his outstanding piece of work which emerges from a full life devoted, with great success, to the progress of science [11]. But everybody that had the great luck of meeting him or at least of knowing some detail about his life, was also satisfied or even moved, that such a recognition was given to a person endowed with such extraordinary human values.

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# Chapter 14
# Finally Out of Prison!

Let me go back, very rapidly, to when Fritz Houtermans was transferred to the Gestapo prison at Alexanderplatz in Berlin. After a few days one of the fellow-prisoners was informed that he would be released pretty soon. The news produced a considerable excitement among the prisoners and many of them gave the fortunate fellow messages for relatives and friends to be communicated as soon as he was out of prison. Fritz gave him the name of an old friend and colleague at the Technische Hochschule, with the recommendation simply to say on the telephone "Fissel is in Berlin".

After a first astonishment Dr. Robert Rompe [1], who received the message, understood its real meaning and concluded: « If Fissel is in Berlin, he must be in jail! » He went immediately to see Max von Laue and communicated him the message he had received and its obvious interpretation. Von Laue went to look for Houtermans' name in the list of prisoners kept in appropriate offices, found where he was and went to visit him carrying some food and money. Immediately afterwards he took all necessary steps to get him out of prison, as he had done on many other similar occasions, and always with success.

Friedrich Georg Houtermans was finally out of prison! One of his first acts was to use a considerable part of the money he had received from von Laue to buy an expensive gold pen. Immediately he started to exchange letters with his wife Charlotte and his mother.

Fritz's attachment to his family can be appreciated from the beginning of the letter he sent from Berlin to his mother, the 28th September 1940. The other letters are all of similar tone.

9th Letter, Berlin 28.9.1940

« My Mammy,

What good luck: yesterday a postcard from Schnax, early this morning one from you and both your letters; I live only waiting for the mail and often I come suddenly home in order to see if there is some letter. I have not written to you for such a long time, but I believe that you read my letters to Schnax and she hers to

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DOI: 10.1007/978-3-642-32855-8_14, © The Author(s) 2012

you. I have no secrets from you. I am so proud of Jan that I tell everybody he has received 185 at the intelligence test, but I am a little afraid that he may grow up in the conviction of his importance, and this could damage him, but he is welcome to have a little more than I.

You cannot imagine how terrible it is that he grows up without me, obviously only as far as I'm concerned, because without any doubt he has all he needs and this comforts me. But I miss his best age and that of Bamsi (Giovanna). If, however, it is fated that one loses one's children to the world and to opinions and perspectives that one believed overcome long ago, to problems that do not appear any more in an acute form, they might, eventually, return to you only after many years, if they return at all. Perhaps one has to give them a lot, avoiding that they notice it, one should not explain to them everything, because, if they have some value, sometimes they will open the eyes, if they will need it; and if you are needed you only have to wait.

Anyhow, nature is very complicated. Intelligence tests alone do not make a man of somebody and, without talent one can perhaps obtain more than with talent, once one has understood that one should work with a high degree of efficiency, because everybody has good ideas, the problem is that of carrying them out. For what concerns me, my mathematic foundings have been such a decisive event that I nearly do not care of finding now everything in Euler, Gauss and others, so that there is almost nothing new in what I have discovered. Still I regret it. Anyhow my manuscript goes for my son and will always remain as a proof that the spirit cannot be destroyed.

I have now a little book by Fermat and I can describe more or less how far I have arrived… ».

The remaining three quarters of the letter are devoted to a summary of the results he had found during the years of prison in the "theory of numbers" /19/ and information about aunt Lilly and the shock of his cousin Tully's suicide. She was a gifted pianist, became an anthroposophist [2] and emigrated to London.

There are only a few words about his future work in von Ardenne's Laboratory and some sentences about his reading again the books of Burkhard and of "my old Laotse".

At the end, referring to history in general, Fritz writes: « The history of the Church and of China should be read. The Chinese empire and the Church are the wisest institutions that ever existed and now I can permit myself to say that one should not become too excited about a couple of hundred years. Everything goes in order … ».

Already in July, Fritz sent a short scientific paper to the "Naturwissenschaften", which appeared in the issue of August 1940, i.e. about one month after his liberation from prison /20/. In ten lines, under the title "Half-time of radio-tantalum", Houtermans reports the results of measurements completed in October 1937, the publication of which, as he says in a footnote, "has been postponed until now because of external reasons". He expresses his thanks to Herrn Kurschatov [3] for help in the irradiation of the samples and to Fräulein Poluschkina for help in the measurements with counters. As address of the author he gives: Berlin-Charlottenburg 2, Uhlandstrasse 189, i.e. his private address.

The real meaning and aim of his short communication was to inform all his friends and scientific acquaintance that he was back in Germany and back at work. Now clearly, there were new problems to be solved. First of all how to provide himself with the means for survival?

The solution was found once more by von Laue, who recommended him to Manfred Baron von Ardenne for a research position in the "Laboratorium für Elektronenphysik" he had founded in 1928, in Berlin-Lichterfelde Ost. Von Ardenne (Hamburg, 1907—Dresden, 1997), a remarkable inventor and applied physicist, financed his private laboratory by means of contracts with industries, orders from ministerial departments and royalties from the many (600 in all his life) patents regarding radio communications, electron microscopes, mass spectrometers, etc.

Fritz entered the "Laboratorium Manfred von Ardenne" on 1st November 1940 [4] and immediately started to work very hard. Already at the beginning of May of the following year, appeared in the Archiv für Elektrotechnik /21/ a paper written by Fritz, in collaboration with Karl-Heinrich Riewe, "On the action of space-charge on a beam of charged particles (shaped) by a rectangular window" and in July of the same year a second one by Fritz alone appeared in the Annalen der Physik "On the energy required for the separation of isotopes" /22/. In this paper Houtermans extends and completes the previous work by Walcher [5] by discussing for various separation procedures, the enrichment factor, the transport per unit time of the desired isotope and the amount of energy required for its separation.

The subjects of these two papers clearly belonged to the typical research lines cultivated in the von Ardenne's Laboratory.

A third paper, dated August 1941, was given by Houtermans to von Ardenne as an "internal report" of the Laboratory, but never appeared in print because of the importance of its military and political implications. In this report /23/, about 30 typewritten pages long, Houtermans discusses the possibility of producing energy by means of nuclear chain-reactions based on the fission of heavy elements. It is divided in seven sections concerning: (1) the general point of view; (2) the processes in competition with fission which can produce an undesired reduction of the neutron density; (3) the chain reaction based on fission produced by fast neutrons; (4) the chain reactions based on the use of thermal neutrons; (5) the possibility of realizing a nuclear chain reaction with thermal neutrons; (6) the chain reaction in the case of a finite volume of the system; and finally (7) the meaning of a chain reaction at low temperature as a source of neutrons and a device for producing nuclear transmutations.

The author quotes from the beginning the theory of nuclear fission published in 1939 by Bohr and Wheeler [6] as well as the experimental papers by the Paris and Columbia University groups concerning the emission of secondary neutrons in fission [7].

The most interesting points of Houtermans' paper are: (a) the conjecture derived from the theory of nuclear fission [6] that the nuclide of mass number 239 and atomic number Z = 94 (called by its discoverers plutonium: $^{239}_{94}$Pu, Chap. 16)

should undergo fission even with slow neutrons; (b) the impossibility of a chain reaction with fast neutrons using ordinary uranium ($^{238}$U 99.3%; $^{235}$U 0.7%); (c) the advantage as a fissionable material of the new nuclide ($^{239}$Pu) with respect to $^{238}$U because the use of the latter requires the separation of this rather rare isotope from the about one hundred times more abundant $^{238}$U; (d) the possibility of constructing a bomb based on nuclear chain reaction, and finally (e) the possibility of constructing what today is called a fast breeder reactor as the most rational procedure for the exploitation of nuclear energy and the only one which allows the utilization of the whole energy content of natural uranium. In a conversation he had years later with Giuseppe Occhialini and Connie Dilworth (Chap. 18), Houtermans said clearly that all his considerations were "highly hypothetical" since he did not known the various cross sections and the fact that plutonium would show thermal fission was only derived from Bohr and Wheeler considerations. This lack of essential data explains the wrong view contained in his paper that a nuclear reactor would have to be run at low temperature (about 100 °C).

The paper was sent by von Ardenne to the Post Minister Ohnesorge who was well informed about the research activities carried on by the Baron and his collaborators. In 1934 von Ardenne had started to develop for the Post Ministry communication devices based on decimeter radio waves, and in 1940 had received substantial financial support for the construction at the Lichtenfelde Laboratory of a one million volts Van de Graaff that was first used as a generator of fast electrons and, later, converted into a deuteron accelerator used for providing an intensive source of neutrons.

The same paper also reached the physicist Otto Haxel (1909–1998), who during the war had served as a navy officer in charge of the supervision of the scientists working in the Uranverein (Chap. 16). In the agreement with Haxel's superior, Admiral … and the assent of the leading scientists of the Uranverein, Houtermans paper was not forwarded to the upper political authorities and the strategic command where it would have triggered a greater interest in the research carried on by the physicists of the Uranverein. Apparently also the information channel passing though Ohnesorge never brought this information to the "higher levels".

Other papers by Houtermans in that period concerned the experimental determination of the cross section of a few elements for thermal neutrons /24/ and the absolute determination of the number of neutrons emitted by a source /25/ by means of a variant of a method used by Fermi and myself in 1936 [8], the essence of which Fissel communicated to me by letter in spring 1942.

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1. Robert Rompe was a distinguished physicist who worked mainly in industry, in particular for the Studiengesellschaft für Elektrotermische Beleuchtung (Osram). After the war he remained in the Deutsche Democratik Republik and reached important positions such as Staatssekretär of the Kultur Demokratische Ministerium.

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# Chapter 15
# Shaken by World-Wide Storms. Fritz's Second Family

On June 22nd 1941 Hitler attacked the U.S.S.R. German troops started to enter the U.S.S.R.'s territory and, in three weeks, advanced 450 miles on the central front, from Bialystok to Smolensk, in the North passed through the Baltic States and advanced towards Leningrad, and in the South moved towards Dniepr and Kiev, the capital of Ukraine. Kiev fell into German hands on September 16th while German units were already 150 miles farther. The battle inside and around the city came to an end only ten days later with the surrounding and surrender of a large contingent of Russian troops (665,000 according to the German command).

Shortly in Berlin, Houtermans was asked by the German authority to take part in a mission to Ukraine to collect scientific instruments from the Universities and other research Institutes. Fritz accepted and went there. The trip lasted only a few days but was considered by most of his friends in Germany as well as abroad, as an act of collaboration. Many years later I asked him why he had accepted to participate in such a mission, and he answered that he had thought to succeed in giving some help to his old Russian friends.

This can also be gathered from what the daughter of Konstantin Shteppa wrote years later [1]. Aglaya describes in her broken English, translated from Russian, Fritz's visit to Kiev as follows:

« I met F.O. (Fritz Ottovich Houtermans) for the first time in 1941 in Kiev. It was just at the beginning of the war, and a very hard period of life for everyone.

F.O. came to Kiev, asked about my father, found out that he was there, and a meeting was arranged. German occupation forces at that time proved already to be cruel, unjust and based on force and terror. It seemed strange to meet a man who was a German, but was not "Nazi" at all. It felt like a miracle. F.O. came to our apartment…We remembered so well father's story about friendship in prison. F.O. entered our house as a friend and was welcomed like a relative…The warm feelings towards him remained the whole future life in our hearts. There was no other person who would prove to be a more sincere and true friend than F.O. It

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DOI: 10.1007/978-3-642-32855-8_15, © The Author(s) 2012

gave us comfort to know, that a person, one like him exists. The whole world seemed to be not so bad. If there is one like him, there is hope…

I shall never forget how he managed to send little food parcels to us, which contained a small amount of different food products, probably, his own and his willing friends' rations. My mother used to shed tears over those packages… ».

But which were the past adventures and present situation of Konstantin Shteppa and his family? The « experience of that year and a half he had passed in prison, forms, as it were, a caesura in Shteppa's life. If, until then he was adjusted to Soviet life-whatever his mental reservations and grievances-primarily absorbed in the pursuit of his scholarly work, henceforth he was forcibly "politicized", concerned with a search for answers to the bedeviling dilemmas of intellectual life under totalitarianism » [2].

Shortly after Hitler's attack on the U.S.S.R. it became clear that in a short while the German troops would occupy Kiev and Shteppa decided not to leave the city.

« In the first days after the departure of the Russian troops, he hoped for a better future.

The remaining colleagues elected him Rector of the Kiev University. But the tragedy was soon to unfold. The Germans closed the University. Arrests, abuse, shooting, and hanging rapidly assumed proportions unprecedented even in the worst days of Soviet terror. The next two years were to cause Shteppa the greatest amount of anxieties and soul-searching, involving him in choices which most of his friends found impossible to understand and leading him to espouse positions which were to net him public recrimination in later years. Having committed himself initially to the imperative of collaboration with any system that was willing and able to topple the Bolsheviks, he felt constrained to stick to his commitment.

Having broken, intellectually and emotionally with what Bolshevism stood for, and having in his wartime cut himself off from the Soviet cause, he left for Germany before the Red Army returned to Kiev » [2].

About one year before the departure of the whole family, Eric, the second child of Kostantin Shteppa, followed the dream of his life to see the Western World, and at the first occasion volunteered for labour in Germany.

He belonged to a group of young Russians that was brought to work for the German railroads. After months of life in a camp under very hard conditions, a few of them including Eric tried to escape, but were captured, severely beaten and put in a "Straflager" (punishment camp).

Here Eric contracted a very serious lung illness but was forced to go to work in spite of his health conditions. He fainted, was declared dead and his death was communicated to his parents.

An unknown truck driver found him on the side of a highway, picked him up and delivered him to a hospital. Later, Eric succeeded in communicating with Fritz, who settled "his case" with the German authorities, brought Eric to live with him in Berlin for a few weeks and arranged his trip back home to Kiev.

In Berlin Houtermans met Doctor Paul Rosbaud, born in Ausma and, at the time, the editor of the German scientific periodical "Naturwissenschaften",

published by the firm Springer-Verlag. They became close friends also because of their common scientific and cultural roots and cosmopolitan interests. Only 40 years later the "secret life" of Rosbaud as a spy of the British Intelligence Service in Hitler's Germany, was revealed to the wide public [3].

Through Paul Rosbaud in Berlin Fritz met, in 1942, Charles Peyrou (1918–2003) a young French physicist who had studied in Paris at the École Polytechnique, under Louis Leprince-Ringuet [4]. He had been enlisted in the French army at the beginning of the Second World War, had fallen prisoner on the Maginot Line in October 1941 and sent first to a prisoner of war camp, later to work in Berlin-Charlottenburg. Years later Houtermans and Peyrou became colleagues at the University of Berne (Chap. 21).

In the period 1942–1943 Houtermans published three more papers, concerning the production of RaE[1] through slow neutron capture in Bismuth /26a/, /26b/ and the photonuclear reaction in Beryllium /27/. These works were carried out in collaboration with Ilse Bartz, a chemical engineer working in the von Ardenne laboratory. She was a beautiful slender girl with black hair and grey-green incredible eyes.

Fritz fell in love with her, obtained the divorce from Charlotte Riefenstahl, who was in the United States, an enemy country, and married Ilse in 1944. They had three children: Pieter, born in Gera (near Ronneburg, see below) in 1944, who became a mathematician at the University of Hannover, Elsa born in Göttingen in 1946, an artist living in Hamburg, and Cornelia, also born in Göttingen in 1947 and also living in Hamburg as an architect.

## References

1. Copies of the following manuscripts by Aglaya Shteppa Corman have been given me by Charlotte Riefenstahl: (a) A 5 page letter by Aglaya Shteppa Corman to Charlotte, dated 27th February 1962, concerning the bad health of Fritz and his relations with Eric Kostantinovich Shteppa. (b) "In Memory of Professor Dr. F. Houtermans, 7 typewritten pages by Aglaya Shteppa Corman.
2. See "The Forward" by Alexander Dallin of Konstantin Shteppa book Ref. [3] of Chap. 17.
3. A. Kramish: "The Griffin, The Story of Paul Rosband, Britain's Master Spy in Nazi Germany", Houghton Mifflin Company, 52 Vanderbilt Avenue, New York, N.Y. 10017 (1986). Fragmentary information about Rosbauds' work for the British Intelligence Service is given in Ref. (97).
4. Louis Leprince-Ringuet (1901-2000).

