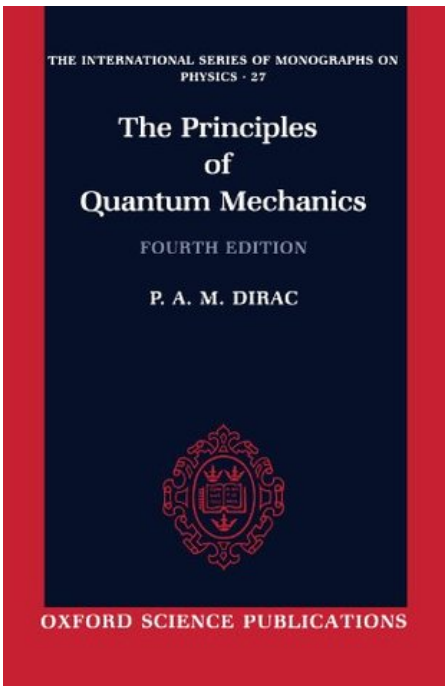

The Principles of Quantum Mechanics

Paul A.M. Dirac

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"The standard work in the fundamental principles of quantum mechanics, indispensable both to the advanced student and to the mature research worker, who will always find it a fresh source of knowledge and stimulation." --Nature "This is the classic text on quantum mechanics. No graduate student of quantum theory should leave it unread"--W.C Schieve, University of Texas

The Principles of Quantum Mechanics Details

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From Reader Review The Principles of Quantum Mechanics for online ebook

Mεδ Rεδ?α says

When the Master speaks !

Meet my expectations? How could it not? It is considered the "Bible" on the Theory. Furthermore, one of the best "popularized" books on Quantum Mechanics is the pocket sized "The Quantum World" which follows the topics in Dirac's "Quantum Mechanics" for laymen by Professor of Mathematical Physics, at Cambridge, J. C. Polkinghorne. He learned the subject attending PAM Dirac's classes from his own book. Professor PAM Dirac ended his days by retiring to a Professor Emeritus chair at Florida State University in Tallahassee, FL.

The book is just over 300 pages including the Index. It is of historical interest, mainly. There are better treatments of the subject, but this is an original work and stands monumental in that regard, historically. The originality and its place in history is this works strength and it stands on its own as a classic in modern theoretical physics, unmatched in many ways in that sense.

This book was first published in 1930. In 1928, Dirac's application of the relativistic treatment of spin-1/2 particles leads to both positive- and negative-energy solutions to the electron. This book was made new in paperback in 1981. It has been reprinted 9 times since. The last reprinting was in 1993. It has a Preface to the first edition, which you should read using the Amazon "Look Inside!" feature. You can view the Contents of the book there, too. There you will find that the book's contents are made up of twelve Chapters and a small Index.

Quantum reality places the subject back into the study of the objective world. Listen to the author in his own words:

"This state of affairs is very satisfactory from a philosophical point of view, as implying an increasing recognition of the part played by the observer in himself introducing the regularities that appear in his observations, and a lack of arbitrariness in the ways of nature, but it makes things less easy for the learner of physics."

If, in your enquiry into quantum mechanics, you have read about these philosophical changes brought about from the discovery of quantum reality, then reading the words of one of its legends will reinforce why many modern physicist's sound more like philosophers than physicists. Here is the author, again, in his own words:

"The methods of progress in theoretical physics have undergone a vast change during the present century. The classical tradition has been to consider the world to be an association of observable objects (particles, fluids, fields, etc.) moving about according to definite laws of force, so that one could form a mental picture in space and time of the whole scheme. This led to a physics whose aim was to make assumptions about the mechanism and forces connecting these observable objects, to account for their behaviour in the simplest possible way. It has become increasingly evident in recent times, however, that nature works on a different plan. Her fundamental laws do not govern the world as it appears in our mental picture in any very direct way, but instead they control a substratum of which we cannot form a mental picture without introducing irrelevancies."

In Chapter X "Theory of Radiation" Dirac derives his theory of radiation in which he connects bosons to oscillators. Relating a system "S (say a quantizied atom)to its Hermitian operator Ho," he was able to identify the states of an assembly of bosons with the states of a set of oscillators. "This means that *the dynamical system consisting of an assembly of similar bosons is equivalent to the dynamical system consisting of a set of scillators--the two systems are just the same system looked at from two different points of view.*" (Dirac pg 228-229). Von Neumann, probably the greatest mathematician of the 20th century, in his book "Mathematical Foundations of Quantum Mechanics", called Dirac's radiation theory "one of the most beautiful achievements in the quantum mechanical field." (Von Neumann, pg. 255)

