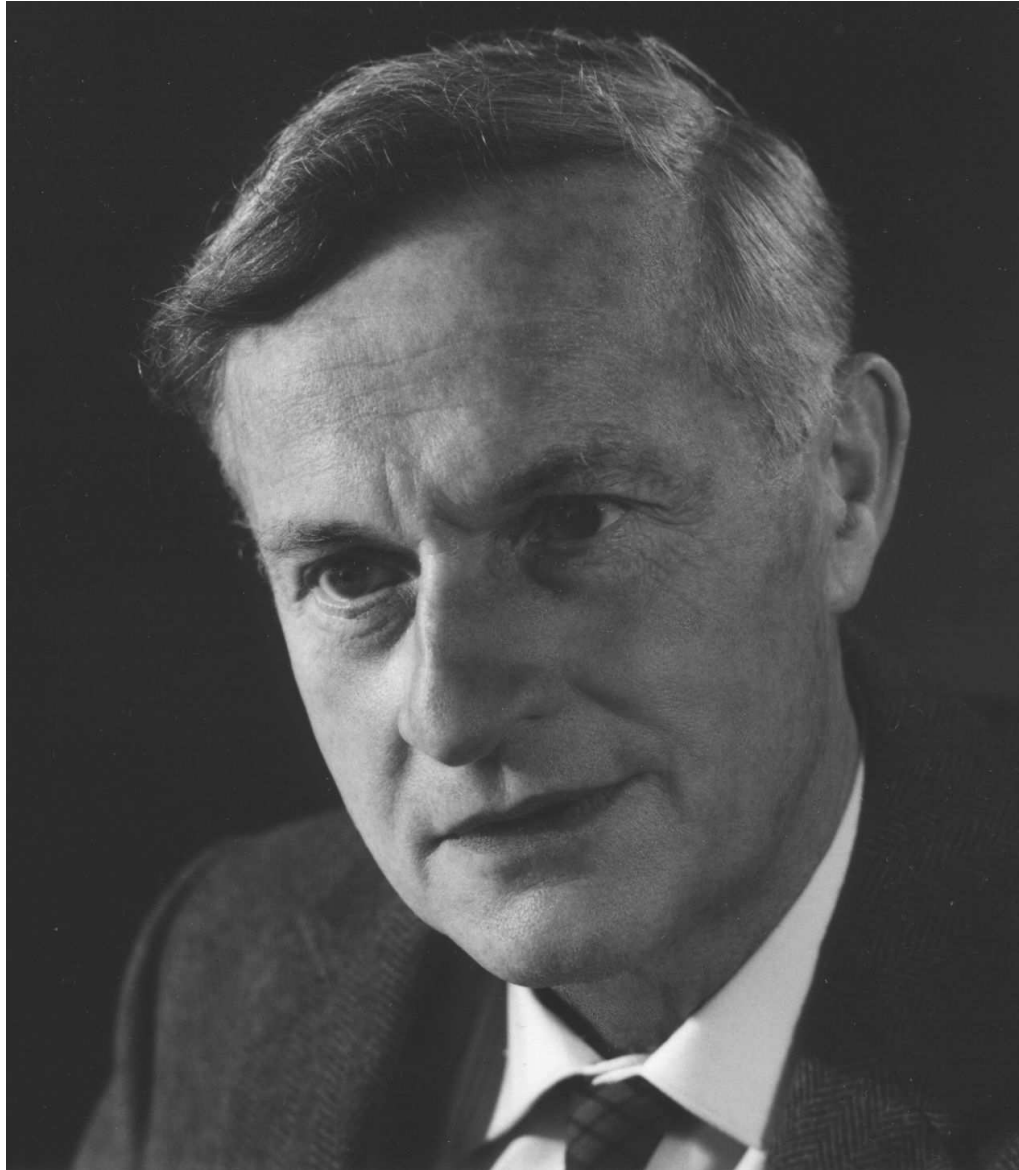


Markus Eduard Fierz-Biber

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Markus Fierz [1] passed away on his 94th birthday in the midst of his family in Küsnacht near Zurich . With him not only an eminent scientist in the field of theoretical physics but also a universal mind, who was able to encompass art, natural science and history of mankind, has left us.

Thus the path of his life shall be briefly sketched :

Markus Fierz was born 20. June 1912 as the first of twins in Basel, the son of Eduard Fierz and Linda Emma Fierz-David. His father was then a senior chemist working for the pharmaceutical company Geigy. His mother he describes in his autobiographical notes [2] as "... a beautiful woman with rich black hair and remarkably long, slim hands."

The family lived in Basel until 1917, whence his father was offered a chair in chemistry at the ETH (Federal institute of Technology) in Zurich and moved to Kilchberg on the lake of Zurich . Markus Fierz stayed until the end of world war I in Madulein in the Engadin to recover from an illness.