[1] Radium E (Note of the editors).

# Chapter 16
# An Outline of the Early Development of Applied Nuclear Energy in Germany

In order to see in the right perspective some of the adventures and scientific activities of Fritz Houtermans in those years, I feel it necessary to summarize very briefly the effort made in Germany during the war for developing the utilization of nuclear energy.

The information about the actual work done by German scientists is found in a four pages article by Werner Heisenberg "On the work in Germany towards the technical utilization of atomic Energy" [1] and in the second of two volumes describing in some detail the research done in Germany during the war in the fields of biophysics, nuclear physics and cosmic rays [2]. This volume consists of three chapters numbered from 5 to 7, since the first 4 form volume one. A part of Chapter 5 (i.e. 5.2: Measurement methods for neutrons) is written by Houtermans /28/. The sections of interest for the present discussion are: "7.1 General Research for the Preparation of the Construction of a Uranium Reactor" by W. Heisenberg and K. Wirtz, and, to a minor degree, "7.2 The Contribution of fast Neutrons to the Neutron Multiplication in Uranium" by O. Haxel. Detailed information of historical interest can be found in a number of books, a fairly long list of which is given in the bibliography [3–7]. Each of them has been conceived and written from a different point of view, and reaches, of course, corresponding conclusions. One of the most objective presentation appears to be that given by David Irving [7], as one a priori would have expected because of the rather long time elapsed from the end of the war to its publication. But all the other books also have their clear, historically justified value and meaning. For instance, one voices the attitudes and views of all those who had suffered for years under the increasing Nazi domination in Germany and Europe, had fought for years against it, and finally saw their military supremacy smashed and their scientific-technical effort practically irrelevant in a field of paramount importance. Another book is a reaction to the generalized conclusions of the first one, treating of those who had worked seriously, sometimes in very difficult conditions and always under-staffed, too modest for the problems to be solved. Another one is the report of a high-ranking officer who had the pleasure of showing

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966),* SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8_16, © The Author(s) 2012

how complex and unusual had been the duty; he had succeeded in bringing to full success.

Here we are not trying to express judgments or comparisons of this kind; our desire is to try to understand individuals, normal individuals, and even some, who, like Fritz Houtermans, were not completely conform to flat normality.

Nuclear physics, as any other field of science, always had been the product of international effort, resulting from contributions put in common by individuals or groups irrespective of their nationality, religious belief or political creed.

This was the situation until the time of the discovery of nuclear fission by Hahn and Strassmann at the Kaiser Wilhelm Institut für Chemie in Berlin-Dahlem at the end of 1938 [8].

A number of important papers which were essential also for the applications of nuclear energy were published in the few months period that preceded the break of the international scientific community.

In Sweden, Lise Meitner and her nephew Otto Frisch, already in January 1939, understood the physical nature of fission and deduced the very large value of the energy released in this process [9]. Similar conclusions independently were reached, in Berlin-Dahlen by Siegfrid Flügge and von Droste, two young physicists of Otto Hahn's group.

Many experimentalists among which first of all Frisch [10] and Joliot [11], carried out experiments, which allowed the observation of the recoiling nuclei produced in uranium fission and the measurement of their large energy [12]. Bohr and Wheeler in Copenhagen developed the general theory of nuclear fission [13]. Part of their results was independently obtained by many other authors [12].

Joliot and coworkers in Paris [14] and independently two groups of the Columbia University, one led by Fermi, the other by Szilard [15], were the first to present experimental evidence for the emission, on the average, of a number of fast neutrons larger than 2 in each uranium fission process. This specific aspect of uranium fission was essential for opening the door towards the release of nuclear chain reactions. These were discussed in a paper by S. Flügge, wich appeared in June 1939 in "Naturwissenschaften" under the title: "Is it possible to exploit the energy contained in atomic nuclei for technical purposes?" [16]. Flügge also developed something like a theory for the production of nuclear energy and gave hints as to how one should proceed in practice for building an "uranium machine". Similar considerations were developed also by other researchers at about the same time, but by then the authors refrained from publishing such results [17].

Two types of applications of nuclear energy were envisaged from the beginning: (1) an energy release under controlled conditions for various peaceful applications, and, perhaps, (2) the construction of a new type of explosive device.

A practical solution for each of these two central problems still required, however, a number of ideas about several particular aspects, the majority of which also involved relatively accurate values of many nuclear constants which, by necessity, had to be found from appropriate experiments.

The most promising solutions of problem (1) clearly were based on the use of slow neutrons and therefore a neutron moderator was an essential ingredient of any

machine: pile or nuclear reactor in the Anglo-Saxon terminology, Uranbrenner (Uranium burner) in German.

The solution of problem (2) requires the use of fast neutrons. It involves a detailed knowledge of the properties of uranium 235, which in great part can be found only after a successful solution of problem (1) was tested and a detailed investigation of the behavior of a nuclear reactor was carried out.

The solution of problem (1) requires: (a) an accurate experimental determination of all the cross sections of the elements present in the reactor for any process produced by neutrons and in many cases their dependence on neutron energy; (b) large amounts of uranium, possibly enriched in the isotope 235, and anyhow of very high purity; (c) a moderator sufficiently effective, of high purity and in sufficient amount; (d) a design of the whole reactor which would reduce to a minimum the losses of neutrons taking place through their absorption in various parasitic processes inside the reactor or their escape through its surface.

Already in spring 1939 a group of foreign-born physicists centering on the Hungarian Leo Szilard (1898–1964) started efforts in U.S.A., both to restrict publication and to get government support in view of the possible military use of nuclear energy.

The first contact with the government was made by G.B. Pegram of Columbia University in March 1939 [18]. In July L. Szilard and E. Wigner [19] conferred with Einstein, who wrote a letter to President Roosevelt explaining the desirability of encouraging work in this field because of the danger that German scientists could succeed first in construct weapons of unprecedented power. The President received the letter in the fall 1939 and appointed a Committee, known as the "Advisory Committee on Uranium" which represents, in an embryonic form, the U.S.A. Government's interest in the field of applied nuclear energy.

First the "Metallurgical Laboratory" at the University of Chicago and later the Manhattan Project with the Los Alamos Laboratories at its center, represented financial and organizational efforts of unprecedented dimensions [20].

In April 1940 at a meeting of the Division of Physical Sciences of the National Research Council, the formation of a censorship committee was proposed for controlling publication in all American scientific journals.

The "Referee Committee", set up a little later that spring, was organized to control publication policy in all fields of possible military interest, with special regard to papers on uranium fission.

Already a few months before, however, Leo Szilard had taken the initiative of convincing scientists in United States, Great Britain and France to take action for preventing the publication in scientific periodicals of any results concerning the possible military application of nuclear energy.

Szilard's advice was followed by the great majority of the physicists working in the U.S.A. and Great Britain, while in France Frédéric Joliot never answered the letter he received from Szilard in early February 1939 and continued the publication of his results [21].

The reason for his attitude had been analyzed, but, perhaps, not deeply enough. A circumstance that should not be forgotten is that, at the beginning of 1939 in the

French communist press as well as in the German (and Italian) fascist information mass media, news had started to appear which was paving the way for the acceptance of the Hitler-Stalin Non-Aggression Pact, signed in Moscow a few months later.

A joint letter sent by Paul Harteck, professor of physical chemistry at the Hamburg University [22], and his assistant Dr. Wilhelm Groth to the Ministry of War on 24th April 1939, two days after the publication of the Paris physicists' paper in Nature [14], is quoted as the first solicitation to the German Government to start action in the field of nuclear energy in view of possible military applications. The authors outlined, in simple terms, that, due to the discovery of Hahn and Strassman, it had now in principle become possible to produce a new type of powerful explosives. After stressing the importance of Joiliot's results [14], they continued that while in the U.S.A. and Britain great emphasis was placed on research in nuclear physics, the subject had been neglected in Germany. One thing above all was important « That country which first makes use of it has an unsurpassable advantage over the others » [23].

Information about this new possibility, however, reached at about the same time the Government level through a completely different channel. Immediately after the publication of the results on the emission of secondary neutrons in fission [14], Professor Wilhelm Haule presented a short paper to the Physics Colloquium in Göttingen on the employment of uranium fission in an energy producing reactor. After the Colloquium, Haule's chief, Professor Georg Joos told him that this was a development which they could not keep for themselves and at once wrote a letter to the Reich Ministry of Education. The ministry acted promptly. They deputed Professor Abraham Esau [24], former professor of physics at the University of Jena and at the time President of the Physikalisch-Technische Reichsanstalt (Reich Bureau of Standard) and head of the Ministry's Reich Research Council, Physics Section. He drew up a short list of scientists to attend the first conference, headed of course by Professor Otto Hahn. Hahn was happy to himself: he had a previous lecture engagement in Sweden, and deputized Professor Josef Mattauch [25] who recently arrived in Dahlem from Vienna to take the place of Lise Meitner. The meeting took place in all secrecy on 29th April 1939, at the Ministry's building at Unter den Linden in Berlin [26]. Dr. Dames, head of the Ministry Research Department, voiced his discent at the way in which Hahn had been able to publish his vital discovery to the world. Mattauch reacted with vehemence to this critical remark on the behavior of his new chief and the reproaches were not repeated. After Joos and Haule had outlined the stage reached in nuclear research abroad and in Germany, the practicability of building a "uranium bureau" (or uranium reactor) was examined. Also the possibility of constructing uranium bombs for military use was explicitly mentioned. A few considerations were also formulated by Esau as a result and conclusion of the discussion: the first was to secure at once all available uranium stocks in Germany. A second one was that the most important nuclear physicists in the country should be co-opted to a joint research group under the overall administration of Esau. The last recommendation was that the participants were obliged to keep the meeting secret.

According to a typewritten memo signed by S. Flügge [27], the same evening Mattauch told Flügge the details of the discussion and Flügge, who had not participated in the meeting and did not feel bound to secrecy, decided immediately to intervene and prevent by means of a publication that "this possibility were withheld from the general public". Thus he wrote "the review article" that appeared in "Naturwissenschaften" of 9th June, 1939 [16] and used this opportunity, as a representative of the Deutsche Allgemeine Zeitung, to publish an extensive article on the same subject in this daily newspaper of 15th August 1939.

This was the beginning. To summarize the main points of what happened later, I will follow Heisenberg's report [1], which is an accurate summary of the project as its participants viewed it in retrospect after the war: « Around the outbreak of the war news arrived in Germany from North America, that American military organs had provided financial means for developing research on the problem of atomic energy. In view of the possibility that from the Anglo-Saxon side atomic weapons were developed, a Forschungsstelle (Research Establishment) was created within the Heereswaffenamt (Army Ordinance Department) and put under the leadership of Colonel Eric Schumann, who was in charge of investigating the possibility of the technical utilization of atomic energy.

Already at the end of September 1939, many nuclear physicists and experts in various related fields were ordered to collaborate in this research program, and Kurt Diebner was committed with his administration. This Uranunternehmung (Uranium Enterprise) or Uranverein (Uranium Association or Club), as it was commonly named, consisted of four main research groups.

I A group led by Werner Heisenberg at the Kaiser Wilhelm Institut für Physik in Berlin-Dahlem with ramifications at the Institut für Physik of the Leipzig University; this group included K. Döpel, C.F. von Weizsäcker [28] and others. The Kaiser Wilhelm Institut für Physik was located near the Kaiser Wilhelm Institut für Chemie, where Hahn and Strassmann had made their discovery in 1938 and where Hahn and collaborators continued during the war their work on the chemical identification of fission products, which was regularly published in scientific journals.

II A group led by Paul Harteck at the University of Hamburg, which included P. Jensen, W. Groth and K. Beyerle.

III A group led by Walther Bothe [29] at the Kaiser Wilhelm Institut in Heidelberg, which included Bothe's pupils: W. Gentner and H. Maier-Leibnitz [30].

IV A group led by General Karl Becker, chief of the technical Services of the Wehrmacht and professor of "Explosive Materials" at the Technische Hochschule in Berlin. This group was located at Kummersdorf (near Berlin, a military place for experimental ballistics) and was the only one with a military structure and attitude.

Connections of these four groups also existed with smaller groups or individuals working in other laboratories or universities: for example with G. Stetter and K. Lintner at the University of Vienna and Houtermans working in Berlin, first at

the von Ardenne Laboratory, later at the Physikalisches Institut of the Physikalisch-Technische Reichsanstalt.

As per decision of Schumann, the Kaiser Wilhelm Institut für Physik in Berlin Dahlem became the scientific centre of the whole Uranverein and therefore was transferred from the Kaiser Wilhelm Gesellschaft, a private foundation established in 1911, to the Heereswaffenamt. Its director, Peter Debye (1884–1966), of Dutch nationality, had either to change nationality or go away. Debye handed in his resignation and went to the U.S.A. (1940). He was replaced by Werner Heisenberg, who until then had been professor of Theoretical Physics at the University of Leipzig ».

It is impossible to summarize here the many results obtained by such a large number of competent people through years of work: from autumn 1939 to the end of April 1945, when U.S.A. troops occupied Haigerloch where "Burner N.8", i.e. the more advanced subcritical reactor constructed by the German scientists, could have been brought to operate at zero power by the addition of about 50 % more uranium and heavy water [1].

The structure and the direction of the Uranverein went through two changes. The first one took place on 26th February 1942 when the results obtained until then were reported to Bernhard Rust, an "Obergruppenführer" of the S.A. [31], for years Hannover Gauleiter [32] and Hitler's friend since 1920, and at the time Reich Minister for Education. Also a few leaders of war oriented research were present.

A number of essential cross sections had been measured (W. Bothe, W. Gentner, H. Maier-Leibnitz, 1940), the necessity of using $^{235}U$ pure or almost pure for the construction of bombs had been recognized, the possibility of using heavy water ($D_2O$) or pure graphite as moderators had been theoretically clarified (W. Heisenberg, K. Döpel 1939), the minimum dimensions of a reactor had been explored, the neutron absorption by the $^{238}U$ resonances had been studied theoretically (S. Flügge) and the necessity of separating the uranium from the moderator by shaping the fissionable material in layers or blocks had been recognized already in 1939 (P. Harteck).

The production of very pure uranium oxide ($U_3O_8$) had been studied and entrusted to the Auer-Gesellschaft and the fusion of the produced metallic uranium powder to the Fa. Degussa, Frankfurt/M. These developments went on very successfully.

The enrichment of the important isotope $^{235}U$ by using Clusius-Dickel separation tubes with uranium hexafluoride ($UF_6$) turned out to be impossible (1941), while such an enrichment by means of a centrifuge gave promising results about one year later (Harteck, Groth, Beyerle, 1942). No attempt, however, was made to begin such an isotope enrichment at a large scale.

In summer 1940 Weizsäcker mentioned the fact that the nucleus of mass 239 and atomic number 93 (neptunium) and 94 (plutonium) produced by neutron capture by the $^{238}U$ present in a reactor, should show a behavior with respect to fission similar to that of $^{235}U$. This is one of the ideas contained in the Internal Report of Houtermans from the von Ardenne's Laboratory /23/ that we have

already discussed in Chapter 14. In Heisenberg's paper [1], however, only Weizsäcker is mentioned in this connection.

The neutron absorption of technically pure graphite was determined by the Heidelberg group (W. Bothe, P. Jensen) who arrived at the conclusion that even extremely pure carbon didn't have the properties required for its use as a moderator in a nuclear reactor. This was a mistake of unclear origin: it could be due to impurities (such as $H_2$ or $N_2$) present in the graphite and not taken into consideration, or to imperfections of the theory used to interpret the experimental results.

All the German efforts were concentrated on the use of heavy water ($D_2O$) as moderator, the production of which took place at the Rjukan plant of the Norsk Hydro in Norway where the production was increased by a factor between 10 and 20 by improvements introduced by P. Harteck, H.E. Süss [33], J.H. Jensen [34] and K. Wirtz.

Also a number of subcritical structures of increasing dimensions and improved design, all composed of heavy water and uranium ($^{308}$U uranium at the beginning, later metallic uranium), were constructed and tested starting from the first one (K. Döpel) in 1940.

