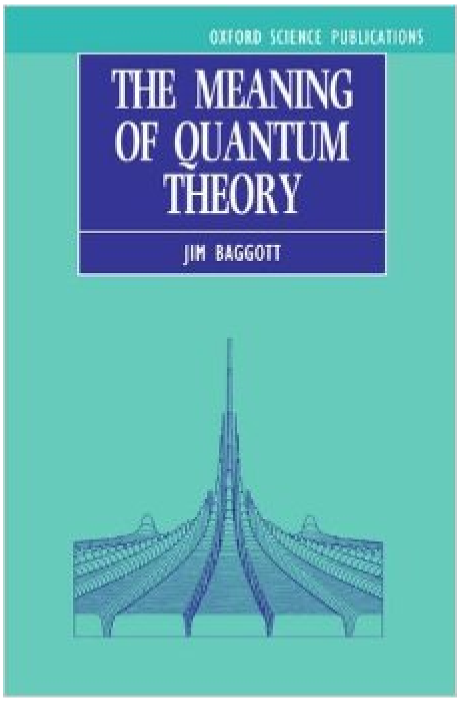
The Meaning Of Quantum Theory: A Guide For Students Of Chemistry And Physics (Oxford Science Publications)



Synopsis

Why is quantum theory so difficult to understand? In this book, written for both undergraduate and graduate students of chemistry and physics, the author looks at the continuing debate about the meaning of quantum theory. The historical development of the theory is traced from the turn of the century through to the 1930s, and the famous debate between Niels Bohr and Albert Einstein. The book examines in detail the arguments that quantum theory is incomplete, as made by Einstein, Boris Podolsky, and Nathan Rosen; the development of Bell's theorem; and crucial experimental tests performed in the early 1980s. Alternative interpretations -- pilot waves, quantum gravity, consciousness, and many worlds -- are described in the closing chapter.

Book Information

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Customer Reviews

I have a fascination for books on the meaning of quantum theory. Many target the layman and dispense with mathematics. Others assume the reader is adept at applying both wave mechanics and matrix mechanics to quantum problems. Published by Oxford University Press, "The Meaning of Quantum Theory", strikes a good balance that is ideal for undergraduate students of physics and chemistry, and is especially useful as a companion for a formal text on quantum theory.The author, Jim Baggott, combines his experience as a freelance science writer with his skill as a respected lecturer in physical chemistry. In 1989 he was awarded the Marlow Medal from the Faraday Division of the Royal Society of Chemistry for his research contributions in chemical kinetics and spectroscopy. Baggott is an exceptional writer and I enjoy reading sections at random. I have twice read his book and probably will do so again.About quantum theory Baggott says, "For the first time, students are taught about a theory which they have to accept and which they have to learn how to apply, but which they cannot be expected to be told its meaning." Baggott argues that beneath the mathematical formalism of quantum mechanics, there exists an interpretation, and a philosophy, that warrants investigation.The first chapter (40 pages) offers a historical overview of the early development of quantum theory that is probably familiar to many readers.Chapter 2 (35 pages), titled "Putting it into Practice", differentiates Baggott's work from many others. We learn about operator algebra, and then we encounter experimental evidence that we must either use non-commuting matrices, or non-commuting operators, to describe position-momentum relationships in quantum physics.

This book covers pretty much the same ground as Gribbins "In Search of Schrodingers Cat", but does so in a more mathematical manner. The math is not overly complex, it does not go beyond algebra, but does use very complicated notation systems (including Dirac's bracket notation). The reader should be familiar with the concept of an operator and not be frightened by the sight of partial differential equations, although none are actually solved. The book is aimed at students of Chemistry and Physics, but it is not a textbook per se, but rather an adjunct to a quantum theory text. This book is about the meaning of quantum theory, rather than about solving specific quantum problems. It focuses on the implications of the various interpretations of quantum theory. It not only goes into the standard Copenhagen interpretation (developed by Niels Bohr and colleagues) and the objections to it raised by Einstein and others, but also goes into several other interpretations, such as Einstein's hidden variable idea, DeBroglie's pilot waves and Bohm's quantum potentials. Baggott not only develops these other ideas, but also shows where many have been abandoned by their developers or proved to be inconsistent with quantum theory and experimental data.By using some math the book Baggott is able to derive the Schridinger wave equation is a very simple manner. This derivation comes from Schrodingers own notebooks and is much simpler than the more sophisticated one that Schrodinger used in his paper describing the wave equation. Baggott also shows where the uncertainty principle comes from and why it is inherent in the mathematics of wave and matrix mechanics because it is a feature of all non-commuting operators.

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