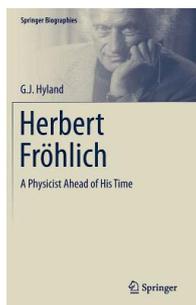


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G. J. HYLAND

HERBERT FRÖHLICH
A PHYSICIST AHEAD OF HIS TIME

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I had the good chance to read this wonderful scientific biography of Herbert Fröhlich, a physicist ahead of his time, as firmly said in the book's subtitle. The book appeared more than two years ago and there is no need to review it now, after quite a few excellent and more timely reviews. The towering personality of Herbert Fröhlich in the XX century physics and the style adopted by the author will make of this book a classic. Gerhard Hyland, last Fröhlich doctoral student in Liverpool, then professor of theoretical physics in Warwick and now at the International Institute of Biophysics in Neuss-Holzheim, has masterfully combined the narrative of Fröhlich's adventurous life with a tutorial, though highly professional presentation, with equations and enlightening explanations, of Fröhlich's theoretical breakthroughs. Fröhlich's life was adventurous as that of many Jewish scientists of his generation, and nevertheless, as stated by Fröhlich's wife Fanchon in her foreword, "Herbert's experiences ... clearly reveal how science and scientific curiosity are not to be extinguished by mere national enmities; how scientists – then as now – form a mutually self-supporting global community that is often able to overcome the whims of dictators ... in their pursuit of scientific progress". All periods of Fröhlich's life, particularly the British period, are illustrated by a rich collection of photographs and other interesting documents, front pages of landmark papers, etc. The book is made precious by the reproduction of two Fröhlich's portraits, a drawing and an oil painting by Fanchon, excellent artist who captured Herbert in a deep thinking attitude, as no photograph could render.

Condensed matter physicists are familiar with Fröhlich Hamiltonian of electron-phonon interaction, as well as with his groundbreaking contributions to the theory of electrons in metals, the theory of dielectrics (entitling a classical book), and of course the seminal 1950 work on the electro-phonon mechanism of superconductivity – the starting point of the famous 1957 paper by Bardeen, Cooper and Schrieffer. In the meantime (1954) an

exchange of letters (reproduced in the book) between Feynman and Fröhlich on the polaron mechanism, as well as a further Fröhlich's 1968 paper on the acoustic-plasmon mechanism, are clear forms of prescience. The polaron mechanism came into play with the high-temperature superconductivity in cuprates (1986), while the acoustic plasmons with that in MgB_2 (2018, daily fresh!). Prescience does not yield a Nobel prize, *nemo propheta in Stockholma* – though the fundamental idea of the electron-phonon mechanism would have been more than enough – nor helps a universal attitude. Herbert Fröhlich made also seminal contributions to the theory of nuclear forces (1938, with Heitler and Kemmer) and of elementary particles, as can be found in the impressive list of publications reproduced at the end of the book. But later Fröhlich's subjects which fascinated me most, especially when I had the good chance to meet him during my 1979 sabbatical stay at the Max-Planck-Institut (MPI) FKF in Stuttgart, were the micro-macrophysics connections and the long-range coherence phenomena in biosystems. At that time I was professor of physics to biology students in Milano, and Fröhlich demonstration of selective long-range recognition mechanisms in systems far from equilibrium was for me a revelation.

Gerhard will forgive me if I pretend to have been Herbert's last student after him (probably many have been in the way I was). As soon as Herbert Fröhlich arrived at the MPI, I had the honour to be introduced to him by Ludwig Genzel – one of the founders of the MPI-FKF – and since then I could not refrain from visiting him in his office everytime I thought I had a reasonably good question. Herbert was always smiling and willing to explain something new to me. Sometimes I even left his office with homework! "I'm fascinated by your demonstration: two alike oscillators out of equilibrium interact with a selective long range force; can it be true also for two alike two-level systems?". "Yes, of course, but you have to prove it, by tomorrow!" replied Herbert while hiding his handwritten notes.

I knew that Fröhlich was a good friend to Beppo Occhialini, the famous particle physicist with whom he shared some years in Bristol after the war. Beppo was another legend of mine; when home we decided to invite Herbert in Milano for a seminar, and for an evening party at the home of two colleagues, where Beppo and Herbert, both unaware, finally met again after thirty years! Occhialini does not appear in the author index of the book, but is one of the characters, with Powell and Lattes, in the playlet *Wrong Interactions* (reproduced in the book) that Klemmer composed for the celebration of Fröhlich's 80th birthday. He was clearly joking about the strong interactions that himself with Fröhlich and Heitler wrote on in 1938. Consider that just in Bristol in 1947 Lattes, Muirhead, Occhialini and Powell were able to single out pions and muons in the cosmic rays, identifying the former with the Yukawa particles! The great progress stemming from these experiments, expressed on stage by the sequence of outstanding characters like Feynman, Schwinger, etc., up to 't Hooft and Higgs, actually sheds new light on the importance of Fröhlich-Heitler-Kemmer paper – in many respects another case of prescience. Correctly Gerhard Hyland entitled his great book "Herbert Fröhlich, a physicist ahead of his time".

Giorgio Benedek
Università di Milano Bicocca