At the meeting of February 1942, Reichsminister Rust decided to transfer the Uranverein from the Heereswaffenamt to the Reichsforschungsrat (Reich Research Council) and appointed as new director Esau, then President of the Physikalisch-Technische Reichsanstalt.

Shortly after, on 6th June 1942, the results obtained by the Uranverein were reported to Albert Speer, Reichsminister of Armaments and War Production. The situation was as follows: « There was a clear proof that the technical utilization of atomic energy in a uranium reactor was possible. In addition one could expect that in such a reactor one could produce an explosive for atomic bombs. No research, however, had been pursued on the technical aspects of the atomic bomb, for example, on its minimal dimensions. More emphasis was given to establishing if the energy liberated in a nuclear reactor could be used for the operation of machines, since it appeared that this goal could be reached more easily and with limited (financial) means » [1].

After this meeting Speer decided that the project, carried on until then at a small scale, had to be strengthened. The only feasible goal could be the construction of an uranium reactor for the production of energy to be used for the operation of machines. From this moment on experts of the German Navy took part in the discussions in view of the possible use of nuclear energy for the propulsion of war ships.

The Kaiser Wilhelm Institut für Physik was given back to the Kaiser Wilhelm Gesellschaft and the leadership of the whole Uranverein passed from Esau to Gerlach [35], who was in charge of the "Sparte" (Section) Physik in the Reichsforschungsrat.

Important progress was made in various endeavors, but the difficulties of German industry had started to be considerable because of the raids of the Allied Air Forces. The production of uranium and of blocks of fused metallic uranium proceeded with considerable difficulty.

In spring 1943 the electrolytic plant of the Norsk Hydro in Norway was destroyed by a parachute commando. In October of the same year the destruction was completed. At that time the Uranverein had at its disposal 2 tons of heavy water and about 2 tons of metallic uranium.

On 15th February 1944 the Kaiser-Wilhelm Institut fur Chemie in Berlin-Dahlem was destroyed and the group working at the nearby Institut für Physik was in great part moved from Berlin to Hechingen (now Baden-Württemberg). At the order of Gerlach, a cellar excavated in the rocks was rented in the village of Haigerloch and the more advanced subcritical structure was mounted there. It consisted of 1.5 tons of $D_2O$ and 1.5 tons of uranium, surrounded by a blanket of 10 tons of graphite and equipped with cadmium rods for its control (K. Wirtz, E. Fischer, F. Bopp, P. Jensen, O. Ritter). This structure yielded a multiplication by 7 of the neutrons emitted by a source placed at its center. "The material available at Haigerloch was not sufficient for reaching the instability point. Probably the addition of a relatively small quantity of uranium would have been enough but this could not be done because the transports from Berlin to Haigerloch could no longer arrive. On 22nd April l945 Haigerloch was occupied and the material was seized by the American troops [1]".

The group of physicists of the Uranverein (Bagge, Bothe, Heisenberg, Weizsäcker, Wirtz and others) including Hahn who had not participated in these activities, was arrested by the Allied Forces and held prisoners in Britain until spring 1946 [36].

They were extremely surprised when they learned, on 6th August 1945, that the first atomic bomb had been dropped on Hiroshima. They could not imagine that somebody else could have been so much ahead of them!

Asked later, even from English or American sides, about the reason one had not attempted also in Germany the building of atomic bombs, Heisenberg said [1]:
« The simplest answer one can give to this question is: because this enterprise could not have succeeded before the end of the war ».

In the U.S.A. the group lead by Fermi used from the beginning graphite as moderator and the chemical industry succeeded in providing increasing amounts of this material of gradually higher purity. As a result on 2nd December 1942, the first nuclear reactor was operated successfully at the University of Chicago.

One should also recognize that the design of the many subcritical systems that the Chicago group constructed and tested before autumn 1942 appear simpler and more suited for a clear interpretation of the experimental results than the few corresponding heavy water-uranium devices developed by the Uranverein. Perhaps the experiment carried out with Burner N.8 could have been successful if its form had been a sphere and not a cylinder.

I have mentioned above that during summer 1940 both Houtermans and Weizsäcker suggested that the nucleus that today we call plutonium 239 ($^{239}Pu$) should show the same properties as $^{235}U$ i.e. it should undergo fission under irradiation of slow neutrons.

Similar conclusions were reached by Bretscher in Great Britain and Joliot in France [7] and by Fermi and Segrè in the United States, who, around Christmas

1940, discussed the possibility of producing $^{239}$Pu with the Berkeley cyclotron in a quantity large enough for establishing its nuclear properties in particular its fission cross section for slow neutrons [37]. During the first months of 1941 Kennedy, Seaborg, Segrè and Wahl [38] succeeded in preparing, by means of the Berkeley cyclotron, about one microgram of this new isotope and to show that, as expected, it undergoes fission with slow neutrons.

Such an experiment could not have been carried out in Germany, where the Heidelberg cyclotron (W. Gentner) was ready for a first test only in 1944.

From Einstein's letter to Roosevelt as well as from the beginning of Heisenberg's article, mentioned above, the main argument for a secret development of nuclear energy in view of its peaceful as well as military applications was, for both parties of the Second World War, the fear that the "enemy might succeed first".

In this psychological struggle, unavoidable in this as well as in any other fight or cold war, Fritz Houtermans found the way to inject his contributions.

Robert Jungk, in his book on the history of the atomic bomb [39], mentioned Houtermans at many points and, in particular, on page 114 he wrote: « In 1941 the chemical expert Professor Reiche, who had escaped from Germany a few weeks before, arrived at Princeton. He brought a message from Houtermans to the effect that the German physicists had hitherto not been working on the production of the bomb and would continue to try, for as long as possible, to divert the minds of the German military authorities from such a possibility. This news was passed on from Princeton to Washington by another scientist who had emigrated to America, the physicist Rudolph Ladenburg. But it does not seem ever to have reached those actually engaged on the atomic project ».

In 1943 the anxiety of the scientists working in the Metallurgical Laboratory, the Chicago phase of the Manhattan Project, was increased by another message they received from Fissel: "Hurry up-we're on the track" was the warning to his colleagues [40].

I tried to get more information by correspondence with the author of the book containing this news, who suggested to contact E. Wigner. But also Professor Wigner could not add much, except that the cable was sent from Switzerland.

Apparently this message had an influence on the engagement of the scientists working on the Manhattan Project. It was clearly inspired by the deep antifascist attitude of Houtermans, but seen today, in retrospective, it appears very naive and unjustified or at least inspired by unjustified presumptions.

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14. H. von Halban, F. Joliot, L. Kowarski: "Liberation of Neutrons in the Nuclear Explosion of Uranium", Nature (London) 143 (1939) 470-471; "Number of Neutrons liberated in the Nuclear Fission of Uranium", ibidem 680; "Energy of Neutrons liberated in the Nuclear Fission of Uranium Induced by Thermal Neutrons", ibidem 939; M. Dodé, H. von Halban, F. Joliot, L. Kowarski: "Sur l'énergie liberée lors de la partition nucleaire de l'Uranium", C.R. Acad. Sci. Paris 208 (1939) 995-997.
15. (a) H.L. Anderson, E. Fermi, H.B. Hanstein: "Production of Neurons in Uranium Bombarded by Neutrons", Phys. Rev. 55(1939)797-798. (b) L. Szilard, W. H. Zinn: "Instantaneous Emission of Fast Neutrons in the Interaction of Slow Neutrons by Uranium", ibidem 56 (1939) 619-624.
16. S. Flügge: "Kann der Energieinhalt der Atomkerne technisch nutzbargemacht werden?", Naturwissenschaften. 27 (1939) 402-410.
17. This was done in particular by O. Frisch and R. Peierls in Great Britain.
18. G.B. Pegram (1876-1958).
19. E. Wigner (1902-1995).
20. H.D. Smyth: "Atomic Energy for Military Purposes", Rev. Mod. Phys. 17 (1945) 351-471.
21. S.R. Weart: "Scientists in Power", Harvard University Press, Cambridge, Mass. (1979).
22. Paul Harteck.
23. The full text of this letter is given in the book by General Groves, Ref. [5] of Chapter 16.
24. Abraham Esau was a leading authority on high-frequency electronics. He was politically active and had followed the rising star of nationalism in Germany.
25. Josef Mattauch.
26. According to D. Irving, who reports at this conference the beginning of Chapter 2 of his book, Ref. [8] of Chapter 16. The participants were: Esau (chairman), Joos, Houle, Geiger, Mattauch, Bothe and Hoffmann, and the Ministry's representative, Dr. Dames.

27. I use here a memo by S. Flügge, slightly longer than one typewritten page and dated: Göttingen, 3rd October 1945. He had sent a copy of it to Charlotte Riefenstahl, first wife of F.G. Houtermans, who years later passed it to E. Amaldi on occasion of one of his visits to her (see the Preface). Flügge's publication had also an epilogue: probably in autumn 1941. At that time Diebner, Wirtz and Stetter tried to obtain from Flügge a declaration that he had already worked in connection with the Heereswaffenamt before his publication. They were trying to attribute to him a "priority" with respect to the French group. To this remark that such a declaration was not true, it was answered that, this was his "patriotic duty". Flügge's argument that the French group had published before him initially was not believed. Only later, when he presented the published papers, they renounced to get the declaration from Flügge.
28. C.F. von Weizsäcker.
29. Walther Wilhelm George Bothe.
30. Wolfang Gentner, Hans Meier Leibniz.
31. S.A. means "Sturm Abteilung". It was the name of the paramilitary corp of Hitler's party."Obergruppenführer" was a high rank officer of the S.A.
32. Gauleiter was the highest authority of Hitler's party in a province.
33. H.E. Süss.
34. J.H. Jensen.
35. Walter Gerlach.
36. The ten German scientists detained in Great Britain (at Farm Hall) were: Dr. Eric Bagge, Dr. Kurt Diebner, Prof. Walter Gerlach, Prof. Otto Haber, Prof. Paul Harteck, Prof. Werner Heisenberg, Dr. Horst Korseling, Prof. Max von Laue, Prof. Karl-Friedrich von Weizsächer, and Dr. Karl Wirtz.
37. E. Segrè: "From X-rays to Quarks. Modern Physicists and their Discoveries", Frieman, S. Francisco (1978).
38. J.W. Kennedy, G.T. Seaborg, E. Segrè, A.C. Wahl: "Properties of 94 (239)", Phys. Rev. 70 (1946) 555-556, dated 29th May, 1941, voluntary withheld from publication until the end of the war.
39. R. Jungk: "Brighter than a Thousand Suns", Harcourt, Brace and Co., New York (1958).
40. J.P. Lash: "Eleanor and Franklin, based on Eleanor Roosvelt's private papers", W.W. Norton & Co. Inc. New York. For this episode see p. 704-705. Houtermans' message is discussed also by: F. Herneck: "Eine alarmierende Botschaft", Spektrum 7 (1976) 32-34.

# Chapter 17
# From Berlin to Ronneburg

In 1944 Houtermans went from the von Ardenne's Laboratory to the Physikalische-Technische Reichsanstalt (PTR) in Berlin, which from 1933 to 1943 was under the presidency of Johannes Stark (1874–1957).

When von Paschen retired from the presidency of the PTR, Wilhelm Frick, Minister of the Interior, named Stark in his place, in spite of von Laue's warning that the great majority of the scientists rejected Stark's candidacy [1].

At the PTR Houtermans was expected to resume research work on neutron physics, but because of the frequent bombardment of Berlin by the Allied Air Forces during the year 1944, the Department of Physics of the PTR was transferred to Ronneburg (in Thüringen, about halfway between Leipzig and Weimar).

Fissel, who also had moved to Ronneburg with Ilse, started to do some research work. The paper "On a phenomenological relation between the strength of a source of neutron and the maximum density of slow neutrons in a hydrogen medium" /29/, received by the Physikalische Zeitschrift on 18th June 1944 from the PTR, was probably sent from Berlin shortly before Fritz moved to Ronneburg.

The considerations presented in this note are connected with certain aspects of the problem he had treated in the previous paper on the absolute determination of the intensity of a neutron source /25/. The semiempirical relationship found by Houtermans is interesting but remained outside the main lines of development of neutron physics because it was not very useful.

In Ronneburg Fritz felt rather unhappy because the tobacco war ration was not sufficient for the chain smoker he was. He then wrote, on PTR paper, a letter to the "Land Zigaretten Fabrik" in Dresden saying that he was carrying on research on the absorption of light by "fog and smoke" for which about one kilogram of tobacco powder was needed. In consideration of the national interest of this research, please send it to PTR Ronneburg, care of Dr. F.G. Houtermans.

The answer was prompt and positive! Pretty soon Fritz received a large package containing a mixture of tobacco and tobacco powder that had been collected from the waste of cigarette-machines. Fritz had to work very carefully for hours and hours to separate, by means of meshes, the tobacco from the powder. Finally he

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DOI: 10.1007/978-3-642-32855-8_17, © The Author(s) 2012

succeeded in recovering almost a kilogram of tobacco that he started to smoke with the greatest physical and moral pleasure.

In a few months this first shipment came to an end and Fissel thought to repeat the game. He wrote that the researches on "fog and smoke" had undergone a satisfactory progress but their termination required further experimentation and, therefore, a second tobacco shipment from Land Zigaretten Fabrik.

He forgot, however, to note on this second order that the bill was to be sent to PTR-Ronneburg. So, finally, it came into the hands of the president who did not like Fissel and now saw a welcome opportunity to fire him.

Once again Fritz faced the problem of finding a source of income for himself, Ilse and their first child. Fritz went to see Heisenberg and Weizsäcker and asked for their help. They immediately arranged a meeting with Walter Gerlach, who was "Der Beauftragte (authorized representative) des Reichsmarschalls für Kernphysik".

In the meeting the decision was taken to send as soon as possible Houtermans to work in Göttingen with Hans Kopfermann (1895–1963), a pupil of James Franck, who had been assistant of Haber in Berlin, had worked in Copenhagen, and was well known for his spectroscopic work on hyperfine structures of optical spectra and for his clear convictions against national socialism.

Gerlach provided a letter of authorization for the railroad ticket and thus Houtermans with his second wife Ilse and the baby moved to Göttingen. It was spring 1945.

Once more there was a great concentration of physicists in Göttingen, since, for various reasons, its famous University was considered a safer place than any institution in Berlin or Leipzig. Besides Kopfermann there were Richard Becker, L. Prandtl and W. Walcher.

A new problem for Fritz Houtermans arose shortly after his arrival in Göttingen. He was a 42 year old tall man and could be mobilized at any moment. To avoid this, it was necessary to prove that he was involved in a research program of importance for the defense of the Reich and with a high priority. Kopfermann wrote the necessary letters and his pupil Wolfgang Paul [2], took them by bicycle, to a village in the Harz Mountains, about 50 km from Göttingen. Here was the administrative section of the "Osenberg Organization" which was in charge of the utilization of scientists in appropriate work, bringing them back from the front, whenever necessary (and possible). As a result of this action Houtermans became formally a collaborator of Richard Becker, who was in charge of a research program concerning the demagnetization of ships, a problem of considerable interest in connection with the magnetic mines used in the war at seas. But the war came to an end in Europe on 7th May 1945 with the unconditional surrender of Hitler's Germany, and Houtermans was again free to purse his scientific activities in various fields.

One day, before the end of the war, walking in the street in Göttingen, Fritz met, with the greatest surprise, Konstantin Shteppa. After he had left Kiev with his family and settled in Plauen, the advance of the U.S.S.R. troops had forced him to escape from what became the Russian zone.

He was just arrived in Göttingen, had left his family at the railroad station and was looking around for his dear friend. Fritz was delighted to help the Shteppas to settle in West Germany. The authorities did not allow them to stay in one place more than three days, outside from the camps for displaced foreigners, but these camps offered only one solution: repatriation.

The Shteppas were wandering from town to town, absolutely hopeless, trying to find a place to stay. Houtermans obtained the permit for the family to remain in Göttingen, found rooms where they could live and obtained a job for Aglaya in a factory. Aglaya was about twenty years old, she had married about two years before, but her husband had been killed during the Kiev battle.

