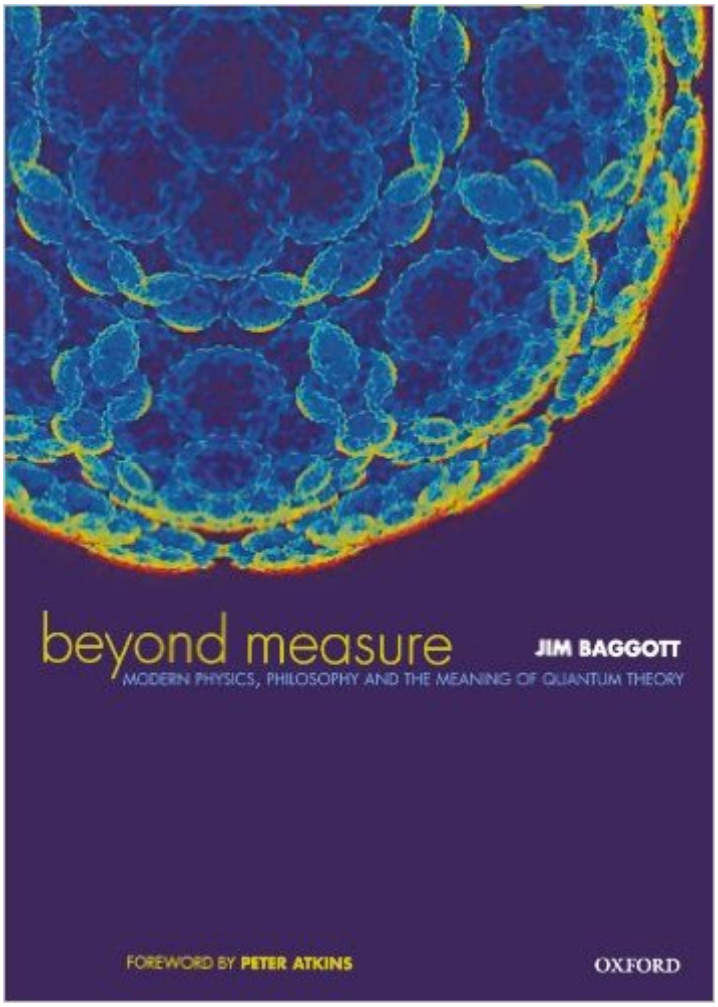
Beyond Measure: Modern Physics, Philosophy, And The Meaning Of Quantum Theory



Synopsis

Quantum theory is one the most important and successful theories of modern physical science. It has been estimated that its principles form the basis for about 30 per cent of the world's manufacturing economy. This is all the more remarkable because quantum theory is a theory that nobody understands. The meaning of Quantum Theory introduces science students to the theory's fundamental conceptual and philosophical problems, and the basis of its non-understandability. It does this with the barest minimum of jargon and very little mathematics in the main text. Readers wishing to delve more deeply into the theory's mathematical subtleties can do so in an extended series of appendices. The book brings the reader up to date with the results of new experimental tests of quantum weirdness and reviews the latest thinking on alternative interpretations, the frontiers of quantum cosmology, quantum gravity and potential application of this weirdness in computing, cryptography and teleportation.

Book Information

Paperback: 400 pages

Publisher: Oxford University Press; 1 edition (January 1, 2004)

Language: English

ISBN-10: 0198525362

ISBN-13: 978-0198525363

Product Dimensions: 9.4 x 0.7 x 6.6 inches

Shipping Weight: 1.8 pounds (View shipping rates and policies)

Average Customer Review: 5.0 out of 5 starsÂ Â See all reviewsÂ (9 customer reviews)

Best Sellers Rank: #399,276 in Books (See Top 100 in Books) #19 inÂ Books > Science & Math > Chemistry > Physical & Theoretical > Quantum Chemistry #357 inÂ Books > Science & Math > Chemistry > Organic #420 inÂ Books > Science & Math > Physics > Quantum Theory

Customer Reviews

Two thumbs up (in superpostion)! By far the best overview of Quantum theory that I've read thus far (out of 10 books). The author doesn't pick and choose from the competing interpretations of QT to advance an agenda, (philosophical, social, political, or scientific). QT development is presented in its historical context with all the resistance that accompanies new theories. Alternatives to the orthodox Copenhagen interpretation are fairly presented. All the mathematics are thankfully placed in appendices at the end of the book. Still, some of the text explaining experimental setup and reasoning was too technical for me, but I grasped the gist of the "interpretation." The meaning of QT

is still being debated. The many interpretations articulated in the many theories designed to explain microphysics phenomena essentially boil down to 2 competing metaphysical postions: the "anti-realist" Copenhagen interpretation (Heisenberg, Bohr, Pauli) and the "realist" hidden variables interpretation (Einstein, Schrodinger, Bohm, etc.). This is obviously an oversimplification, but I can confidently now state that I understand that I don't understand Quantum Theory.

