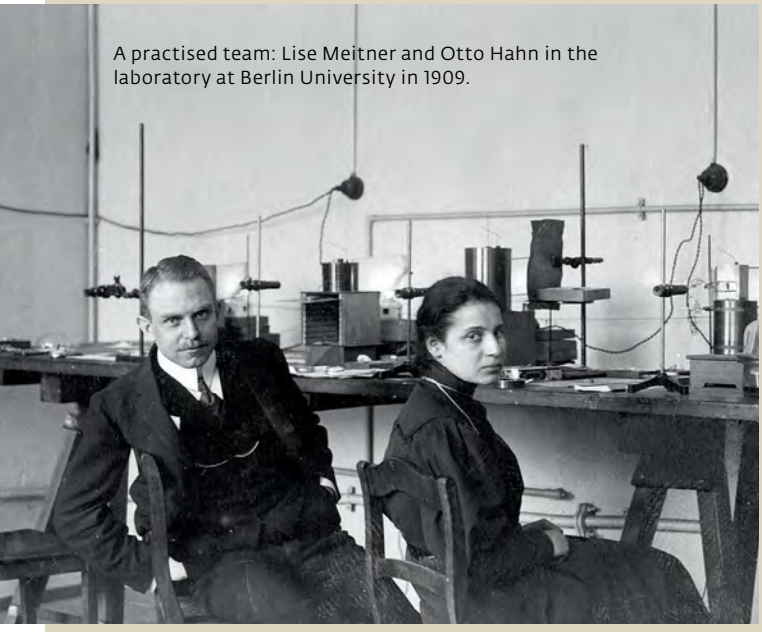
A fateful year for a physicist

For **Lise Meitner**, 1938 is something like a turning point in her life. She flees the Nazis and goes to Sweden, where she tries to establish herself as a scientist and finds the solution to a problem that Otto Hahn told her about in a letter. As a result, the former researcher at the **Kaiser Wilhelm Institute for Chemistry** becomes one of the co-discoverers of nuclear fission.

TEXT **SUSANNE KIEWITZ**

July 1938. Lise Meitner flees from Germany, her adopted country since 1907. After the annexation of her native country of Austria, she is at grave risk of falling victim to the anti-Semitic persecution in the Third Reich. At the urging of friends and colleagues – most notably Otto Hahn – Meitner finally decided with a heavy heart to emigrate to Sweden. For her, it is the end of an era. In resigning from the Kaiser Wilhelm Institute for Chemistry in Berlin, the almost sixty-year-old scientist is giving up a hard-won, prestigious position in her profession.

Since 1912, Meitner had worked with Otto Hahn to make the Institute one of the world's leading research facilities in the fields of radiochemistry and nuclear physics. From 1923 on, she was in charge of the Department of Radiophysics and thus held a leading position that only a very few women attained in those times. The Institute had unique research opportunities, first-rate equipment and a motivated team of staff, which until 1937 included Max Delbrueck, who went on to win the Nobel Prize.



A practised team: Lise Meitner and Otto Hahn in the laboratory at Berlin University in 1909.

The scientific community tries to support Lise Meitner as best it can, but ultimately with little success. As the best option offered is a temporary job at the Nobel Institute in Stockholm, she decides to go to Sweden. Yet the disappointment is great. "At the Institute, I have a workroom which is also my study and experiment room with lots of people coming and going," writes Meitner in frustration to her friend Gertrud Schiemann in Berlin at the end of October 1938.

In this situation, her written correspondence with Otto Hahn becomes a vital link with a familiar world. This is all the more important as her escape has torn her away from another phase of intensive collaboration. It is also why Meitner's Christmas parcel contains a letter in which Otto Hahn gives her strictly confidential information about the most recent experiments.

Lise Meitner, who had been a fascinated observer of Enrico Fermi's experiments on transuranes using the newly discovered neutrons, had in 1934 proposed a joint research program exploring how atoms react when bombarded with slow neutrons. In Stockholm, Meitner follows her colleagues' work from a distance and is the first to hear of the unexpected results of the latest series of experiments. "There is something about the 'radium isotopes' that is so remarkable that for now we are telling only you," writes Hahn to Lise Meitner on 19 December 1938. "Our Ra[dium] isotopes do not act like Ra but like Ba[rium]," in other words, like an element with a significantly lower nuclear mass than expected.

This suggests that the radium nucleus could have split. Hahn is more than cautious about propounding this possibility and requests Meitner's support. He is an expert in chemical fractionation but not in nuclear physics. "Perhaps you can come up with some sort of fantastic explanation," he suggests to his colleague. "We know ourselves that it can't actually break apart into Ba." And Hahn, who is already preparing to publish the results of his work, adds: "If there is anything you could propose that you could publish, then this would still in a way be work by the three of us." The third researcher is Fritz Strassmann, who is conducting experiments with Hahn in Dahlem. In order to give Meitner a head start, Hahn does not tell even his own Institute of the astonishing discovery.