Konstantin Shteppa had obtained the German citizenship and, since Eric was still under age, he had also become a citizen of Germany. He was drafted into the German army, shortly later was captured by the Russians, declared a collaborationist of Germany, and sent to a reeducation camp. Only after the death of her father (1958) did Aglaya learn through an office of the Red Cross in Turkey, that Eric was living in Siberia working as a stone cutter. Later he started to correspond with his mother and after a few years succeeded in going to live in Rostov.

In West Germany Aglaya met an American soldier, Bill Corman, married him and moved to the U.S.A. where Bill became an architect.

Shteppa and his wife also moved to U.S.A. in 1952, and for the next three years he was associated with the "Research Program on the U.S.S.R.", a subsidiary of the East European Fund, established to help refugee scholars return to scholarly work under American standards and conditions. At the time of his death in 1958, the manuscript of a book "Russian Historians and the Soviet State" had been completed. It was published shortly later with the assistance of a grant from the Research program on the U.S.S.R. [3]. According to a well recognized reviewer "in terms of factual content and documentation this is the most substantial study which has yet been made of the relationship between historical scholarship and politics in the Soviet Union."

## References

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2. Wolfgang Paul.
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# Chapter 18
# In Göttingen Again

During the seven years spent in Göttingen, from 1945 to 1952, Houtermans worked at the Physics Institute of the University and the Max Planck Institute, directed by Werner Heisenberg.

This was one of his most productive periods. Besides his old theme of research, neutron physics, Houtermans tackled a few subjects completely new to him, and started to develop a deep interest in the methods currently used for determining the age of the rocks.

The papers concerning neutron physics /28/ /30/ /31/ /32/ are a natural continuation of his previous work at Kharkov and Berlin. In paper /30/ Fritz presents an experimental determination of the Beryllium cross section for the (n, 2n) process produced by the neutrons of a Polonium plus Beryllium source. The report /28/ devoted to "Measurement Methods for Neutrons" is Houtermans' contribution to the presentation made by the German physicists of their work during the war [1]. It has been already mentioned in Chap. 16. The first of the two papers in collaboration with his pupil Martin Teucher /31/ is a development of a research line already tackled by Fritz alone in a previous publication /25/, while the second one /32/ concerns the inelastic scattering undergone in lead by the neutrons of a Polonium plus Beryllium source. All other papers, however, concern research problems completely new to Houtermans.

A paper of 1947 is in collaboration with Jensen, who in 1963 shared with Maria Göppert-Mayer the Nobel Prize for Physics for their discoveries concerning the nuclear shell structure. Under the title "On the Thermal Dissociation of Vacuum" /33/ Houtermans and Jensen discuss some of the consequences of the Dirac-hole theory. They notice that the density of electron–positron pairs present in a "free from particles" volume in thermal equilibrium is small at low temperature ($kT << m_e c^2$) but increases rapidly with increasing temperature, reaching, for $kT \approx 137\, m_e c^2$ ($T \sim 10^{11}$ K), values larger than one pair per elementary volume ($V_o = 4\pi/3(e^2/m_e c^2)^3$), thus giving rise to a "closely packed structure of elementary particles" in space. They point out that this effect had been neglected in

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DOI: 10.1007/978-3-642-32855-8_18, © The Author(s) 2012

all discussions about many cosmological problems and the origin and abundance of the elements in the Universe, where temperatures of this order of magnitude had just started to be considered.

They add that at these temperatures also neutrinos and mesons [muons][1] should be present in considerable amounts and raise (but do not discuss in detail) the question of thermal equilibrium under these conditions.

The idea of an abundant presence of electron pairs in thermal equilibrium remained, in its essence, in present treatments of the evolution of the Universe during the first seconds after the initial big bang [2], but any reference to the classical radius of the electron has disappeared. We know that this length has nothing to do with the structure of the electron, which is a "point-like particle" or at least an object of linear dimensions a hundred times smaller than $e^2/m_e c^2$.

In the same paper the authors also consider the polarization of the real electron–positron pairs around any electric charge and its temperature dependence, a problem clearly related to the polarization of vacuum, which usually is computed today at low temperature, where the virtual positron–electron pairs give the by far dominating contribution.

In a paper of 1946 /34/, in collaboration with Pasqual Jordan, one of the founders of Quantum Mechanics, the authors tackled the possibility of observing experimentally a very slow variation in time of the beta-decay constant. The possibility of phenomena of this kind was first pointed out by Dirac in 1937 [3], who had noticed a remarkable numerical coincidence among fundamental quantities in physics: the time t elapsed since the beginning of the Universe, expressed in terms of a unit fixed by the constants of atomic theory, say the unit $e^2/m_p c^3$, turns out to be of the order $10^{40}$, i.e. of the same order of magnitude as the ratio $\gamma$ of the electric to the gravitational force between two protons.

Dirac suggested such a coincidence to be due to some deep connection in Nature between cosmology and atomic theory: if such a law exists and holds not only at the present epoch but for all times, then, for example, in the distant future, when the epoch has become $10^{50}$, also $\gamma$ should be of the same order of magnitude. Since it is rather reasonable to assume that the atomic constants $c$, $e^2$, $h$ and $mp$ remain constant, such a variation of time requires a decrease of the gravitational constant G proportional to $t^{-1}$.

A further study of cosmology leads to the appearance of other very large dimensionless numbers. These all turn out to be of the order of $10^{40}$ or, sometimes, $10^{80}$. By a natural extension of the foregoing ideas, Dirac suggested all those numbers of the order of $10^{40}$ to increase proportionally with time t, and all those of the order $10^{80}$ to increase proportionally to the square of the time.

These ideas of Dirac's were the point of departure for few papers by P. Jordan [4] who developed his cosmological considerations by incorporating Dirac's suggestion within the frame of the theory of General Relativity. From the start Jordan points out that, while there are observational data in favor of the "cosmological constancy" of

[1] At that time muons were called "mesons" or "mesotrons" (Note of the editors).

dimensionless quantities such as $e^2/hc$, $m_pc^3$ as well as of the time interval $e^2/m_pc^3$ and the coupling constant of nuclear forces, nothing can be stated about the constancy of the beta-decay coupling constant. He also noticed that an experimental test of a possible time variation of the last coupling constant requires measurements of a precision at the limit of the technology of the time.

This problem is discussed in detail by Houtermans and Jordan, who devote the first section of their paper to the derivation of the law of beta-decay and outer-electron capture on the basis of Dirac–Jordan cosmological theory and to the discussion of the possibility of an experimental test of the time variation of the beta-decay constant. In the second section they deal with the hypothesis proposed by Weizsäcker that the $^{40}$Ar present in the atmosphere is produced by outer-electron capture in $^{40}$K. They estimate the half time of this process on the assumption that the $^{40}$K present in the Earth's crust is the only source of the $^{40}$Ar observed in the atmosphere. As a result they deduce, from the $^{40}$K half-life ($1.42 \times 10^9$ years), the ratio k of outer-electron capture to total decay which is obtained as a function of the age of the atmosphere. In the third section the authors discuss the consequences of the decay law with respect to age determination by the Rb–Sr method. Finally they examine the constancy of the beta-decay constant using the end point of the Th-series in specimens of different geological ages.

Two other papers refer to surface phenomena taking place in the electric discharge /35/ and the electrolytic separation /36/, and two others /37/ /38/ report on the experimental determination of the isotopic shift of the spectral lines of the lead isotopes 206, 208, 210 (radium). This indicates in agreement with the nuclear shell model, that, for a number of the constituent neutrons $N = 126$, there is a rather large variation of the nuclear volume, as had previously been observed for $N = 82$.

The remaining papers of this period deal with the mean life and use of various radioactive substances for the determination of geological ages and the pertinent experimental techniques: the half-life of uranium and the Pb–U method /39/ /40/ /41/ /42/ /43/ /44/, the half life of RaE /45/ /46/ /47/, which was conveniently used by Houtermans in a modified method, the mean life of potassium $^{40}$K /48/ and the decay of rubidium /49/ /50/ /51/ dealt with in papers in collaboration with Otto Haxel.

The discrepancy found between the values of the half-life of $^{87}$Rb obtained from geological data and by direct measurement of the electrons decay appeared to indicate a substantial difference between the time scale of alpha- and beta-decay in the sense postulated by the cosmological theory of Jordan [4].

Houtermans and Haxel observed /51/, by means of two counters in coincidence, that the $^{87}$Rb nucleus emits simultaneously two electrons per disintegration: one of nuclear origin, the other due to the almost hundred percent conversion of a gamma ray. By taking into account only the electrons of nuclear origin the discrepancy mentioned above is eliminated and the time scales of alpha and beta-decay of $^{238}$U and $^{87}$Rb turn out to be in agreement.

I will not try to discuss here a few interesting developments of the Pb–U method introduced by Houtermans in the papers of the Göttingen period

mentioned above, because he continued also at later times to pursue this line of research and we will come back to it in Chapter 21.

In this section I would like to mention his interest in the use of the nuclear emulsion technique in problems of geology and mineralogy /52/ /53/ and in particular his paper with Buttlar "On the Determination by the Photographic Method of the Activity Content of Manganese Nodules of the Deep-See" /54/.

In order to become acquainted with this technique, Houtermans went to Bruxelles where Occhialini had created one of the most advanced centers of research in this field. The Belgian physicists, still very sensitive on the subject of "war time collaborators", had heard various rumors about Houtermans: that he had been a Nazi spy in Russia and had collaborated in the German war effort, and in particular in atomic bomb research. There was even the rumor that he had deposited, at the Post Office in Berlin-Charlottenburg, the application for a patent of a fissionable device of military interest.

In order to understand what he had actually done, at Fritz's arrival in Brussels, "Occhialini started asking questions, but, lost patience, went off to a cinema and left me (Constance Dilworth) to carry out a "third degree". Dilworth took notes during the conversation, which were summarized in one and a half typewritten pages already mentioned in Chapter 14" [5].

It came out that, for priority reasons, Fritz wished to depose a document about some of the ideas he had developed in the internal report /23/ but did not want to make it available to the Nazi. Therefore he thought to "bury" his ideas in a place (The Post Office) where nobody would pay any attention to it.

Turning back to Fritz's family life in Göttingen, some difficulties started to arise between him and Ilse already in 1950. Fritz's attention for any pretty woman he had the occasion to meet here and there was much less an issue than the irritability he had developed with regard to any small difficulty of daily life.

One evening in 1951, W. Pauli and his wife were sitting at home when the doorbell rang. Fritz and Ilse were there with a bottle of wine, and asked to enter since they wished to celebrate an important decision they had taken. With a glass of wine in their hands they announced the decision to divorce.

In the meantime Houtermans had received the offer of the chair of Experimental Physics from the University of Berne. He accepted and took up the new job starting from September 1952.

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2. See, for example: S.Weinberg: "Gravitation and Cosmology". "Principles and Applications of the General Theory of Relativity", John Wiley & Sons, New York (1972).
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4. P. Jordan: “Bermerkungen zur Kosmologie”, Ann. d. Phys. 36 (1939) 64-70; “Über die Entstehung der Sterne”, Phys. Zeit. 45 (1944) 183-190.
5. I express my warmest thanks to G.P. Occhialini and C. Dilworth Occhialini for these informations.

# Chapter 19
# Houtermans' Third Family

When Fritz decided, in 1944, to marry Ilse Bartz, he did not inform his first wife Charlotte of his desire of divorcing her, but took advantage of a law which exempted from such a "formality" any person living separated from his wife or husband for more than five years. The law, promulgated by Hitler's Government, had been used to terminate many marriages of "pure Aryans" to Jewish people.

As an announcement to Charlotte of his second marriage, Fritz sent her a reprint of one of the papers he had published in collaboration with Ilse.

Charlotte was already aware of the existence of these papers, which had been pointed out to her by Otto Oldenburg, an old friend from Göttingen and now professor of physics at Harvard University. But only a few months after the arrival of the "reprint", Charlotte learned of Fritz's divorce from her and of his marriage with Ilse.

In 1951 Charlotte went to Europe in order to visit her mother in Bielefeld. Coming back, with Casimir [1], from a conference in Copenhagen, Fritz went to see her. After a first rather stormy encounter, Fritz told Charlotte of difficulties he had with Ilse, expressed to her his affection and insisted that she should remain in Europe and immediately go live with him. But such an unexpected radical change was not possible for Charlotte. She had commitments at Sara Lawrence College, and Giovanna had to finish school in the United States.

Charlotte came back to Europe with Giovanna and Jan a first time during summer 1952. At their landing in Rotterdam, they were received by Fritz who had organized a vacation in Überlingen am Bodensee. All the children were there with Fritz and Charlotte: Giovanna, Jan, Pieter, Elsa and Coja.

In spring 1953 Charlotte and her two children were awarded fellowships from three different organizations, which facilitated their second trip to Europe. After their landing, she drove with a friend through France and met Fritz again in Bagneres de Bigorre, in the French Pyrénées where, from 6th to 12th July 1953, took place "Le Congrès International sur le Rayonnement Cosmique". That week was just in the middle of the Second Expedition to Sardinia for the study of cosmic

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DOI: 10.1007/978-3-642-32855-8_19, © The Author(s) 2012

rays at high altitude by means of balloon flights [2], in which also the Berne physicists Houtermans and Teucher were involved (see below).

Among the many participants in the Bagnéres de Bigorre Conference I should recall P.S.M. Blackett, B. Rossi, G. Bernardini, Cecil Powell, L. Leprince-Ringuet, G. Occhialini, C. Dilworth, etc., many of which were old friends or more recent friends of Houtermans. I also was there and thus had the opportunity of taking up some of the conversations I had started with Fritz not long before when he passed through Rome on his trip to Sardinia.

During the conference we read in the international press that recently Beria had been condemned and executed. I will always recall Fritz's excitement when we talked about this event.

After the conference, Fritz, Charlotte with Giovanna and Jan went to Marseille, where Fritz and Charlotte left the children with a friend. They themselves visited James Franck in Bad Kreuznach, Germany, that was there for a few weeks cure for heart troubles. Asked for advice by Fritz about his planning of marrying again Charlotte, Franck expressed a clear negative view, which, however, was not followed by Fritz in spite of his almost filial devotion.

From Kreuznach they went to Hamburg to participate in a meeting of people that had been communists or very close to them, in the thirties, had moved to the U.S.S.R. with the idea of helping in the construction of the socialist society and that, once over there, had experienced very awkward adventures and had the great luck to be still alive [3].

Towards the end of August 1953, Charlotte arrived in Berne. At their marriage on 28th August, the witnesses were Giovanna, Jan and W. Pauli.

The "third family" of Fritz that settled in Berne included two children, Pieter and Elsa, but not Coja, who was only five years old and still needed the devotion of her mother. Giovanna was in Tübingen as a Fullbright student and Jan at the University of Rochester (U.S.A.).

Houtermans and Charlotte went to the annual conference of the Italian Physical Society that in 1953 was held in Cagliari from 23rd to 27th of September. Ilse Bartz was also there.

In October of the same year a meeting was organized at the Department of Physics of the University of Berne, by Houtermans and Teucher for the distribution of the packages of nuclear emulsion exposed to cosmic rays at high altitudes among the participants of the Second Expedition to Sardinia [2]. I was also there, and one evening after work, Fritz and Charlotte invited all participants to their house, where all enjoyed their hospitality and the friendly atmosphere created by the great part and by the cordial and witty conversation and jokes of Fritz.

During the winter 1953–1954 Fritz started to drink abundantly and the relationship with Charlotte deteriorated rapidly. On 1st March 1954 she left Berne and went to Paris, where she remained for a few weeks and had the opportunity to meet once more old friends like Manes Sperber and Weissberg-Cybulski. From Paris she went to Bristol where, from April to September, she worked in Cecil Powell's Laboratory at the microscope on the investigation of events produced by cosmic rays in nuclear emulsions.

At the end of August Charlotte went back to the United States and took up again her teaching work at Sarah Lawrence College. The divorce from Fritz was accorded her in 1954. It was a shock for both of Charlotte's children, in particular for Jan, who by now was 18 years old and had started to study physics at the University of Rochester.

