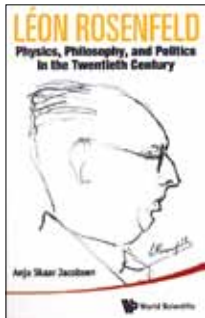


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LÉON ROSENFELD
PHYSICS, PHILOSOPHY, AND POLITICS IN THE
TWENTIETH CENTURY

World Scientific, Singapore, 2012
pp. IX + 354; \$81.00
ISBN 978-9-814-307819

The life and intellectual work of Léon Rosenfeld, an important figure in the development of Quantum Theory, and a key contributor to its epistemological interpretation in the scientific and political contexts of the time.

This book is the first, detailed biography of the Belgian theoretical physicists, Léon Rosenfeld (1904-1974). Much shorter, obituary-style accounts had already been written by Belgian scientists, the astrophysicist Pol Swings, the Nobel laureate Ilya Prigogine or by Rosenfeld students Jean Serpe and Léo Houziaux. The present book goes far wider and deeper into the scientific, the philosophical and the political aspects of Rosenfeld's activities and writings. It is a most recommendable book for its excellent writing and its erudition well suited to the great erudition of Rosenfeld himself. The book is addressed to anyone interested in the early days of Quantum Mechanics (QM) (and Quantum Electrodynamics, QED), its philosophical implications, the political atmosphere surrounding its genesis and the relationship between Rosenfeld and the many key actors of the period.

In Chapter 1, Léon Rosenfeld is characterized as a "Physicist of the Second Quantum Generation". Second in the sense that, although born in the early years of the 1900's like the pioneers Heisenberg, Dirac, Jordan, Pauli and others, Rosenfeld personal contributions to the field began only after the basic formulation of QM was achieved by these pioneers. What caused Rosenfeld to be a late comer on the scene is that his initial training at the University of Liège in the then frontier physics was virtually inexistent, so he had to teach himself elements of QM. After graduating he left Belgium to study further under de Broglie in Paris (1927), Born in Göttingen (1928), Pauli in Zurich (1929) and Bohr in Copenhagen. What a "postdoc" curriculum! Jacobsen skilfully explains the various circumstances and professional relationships acting in favor

of this burgeoning scientific career in such a brilliant set of venues. In Paris, Rosenfeld was introduced to de Broglie's pilot wave interpretation of the wave function of QM. In Göttingen, however, under the influence of the quantum physicists there, Rosenfeld quickly rallied to the Born statistical ideas and later on, in Copenhagen, to the "orthodox", Bohrian dogma for which he was to become, after Bohr himself, the most prominent and active spokesman.

In Paris, Rosenfeld was also exposed and quite receptive to leftist political ideas prevalent there and elsewhere in Europe in many intellectual circles since the Russian revolution. In Zurich and Copenhagen he explored in depth the ideology of Marx and Engels. This gave him a tremendous initial momentum for what was going to remain, for his entire philosophical life, his determined socialist ideology and to dictate much of his political-scientific activities.

In Chapter 2, Jacobsen explains the genesis of Rosenfeld's beginning association with Niels Bohr. Appointed in 1930 professor at the University of Liège, Rosenfeld established the routine of regularly visiting Bohr's Institute in Copenhagen while discharging his academic duties in Liège. This lasted until the war with the important consequence that, with his students mentioned above, Rosenfeld was able to create and develop during this period a tradition of theoretical physics in his Alma Mater¹.

Jacobsen discusses at length the post-QM gestation of QED by the major contributors Bohr, Rosenfeld, Dirac, Pauli, Heisenberg, Landau, Peierls and several others (a detailed

analysis of the major paper published in 1933 by Bohr and Rosenfeld on QED is given by A. Pais in his book *Niels' Bohr's Time*, Oxford UP, p. 362). The chapter ends with the Copenhagen reaction to the Einstein-Podolsky-Rosen paper of 1935 ("the bolt out of the blue"). As it involved a further clash between the two giants of the new physics, Einstein and Bohr, the dispute raised far more public attention, including in philosophical circles, than the more technically complex QED and other developments of the "second generation" of Quantum Theories.

