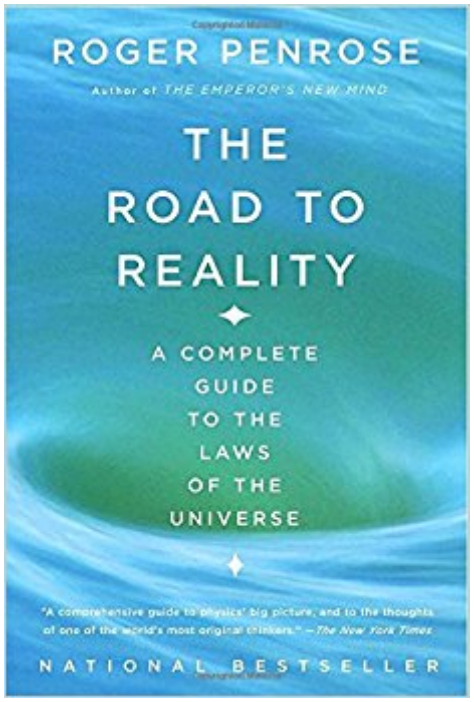
The Road To Reality: A Complete Guide To The Laws Of The Universe



Synopsis

Roger Penrose, one of the most accomplished scientists of our time, presents the only comprehensive and comprehensible account of the physics of the universe. From the very first attempts by the Greeks to grapple with the complexities of our known world to the latest application of infinity in physics, The Road to Reality carefully explores the movement of the smallest atomic particles and reaches into the vastness of intergalactic space. Here, Penrose examines the mathematical foundations of the physical universe, exposing the underlying beauty of physics and giving us one the most important works in modern science writing.

Book Information

Paperback: 1136 pages

Publisher: Vintage; Reprint edition (January 9, 2007)

Language: English

ISBN-10: 0679776311

ISBN-13: 978-0679776314

Product Dimensions: 6.1 x 1.2 x 9.3 inches

Shipping Weight: 2.4 pounds (View shipping rates and policies)

Average Customer Review: 4.3 out of 5 stars 276 customer reviews

Best Sellers Rank: #130,040 in Books (See Top 100 in Books) #57 inÃ Â Books > Science & Math > Physics > Mathematical Physics #120 inÃ Â Books > Health, Fitness & Dieting > Diseases & Physical Ailments > Nervous System #166 inÃ Â Books > Textbooks > Science & Mathematics > Astronomy & Astrophysics

Customer Reviews

If Albert Einstein were alive, he would have a copy of The Road to Reality on his bookshelf. So would Isaac Newton. This may be the most complete mathematical explanation of the universe yet published, and Roger Penrose richly deserves the accolades he will receive for it. That said, let us be perfectly clear: this is not an easy book to read. The number of people in the world who can understand everything in it could probably take a taxi together to Penrose’s next lecture. Still, math-friendly readers looking for a substantial and possibly even thrillingly difficult intellectual experience should pick up a copy (carefully--it’s over a thousand pages long and weighs nearly 4 pounds) and start at the beginning, where Penrose sets out his purpose: to describe "the search for the underlying principles that govern the behavior of our universe." Beginning with the deceptively simple geometry of Pythagoras and the Greeks, Penrose guides readers through the

fundamentals--the incontrovertible bricks that hold up the fanciful mathematical structures of later chapters. From such theoretical delights as complex-number calculus, Riemann surfaces, and Clifford bundles, the tour takes us quickly on to the nature of spacetime. The bulk of the book is then devoted to quantum physics, cosmological theories (including Penrose's favored ideas about string theory and universal inflation), and what we know about how the universe is held together. For physicists, mathematicians, and advanced students, The Road to Reality is an essential field guide to the universe. For enthusiastic amateurs, the book is a project to tackle a bit at a time, one with unimaginable intellectual rewards. --Therese Littleton --This text refers to an out of print or unavailable edition of this title.