## References

1. H.B.G. Casimir, born in The Hague in 1909, has been for many years extraordinary professor at the University of Leiden and Director of the Physics Laboratory of Philips at Eindhoven and later President of the Royal Academy of Sciences of Amsterdam. He worked in close contact, especially during his formation period, with Niels Bohr in Copenhagen, and W. Pauli in Zurich. He has worked as a theoretical physicist on the applications of the group theory to quantum mechanics [Casimir operator] on the thermodynamics of superconductors and on the Van der Waals forces [Casimir effect]. In his memory's book "Halphazard Reality, Half a Century of Science" (Harper and Row Publ., New York, 1983) he mentions Houtermans, his life's adventures and jokes at various points (pp.133 and 220 to 223). He died in Heeze on 4$^{th}$ May 2000.
2. Three international expeditions, promoted by C.F. Powell of the University of Bristol and based on the support of the Milan, Padua and Rome Universities, were made in the Mediterranean area in the years 1952, 1953 and 1954. The Physical Laboratories of the following Universities took part in the second one (June-July 1953): Berne, Bristol, Brussels, (Université Libre), Catania, Copenhagen, Dublin, Genoa, Göttingen (Max Planck Institute), London (Imperial College), Lund, Milan, Oslo, Padua, Paris (Ecole Politechnique), Rome, Sydney, Turin, Trondheim, Uppsala.
3. "Encounter, literature, arts, current affairs", December 1955.

# Chapter 20
# Fritz's Fourth Family: His Departure

In 1955 Fritz married Lore Müller, the sister of the wife of his stepbrother Hänsi that he had met a few years before in Göttingen. For their marriage Wolfgang Pauli sent Fritz the following telegram: "The usual congratulations".

Lore already had a few years old daughter, Sabine (b. 1951) who was later adopted by Fritz. In 1956 Fritz and Lore had a son, Hendrik, who unfortunately a few years after the death of his father, died, at the age of seventeen, in a car accident.

In 1957 Houtermans took a sabbatical year and went to the United States, where he spent months at the California Institute of Technology (Pasadena, California) and the Scripps Institution of Oceanography (San Diego, La Jolla, California). In both places he was in close contact with well known figures in the Earth Sciences: Harrison Scott Brown (b. 1917), Samuel Epstein (b. 1919) and Gerald J. Wasserburg (b. 1927) in Pasadena, and Roger Randall Dougan Revelle (b. 1909), Director, and Hans Eduard Suess (b. 1909) in La Jolla.

As we shall see in more detail in Chap. 21, nuclear geology had become perhaps the most important part of the scientific program set up by Houtermans in Berne. Another subject was the investigation of particle physics by means of nuclear emulsions, and Lore started to take part as a microscopist, in the work of the group composed of eight or ten people that were active in this field under the direction of Teucher.

Lore remembers these years with great pleasure not only for the trip to the United States, but also for a number of other trips in Europe, in particular to Italy, where they visited many towns that combined artistic and natural interest either with new friendships, like Pisa and Rome, or Fritz's youth recollections, like Naples (Fig. 20.1).

The year 1961 marked a break in Houtermans' life. He was supposed to go to a far eastern country and therefore had to have a certain number of preventive injections. He had a rather strong reaction with high fever, and when at a very early hour of the day he tried to get up for greeting Lore's daughter that was going on an excursion to see the sunrise, he fell and hit his head against the banister of the stairs. The concussion he had was not too serious, and, after six months the

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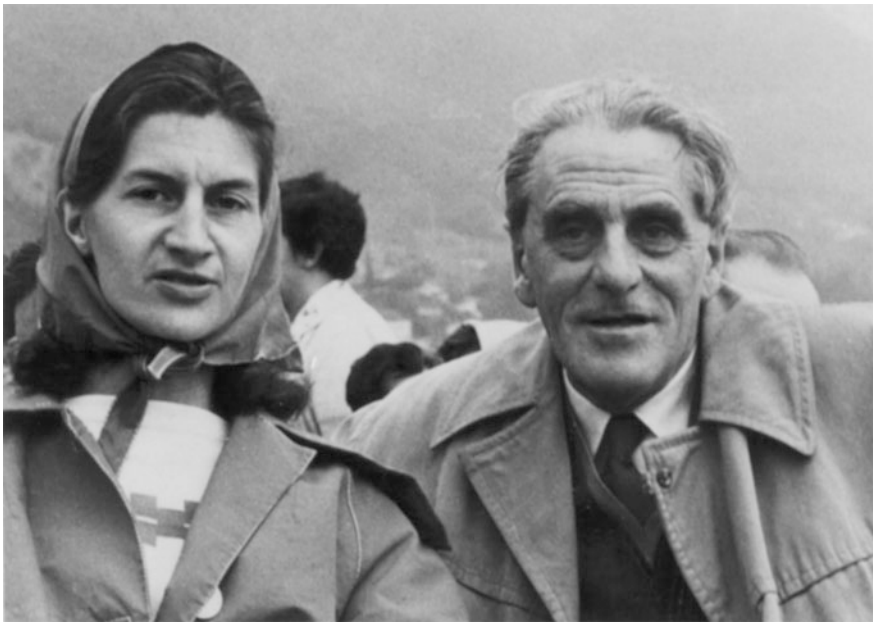

**Fig. 20.1** F.G. Houtermans with his wife Lore on a boat on Lago Maggiore during the summer course on nuclear geology in Varenna in 1960 (Courtesy of the Physics Institute of the University of Berne)

neurologist declared him normal. The accident, however, had triggered some damage that the doctors never really identified. The hard experience of his life, his demanding work and life style, in particular his rather heavy drinking habit during the last few years, caught up with him. Thus, from about 1962 on he was never again able to work with the enthusiasm and the success which had characterized the first eight or ten years of his life in Berne.

At the beginning of autumn 1965 a doctor diagnosed him with a lung cancer: a dark stain was clearly visible in the radiographies. After about three months of irradiation the stain disappeared and Fritz started to regain part of the weight he had lost. He felt much better and enjoyed again sitting in his house, at his working table and wrote the paper on the "History of the War-Method of Geochronology" for the book dedicated to Wolfgang Gentner's 60th birthday [1]. Lore still remembers when Fritz went out of their house to mail his manuscript.

Shortly after, on 1st March 1966 he had a stroke: a pulmonary artery broke, his heart stopped and he suddenly died.

## Reference

1. Wolfang Gentner, Hans Meier Leibniz.

# Chapter 21
# Houtermans' Scientific Work and Influence in Berne

Heinrich Greinacher (1880–1974) had been Professor of Physics and Director of the Institute of Physics at the University of Berne for many decades. He had invented the voltage multiplier [1], that became well known after Cockcroft and Walton, at Cambridge (U.K.) in 1932, reinvented it and applied it to construct the accelerator they used in the discovery of the first nuclear reactions produced by accelerated particles [2]. Greinacher had also constructed the first ionization chamber connected to a linear amplifier capable of detecting the ionization produced in a gas by a single alpha particle or fast recoiling proton [3]. But the full power of this new detection technique was exploited by others, in particular by Chadwick in the discovery of the neutron [4].

In spite of these remarkable contributions the Bernese Institute of Physics, under Greinacher's direction, remained small and in some way provincial.

When he reached the age of retirement, the Bernese Faculty looked for a successor. At that time all the chairs of experimental physics in Swiss universities were occupied by students of Paul Scherrer (1890–1969), the Director of the reputed Physics Institute at the Federal Institute of Technology in Zurich (ETH). The Dean of the Faculty at that time, the professor of astronomy Max Schürer (1910–1997), André Mercier (1913–1999), Professor of Theoretical Physics, and the Director of the Federal Bureau of Standards, Hans König (l904–1988), asked for advice from Paul Scherrer in Zurich concerning the right successor. Wishing to have a wide appreciation of all possibilities, and went to the yearly meeting of the German Physical Society in Heidelberg and consulted Hans Kopfermann of the University of Göttingen (Chapter 17). Kopfermann mentioned to the Bernese delegation Fritz Houtermans who-as we have described-occupied quite an unsatisfactory position in Göttingen in Kopfermann's Institute. In contrast to Houtermans, Kopfermann was a very balanced personality but he shared with Houtermans the sense of wit and humor that was characteristic for physicists of their generation.

However, when Kopfermann mentioned this nomination to Fritz Houtermans, he was already having second thoughts which he expressed to Houtermans in these

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**Fig. 21.1** F.G. Houtermans in his office in Berne (Courtesy of the Physics Institute of the University of Berne)

terms: «I wonder whether you could get along with the staid Bernese bourgeoisie" whereupon Houtermans tried to reassure him "I would not worry so much, I am sure they don't replicate them by spoors».

A few weeks later, Houtermans was invited to Berne for a talk that gave the other faculty members the opportunity to look him over. There were, of course, competitors, and in the end, the Bernese Faculty and government had to choose between the leftist Houtermans and a German that had a reputation for leaning toward other side of the political spectrum. In the end, faculty and government decided in favor of Houtermans, because he could introduce new research fields in Switzerland. This was the right decision as it turned out pretty soon.

On his part, Houtermans had the choice between several offers of professorship: Graz in Austria, one or two places in Germany and Berne. He decided on Berne (Figs. 21.1 and 21.2). Perhaps his remark that his decision was biased towards

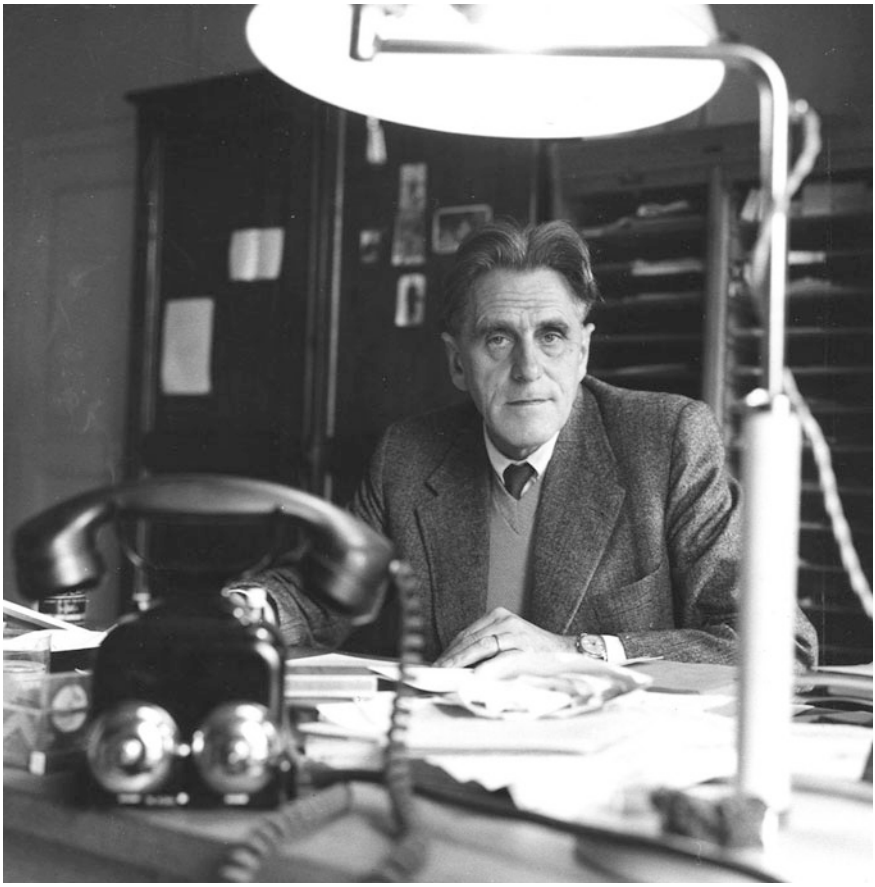

**Fig. 21.2** F.G. Houtermans in his office in Berne in 1966 (Courtesy of the Physics Institute of the University of Berne)

Berne because this was the town where Albert Einstein did his famous work at the beginning of the century was meant only half jokingly.

The members of the Institute in Göttingen remember the day when Houtermans was leaving the town where he had lived and worked for seven years. After a proper farewell party everybody accompanied him to the train. With his salary in Göttingen, he could not afford a sleeping car, but he reassured them that brandy was the best sleeping car. There is no record of the circumstances of his arrival at Berne, but with a decisiveness and initiative which surprised his friends, he began to build up a small but active institute doing excellent research. With his magnetic personality, he succeeded in getting Charles Peyrou from the École Polytechnique in Paris to assume the newly created position of extraordinary Professor in Houtermans' "Institute" and for a while also Walter Thirring (b. 1927), now Professor of Theoretical Physics in Vienna, joined him. He brought with him from Göttingen Martin Teucher (1921–1978), who had done his Ph.D with Houtermans

**Fig. 21.3** F.G. Houtermans analyzing a nuclear emulsion film with an optical miscroscope (Courtesy of the Physics Institute of the University of Berne)

in the field of nuclear physics, and Friedrich Begemann (b. 1927) as a graduate student. A year later, after finishing his thesis on lead isotopes with W. Paul (1913–1993), Johannes Geiss (b. 1926) joined the Institute.

At Berne he found three young Swiss who were eager to start their Ph.D work with the new professor: Hans Oeschger (1927–1998), Christoph Burckhardt (b. 1927) and Walter Winkler (b. 1927). These young men filled all the scientific positions available. Houtermans put M. Teucher in charge of building up a high energy physics group using the emulsion method (Figs. 21.3, 21.4 and 21.5). Geiss was to introduce mass spectrometry and Hans Oeschger got as a thesis theme a pet project of Houtermans, low level counting, with the aim of applying it to the carbon-14 dating method that a short while ago had been invented by Willard F. Libby (1908–1980) [5].

**Fig. 21.4** F.G. Houtermans with M. Teucher, discussing particle tracking using nuclear emulsion films (Courtesy of the Physics Institute of the University of Berne)

The influence of Houtermans not only on the young men in his Institute but also on many colleagues in the faculty was enormous (Figs. 21.6 and Fig. 21.7). He brought to Berne an internationalism which meant at least in the physical sciences a new spirit (Figs. 21.8, 21.9, 21.10, 21.11 and 21.12). He was fortunate to have arrived in Berne at the right moment because Alexander von Muralt (1903–1990), Professor of Physiology at the University of Berne and a very influential man in Switzerland, had just single-handedly created the Swiss National Science Foundation. Up to that point it was very difficult in Switzerland to pursue modern experimental physics outside the ETH in Zurich (Scherrer's Institute) because the universities in Switzerland are cantonal and the cantonal governments did not see themselves in a position to support expensive research.

Houtermans had instilled in the young men working with him a sense of urgency and devotion to science that very soon produced interesting and scientifically significant publications: the anomalously high radioactivity in the lead of fumaroles of Vesuvio, the first lead age of a rock published from a European laboratory, several significant papers with Geiss and Eberhardt on the large variations of the isotopes of lead in galenas and their interpretation in terms of geologic history and the age of the Earth. Under Houtermans' leadership, Hans Oeschger constructed a new type of anticoincidence counter which was for many years unsurpassed in the important aspect of background rejection, etc.

**Fig. 21.5** F.G. Houtermans and his group of "Scannerinnen" at the Physics Institute of the University of Berne in 1955/56. In continuity with those times, the treatment, the scanning and the data analysys of nuclear emulsion films are presently one of the main research activities of the Laboratoratory for High Energy Physics of the University of Berne (Courtesy of the Physics Institute of the University of Berne)

In the field of nuclear geology Houtermans established close cooperation with the Institute of Ezio Tongiorgi [6] in Pisa and of Edgar Picciotto [7] in Brussels. Some of his young Bernese collaborators spent many weeks in Pisa and Brussels helping to build up mass spectrometry and low level counting equipment there, while Berne profited from Picciotto's talent as a nuclear chemist and from Tongiorgi's wide-ranging interests and knowledge in the Earth sciences and in archaeology.

However, success is a mixed blessing for an Institute, because the young people working with Houtermans got offers to other places and were eager to widen their horizon. First Begemann went to the University of Chicago to work with William Libby and later became a director of the Max Planck Institute for Chemistry at Mainz. A year later Geiss followed to work with Harold C. Urey (1903–1981) [8] and Martin Teucher also went to the United States and later became one of the directors of Desy laboratory in Hamburg. But in the meantime, the younger students such as Peter Eberhardt (b. 1931) and Peter Signer (b. 1929) had gained experience, and Hans Oeschger stayed at Berne after his thesis was completed and they were able to carry on with the work very well.