In Chapter 3 Jacobsen goes into Rosenfeld's involvement in the Philosophy and Politics of the 1930's. So convinced was Rosenfeld of the merits of Marxist ideology that his most original philosophical activity in that period and onward was his attempts to blend a scientific quantum revolution, QM and Copenhagen Complementarity, with a socio-political revolution, that of Dialectic Materialism. Rosenfeld's constant reflections and writings along these lines were later marvellously summarized by Pauli who wrote the formula $\text{Rosenfeld} = \sqrt{\text{Bohr} \times \text{Trotsky}}$.

Jacobsen recounts that confronted with the other, frightening ideologies of the 1930's, Nazism and Fascism, Rosenfeld and the young physicists at Bohr's Institute reacted with "a reckless and satirical attitude", e.g. by the creation of "The Journal of Jocular Physics" with Rosenfeld as chief editor. Bohr himself carefully kept his distances, insisting that it was up to philosophers and ideologues to adjust to modern quantum epistemology, not the other way round.

The chapter ends with the (in)famous involvement of Rosenfeld in involuntarily causing the premature disclosure in the USA, early in 1939, of the discovery of fission by Hahn and Strassmann in Berlin. Rosenfeld was then accompanying Bohr in America and was not aware that Bohr had promised not to reveal the discovery before its physical explanation, provided by Lise Meitner and her nephew Otto Frisch, was duly published. The

¹ This reviewer was a student, in the 1950's, of Rosenfeld's early disciples such as J. Humblet, J. Serpe, J. Pirenne some of whom also regularly trekked to Copenhagen and developed elements of Nuclear Physics, Quantum Electrodynamics and Solid State Physics, all subjects inexistent in Liège before Rosenfeld.

incident caused much anxieties to Bohr but, fortunately did not result in any intellectual misappropriation.

In Chapter 4 Jacobsen begins by relating Rosenfeld's appointment and transfer to the University of Utrecht in May 1940, just at the time of the invasion of the low countries by Nazi troops. The chapter is then entirely devoted to Rosenfeld in occupied Holland. Rosenfeld most famous PhD student in Utrecht was Abraham Pais who later would pursue a brilliant career in Particle Physics and as one noted biographer of Einstein and Bohr. Both Rosenfeld and Pais had to go into hiding for the last year of the war. I will cite here, as quoted by Jacobsen, a revealing remark by Pais about the epistemological-political teaching that he received from Rosenfeld : "... already in 1946, I knew more about complementarity than most of my generation, because my teacher Rosenfeld had often talked to me about this subtle subject. ... I must confess that in my Utrecht years complementarity interested me as much as communism – very little". This statement is quite representative of the general attitude adopted by the majority of professional physicists after the war: forget

about quantum epistemology and let us get on with solving concrete QM problems; and a bit later in the century: forget about communism and let us get on with democracy.

Jacobsen devotes Chapter 5 mostly to Rosenfeld's political commitments in the immediate post war era. While Bohr may have been indifferent or even well disposed towards the Soviet Union and its political system before the war, things changed drastically after the war. If the two scientists remain friendly and solid allies in physics, they severely split in post war politics, rallying on opposite fronts of the Cold War. In 1947, through his relationship with the British socialist Patrick Blackett, incipient Nobel Laureate (awarded in 1948), Rosenfeld was offered and accepted a professorship at the University of Manchester. He would stay there until his next and last professional offer, from Bohr himself, to a Nordita chair at Copenhagen in 1958. In 1949, Rosenfeld received the prestigious Francqui prize for the exact sciences in Belgium, in recognition of his achievements and confirming his reputation as one of the premier Belgian scientists of the period.

In the last chapter of his book, Chapter 6,

Jacobsen goes into Rosenfeld's opposition to Bohm's and other attempts at a deterministic interpretation of QM and his continuing support to the, by then, "orthodox" Bohrian interpretation. The author makes a very interesting discussion of this opposition in the political context of the cold war. As for Rosenfeld's Marxist ideas, they remained suspicious to most of the original creators of QM who never liked his claim that QM complementarity is the modern form of dialectical materialism. The chapter ends with Rosenfeld's efforts, during the 60's, to advocate tolerance and free thinking in the world and to fight censorship against deviations from the official scientific-political orthodoxy of the communist rulers behind the "iron curtain". In spite of all the often tragic communist absurdities of that period, like the Lysenko affair and the Russian crushing interventions in Hungary and Prague, Rosenfeld like most of the communist-leaning intellectuals of the time, managed to remain faithful to their rigid Marxist ideologies until the end.

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