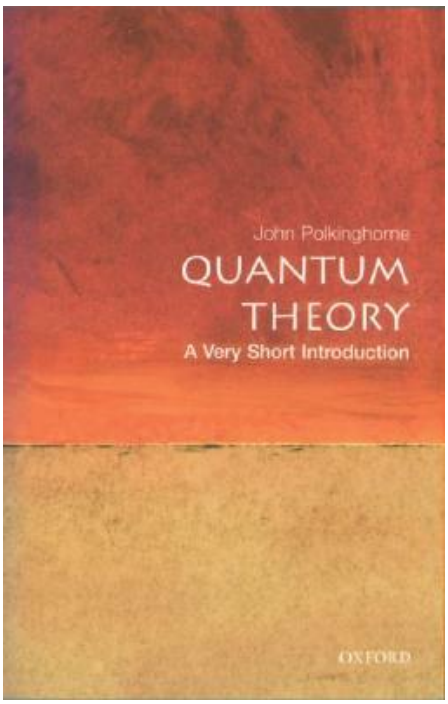

Quantum Theory: A Very Short Introduction

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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 twentieth century.

About the Series: Combining authority with wit, accessibility, and style, **Very Short Introductions** offer an introduction to some of life's most interesting topics. Written by experts for the newcomer, they demonstrate the finest contemporary thinking about the central problems and issues in hundreds of key topics, from philosophy to Freud, quantum theory to Islam.

Quantum Theory: A Very Short Introduction Details

Date	:	Published 2002 by Oxford University Press
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Author	:	John C. Polkinghorne
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Genre	:	Science, Physics, Nonfiction, Philosophy, Popular Science

From Reader Review Quantum Theory: A Very Short Introduction for online ebook

Gendou says

A short overview which wastes time in the mire of philosophy and metaphysics.
Sadly avoids mathematics, which is typical for a popular science book.
Still, quite informative for the newcomer and good review for those already familiar with the topics.

Bob Nichols says

Polkinghorne's preface opens with this statement: "The discovery of modern quantum theory in the mid-1920s brought about the greatest revision in our thinking about the nature of the physical world since the days of Isaac Newton. What had been considered to be the arena of clear and determinate process was found to be, at its subatomic roots, cloudy and fitful in its behavior. Compared with this revolutionary change, the great discoveries of special and general relativity seem not much more than interesting variations on classical themes."

For Polkinghorne, the quantum world is more than just small (where at the Planck scale "a row of dots looks like a solid line"). At the nucleus level, subatomic particles behave differently than in the deterministic universe of Newton and Einstein, where linear cause and effect relationships are clear. Rather, in the quantum world, there's Heisenberg's uncertainty and its "epistemological principle of ignorance" regarding position and momentum that lies at the core of reality. Polkinghorne writes of quantum logic that, as opposed to an Aristotelian true/false dynamic, includes a "maybe," where what can be said about electrons can only be stated in probabilistic terms. In quantum mechanics, a particle can jump through barriers "provided it reaches the other side quickly enough to pay back energy within the necessary time limit. It is as if the particle had tunneled through the hill." Per Feynman, we have virtual particles without physical mass that exist as intermediate particles, different than what exists initially or at the end of a process. Polkinghorne states that even Newtonian mechanisms exhibit quantum properties – when very small disturbances make "their future behavior beyond our power to predict accurately. These chaotic systems (as they are called) soon come to be sensitive to detail at the level of Heisenberg uncertainty or below."

Polkinghorne writes that within a vacuum, the lowest energy state, there is still "an infinite collection of harmonious oscillation" with specific frequencies. Even in empty space, particles move (there's "zero point motion"). A vacuum "is a humming hive of activity," he says. "Fluctuations continually take place, in the course of which transient 'particles' appear and disappear. A quantum vacuum is more like a plenum than like empty space." Finally, at the heart of the quantum world, Polkinghorne writes that there is a "deep-seated relationality" or correlation between two events where "entities that have interacted with each other remain mutually entangled, however far they may eventually separate spatially." This, for Polkinghorne, means that at the smallest levels of matter and energy there's more than pure atomism that is involved.

Polkinghorne closes with a chapter on "lessons and meanings." His quantum world counters positivism with its self-imposed limitation on using only observational data. For him, the quantum world of electrons and photons, quarks and gluons are real, operating at very small scales. They don't overturn classical theory but they make "intelligible great swathes of physical experience that otherwise would be opaque to us." The quantum world is a relational reality that transcends atomism. And, he advises, the quantum world is

anything but arbitrary. In fact, he argues that it accounts for the fundamental stability of atoms. While probabilistic and not deterministic, and while it operates in a “wraithlike” fashion, the quantum world has order and stability. And “random subatomic uncertainty is very different, indeed, from the exercise of the free will of an agent,” he says for those who attempt to use the meanings of quantum physics this way.

Polkinghorne draws heavily on the work of Dirac. This book, while short, is a lucid description of a complex subject.

Abhijeet Jain says

The first half of the book is great, briefly explains all the theories involved in formation of Quantum theory. The second half wasn't something I was expecting, it was way to tough for me though I have read few other books on the same subject no one talked about the actual maths. The author tried to explain some mathematics related to quantum theory very briefly which wasn't actually needed in a book meant for general public. For people who don't have major in Quantum theory will surely feel uneasy in the second half. Verdict : it's worth reading, leave it when mathematics hits you !