When, in 1952, Houtermans accepted the offer of the chair of experimental physics of Berne, he was promised, by the authorities of the University, the

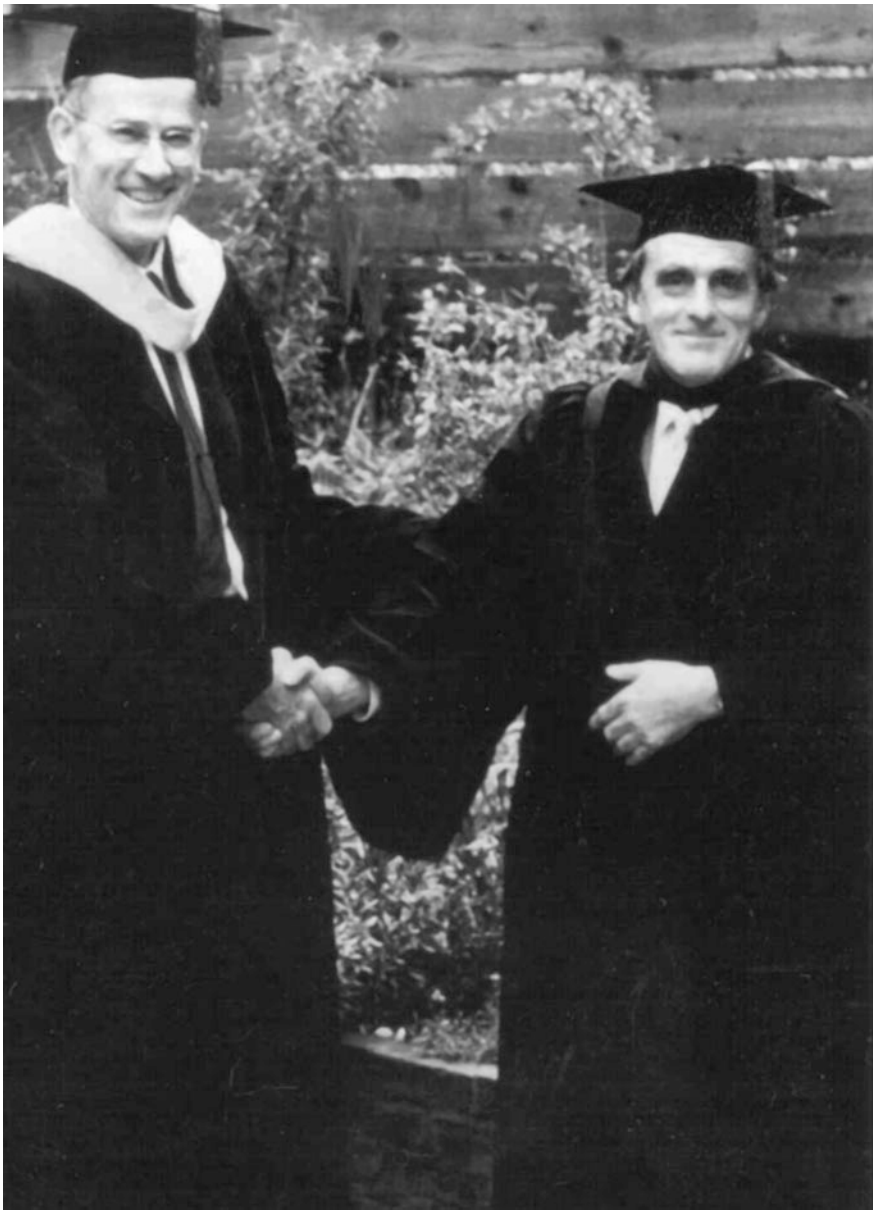

**Fig. 21.6** F.G. Houtermans was Dean of the Faculty of Sciences of the University of Berne from 1956 to 1957 (Courtesy of the Physics Institute of the University of Berne)

creation of a new building for the Institute of Physics. For various financial and bureaucratic reasons this was ready only nine years later.

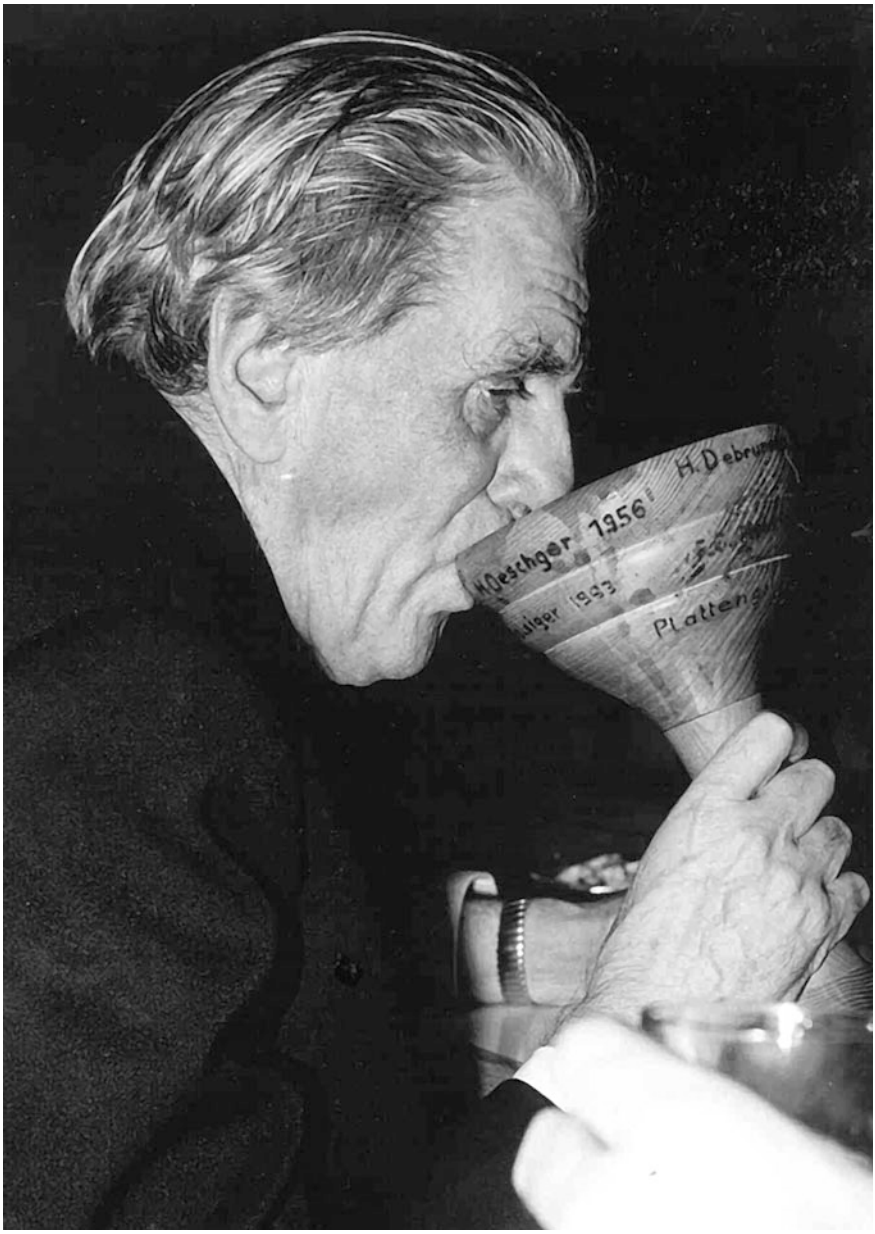


**Fig. 21.7** In 1960 F.G. Houtermans received the traditional wooden cup which was awarded to the members of the institute for "great, unusual or odd achievements or happenings" and was then passed on in the following year to a newely elected laureat. This cup is still conserved at the Physics Institute of the University of Berne (Courtesy of the Physics Institute of the University of Berne)

**Fig. 21.8** F.G. Houtermans with G. Occhialini and M. Teucher at the Physics Institute in Berne in 1953 (Courtesy of the Physics Institute of the University of Berne)

**Fig. 21.9** F.G. Houtermans with L. Meitner on the day of Nobel Laureats in Lindau (Courtesy of the Physics Institute of the University of Berne)

**Fig. 21.10** F.G. Houtermans with W. Pauli, P. Jordan and P.G. Bergmann at the Einstein Congress in Berne in 1955 (Courtesy of the Physics Institute of the University of Berne)

**Fig. 21.11** F.G. Houtermans with his first motor bike in 1954 in Berne (Courtesy of the Physics Institute of the University of Berne)

**Fig. 21.12** F.G. Houtermans playing the triangle at the end of the year party of the Physics Institute in Bern in 1963. The end of the year party has always been a tradition of the Physics Institute and often an orchestra or music band was formed to enjoy music together. That year, the "Kindersinfonie" by Joseph Haydn was performed. In continuity with those times, this tradition is still alive in the present days. B. Alder (*1*); M. Alder-Hofer (*2*); K. Meyer (*3*); T. Binkert (*4*); F.G. Houtermans (*5*); O. Eugster (*6*); M. Wahlen (*7*); T. Riesen (*8*); Unknown (*9*); S. Aegerter (*10*); H. Oeschger (*11*); H.R. Lutz (*12*); H. Loosli (*13*); J. Geiss (*14*); B. Wälti (*15*); H. Winzler (*16*). The editors are grateful to Prof. Otto Eugster and Prof. Peter Grieder for providing the names of the people in the picture (Courtesy of the Physics Institute of the University of Berne)

The new institute was called by Houtermans "Institut für exakte Wissenschaften" (Institute for Exact Sciences) in order to stress that the research program encompassed many fields of applied mathematics, theoretical physics, experimental physics (such as cosmic rays and particles physics), astronomy and nuclear geology /55/ [9].

Beginning in about 1959, Houtermans with his collaborators began to cooperate with the mineralogist Professor Ernst Niggli (1917–2001) to date rocks. After some years a separate "Laboratory for Isotope Geology" in Niggli's Institute grew out of this collaboration.

When, starting from 1962, the scientific leadership of Houtermans was strongly reduced because of his health conditions (Chapter 20), his "boys", as he called his younger collaborators, were suddenly left to themselves. Geiss had returned from the Oceanographic Institute in Miami to succeed Peyrou, gone to CERN, as an extraordinary professor, and he, Oeschger, Eberhardt and Debrunner, all very young men, faced the challenge of continuing the research and ensuring the functioning of the Institute without Houtermans' leadership, and they managed to meet this challenge with success. There were difficulties with the National Science Foundation to continue the support of the research work and they were helped by senior friends of Houtermans, Hans König (1904–1988), Klaus Peter Meyer (1911–1986), who became the Director of the newly created Institute of Applied

Physics, and Max Schürer. Also A. von Muralt helped to prevent that the very promising work started by Houtermans did not remain an episode in the history of the University of Berne. When Houtermans died in 1966, Geiss became his successor as Director of the Institute. He was able to convince Beat Hahn (1921–1995) to assume the responsibility for the High Energy Physics. At that time Max Keller (b. 1919), a high-ranking civil servant, was responsible for university matters in the cantonal government. Among civil servants he was outstanding for his insight, very good at judging people and he was determined to use the rather good financial situation of his government to create a modern university. Geiss and his colleagues established good relations with Max Keller and the result is that a powerful institute was gradually built up, which is today generally considered one of the best research Institutes in Switzerland.

Geiss ventured into the new field of Space research and together with Eberhardt and Signer did a solar wind experiment with the Apollo program. This experiment became very popular in Switzerland, helping the Institute to obtain support. After some urging by Giuseppe Occhialini, Geiss also became active in the newly formed European space research organization and together with Eberhard and some younger people, he built up a well- known research group in space physics and planetary physics, working successfully with the European Space Agency and with NASA. Hans Oeschger continued to work in nuclear geology, applying low-level counting methods to Earth Science problems. His group is in Europe now on the forefront of this field that is particularly significant for environmental problems. H. Debrunner (1931–2002) continued with the thesis theme given to him by Houtermans, cosmic rays. He has not only installed instrumentation on the Jungfraujoch Scientific Station, but he succeeded A. von Muralt as the Director and President of the Jungfraujoch Scientific Station. Thus, the seeds planted by Houtermans, his internationalistic approach to science, his refusal of even considering secondary scientific questions and his taste for the interdisciplinary approach had a lasting and even today visible effect on the University of Berne.

Concerning the "staid Bernese bourgeoisie", Houtermans and they got along very well. They were quite willing to accept an unconventional character like Houtermans if he was a "foreigner", and to this day the elder generation in Berne remembers many stories about Houtermans, whom they consider an original who has instilled a spirit of adventurism and unconventionality into their University.

Some more details about Houtermans' scientific activities during the Bernese period can be of interest to many people.

His contributions to the investigation of cosmic rays concern the systematic recording of the nucleonic component at the Jungfraujoch station (3450 m.s.1.) /56/ /57/ /58/, the daily periodic variation of cosmic rays /59/, the correlation between Forbush decreases of cosmic rays and satellite drag /60/, and the sudden increase of the nucleonic component observed in cosmic rays on 4th May 1960 /60/.

Two papers concern particle physics /62/ /63/. The first one, in collaboration with W. Thirring /62/, contains an estimate of the solar neutrinos produced in the carbon-cycle and a discussion of their mean free path for absorption inside the Sun. The attempt was premature; the paper was written in 1954, just before the publication of

the experimental results by Cowan, Reines et al. [10] on the inverse beta-decay induced by a beam of neutrinos generated inside a large nuclear reactor. The authors derive an estimate of the neutrino-electron cross section from Fermi's theory of beta-decay [11] by taking into account only the processes corresponding to the decay of the nucleon and the muon, and obtain a much too small value. Only in 1958 by expressing the weak interaction Lagrangian as a current - current interaction, Feyman and Gell-Mann showed [12] that it contains also lepton–lepton terms which give an appreciably larger direct neutrino-electron interaction.

The second paper on particle physics /63/ is the report on the experimental work carried out by a rather large group of the Berne Institute with the nuclear emulsion technique on a sample of 1600 $K^-$ mesons of 130 MeV mean kinetic energy, produced by the Bevatron in Berkeley. It contains evidence for the $K^- \rightarrow 2\pi$ and $K^- \rightarrow 2\mu$ decay in flight, a determination of the differential scattering cross section and of the relative reaction rates for the production of $\Sigma^{\pm}$, $\Sigma^{\circ}$ and $\Lambda^{\circ}$, in nuclear emulsions.

Two other papers of 1960 by Houtermans alone /64/ /65/ deal with the "Maser condition" in the spectra emitted by dissociating molecules, a subject closely connected with some ideas he had glimpsed many years before (Chapter 4).

Almost all other papers of the Bernese period regard nuclear geology, studied by means of the more appropriate techniques for measuring the relative abundances of stable isotopes and radioactive isotopes and for stimulating thermoluminescence in meteorites or rock samples.

In particular the paper /66/, in collaboration with Bot, Geiss, Niggli and Schürmann, contains the first determination of the age of a rock performed in Europe.

Continuing the work carried out in Göttingen in 1947, and pursued also by Holmes at about the same time [13], Houtermans went on improving the determination of the age of the Earth from the isotopic composition of lead. The method, already employed in the papers /41/ and /42/, starts from the results obtained by Nier [14].

Lead found in terrestrial rocks or meteorites has stable isotopes of masses 204, 206, 207 and 208. The isotope 204 is not the product of radioactive disintegrations while the isotopes 206, 207 and 208 are the final products of the radioactive families beginning with $^{238}$U(= UI), $^{235}$U (= AcU) and $^{232}$Th, and are frequently called RaG, AcD and ThD. A sample of a rock or meteorite is characterized by the measured values of the following ratios[1]

$$\alpha = \frac{\left(^{206}Pb\right)}{\left(^{204}Pb\right)}, \quad \beta = \frac{\left(^{207}Pb\right)}{\left(^{204}Pb\right)}, \quad \mu = \frac{\left(^{238}U\right)}{\left(^{204}Pb\right)}$$

where ($^{A}$X) means the number of atoms of the isotope A of the element X found in the sample at present. The values of $\alpha$, $\beta$ and $\mu$ we observe today are clearly

[1] The formulas have been taken from the original paper by F.G. Houtermans on Il Nuovo Cimento Vol. 12 (1954) 17–25 to correct some typos in the manuscript (Note of the editors).

determined by the past history of the sample. In the simplest possible model, one can consider the time $w$ elapsed from the formation of the lithosphere until today (t = 0) and the present age $p$ of the lead mineral (for example a galena, PbS), i.e. the time elapsed from when the sample separated from the rock or magma, containing, in addition to lead, also a certain amount of uranium and thorium.