In 1918 his mother was stricken by an epidemic of influenza . As her recovery was slow she sought help from Carl Gustav Jung in his analytic psychology. This should become important later, when Markus Fierz had become assistant and collaborator of Wolfgang Pauli, as the latter was afflicted by a psychological crisis from which he was cured by Jung.

In Zurich Markus Fierz attended the Realgymnasium (high school) , from which he graduated in 1931. In the same year he enrolled as a student in the University of Göttingen in Germany with the intention to study physics and biology.

In Göttingen Markus Fierz attended with delight the lectures by Hermann Weyl. He also read the works of Emmanuel Kant. After the seizure of power by Hitler, Markus Fierz returned to Zurich in 1933, where he continued studies, now physics, at the university. He attended with profit the lectures in theoretical physics by Gregor Wentzel (University of Zurich) and Wolfgang Pauli (ETH-Z) and he decided to follow this discipline in depth.

In his PhD thesis Markus Fierz studied the reaction



as he describes it "in order to treat this process with calculations with which I was familiar". Hereby he discovered – in lowest order with respect to electric charge – the divergence of the cross section stemming from long wavelength photons in the final state.

On the basis of this work Markus Fierz obtained his PhD from the University of Zurich in 1936 .

The summer semester 1936 he spent in Leipzig, where Werner Heisenberg had formed a school. The latter did not want to believe in the infrared catastrophe caused by photon emission, instead Markus Fierz got to know Arnold Nordsieck, who would show much understanding for this problem [3] in a basic paper with Felix Bloch in 1937 .

In July 1936 he accompanied Werner Heisenberg to a conference in Copenhagen, which was also attended by Wolfgang Pauli. At this occasion the latter proposed to him to become his assistant. Markus Fierz decided to accept this offer and returned to Zurich .

In 1938 Wolfgang Pauli suggested that he should write a habilitation thesis. This led Markus Fierz to the inner structure of spin of a field in the realm of special relativistic covariance and to master the difficulties, which arise for values greater than $1/2$, as discussed in [4] by Paul Dirac.

He submitted the habilitation to the ETH-Z in 1939 [5] . In this treatise, which – as a first step – was dedicated to massive and massless free fields, Markus Fierz proved the intrinsic relation between spin and statistics : Bose-Einstein statistics for integer values and Fermi-Dirac statistics for half-integer values of the spin . For this derivation he was awarded the Max Planck Medal in 1979 . Ever hereafter Markus Fierz was – for a long time lonely – defendant of the fundamental meaning of *chiral dotted and undotted spinor components* that had been introduced in [4] .

The habilitation gave rise to a common work with Wolfgang Pauli [6] , where the methods elaborated in [5] were extended to electromagnetically interacting fields. Far ahead of the times was the direct comparison of the additional local transformations arising for massless charged fields with spins 2 and 3/2 , which can be extended to the full local gauge group of supergravity as Ferrara, Freedman und van Nieuwenhuizen [7] have shown in 1976 .

Since his youth Markus Fierz played the violin and was then part of a string quartet. This way he met Menga Biber. The two lovers of music became engaged in 1939 and married in 1940.

The couple moved to Basel, where Markus Fierz took on a position as assistant and 'Privatdozent' at the Institute for Experimental Physics, at the university, which he held until 1943, when he was appointed associate professor.

He thus became a member of the faculty and of the University of Basel. In 1944 Markus Fierz was appointed Ordinarius for theoretical physics. In this function he served the University of Basel until 1959, when he accepted the position of director of the Theory Division of CERN, which had meanwhile been created in 1954 .

Also in Switzerland, which was luckily spared from war action, the time of the second world war brought an incision in the free shaping ('Gestaltung') of the arts but also of natural science.

Both Markus Fierz and Res Jost belonged to a generation, which was 'nolens volens' part of these times unfolding.

Yet the inspection of Helvetica Physica Acta from 1941-1954 reveals a rich scientific activity also of the Swiss Physical Society.

From this period a paper by Markus Fierz

on electromagnetic multipole radiation [8] deserves mention .

Also in the war years the two sons of the Fierz couple were born : Lukas, today physician and neurologist in Bern and Hans, chemist in Basel.

1950 Markus Fierz visited the Institute for Advanced study in Princeton. There he met Res Jost and his wife and a lasting friendship arose.

As mentioned Markus Fierz was offered the position of director of the Theory Division of CERN, which he accepted in spring 1959. In December 1958 Wolfgang Pauli died and as his successor Markus Fierz was named soon thereafter. Yet he stayed for one year at CERN and then took up in 1960 the succession of his mentor and friend Wolfgang Pauli at the ETH in Zurich. He remained faithful to this school until his retirement in 1977 .

