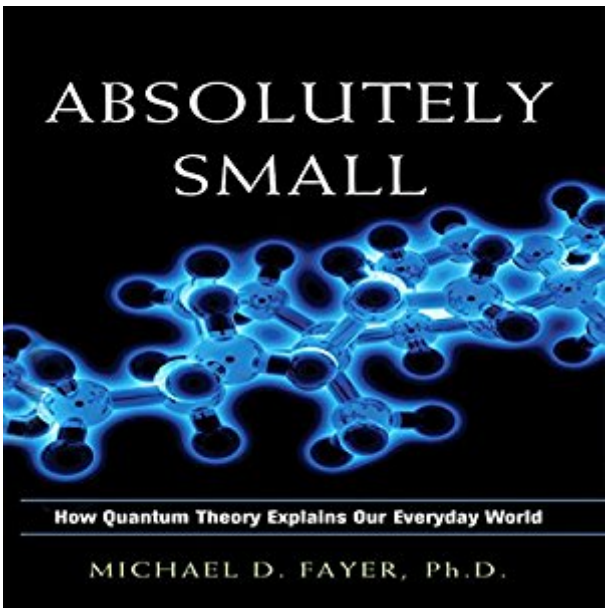
Absolutely Small: How Quantum Theory Explains Our Everyday World



Synopsis

Our intuition about how things should behave is usually right in the everyday world. We see the baseball soar in the air, arc, drop, and lie stationary on the ground. Through data gathered by our senses and basic knowledge of the laws of classical mechanics, the motion of a ball makes perfect sense.But enter the world of the tiniest particles on earth-the motion of electrons, the shapes of molecules-and everything we think we know about the world radically changes. To understand what's really happening in the world around us, to comprehend the mysterious, counterintuitive science of the small, we must take a quantum theory view of nature. Like no other book before it, Absolutely Small makes the inherently challenging field of quantum theory understandable to nonscientists, without oversimplifying and without bogging down in complicated math. Written by an award-winning professor at Stanford University, the book uses clear explanations and real-world examples instead of dense equations to help you understand:Why strawberries are red and blueberries are blueHow particles can change from "mixed states" to "pure states" based solely on observation How a single photon can be in two places at the same timeWhy quantum matter sometimes acts like particles, and other times like wavesWhy a piece of metal will glow red when it is hot, and turn blue when it's even hotterWhat makes salt dissolve in water, while oil does not, and much moreIn the tradition of Stephen Hawking and Lewis Thomas, but without the rigorous mathematical requirements, Absolutely Small demystifies the fascinating realm of quantum physics and chemistry, complete with compelling accounts of the scientists and experiments that helped form our current understanding of quantum matter.

Book Information

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Customer Reviews

Professor Fayer utilizes the reflexes and guidance of a supurb teacher in taking the reader from basic quantum concepts to deeper levels, building and expanding as each page turns in a satisfying stepwise process. He takes care to relate quantum theory to our everyday experiences explaining how the mind and body discriminate and interpret quantum effects and actions. Another teaching skill frequently found is Professor Fayer's understanding that students may need their recall refreshed at various points without having to thumb back many pages for a definition or explanation. He "tells you what he's going tell you...then he tells you...then (when needed) he tells you what he told you."The treatment of the orbital levels of the atom and the bonding within and between molecules is the best I have ever seen. In fact, the descriptions I have seen just didn't paint the complete picture...but here Professor Fayer presents each brush stroke successively composing these difficult concepts into an understandable picture. It's all there, and if some particular aspect is a bit foggy in the reader's mind, no problem, this book is an excellent resource. Just go back and review...it's all there.

I minored in physics at the university and survived 3 years of it because I was good at math. My courses in physics stopped with Maxwell, so I didn't get into quantum mechanics or relativity. After retiring I decided to keep my mind active by going over my toughest courses that I had taken, essentially analytical mechanics and electricity and magnetism. I had a 1935 edition of Linus Pauling's Quantum Mechanics that my father had used while he was studying for his Ph.D. in chemistry at Purdue University. I got through 50 pages, but I didn't get much of a mental picture, so I decided to try to find texts that were more descriptive. I read Gamow's Thirty Years That Shook Physics and some Feynman. These definitely helped. When I noticed that Leonard Susskind, two books of whom I had read, recommended Absolutely Small, I ordered it. Now after having carefully read it, I feel that I understand these things to a moderate degree, and I am more content than before, that the universe makes more sense to me. The best aspect of this book is that it motivates in an intuitive manner the meaning of Schrodinger's equation and Heisenberg's Uncertainty Principle, both of which I previously was aware of, but didn't understand the "why" of. When one starts to understand something that was an enigma before, a kind of light gets turned on and one thinks "That's Cool." To all curious people who want to know more about reality in this sense, I heartily recommend this book. It was a breakthrough for me.

Echoing other reviews, I liked this book but it's certainly not for everyone. Chapters 1-10 are an excellent primer on basic quantum theory. Chapters 11-14 on chemistry fundamentals are much

more challenging- and a chemistry background would be very helpful. The rest of the book is on "applications" (alcohol, fats, CO2, conductors, etc.)- thankfully, it’s not necessary to fully understand chapters 11-14 to appreciate this section.Overall, this is one of the best QM books for those who are interested in the technical details (without overwhelming math)- two other outstanding books are Susskind’s Quantum Mechanics (2014) and Gerry’s Quantum Divide (2013).By the way, I bet this book’s sales would be higher if the title was "Quantum Small"- it doesn’t readily show up as a QM book when doing a search on .

Finally, a book about the essentials of quantum physics that actually discusses those essentials clearly and in adequate detail that beginners may, with some effort, glean understanding.Fayer initially establishes the classical context that forced the quantum revolution because specific experimental results could not be explained through classical theories. Other books discuss this history, things like the photo-electric effect and the black-body radiation dilemma, but Fayer puts it in an experimental context and demonstrates why quantum perspectives were necessary to solve and explain these and other puzzles that emerged as classical physics reached explanatory walls or barriers.By walking the reader through the Periodic Table to emphasize the roles that quantum effects play in structuring atoms and enabling molecular bonding, Fayer reveals better than any of the dozens of books I have read on quantum topics how everyday phenomena owe much of their character to the quantum constraints of size and the complementarities where Uncertainty lurks.Philosophically speculative books on the "meaning" of quantum physics abound, some interesting, some intriguing, and many appear off some deep end. If such a search for meaning is your only interest, this is not the book you want. That Fayer does not engage in such speculation is a strength of his book. He maintains his attention to elucidation of the known characteristics and effects of quantum bedrock, albeit superpositioned bedrock. No single book ever fully exhausts the possibilities for exploration of a topic. Fayer, however, provides, through his discussion of the elements and the ways that electrons fill the orbitals (atomic and molecular bonding and nonbonding), a solid base for his excellent examples of why these things are important to us in our encounters with the resulting chemistries that may do us well or do us harm or even do us in.Close attention to the graphics and the verbal descriptions of what they convey pays off for the reader. Absorption rates vary, but quantum leaps of understanding make an appealing metaphor. I think even Robert Pirsig would say this book embodies quality. I know it does for me. Kudos again, Mike.

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