Lise Meitner and her nephew Otto Robert Frisch – a physicist at Niels Bohr's renowned institute in Copenhagen – spend the

Photo: Archives of the Max Planck Society, Berlin

Christmas holidays of 1938 in deep discussion of Hahn's report during long walks in the deep snow. Based on Bohr's nuclear drop model and Einstein's formula for the transformation of mass into energy, they calculate all the possibilities of nuclear disintegration with mathematical precision.

More letters are sent back and forth between Sweden and Berlin, until Meitner finally confirms Hahn's cautious theory on 3 January 1939: "Now I am almost sure that you have indeed discovered decay into barium, and I consider this result beautiful indeed. I cordially congratulate you and Strassmann." Hahn's report appears in the prestigious publication Die Naturwissenschaften (The Natural Sciences) very shortly afterwards, on 6 January 1939. Meitner and Frisch likewise rush to complete their paper, which is published in February by the no less prestigious journal Nature. A joint project would be practically impossible in the current political situation, especially as Hahn and Strassmann have already drawn negative attention from the Nazi regime.

A close friendship: Lise Meitner and Otto Hahn on his 80th birthday in 1959.

However, the paper by Meitner and Frisch goes unheeded in the scientific world, as Niels Bohr has taken the sensational results of the measurements with him to the U.S. at the beginning of January and given a spontaneous report on them at a conference. Other nuclear physicists also quickly produce an explanation for the chemical findings and calculate the enormous quantity of energy released by nuclear fission, as Meitner and Frisch have already done. Everyone is sure that this is one of the most far-reaching discoveries in physics of the 20th century. Something that had previously only been given hypothetical consideration by a few bold spirits and was at most the stuff of science fiction now turned out to be scientifically proven and in principle therefore technically feasible. Six months later, when German troops invaded Poland and started World War II, the idea of using nuclear energy to construct a new type of bomb quickly took shape.

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» Lise Meitner did it with mathematics.

The events of 1938/39 were a watershed for Lise Meitner: a watershed, but not a peak, as the scientific world withheld its ultimate accolade for the role she had played in the discovery of nuclear fission. In 1945, the Nobel Committee awarded the 1944 Nobel Prize for Chemistry to Otto Hahn alone, while in 1953, a paper written by physicist Werner Heisenberg demoted his former colleague in Dahlem to Hahn's "assistant".

However, the public paid extensive tribute to Lise Meitner's contribution to the discovery of nuclear energy after the war. An array of honors including the order Pour le Mérite, together with German and international reports on the "chief witness of the nuclear age", testified to her reputation after the end of World War II as the most important person in contemporary history.

Initially, the atomic bombs dropped on Hiroshima and Nagasaki in August 1945 catapulted the publicity-shy researcher into the public spotlight rather abruptly. The American tabloid press were not the only ones to celebrate Meitner as the "mother of the atomic bomb" and claimed that the "Jewish refugee" had collaborated on the Manhattan Project. Meitner did actually receive offers of this kind in the 1940s, but refused them all. In 1946, she told the Evening News: "I hate all bombs."

That same year, Meitner traveled to the U.S. to meet relatives and old acquaintances. She gave lectures at universities and was voted "Woman of the Year" by the Women's National Press Club. Having carved out a career driven by stamina and curiosity in the male-dominated field of physics, she became a role model for many female students.

Looking back, Meitner emphasized that this would have been impossible without the support of her parents and academic teachers. These included Ludwig Boltzmann, who was her supervisor when she obtained her doctorate in physics at the University of Vienna in 1906, and Max Planck, who despite initial reservations made her his assistant at Berlin University in 1912, thus giving her a sound financial basis.

However, the most vitally important events of her life were her meeting with Otto Hahn and their collaboration from 1907 until the discovery of nuclear fission in 1938. Their friendly relationship continued even after the war. What made this possible was Meitner's big-hearted willingness to forgive the injustice and rebuffs she received, although she did not hesitate to reproach those of her friends who had remained in Germany for being partly responsible for the atrocities of Nazism. Meitner first went back to Germany in 1948 to attend the memorial service for Max Planck.

In 1953, the Frankfurter Rundschau published a profile of her to commemorate her 75th birthday. Asked about the beginnings of their collaboration, Hahn and Meitner showed a friendly camaraderie to the press: "'I was delighted to have found someone who could teach me about the chemistry of radioactive substances,' she [Meitner] admitted with an engaging smile; 'I had hardly any idea of chemistry!' Hahn promptly countered, 'And as a chemist, I had even less idea of physical and mathematical problems. Yet Ms. Meitner always kindly worked out everything I didn't quite understand – and in this way we were always able to help each other!'"

Photo: Archives of the Max Planck Society, Berlin