The Fierz family moved to Küsnacht, to Felseneggstrasse 10, the house of the parents.

The following sentences shall be translated from the obituary by Jürg Fröhlich und Klaus Hepp [9] : "Together with his colleague and friend Res Jost he coined research, style and atmosphere at the Theory Institute, which then was a magnet with international attraction for all theorists with a taste for a mathematical view of physics. The intellectual overview of the two colleagues generated a uniting spirit at the Institute, never felt anymore since their departure."

At least since the eminent papers [5] and [6] , regarding the consistet embedding of higher spin fields into special relativistic kinematics, Markus Fierz intensively studied general relativity.

This can only be traced incompletely from his published work. Here mention is due to the discussion [10] of Weyl-transformations within the so called Jordan-Fierz-Brans-Dicke theory [11, 12] , as well as a treatise on spinors [13] , in a conference report.

1963-1967 I carried out first a diploma thesis on the subject of the degenerate representations of the Lorentz subgroup, which leave invariant a light-like momentum vector, followed by the study of the problem of higher spin fields [5, 6] extended to full quantisation. This led 1966 to my PhD thesis [14] .

In this time I was able to learn very much from Markus Fierz. Some topics shall be mentioned here :

- the structure of Stirling's formula and the meaning of Bernoulli numbers.**

- Riemann's derivation of hypergeometric functions from the singularities of the underlying differential equation.
- Planck- und Fermi- functions in thermodynamics, the Riemann ζ function and the density of prime numbers.
- there exist no Dirac monopoles [15] .
- the meaning of the conformal group and the subtle nature of massless fields [16] .

But I also learned plenty by carefully retaining topics, which consciously or unconsciously he eschewed.

For his integral work as researcher, teacher and his mediation of general cultural values Markus Fierz received the Albert Einstein medal in 1989.

We loose in him an outstanding physicist, a creative artist of personal engraving ('Prägung'), maybe very near to the ideal of the 'glassbeadplayer' of Hermann Hesse [17]. We will keep him in honorable memory.

- [1] **The photograph from 1970 is by Barbara Kruck. Thanks are due to Lorenzo Mercolli for his graphics reproduction .**
- [2] **M. Fierz, 'Lebenserinnerungen', 1964, 1985, 1991 .**
- [3] **F. Bloch and A. Nordsieck, 'Note on the radiation field of the electron', Phys. Rev. 52 (1937) 54 .**
- [4] **P. A. M. Dirac, Proc. Roy. Soc. A 155 (1936) 447 .**
- [5] **M. Fierz, Helv. Phys. Acta 12 (1939) 3 .**
- [6] **M. Fierz and W. Pauli, 'On relativistic wave-equations for particles of arbitrary spin in an electromagnetic field', Proc. Roy. Soc. A 173 (1939) 221 .**

- [7] **S. Ferrara, D. Z. Freedman and P. van Nuiwenhuizen, Phys. Rev. D13 (1976) 3214 .**
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- [9] **Jürg Fröhlich und Klaus Hepp, 'Zum Tode von Markus Fierz', Neue Zürcher Zeitung, Donnerstag, 29. Juni 2006 .**
- [10] **M. Fierz, Helv. Phys. Acta 29 (1956) 128 .**
- [11] **P. Jordan, 'Schwerkraft und Weltall', Vieweg Verlag, Braunschweig 1955 .**
- [12] **C. Brans and R. H. Dicke, Phys. Rev. 124 (1961) 925 .**

- [13] **M. Fierz, 'Spinors', in Proceedings of the International Conference on Relativistic Theories of Gravitation, London, July 1965, H. Bondi ed., Kings College, University of London, 1965 .**
- [14] **P. Minkowski, ' Versuch einer konsistenten Theorie eines spin-2 mesons',
Helv. Phys. Acta 39 (1966) 474 .**
- [15] **M. Fierz, 'Warum gibt es keine magnetischen Ladungen?',
Helv. Phys. Acta 37 (1964) 663 .**

- [16] **M. Fierz, 'Die unitären Darstellungen der homogenen Lorentzgruppe', in "Preludes in theoretical physics", in honor of V. F. Weisskopf, A. de-Shalit, H. Feshbach and L. van Hove eds., North Holland, Amsterdam, 1966 .**
- [17] **H. Hesse, 'Das Glasperlenspiel', Fretz und Wasmuth, Zürich, 1943 , Suhrkamp, Frankfurt am Main, 2001 .
english translation : 'The glass bead game', translated by Richard and Clara Winston, ISBN 009928362X, Picador, New York, USA, 2002 .**