In this model one has

$$\left(^{206}Pb\right)_p = \left(^{206}Pb\right)_w + \left(^{238}U\right)_w \{1 - \exp[-\lambda(w-p)]\}$$

where

$$\frac{\left(^{238}U\right)_o}{\left(^{238}U\right)_w} = \exp[-\lambda w]$$

Dividing this equation by ($^{204}$Pb) one obtains

$$\alpha - \alpha_w = \mu(\exp[\lambda w] - \exp[\lambda p])$$
$$\beta - \beta_w = \frac{\mu}{139}(\exp[\lambda' w] - \exp[\lambda' p])$$

where $\lambda'$ is the decay constant of $^{235}$U and

$$\frac{\left(^{238}U\right)_o}{\left(^{235}U\right)_o} = 139$$

From these ratios it follows

$$\frac{\beta - \beta_w}{\alpha - a_w} = \frac{1}{139}\frac{\exp(\lambda' w) - \exp(\lambda' p)}{\exp(\lambda p) - \exp(\lambda p)}$$

In a plane with $\alpha$ in abscissa and $\beta$ in ordinate this equation represents a family of straight lines, each corresponding to a different value of the parameter $p$, but all passing through the same point ($\alpha_w$, $\beta_w$). These straight lines are called isochrones.

Through the same point ($\alpha_w$, $\beta_w$) pass also all the development curves representing the dependence of $\beta$ on $\alpha$ for any fixed set of values of $\alpha_w$, $\beta_w$ and $\mu$. In principle each measured sample ($\alpha$, $\beta$, $\mu$) allows the determination on the "Berne graph" /67/ of the corresponding isochrone and development curve which pass through it and cross again at the point ($\alpha_w$, $\beta_w$).

By applying this kind of analysis to the first measurements carried on by Patterson and the University of Chicago [15] for the troilite phase of the Cañon Diablo meteorite, and assuming that this material has the same age as the lithosphere, Houtermans arrived in 1953 /68/ to derive a fairly good estimate of the age of the Earth

$$W = (4.5 \pm 0.3) \times 10^9 \text{years}.$$

A similar analysis was carried out also by the Chicago group, which obtained the same result [16].

As I mentioned in Chapter 18, Houtermans also introduced a very convenient variant of the Pb-U method, consisting in deriving the value of $^{206}Pb$-$^{238}U$ from the ratio RaD/Pb where RaD (= $^{210}Pb$) decays into RaE which, because of its short half-life, reaches in a few weeks the radioactive equilibrium with its mother. Because of their higher energy the beta rays of RaE are measured with greater accuracy than those of RaD. This method was applied by Begemann, Buttlar, Houtermans, Isaac and Picciotto /69/ for determining the age of uranium minerals.

A few other papers, in collaboration with Begemann and Geiss /70/ /71/ /72/ /73/, concern the radioactivity of the lava of Mount Vesuvius, others /74/ /75/ /76/ /77/ /78/ /79/ /80/ the determination of the age of the galenas of Madagascar and of the yttrocrasite of Katanga. In paper /81/, in collaboration with Herr, Gfeller and Oeschger, Houtermans studied the presence of $^{36}Cl$ in meteorites. This work represents one of the first successful attempts at using the radioactivity induced by cosmic rays in meteorites. Still other papers concern the isotopic analysis of osmium in iron meteorites and Earth samples /82/ /83/, leading to the determination of the corresponding ages.

Houtermans also made interesting contributions to the development of the instrumentation required by his geological work. He and Oeschger constructed proportional counters for the determination of very weak beta activities /84a/ /84b/ /85/ and in collaboration with a Milan-Pisa group detectors of alfa activity in very low concentrations /86/.

In another series of papers Houtermans used the thermo-luminescence as a method for investigating the thermal and irradiation history of various minerals and stones /87/ /88/ /89/ /90/ /91/ /92/ /93/. The more important of this set of papers is /91/ in collaboration with N. Görgler and H. Stauffer. In paper /94/ Houtermans and Stauffer proposed the use of thermo-luminescence for dosimetry, on a variant of which the authors took also out a patent.

In paper /95/, in collaboration with Görgler and Stauffer, Houtermans was one of the first to use thermo-luminescence for dating also ceramics and tiles.

In another paper of 1966, in collaboration with Görgler, Geiss and Grünenfelder /96/ he applied the isotopic analysis of lead for establishing the origin of Roman lead pipes and lead bars.

Finally the paper on the production of $^{81}Kr$ ($T_{1/2} \sim 200{,}000$ years) by cosmic rays /97/ opened a line of research that later became significant, mainly through the work of Houtermans' pupils, for dating water masses.

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5. Willard Frank Libby (1908-1980) at the end of his career was director of the state wide University of California Institute of Geophysics and Planetary Physics. He discovered the natural alpha-particle radioactivity of samarium and invented the method for determining the age of archeological artifacts by means of the radioactivity of $^{14}C$. For this work he was awarded the 1960 Nobel Prize for Chemistry.
6. Ezio Tongiorgi (1912-1987), after the accomplishment of his studies at the University of Pisa, has devoted most of his research activity to paleobotanic, geology and paleontology of the Quaternary. From 1953 he has started to apply the nuclear physics methods to geological problems, creating in Pisa a well known laboratory of nuclear geology.
7. Ezra Edgard Picciotto (Italian citizen b. in Istanbul, Turkey, 1921) has studied in Brussels, where he became "Docteur ès Sciences" of the Université Libre in 1952. He made most of his carrier at the same University, except for a number of study periods spent at foreign institutions. His research activity refers to the geochemistry of stable and radioactive isotopes in rocks, ocean and atmosphere. In the period 1957 to 1966, Picciotto concentrated his work on the chemistry of antarctic ices, taking part in a number of Belgian and American expeditions to the Antartic. He likes to remind that his orientation and formation as a chemist was influenced by Irène Curie and mostly by Giuseppe Occhialini and Friedrich Houtermans.
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# Chapter 22
# Why We Remember Him

The most important contribution given to science by Fritz Georg Houtermans consists in the work, carried out in Göttingen in 1928–1929 in collaboration with Robert d'Escourt Atkinson (1898-1982), on the formation of light elements and the consequent energy production in the center of stars /6/ /7/ (Chap. 4). These papers, which appeared years before the discovery of the neutron (1932), are quoted in all review articles reporting on the history of the interpretation of stellar energy in terms of nuclear processes. They provided the motivation for the IAU [1] to assign, on occasion of its meeting in Sidney in August 1973, the name of Houtermans to one of the lunar craters located near the eastern edge of the visible disk of the Earth's satellite (lunar long. + 87.0, lunar lat. −9.3) [1].

The rest of his scientific production reaches from atomic spectroscopy to electron microscope technique, from neutron physics to cosmic rays and from theory and experiments on sub-nuclear particles to nuclear geology, keeping always a very good quality and frequently showing clear signs of a very brilliant and versatile mind.

The Berne graphs, introduced by Houtermans for determining the age of a rock from the isotopic composition of lead and uranium (Chapter 21), are sometimes called, even today, "Houtermans plots". In the field of nuclear geology, he has opened several research lines and has created in Berne a lasting school of research which is the only one in Switzerland and one of the few well established in the world.

All the people who worked with him have kept a very high regard of him, not only as a scientist but also as a human being. For instance, in a letter of 23rd October 1985 that Picciotto sent me after having read these pages, he summarized his views as follows:

«Houtermans était un personnage de roman, avec ses grandeurs, ses faiblesses, ses conflits intérieurs, le tout régi par son humanité, sa générosité et son humour

[1] International Astronomical Union (Note of the editors).

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966),* SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8_22, © The Author(s) 2012

tellement personnel, qui était évidemment le défaut qu'aucun régime totalitaire ne peut admettre. C'est pourquoi je crois que seul un romancier de grand talent aurait pu rendre le personnage, aux dépens évidemment et inévitablement de la fidélité historique que vous avez si scrupuleusement observée».[2]

Talking repeatedly about Houtermans with Giuseppe Occhialini, he recalls the verses of Orson Welles:

«For he who lives more than one life more than one death must die»

For Beppo,[3] Fissel had a number of little deaths during his life. The first one was his flight from Germany and from scientific work for going to Middlesex. The second one was his "Russian disillusion and his serving in Russian prisons under the accusation of being a nazi spy, culminating in an exchange "together with Nazi spies". The third one was his return to Kharkov in order to help his old friends, to find out what had happened to Leipunski and many others over there. Still years later, Fissel anxiously asked his friends in London (Occhialini and George [2] in 1950): "Did they tell you I went to Kharkov in a Nazi uniform? …that is not me! Did Rosbaud tell you I had a military cap? …that is not true!"

The fourth little death of Fissel was his divorce from Charlotte, without asking her consent, for marrying Ilse. About 4 years had passed since his arrest in Moscow, and when finally free, after more than 2 and 1/2 years of prison, life in Berlin was extremely hard. From the end of August 1940, after a few heavy bombings by the Germans of London and other British cities, the Royal Air Forces had started frequent raids on Berlin. It was in the atmosphere of nervous tension among the people in an underground shelter during a heavy bombing of the city that the unavoidable happened between Ilse and Fritz, which brought Fritz to marry the girl, with whom he had been in love since months. The fifth and last little death was the abandonment by Ilse followed by the return of Charlotte and the second separation from her, everything happening in an incredible short span of time. Of all these little deaths or crises for Fritz the most serious was the third one. Already at the time of the trip from Kharkov to London of Charlotte and Giovanna in summer 1937 (Chapter 9), Houtermans strongly desired to survive for convincing his friends in the West that the U.S.S.R. was quite different from what all of them thought. But nobody took seriously their appeals! He had also friends in Kharkov, and with the German occupation they were certainly in an extremely difficult situation.

The thought of how, eventually, he could try to help his friends, dominated his mind and cancelled any other consideration about how his behavior might be interpreted by others.

Around 1950 Fritz Houtermans fully convinced of his fair intentions a few open minded people like the Occhialinis, but not most of his more ideologically rigid

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[2] «… Houtermans was a fictional character with his greatness, his weaknesses, his internal conflicts, all governed by his humanity, his generosity and his particular personal humor that could not be tolerated by any totalitarian regime. This is why I believe that only a novelist of great talent could describe his character, obviously and inevitably at the expense of historical accuracy that you observed so scrupulously» (Translation provided by the editors).

[3] Giuseppe Occhialini (Note of the editors).

old friends in France, Great Britain and Belgium. He was condemned for his trip to Kharkov also by some of his Russian colleagues like Kurchatov, Iwanenko [3], Leipunski, and Silienikov. Other Russian physicists, however, spoke well of him for having saved the electrostatic generators of the Physics-Technical Ukrainian Institute by convincing the Nazi authorities that there was no point in dismantling this equipment and moving it to Germany because it was obsolete.

There is a short book published in Kharkov in 1944 [4], which describes how the Kharkov physicists set to work to restore the electrostatic generators once Kharkov had been liberated, thus proving that this equipment was still there.

In a book (in Russian) dealing with Soviet nuclear physics from 1932 to 1945, written by a Soviet science fiction writer on the basis of interviews with physicists [5], Houtermans is portrayed as a very good physicist and as someone very glad to have found a new homeland. The author also hints that he was not firm in his left-wing political views and that he was something of an anti-Semite.

This last accusation is so impudently false that it throws strong doubts on the sincerity of the others.

According to Giuseppe Occhialini we frequently came across figures of this kind in the past and present literature and we like them. But usually we are not ready to accept them when we meet them in real life.

Dimitri Karamazov is an innocent, accused of infamies, even of his father's murder; the reader likes him mainly for his intelligence, but then discovers that he is "a screw-ball". From time to time Fissel was a romantic hero with the cynicism of Heine von Kleist, the officer in the book by Guy de Maupassant. But on most occasions he appeared more similar to Puck or Robin Goodfellow, the goblin of the British heath, who, as an agent of the king of the Fairies is ultimately beneficent but has an independent love for mischief.

According to Connie Dilworth we recall Fritz Houtermans not only [6]: «As individual but also as a representative of a culture that is lost. The latter is what he had in common with Touschek [7]. Both were essentially "Mittel Europa", Germanic in the best sense, of the anarchistic breed; in revolt against the Prussian element, and against bureaucracy. Individualistic, romantic, but with a crystalline cynicism with regard to any form of fanaticism: enthusiastic and in love with life, but life of the city.

Professionally, both were much better than their work, their intelligence was at least equal to that of the most successful of their contemporaries. The lack of success was in part due to being in the wrong place at the wrong time.

Houtermans was an innocent, of the tribe of Peter Pan. His refusal to grow up, to become serious, was the basis of his charm. On the other hand-as all Peter Pans-he never understood women. His four marriages, three wives and many children do not denote the profligate but rather a child seeking the road to the Never Never Land.

Part of this was his warmth and generosity. He may have lied, betrayed and twisted truth to feed his vanity, but he was not mean. He had no ideals, but was idealistic in the sense that he did not live for today or tomorrow. He lived in the stream of history, egoistic but not egocentric, that his culture forbade. Above all,

life was a great joke, a continuous laugh against the "Lumpen-Bourgeoisie". They don't make them like that anymore. That's why we remember him».

Apart from his important scientific achievements, the case of Houtermans is almost unique for the adventurous life imposed on him by the political events of his time. Only in the twentieth century could a life like that of Fritz take place.

On some occasions the situations Fritz had to face were extremely difficult and delicate and this explains why, sometimes, his behavior was not as clear and transparent as his relatives and friends would have desired.

For those who met him personally, it is impossible to forget his enthusiasm for science, his devotion to research, his friendliness for anybody and his readiness to participate in any conversation, discussion or action aiming at a deeper understanding of a new observation or idea. In spite of the hard experience he had in his life, he maintained a joyful view on life contributing, in many cases, to help friends, pupils et al. to achieve greater happiness and appreciation of their own work and life.

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# Memories of the Berne Times

## *My Relationship with Professor Houtermans, by Prof. Grieder*

I met Prof. Houtermans in the fall of 1959, when I returned to Switzerland after having lived in Chicago for many years, where I had completed a M.Sc. in Physics. I joined his team at the "Physics Institu" of the University of Berne with the intention to top-off my education with a Ph.D under his wings as thesis advisor. I was fascinated from the very beginning by the cosmopolitan and most friendly atmosphere that existed at his institute. There was a continuous coming and going of leading physicists from Europe and around the world that interacted in a most constructive way in Houtermans' environment. This atmosphere had a highly stimulating and motivating effect on everyone in his team.

The scope of scientific activities under his leadership was very broad, ranging from the study of meteorites, nuclear chronology, thermoluminescence, cosmic rays, astrophysics to high energy particle physics. There was hardly a subject that was not of interest to him. The branch of particle physics was rapidly growing in the early sixties with the coming into operation of the 30 GeV proton synchrotron at CERN, the European Particle Physics Laboratory, as it is called today, in Geneva, Switzerland. There, the Berne group participated from the very beginning.

The thesis topic which Houtermans suggested to me to tackle was actually a problem proposed by Prof. Bernard Peters from the Niels Bohr Institute in Copenhagen, a close friend of Houtermans and co-discoverer together with Phyllis Frier and Hale Bradt of heavy primaries in the cosmic radiation. The research project involved the investigation of the question whether there exists a correlation between multiple cores in extensive air showers and heavy primaries. I found the project very challenging and I accepted.

Houtermans was a very engaged thesis advisor and soon a sort of father-son relationship developed between us. Since his health was not the very best anymore and he disliked public transportation, he used to call me around 6 p.m. and inquired when I planned to go home. I immediately offered to drive him home at

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966)*, SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8, © The Author(s) 2012

his convenience. This almost daily ritual ended usually with an invitation to join him for a cocktail at his home. Still being a bachelor at that time, his most hospitable wife, Lore, frequently invited me for dinner.

One day, however, I disclosed that I had plans to get married. Houtermans, almost shocked by this announcement burst out: "but me as your boss, I must give my consensus, I must meet her at once, come and present her to me next Saturday, come with her for coffee after lunch". I did as I was told. That day, as soon as I rang the doorbell, the door was opened by Houtermans personally and I said: "this, Herr Professor, is my prospective wife". He took her by the shoulders, looked her over, then hugged and kissed her and said, "it's ok with me". Some months later he was guest of honor at our wedding. This is one of so many particular episodes that was characteristic of the warm and friendly relationship that was unique and remains unforgettable in my mind.

