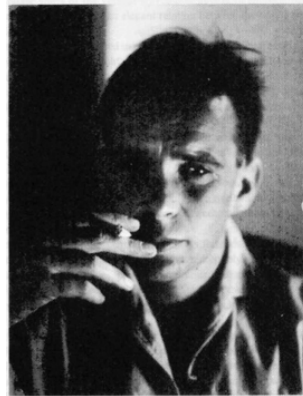


Bruno Touschek (1921-2021)



Bruno Touschek, 1955, from E. Amaldi, *The Bruno Touschek Legacy*, CERN 81-19.

Early years in Vienna (1921-1942)

Bruno Touschek was born in Vienna, on February 3rd, 1921. The March 1938 annexation of Austria to Germany disrupted his gymnasium studies because of his Jewish origin from the maternal side. In 1939, after some (unsuccessful) attempts to emigrate to England to study chemistry in Manchester, and a short visit to Rome, where his maternal aunt Ada lived, he was enrolled to study physics at the University of Vienna, but was expelled in May 1940 because of his mixed origins. Following an unsuccessful renewed application in 1941, he decided to continue his studies in physics by moving to Germany, under the protection of Arnold Sommerfeld. In February 1942, he left Austria for Munich, not knowing when or whether he would return to the country of his birth.

Germany: 1942-43

After first visiting Sommerfeld in Munich, he went to Hamburg, attending classes at the University, while earning his living at the Studiengesellschaft für Elektronengeräte, under the protection of Sommerfeld's former students. Unsatisfied by the work, and anxious to go on with his studies, he moved to Berlin, where a chance encounter on the S-bahn, on November 12th 1942, opened the way for Bruno's being hired by the electronic firm Löwe Opta. The next turning point in his life took place in February 1943, when he came across an article submitted to the Archiv für Elektrotechnik by the Norwegian scientist, Rolf Widerøe, inventor of the betatron. This article led to a secret project for the construction of a 15 MeV betatron, financed by the Aviation Ministry of the Reich, and directed by Widerøe. The project was approved in summer 1943, and Touschek joined the project. Working with Widerøe, Touschek first heard about the idea of storing particle beams and make them clash again each other.

Germany: 1944-45

During the last two years of WWII, Bruno Touschek worked on the secret betatron project. He was moving between Hamburg, where the betatron was being built at the C.H.F. Müller factory, and Berlin, where he attended University classes by Max von Laue and Werner Heisenberg, while continuing to work at Löwe-Opta, and experiencing the heavy fire-bombing of both Hamburg and Berlin.

While on the betatron project, Bruno, as a half Jew, was under constant threat to be deported to forced labor by the Todt Organization. In March 1945, as the English and American forces were approaching Hamburg, Bruno and Widerøe transferred the working betatron to Wrist. On his return to Hamburg, Bruno was arrested by the Gestapo. He was brought to the infamous Fuhlsbüttel prison, where he was held for four weeks, until a forced march of 200 prisoners took him toward the Kiel concentration camp. Shot by a guard and left for dead, he was finally freed on April 30th, coming under the protection of the T-force, the Allied Corp in charge of assessing Germany's scientific assets and preparing its post-war reconstruction.

Formation years: Göttingen (1946) and Glasgow (1947-52)

In 1946, Bruno was taken to Göttingen, where German science was being reconstructed for pacific purposes under Werner Heisenberg's leadership. After obtaining the Diploma in physics on the theory of the betatron, Bruno was Heisenberg's assistant for 6 months. In March 1947, his war time expertise with Widerøe's betatron was sought by the University of Glasgow, where a 350 MeV electron synchrotron was to be built. Awarded the PhD in 1949, he remained in Glasgow as research fellow. He was befriended by Max Born in Edinburgh and started contacts with Bruno Ferretti from University of Rome, where he moved in December 1952.

Italy (1953-1977) and France (1962-64)

Rome: Theoretical Physics and academic life

Strongly supported by Edoardo Amaldi, who attracted him to Rome as INFN researcher, Bruno worked on neutrino physics, and Time Reversal, becoming friends with Wolfgang Pauli who inspired Bruno's faith in the CPT theorem (and thus AdA's feasibility). Nicola Cabibbo and Francesco Calogero graduated with him in 1957 and were supportive of his October 1959 idea for exploiting electron-positron physics as the optimal tool to study the hidden structure of matter. He gave lasting contributions to theoretical physics and to the academic life of University of Rome, where he was appointed Professor of mathematical methods of physics in 1973. His extraordinary scientific merits were recognized by becoming a Foreign Associate to the Accademia Nazionale dei Lincei in 1972.

Frascati National Laboratories and AdA in Orsay

In April 1959, an electron synchrotron, whose construction had been directed by Giorgio Salvini, started operating in Frascati. Following this success, in March 1960 Touschek proposed to the Rome and Frascati scientists to build the first ever storage ring for electron-positron collisions, AdA, Anello di Accumulazione. The proposal was accepted, and, in February 1961, a team led by Touschek with Carlo Bernardini, Giorgio Ghigo, Gianfranco Corazza, Ruggero Querzoli and Giuseppe Di Giugno, was able to see the first electrons circulating in AdA.

To improve the electron injection mechanism, AdA was brought to the Laboratoire de l'Accélérateur Linéaire d'Orsay, in France, where the *Touschek Effect* was discovered and proof of the feasibility of electron-positron storage rings was obtained, with the collaboration of Jacques Haïssinki and Pierre Marin.

Inspired by AdA's success, electron-positron colliders were designed and built in all major world laboratories. In November 1960, fully confident in the feasibility of electron positron storage rings as a major discovery tool for particle physics, Touschek had already proposed to construct a bigger and more powerful AdA, ADONE. Operational in 1969, ADONE was first in discovering multi hadron production and, in 1974, confirmed the discovery of J/Psi, a bound state of a new type of quark, the *charm*.

CERN (1977-78)

Touschek spent the last months of his life as visiting scientist at CERN, where early plans for a giant electron-positron collider were discussed. However, when LEP, with an energy of 50 GeV per beam and a circumference of about 27 Km eventually came into operation in 1989, Touschek was no more there. Unfortunately, he had prematurely passed away, while he was participating in the planning of the Spbar-pS, the CERN antiproton-proton collider, where the W- and Z-boson were discovered in 1983. When he became very ill, a CERN car took him to Austria, where he passed away on 25th May 1978.



1978: Bruno Touschek, leaving CERN for Austria.