In the last chapter, the author solves both a positive-energy and a negative-energy solution for an equation (now called the "Dirac equation") that applies relativistic solutions to the problem of particle physics, specifically, that of elementary spin-1/2 particles like the electron. The positive-energy solution is the electron. The author doesn't ignore the negative-energy solution, though! This is one of the philosophical differences between quantum mechanics and classical mechanics. Dirac simply allows the mathematical result of a negative-energy solution to suggest that another particle actually exists in reality, every way equal to that of the electron, but opposite in sign. This would be like an antimatter particle to the electron! This would be unheard of but perhaps for science fiction writers. Here is the author in his own words:

"In this way we are lead to infer that the negative-energy solutions of (56) refer to the motion of' a new kind of particle having the mass of an electron and the opposite charge. Such particles have been observed experimentally and are called *positrons*. We cannot, however, simply assert that the negative-energy solutions represent positrons, as this would make the dynamical relations all wrong. For instance, it is certainly not true that a positron has a negative kinetic energy. We must therefore establish the theory of the positrons on a somewhat different footing. We assume that *nearly all the negative-energy states are occupied*, with one electron in each state in accordance with the exclusion principle of Pauli. An unoccupied negative-energy state will now appear as something with a positive energy, since to make it disappear, i.e. to fill it up, we should have to add to it an electron with negative energy. We assume that *these unoccupied negative-energy states are the. positrons*"

The positron was confirmed by Carl Anderson just two short years later in 1932.

P.A.M. Dirac was an Englishman. Since he is one of the early founders and contributors to Quantum Mechanics, I suggest that you read up on him if you haven't learned that much about him in the past. I always appreciate a book more if I know a little bit about the author. In the Wiki on him I just learned that he married Eugene Wigner's sister. Cool. It is a small world.

I hope I have peaked your interest enough to make a purchase today.

Ahmed says

ert

Daniel Zaharevitz says

Dirac was one of the most original thinkers of the last century and you really get a sense of that in this book.

Probably one of the most abstract presentations of the subject, but to my mind at least, the most insightful.

Fahad says

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Skymeson Rolnick says

Dirac's view of Quantum Mechanics, very concise and to the point. Not a lot of giberish.

Engy Sherif says

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Hameednader Farraje says

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Valerii Ustyugov says

A very good book. The best I've read on quantum mechanics. A lot of plain explanation of what is happening behind the formulas. Recommend to improve understanding of physical principals behind quantum physics monstrous mathematics!

Ian Carmichael says

Beautiful science. Elegant and perfect mathematical physics, in a lovely binding and typeface from OUP.

Not a popular work. (You do need to know your physics and your mathematics!)

Belongs on shelves with G H Hardy's mathematics texts and Chandrasekhar's physics work.

Manuel Estrella Gonzalez says

¿Que clase de biblia es esta?

William Schram says

Paul A M Dirac, the man, the myth, the legend, discusses Quantum Mechanics and its results from the first principles. Starting with the idea of a state, Dirac goes on to mention Eigenvalues and Eigenvectors and Eigenstates, continuing the discussion with some very advanced mathematics. This treatise builds on itself, deriving solutions from previous examples and ideas. The book is even a good length. My only real complaint is that the edition of this I found is from 1930 and I thought the paper would be damaged by my touching it. However, it seems that this notion of mine was unfounded, the thing I really needed to worry about was the binding.

In any case, this book was quite well done. My impasse came about at around a quarter of the way through the book, when it became necessary to have differential equations and Linear Algebra under your belt. I would like to find a book that explains this sort of thing in a manner that I can understand. Perhaps I shall reach out for that sort of thing.

James Lyon says

Quantum mechanics from the mouth of one of the founders. Everything about his approach I found odd, yet novel. Recommended as a supplement, not a primary text.

Manny says

I read *Principles* shortly after graduating from college. I hadn't attended any of the courses on quantum mechanics, but a friend told me that if I read this book I'd understand what I'd missed. Good advice!

Dirac's intuition is amazing. He messes around with the equations, doesn't obviously seem to be going anywhere, and then suddenly arrives at a conclusion about the real physical world. The piece de resistance comes at the end, where he deduces the existence of the positron more or less from first principles; they were indeed observed experimentally a few years later. He did this work when he was in his mid 20s, and received the Nobel Prize for it when he was only 31.

Lee Smolin, in *The Trouble with Physics*, bemoans the fact that it's now almost impossible for young scientists to get funding to pursue speculative ideas of their own. They usually have to work with other people's ideas until they are in their late 30s at least, by which time it's often too late. When you look at Dirac's great book, you appreciate just how wrong that is.

Noura says

The English background most people have in science makes it difficult to catch up with the information.

Nayara Ferreira says

superb, thanks paul!