Berne, March 4, 2011 *Peter K.F. Grieder*

## *An Interview with Prof. J. Geiss*

The following interview was done by one of the Editors (S.B.) at the International Space Science Institute (ISSI) in Berne on March 13th, 2012.

*Prof. Geiss, you met Houtermans in Göttingen in 1948 when you were a student. Could you tell us something about those times?*
It was during a seminary on nuclear physics at the Max Planck Institut für Physik when I first met Fritz Houtermans. He peppered the discussions with humorous, critical interventions. As students, we liked his criticizing not just students' talks, but also the statements made by the professor who led the seminar. At the time, I worked with Professor Max von Laue on my Diploma thesis. Von Laue was known to have been openly critical with the national socialist regime, but since he was a most prominent physicist, having earned the 1912 Physics Nobel Prize, he had retained some influence. And he made good use of it. When, in 1939, Houtermans was released from Soviet prison and sent back to Germany, von Laue helped him to get quickly out of the repatriation camp and to find a job in a private research institute in Berlin.

Shortly before the end of the war, Houtermans left Berlin, went to Göttingen and found a temporary job at II Physikalisches Institut of the University, the institute where he had obtained his Ph.D in 1929 with James Frank. Although space and funds were extremely scarce, Kopfermann, the director of the institute, and Paul, second in command, offered Fritz Houtermans the chance to resume the experimental work he had begun in Kharkiv many years earlier. With a small group of Ph.D candidates and students, he investigated radioactive isotopes in natural samples for geological application.

*Were you interested in knowing Houtermans better?*
Yes. When he asked me to join him and his Ph.D candidate Müller in writing an article about $\beta$ spectra for the Volume "Kernphysik" of the Landolt-Börnstein series, I agreed and we managed to finish the article by 1951, before I started my Ph.D thesis in experimental physics. This was my first publication with Houtermans; many more were to follow.

*You did your Ph.D thesis with Professor Wolfgang Paul at the II Physikalisches Institute in Göttingen. Was Houtermans interested in your work?*
Since Paul was a leading expert in mass spectrometry, he and Houtermans cooperated when both stable and radioactive isotopes had to be measured. For my thesis I determined the isotopic composition of the lead in natural galena (PbS) samples. I often discussed my results with Houtermans and got valuable advice from him.

*You came to Berne through Houtermans. What was your job there?*
In August 1953, I went from Göttingen to Berne, bringing with me a mass spectrometer that I had built together with Taubert, another Ph.D candidate in Paul's group. Houtermans had ordered this instrument a year earlier, and he had hired me to build up a mass spectrometer group. Assisted by Eberhardt, then a Diplom candidate, I got the mass spectrometer working within a few months and we published a variety of papers in the field of geochronology and other applications of isotope abundances in the Earth sciences. After 2 years, I left for the University of Chicago to do meteorite research with Harald Urey in the Institute for Nuclear Studies (now the Enrico Fermi Institute).

*What can you tell us of those early days in Berne with Houtermans?*
When I arrived in Berne, I was impressed by the projects Houtermans had initiated within his first year. He had come in the right moment. The Swiss National Science Foundation and the KAW (a National Programme for fostering nuclear science and applications) had just been established, enabling for the first time cantonal universities to obtain substantial federal support for scientific research. At that time, the ETH in Zurich was one of the European leaders in experimental nuclear physics, with the cantonal universities now following suite, except Berne. Houtermans decided not to build up an advanced nuclear physics laboratory, and instead directed his institute towards high energy physics. He joined a European cooperation led by Cecil Powell in Bristol and Giuseppe Occhialini in Milano, who had-just a few years earlier-discovered the pion, the long thought "Yukawa particle". For Swiss physics this was a very attractive cooperation, and Houtermans received the necessary funding from the authorities. Balloons were launched from Sardinia–also in collaboration with the research group by Amaldi in Rome-with nuclear emulsions as target material for investigating primary and secondary cosmic ray particles. The group in Berne, lead by Teucher, an expert in research using nuclear emulsions, was in charge of building a large emulsion development facility, and Peyrou, who had joined the University of Berne coming from Paris, initially gave lectures on high energy physics.

Houtermans also initiated national and international collaboration in the fields of geochronology and other applications of nuclear methods. The projects were of interdisciplinary nature. Berne contributed with know-how and instrumentation for stable and radioactive isotope measurements. Let me mention here one of these projects. As part of his Ph.D work with Houtermans, Oeschger developed low level counting techniques for measuring rare radioactive isotopes, in particular $^{14}C$. Out of this early activity, Oeschger developed the very successful climate and environmental research division, now led by Stocker.

*How important was the contact with Houtermans for your scientific career?*
He offered me the chance to go abroad and to build up a mass spectrometer laboratory in Berne. From Berne I went to Chicago. There it became clear to me that I could and would stay in science.

*What did you learn from Houtermans in those early days?*
I learned physics mainly by listening to the famous lectures Richard Becker gave in Göttingen. How you learn and what you learn from a thesis advisor or your superior when you are a post-doc is often more difficult to define. From Houtermans one learned best in discussions. When he had a new idea, and he had many, he would try them out in his office with one or a few of us. You needed to present good arguments if you were to contradict him. Houtermans' expressing thoughts in anecdotal form was legendary, but difficult to imitate.

*Houtermans was used to talking about his life. What do you remember about his personality?*
Neither in his book nor to me in person did he talk about his life in any systematic way. I heard about his life from other people. In Chicago and elsewhere in the U.S.A., I met many emigrants who knew him in his youth, among them James Frank, his thesis advisor and Maria Göppert-Meier. She had been a friend of Charlotte Riefenstahl, Houtermans' first wife. In Göttingen, I learned about his life in Berlin during the war. When I visited the U.S.S.R. after the war, I did not meet anybody who had met Houtermans. I feel that Weissberg- Cybulski's book gives an authentic and moving account on the life and fate of a foreign scientist in Stalin's era.

From my time working with him and as a colleague and friend, I remember him as a very interesting and charismatic personality, who attracted able young scientists and good technicians to work with him.

*You have been the successor of Houtermans and the Director of Physikalisches Institut of the University of Berne from 1966 to 1989. What do you remember of those times?*
In 1960 I became associate professor at the University of Berne. Soon afterwards, Houtermans had an accident and his general health condition deteriorated. I was asked to act as Vice Director, a job I was not at all eager to get, but senior faculty members convinced me to accept. It meant additional work and responsibilities. I had to defend the interests of our institute in faculty meetings, Oeschger and I gave Houtermans' lectures, the number of students was rising sharply, education had to

be reformed, and funding by the National Science Foundation had to be secured. Many who had contributed to Houtermans' successful first years—Teucher, Begemann, Burckhardt or Winkler—had left. I discussed with Houtermans questions of personnel and other important problems, often at his home. Most of the time we came quickly to an agreement, and we became friends. Thanks to the help by colleagues in the faculty and employees in the institute, research and education proceeded very well during these years. When I became director in 1966, I was well prepared.

Looking back at those years, I am glad that we managed to organize a splendid colloquium for Houtermans' sixtieth birthday in 1963. Colleagues and friends came from all over the world and listened to lectures addressed to Fritz Houtermans in different languages, about his life and his work. At the banquet, between dinner speeches and to Houtermans' absolute surprise, we presented him with "Earth Science and Meteoritics", a "Festschrift" edited by myself and Ed Goldberg from University of California San Diego (UCSD), with articles by colleagues from many countries and by scientist who had been working at his institute in Berne, or still were working there.

*Do you have some final remarks?*

We have to be very grateful to Amaldi for this volume. Admirably how he has brought out Houtermans' making important contributions to science: with Atkinson and Gamow in his early days, on transuranium elements in Berlin, or on the age of the Earth in Göttingen and Berne—in spite of much adversity and tragic circumstances he encountered in his life.

Edoardo Amaldi is one of the great founding fathers of European cooperation in cosmic-ray research, high energy physics and Space science. I had the privilege to work with him on various committees of the European Space Agency and the European Science Foundation. Between sessions in Paris, Strasbourg or Noordwijk we found time to talk about Houtermans and also about Amaldi's life and his work with Fermi in Rome before the war, such as their measurement of short-lived radioactive isotopes, fascinating stories for a post-war experimental physicist.

# A Scientific Work of the Kharkiv Times

The following paper by Houtermans, Leipunski, Fomin, Shubnikov appeared in the "Report of Ukrainian Academy of Science" (Вісті АН УРСР, № 4 за 1936 год. Известия Академии наук. №4. 1936 год. Страница 35–36) and represents a rare document of the Kharkiv time. This short scientific paper is centered on the formation of deuterons, a hot scientific topic after the discovery of the neutron by Chadwick. Most of the documents of Houtermans' Kharkiv time are still considered classified information and the editors are grateful to Y. Ranyuk from the Physics Institute in Kharkiv for providing this manuscript.

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966)*, SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8, © The Author(s) 2012

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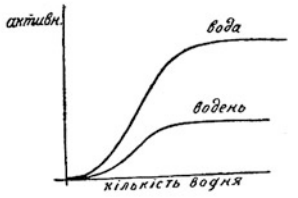
# УТВОРЕННЯ ЯДЕР ВАЖКОГО ВОДНЮ З ПРОТОНІВ І НЕЙТРОНІВ

Акад. О. І. Лейпунський
Нар. 1903 р., член КП(б)У з 1930 р.,
член ЛКСМУ

Досліди Чадвіка і Гольдгабера показали, що можна дисоціювати ядро важкого. водню на протон і нейтрон при освітлюванні важкої води $\gamma$-променями. Тому слід сподіватися існування зворотного процесу з'єднання протона з нейтроном з висиланням $\gamma$-променів.




Ми спробували спостерігати цей найпростіший випадок утворення складного ядра з елементарних часток, вимірюючи уповільнення і вбирання нейтронів з радон-берилієвого джерела в рідкому водні.

Для цього ми виміряли активність нейтронів у центрі сферичного дюара на срібному детекторі в дюарах різного діаметра і порівнювали ці дані з аналогічними даними для води.

З кривих видно, що активність у водні значно менша ніж у воді. Це значить, що у водні нейтрони вбираються значно сильніше ніж у воді. Через те що єдиний можливий механізм вбирання нейтронів у рідкому водні є утворення важкого водню, то ці досліди є доказом того, що цей ефект існує, при чому імовірність його досить велика.

Отже процес вбирання в воді пояснюється, хоч би частково, тим же процесом. Через те що вбирання в воді, при тих же кількостях водню, значно менше ніж у рідкому водні (це видно з того, що активність у воді значно вища), то з цього можна зробити висновок, що вбирання нейтронів дуже залежить від температури. Найповільніші нейтрони в воді мають енергію, яка відповідає 300°К, в той час як у рідкому водні ця енергія — порядку 20°К.

Якщо ймовірність вбирання нейтрона обернено пропорційна швидкості, як це виходить з теорії Bethe-Peierls-a, то треба було сподіватися збільшення вбирання приблизно в 4 рази. Експериментальні результати не розходяться з цією теорією.

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## *Translation from Ukranian into English by Olga Anna Bobrowska-Braccini*

## *F.G. Houtermans, Academician O.I. Leipunski, V. Fomin, L. Shubnikov Formation of Heavy Hydrogen Nuclei from Protons and Neutrons*

The experiments by Chadwick and Goldhaber have demonstrated that it is possible to dissociate a heavy hydrogen nucleus (a deuteron, NT) into a proton and a neutron by irradiation of heavy water with gamma rays. On this basis, the existence of the inverse process is expected: the recombination of a proton and a neutron with the emission of gamma rays.

Caption of the photograph: Academician Leipunski, born in 1903, member of the Communist (Bolshevik) Party of Ukraine from 1930, member of the Lenin Young Comunist Federation of Ukraine.

Plot: Quantity of hydrogen (horizontal axis), Activity (vertical axis), hydrogen (lower curve), water (upper curve)

We have tried to observe the simplest case of the formation of the compound nucleus from elementary particles by measuring the deceleration and the absorption of neutrons produced by a radon-beryllium source in liquid hydrogen.

By means of a silver based detector, we have then measured the activity produced by the neutrons at the center of a spherical dewar. We have used dewars of different diametres and compared these data with the ones obtained with water.

From the curves reported in the plot, the activity induced using hydrogen is much lower with respect to the one obtained with water. This means that neutrons are absorbed in hydrogen much more than in water. Since the only mechanism of neutron absorption in liquid hydrogen is the formation of heavy hydrogen, these experiments demonstrate that this effect (the formation of a deuteron from a proton and a neutron, NT) exists and is characterized by a quite high probability.

The process of absorption in water can be explained, although partially, with the same process. Since the absorption in water with the same quantity of hydrogen is much lower with respect to liquid hydrogen (this can be seen from the fact that the induced activity in water is much higher), it is possible to infer that the neutron absorption is strongly temperature dependent. The slowest neutrons in water are characterized by an energy corresponding to 300 K while for liquid hydrogen this energy is of the order of 20 K.

If the neutron absorption probability were inversely proportional to the speed as stated by the Bethe-Peierls theory, an approximately 4 time larger absorption would be expected (for hydrogen, NT). The experimental results do not disagree with this theory.

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# Edoardo Amaldi: A Brief Biography

## (Carpaneto Piacentino, 5th September 1908—Rome, 5th December 1989)

Edoardo Amaldi was the son of Laura Basini and the famous mathematician Ugo Amaldi. Since very young he had shown a keen interest in science and technology, so that he decided to study at the faculty of Engineering in Rome when he was 17 years old. In 1926, his Professor of physics Orso Mario Corbino encouraged him to change his subject of studies to physics and to work with Enrico Fermi, who had just been nominated full professor at the first chair of theoretical physics in Italy. At the Physics Institute in via Panisperna, the research group still today called "i ragazzi di via Panisperna"—the "via Panisperna boys"—soon wrote fundamental pages in the history of physics under the leadership of Fermi and thanks to the exceptional experimental skills of Franco Rasetti. Together with Emilio Segrè, Bruno Pontecorvo and Oscar d'Agostino, Amaldi played a fundamental role in this group of exceptionally talented and incredibly young scientists. Amaldi got his degree in 1929 under the direction of Rasetti. The major scientific achievement is by far the discovery of the properties of slow neutrons, which, in 1934, opened the way to further fundamental discoveries in nuclear physics, to the exploitation of nuclear energy and to the production of large quantities of radioisotopes for medicine. This group of "ragazzi" is the first example of a modern research team, which unfortunately fell apart in 1938 due to the racial laws and the onset of World War II.

While all his companions emigrated to either US or Canada, Amaldi remained in Italy. After the war he was the main actor in the reconstruction of Italian physics, which soon regained its internationally recognized level. Thanks to his far-seeing intuition and his constant commitment, he gave impulse to the constitution of national and international leading laboratories and institutions such as the Italian Istituto Nazionale di Fisica Nucleare (INFN), the European Organization for Nuclear Research (CERN) in Geneva—of which he was Secretary general from 1953 to 1954—and the European Space Agency (ESA). His interests and scientific contributions ranged from atomic and nuclear to particle physics, from cosmic rays to gravitational waves. At the beginning of the

E. Amaldi, *The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966)*, SpringerBriefs in Physics,
DOI: 10.1007/978-3-642-32855-8, © The Author(s) 2012

seventies—with his assistant and later colleague Guido Pizzella—he created a very successful research group, which constructed a long series of gravitational antennas. For his role in this endeavor the international conferences have been named "Edoardo Amaldi Conferences on Gravitational Waves".

Amaldi was an excellent teacher and author. In particular, he kept the chair of General Physics at the University "La Sapienza" of Rome for almost forty years and formed generations of physicists, starting from high schools where the textbooks he wrote with his wife Ginestra Giovene have been very popular. Amaldi was a staunch promoter of social and political initiatives on disarmament and on the pacific use of nuclear energy, as witnessed still today by the series of the "International Amaldi Conferences on Problems of Public Security".

Edoardo Amaldi, passionate about the history of science, wrote biographies of distinguished colleagues, as those of his friends Ettore Majorana and Bruno Touschek and that one of Fritz Houtermans, which is published in this book.