

Book Review

Les Incertitudes d'Heisenberg et L'Interpretation Probabiliste de la Mecanique Ondulatoire (avec des notes critiques de l'auteur). By Louis de Broglie. Préface et notes complémentaires de Georges Lochak. Gauthier-Villars, Paris, France, 1982, XLII + 304 pp., 220 FF (cloth).

This book, divided into two parts, contains the courses taught at the University of Paris by Louis de Broglie in 1950–1951 and 1951–1952. It is during the spring of 1951 that Louis de Broglie read the *Physical Review* article in which David Bohm⁽¹⁾ developed a theory that was essentially equivalent to the “pilot wave theory” he had presented in 1927 at the Fifth Solvay Council, where it had been strongly criticized by the Copenhagen–Göttingen group. As is well known, this school became the majority group, and Louis de Broglie, one of its members.

So, the book under review should interest the historians and philosophers of science. Such an interest may even not be merely historical: John Bell,⁽²⁾ in his recent contribution to the issues devoted by *Foundations of Physics* to Louis de Broglie's 90th birthday, after pinpointing the postulate of John von Neumann that physically invalidates the “impossibility proof” (a postulate that Bell goes so far as calling “absurd”), shows (after Bohm) how the pilot wave theory bypasses this prohibition. Bell's concluding words are, “Long may Louis de Broglie continue to inspire those who suspect that what is proved by impossibility proofs is lack of inspiration.” Such advice must have gone straight to hearts of the *Fondation Louis de Broglie* group of physicists!

So, in the summer of 1951, Louis de Broglie, stimulated by Bohm's arguments and by his conversations with Vigier, began to reconsider his position. His new hesitations show up, here and there, in the text of his 1951–1952 lecture notes. And as, in the later years, he separated more and more from the Copenhagen–Göttingen “lobby,” he decided at first that he would not have these texts published. It is Georges Lochak, whose thinking was extremely near de Broglie's new one, and who had become the guardian

of his scientific papers, who—stricken by the importance and interest of these lecture notes—finally succeeded in changing de Broglie’s mind. The condition that had to be met was that some later additions, scribbled by de Broglie in the margins, be added, together with some explanatory notes by Lochak.

All this makes fascinating reading—even for one who has chosen a research strategy different from the one prevailing in the *Fondation de Broglie*!

I will not summarize the technical contents of these two courses, which are of a recognizable de Broglie style in his presentation of quantum mechanics. Starting from analytical mechanics and wave mechanics, the exposition proceeds *via* the Schrödinger rather than the Heisenberg approach, and in the idiom of both rather than that of Dirac. Among the questions considered are: Heisenberg’s uncertainty relations (discussed in great detail), the problem of statistical prediction and retrodiction, the 1935 Einstein–Podolsky–Rosen correlation and its 1927 Einstein forerunner (presented at the 5th Solvay Council), along with the “characteristic function” formalism as used by Arnous in his 1966 Ph.D. thesis.

If this writer may be allowed a personal remark, it is this: Not only does the abstract but efficient Dirac formalism not show up, but also the brand new and extremely powerful relativistic formalism of Tomonaga, Schwinger, Feynman, and Dyson is completely absent. This is in some sense surprising, as de Broglie’s 1924 doctoral thesis *was explicitly relativist*! I believe that these are two manifestations of de Broglie’s distrust against abstract formalisms—a distrust which, among other things, led him to view classical statistical mechanics in the Maxwell and Boltzmann rather than in the Gibbs style. During my ten years of intellectual intimacy with Louis de Broglie (1940–1950), I came to know well his defiance of the very idea of trying to “reconcile the relativity and the quantum theories” by means of an adequately devised formalism. I can even testify that (very paradoxically) Louis de Broglie had come to believe that such a “reconciliation” was utterly impossible!

It is not without some emotion that I closed the book after carefully perusing it, as I could almost hear Louis de Broglie speaking while *reading* him!

A very useful exhaustive list of de Broglie’s published papers, classified by species, ends the volume.

REFERENCES

1. D. J. Bohm, *Phys. Rev.* **85**, 166, 180 (1952).
2. J. S. Bell, *Found. Phys.* **12**, 989 (1982).

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