Nick says

Its what it says

Jay Caselberg says

Obtuse and really giving nothing informative rather than multiple references to how the author spent much time listening to the lectures of such a great man. Came out really knowing nothing more than when I went in.

Arko says

Very crisp and clear content. A must read for science lovers.

Nathan says

A good, short overview of quantum theory, but unfortunately does not to a very good job as an introduction, making assumptions about the reader's knowledge of the subject. I fortunately already had some background with quantum theory, but others may have trouble making their way through this book

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Ryan Cutter says

After indulging in many texts themed around quantum mechanics, this particular book came as a relief to me. To my slight frustration many readers seem to think that this particular subject can just be explained with no mathematical detail; it is quite the contrary. Polkinghorne has done a fine job articulating the basic concepts of quantum mechanics while keeping in the minimal amount of maths needed to retain this fundamental understanding. Anyone who claims there are 'better' books on the subject with less maths, unfortunately, have been deluded by their ideas on understanding the topic. My single gripe with the book is centered around the layout, I prefer the hard bits to be integrated with the main text rather than in an appendix at the end. Although you can reference to it immediately, my brain is wired so it doesn't process as nicely if the information isn't on the same page.

Fakhour Mohammed says

I think I can safely say that no one understands quantum mechanics - Richard Feynman

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Oveis says

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Remedy Loame says

Very accessible, took a little chewing sometimes (probably because my physics background is minimal) but there are some nice slices of science history to be had. I'm sure there are plenty of more substantial books on quantum theory out there, but this was a nice sampling of concepts.

Nitpick: Used the words "fitful" and "cloudy" too much.

Joseph Sverker says

Well, this was a truly impressive work. Polkinghorne manages to explain quantum theory and much more I think. He packs so much of interest into this book that it is a miracle how it can be so short. It is also quite

complex I would say (a complex subject though!) that I wonder if it should be called "introduction". That is not a comment against the clarity of view, but a comment on the depth that I think he manages to reach.

Steve says

Polkinghorne, a student of the great Paul Dirac, may have achieved an undeniable eminence in his field, but I'm afraid I was left mostly unimpressed by this attempt to communicate his ideas. Not only one of the weaker books on quantum theory, but also one of the weaker entries in the Very Short Introduction series as a whole (well, of the few dozen I've read).

Two main problems I had with it:

1) Mathematical: It assumes too much of the reader in the way of complex numbers, probability amplitudes, etc. Of course some assumptions of knowledge have to be made, even in something calling itself an introduction - but the author could have done more to elaborate on some of the more vital mathematical content, even without resorting to formulae.

2) Another problem - a surprising one - is its philosophical flakiness. Polkinghorne seems to make some astonishingly flimsy arguments, particularly in the section on positivism. For someone so intellectually gifted, his sloppy reasoning here disappointed me.

And to be frank, the explanations are really not the best. I don't doubt Polkinghorne is (was) a great scientist. Just a shame that, on the basis of this book, he seems to have fallen short as a scientific communicator.

If you want to get up to speed on the fundamentals of this subject, there are more informative and inspirational books out there:

- Quantum: A Guide for the Perplexed - twice the price, but will probably leave you ten times more informed.
- Six Easy Pieces - Feynman's compendium has a good section of quantum theory.
- Fabric of the Cosmos - Brian Greene's magnificent tome also offers a solid foundation.

Ahmad Sharabiani says

Quantum Theory: A Very Short Introduction (Very Short Introductions #69), John Polkinghorne

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 twentieth century.

Christopher says

The insights of quantum physics are key to many technologies we use today, and yet most people are unaware of the key discoveries made already a century ago now, being familiar only with the "classical physics" of their basic high school or university science classes. Though I had an inkling of what I was missing out on from being a great reader of hard science-fiction, I needed to familiarize myself with the basics of field, and John Polkinghorne's slim volume in the Oxford "A Very Short Introduction" series seemed convenient.

Indeed, at little over 100 small-format pages, Polkinghorne does present enough of the field to make you feel like you know the ramifications, even if the real theory is forever beyond you. Polkinghorne only brings in one advanced mathematical concept in the body of the text, eigenvectors, and even that single recourse to maths will probably be too daunting for most readers. Furthermore, even without mathematics, Polkinghorne's writing can often become very egg-headed and opaque, and I was very surprised that his editor at Oxford University Press let all this stand. Clearly no one was able to put themselves in the shoes of a layman reader.

Still, readers will enjoy Polkinghorne's historical tales on how famous physicists of the early 20th-century were forced to drastically revise their views when simple experiments did not turn out the way they expected. I am familiar with this book and Cox and Forshaw's *The Quantum Universe*, and this book is better because it will leave you just as (badly) informed, but it is much shorter than Cox & Forshaw and lacks an annoying rhetorical device in their book.

After a productive academic career, Polkinghorne left physics in the late 1970s and became an Anglican priest. His Christian beliefs make absolutely no appearance in the book, and while he dedicates some space to opposing philosophical views on quantum reality, he points to other scientists, never himself.

At the end of the book, Polkinghorne tries to deflate "quantum hype", the use of new physics to pitch flim-flam. However, what he has in mind among some New Agers is that quantum theory supports ESP. In the years since its 2002 publication date, quantum theory has often been misused by self-help businessmen who claim quantum theory proves that one's thoughts influence the universe, so think positive for riches, but Polkinghorne didn't debunk this form of hype.