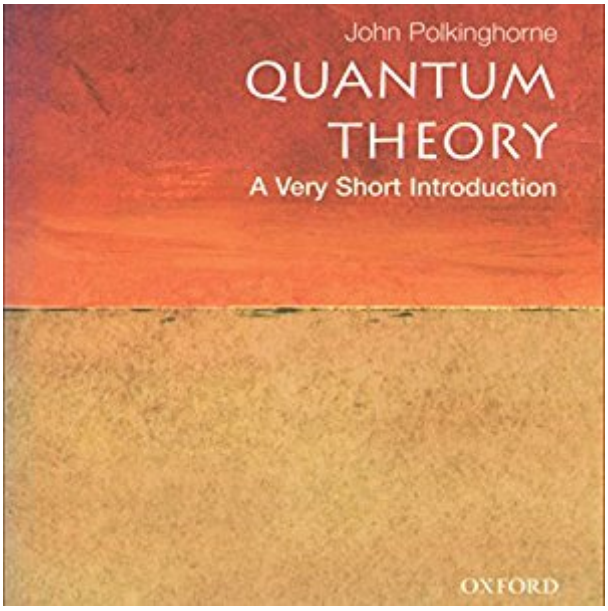
Quantum Theory: A Very Short Introduction



Synopsis

Quantum theory is the most revolutionary discovery in physics since Newton. This book gives a lucid, exciting, and accessible account of the surprising and counterintuitive ideas that shape our understanding of the sub-atomic world. It does not disguise the problems of interpretation that still remain unsettled 75 years after the initial discoveries. The main text makes no use of equations, but there is a Mathematical Appendix for those desiring stronger fare.Uncertainty, probabilistic physics, complementarity, the problematic character of measurement, and decoherence are among the many topics discussed. This volume offers the reader access to one of the greatest discoveries in the history of physics and one of the outstanding intellectual achievements of the 20th century.

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Customer Reviews

This book does its best, but in the end suffers from something that I think is inherent in the material itself. I did learn a little more about quantum theory from this book, but not much more than I already knew to begin with. And this book didn't really make many of the main concepts any clearer. I don't think is the author's fault, I think it's almost impossible to try to explain these things. Most of the problem, (and similar statements go for cosmology, cryptography, etc.) is that it's almost impossible to explain concepts whose fundamental expression is mathematical language without using mathematics. What inevitably results is some kind of vague, touchy-feely idea of what's meant, but little understanding. And I say this as a mathematician.To give just one example, at one point in the book, the author talks about "probability amplitudes", for several pages. The only problem is, he

never says what this term is supposed to mean, but he does mention that complex numbers are involved, and other facts. The result after this happens several times is that the reader starts to read entire paragraphs consisting of terminology that’s never been defined clearly. The word "operator" is the best example here. It’s fine to talk ABOUT operators in indirect, oblique language, but really you don’t have a true understanding of what that word means unless you know its precise mathematical definition, or unless you have a clear understanding of the notion of vector space (axiomatically, not "stuff you can add together").

This pocket-sized, 92-page text--113 pages with appendices and index--professes to be a "very short introduction" to an understanding of quantum theory, to the unseen world that’s so many millions of times smaller than even atoms.It’s not at all a bad summary of the field of quantum mechanics, written fairly lucidly, concisely, and with interest, but I’d have to say it’s lacking as an introduction to the subject, in that it really does assume its readers are intelligent people with something of a science background. Do not buy this expecting it to be QUANTUM THEORY FOR DUMMIES, because it’s still fairly dense and heavy, and not written as clearly or as startlingly as much of Stephen Hawking’s stuff. To some readers, this assumption of their intelligence may be refreshing, and it is to a degree, but with a subject as complex and bizarre as quantum mechanics, most non-scientists will need as much help as they can get, help not necessarily to be found in here.I do have to say, though, that this is a book worth reading, and, then, re-reading. After I read it, I went back through and looked up a few of the more major concepts--quantum entanglement, in which two particles that interact will continue to affect each other no matter how far apart they’re separated; SchrÃ¶dinger’s Cat and the idea of a state between life and death, between here and there, between being and non-being; Heisenberg’s Uncertainty Principle and how you can’t have a knowledge of both position and momentum of a particle; et cetera--and just that brief re-reading was a huge help to me.

I love these "Short Introduction" books. They give you a brief overview of various interesting subjects. I would have to say that this is one of the more difficult ones to understand. John Polkinghorne is a very astute writer, and he does a brilliant job of summarizing this inextricably complex subject. I’ll let him describe the intended reader. "Although the full articulation of the theory requires the use of its natural language, mathematics, many of its basic concepts can be made accessible to the general reader who is prepared to take a little trouble in following through a tale of remarkable discovery." Yes, I think most "general readers" will have a "little trouble" following the

material. That said, what does he cover?He starts by covering some basic concepts such as the particle nature of light, spectra, and the nature of the atom. Chapter 2 is quite difficult to follow. You will be introduced to matrix, wave, and quantum mechanics; there is also information on the double slit experiment and superposition. But the section on probabilities, observables, Hilbert space, vectors, eigenvectors, and eigenvalues is a little deep. He continues to discuss the uncertainty principle, complementarity, and decoherence. When talking about decoherence, Polkinghorne elaborates on something called the "measurement problem," which has to do with the collapse of the wave function where "the superposition principle holds together alternative, and eventually mutually exclusive, possibilities right until the last moment, when suddenly one of them alone surfaces as the realized actuality." There are a number of theories about what exactly happens here and he devotes a few paragraphs to each. In the end, he notes that we still really do not understand what is going on.