Jim Baggott has done a great job of going through non-relativistic, with a smattering of relativistic, quantum mechanics. In the book's appendices there are clear, and concise mathematical explanations of the basic framework of quantum mechanics that anyone, with a working knowledge of algebra, should have no problems with. The book doesn't just deal with the physics of quantum mechanics, but also touches on the philosophical interpretations of what it may mean. It does all of this in an accessible way, without getting over-technical, and without getting airy fairy. This book always remains grounded in science, and I would recommend it to any lay person interested in learning more about quantum mechanics, and especially to college students taking courses in quantum mechanics. And for that matter, I think post-graduates will find this book an interesting, and rewarding read too.

The finest presentation of the history, conceptual and philosophical issues, experimental basis, and interpretations of quantum mechanics that one is likely to find in print. Beautifully clear in exposition, and disinterestedly fair in presenting the spectrum of interpretations and alternative theories, whether they be tainted with metaphysics as the last bastion of the realist, or they offer little explanatory-satisfaction given the rejection of that role in science by the positivist. De facto, the book to read as a primer to a text.The only (slightly) negative critique I can make is that, in the discussion of the philosophy of Hume, Leibniz, Kant, Realist vs Positivist [.etc..],... Baggott misses an opportunity to associate Kant's profound epistemology to the non-intuitive nature of QM. Which is to point out that rather than our core concepts [space, time, causality, separability, locality, simultaneity,...] having been derived from experience, they are rather a-priori conditions for [macroscopic] experience to be possible in the first place; they are hard-wired forms of understanding given the nature of mind. Our minds evolved to synthesize macroscopic experience for the understanding,... and therefore is equipped with an artificial conceptual framework, one not consistently compatible with microscopic reality. The act of observation necessarily conforms the otherwise formless underlying reality within our a-priori concepts, ... resulting in inconsistencies, This formless independent underlying reality is objective but unknowable in itself, ...Kant's

Noumenon. John von Neumann was correct to place the collapse of the wavefunction in consciousness [mind]. An epistemological explanation to the measurement problem is orders of magnitude more scientific than any unobservable metaphysical one, as the mind in principal can be investigated, while the multi-verse or guiding waves, etc, can not.

I am very interested in the question of the _meaning_ of quantum theory, so I've spent a fair bit of time looking for and reading books/articles on the topic. There are plenty of good popular books on the _implications_ of quantum theory, and of course there are libraries of technical literature devoted to these implications. Unfortunately there is very little recent comprehensive and coherent work on meaning. This stems from the "shut up and calculate" approach that took over around World War II and held sway until fairly recently - pondering the meaning of quantum theory was viewed as idle speculation unworthy of a physicist of ability. I think that the cultural and historical origins of this attitude and its lengthy dominance are very interesting, but I think the resulting milieu did a major disservice to physics as "natural philosophy". The good news is that there has been an opening up to these more philosophical questions (I think that the experimental tests of Bell's inequalities were a key driver here). There are now quite a few books addressing meaning, but "Beyond Measure" stands out among popular treatments. The book is "popular" only by a hair - while equations are eschewed in the main body of the text, there is little hand-waving or generalizations - the arguments are meaty. (Additionally a sixty-page technical appendix is included to support the main body.) Baggott combines history, implications and measurements, interpretations, and the (reasonably) current state of speculation in a strongly-written, comprehensive and coherent overview. There are no real answers here - you couldn't expect any - but the book is a singular guide to further thought and reading. (Here the bibliography is a further point of excellence.) Highest recommendation.

to Measure Up: Getting Free from the Demands, Expectations, and Intimidation of Well-Meaning People Quantum Runes: How to Create Your Perfect Reality Using Quantum Physics and Teutonic Rune Magic (Creating Magick with The Universal Laws of Attraction Book 1) Quantum Thermodynamics: Emergence of Thermodynamic Behavior Within Composite Quantum Systems (Lecture Notes in Physics) Quantum Mechanics and Quantum Field Theory: A Mathematical Primer The End of Comparative Philosophy and the Task of Comparative Thinking: Heidegger, Derrida, and Daoism (SUNY Series in Chinese Philosophy and Culture) ... Chinese Philosophy and Culture (Paperback)) Beyond Measure: Rescuing an Overscheduled, Overtested, Underestimated Generation Many-Body Quantum Theory in Condensed Matter Physics: An Introduction (Oxford Graduate Texts) Thirty Years that Shook Physics: The Story of Quantum Theory Quantum Theory of Many-Particle Systems (Dover Books on Physics) The Solid State: An Introduction to the Physics of Crystals for Students of Physics, Materials Science, and Engineering (Oxford Physics Series) Problems and Proofs in Real Analysis: Theory of Measure and Integration Probability and Measure Theory, Second Edition