At first, this hefty new tome from Oxford physicist Penrose (The Emperor's NewMind) looks suspiciously like a textbook, complete with hundreds of diagrams and pages full of mathematical notation. On a closer reading, however, one discovers that the book is something entirely different and far more remarkable. Unlike a textbook, the purpose of which is purely to impart information, this volume is written to explore the beautiful and elegant connection between mathematics and the physical world. Penrose spends the first third of his book walking us through a seminar in high-level mathematics, but only so he can present modern physics on its own terms, without resorting to analogies or simplifications (as he explains in his preface, "in modern physics, one cannot avoid facing up to the subtleties of much sophisticated mathematics"). Those who work their way through these initial chapters will find themselves rewarded with a deep and sophisticated tour of the past and present of modern physics. Penrose transcends the constraints of the popular science genre with a unique combination of respect for the complexity of the material and respect for the abilities of his readers. This book sometimes begs comparison with Stephen Hawking's A Brief History of Time, and while Penrose's vibrantly challenging volume deserves similar success, it will also likely lie unfinished on as many bookshelves as Hawking's. For those hardy readers willing to invest their time and mental energies, however, there are few books more deserving of the effort. 390 illus. (Feb. 24) --This text refers to an out of print or unavailable edition of this title.

With just under 1100 pages, this is no light-weight book, and the content matches. Penrose is an extremely capable mathematician with deep physical understanding, and it shows. It is not, however, suitable for readers with little mathematical or physical understanding. It is not a book for basic learning, but rather it seems directed at a very limited audience with sufficient background

knowledge and for them it will take them far further. The book is designed to take people with advanced physical and mathematical knowledge up to Penrose’s level of understanding. The first third of the book is effectively an introduction to advanced mathematics, and is interesting for this in its own right.The book nominally takes the reader with no background information and fills this in, but I do not believe that is plausible. For example, consider the introduction to Maxwell’s equations. These are introduced in Minkowski coordinates and expressed into a spacetime 2-form F, called the Minkowski field tensor, and a further space-time vector, with components expressed in matrix form that permit various symmetries to be perceived. I do not believe that anyone who had not at least vaguely become aware of this sort of approach would make much headway, but what follows is certainly elegant.My biggest "grumble" with this book is the title: I believe "The" should be replaced with "A". The ancient Greeks founded two approaches to physics. Penrose adopts the Platonic approach, which considers mathematical forms, symmetries, and even beauty, and tries to fit reality to mathematical form. Thus towards the end, Penrose devotes a chapter to twistor theory, and in the end has to acknowledge that this is mathematically attractive, but it is difficult to take it anywhere in physics. The alternative approach, the Aristotelian approach, asks questions of nature and tries to find restrictions that lead to the correct theory. I should mention the caveat that I fall into the latter school, and with that warning, I believe that a true route to reality will involve many people working from both approaches.Irrespective of certain reservations, I believe that anybody with some mathematical ability will gain some insights from this book (the more the ability, the more insights), and anybody interested in theory should at the very least read chapter 34, which gives Penrose’s opinions on where the road will go, and the fashions encountered on it. This is a truly great piece of intellectual effort.Ian J Miller, author of Elements of Theory

I’ve gone through my "getting bearings" reading of this book, meaning a chapter a day just so I can get the trajectory of everything and maybe during my next read-through, which will be much slower, things will make sense. The first thing that has to be said is that this book definitely gives the reader a good perspective of the modern state of theoretical physics: though Penrose does take some positions which are controversial, such as his take on string theory (but then again touching the state of attempts at theories of everything is guaranteed to lead to controversy in the scientific sense), he shows deep knowledge and insight into physical problems and what barriers have to be overcome in order to reach our next physical revolution. He brings the reader through the perspectives of general relativity, quantum field theory, and thermodynamics, each time clearly making a case for what problems in each area need to be considered or explained by a unification

of general relativity and quantum mechanics. This is no small accomplishment; I have not seen any books which have done nearly as good a job in putting all these things together as this one.So why four stars instead of five? Check the title of this review. I have my bachelor's in math and physics (good school, poor student) and a large portion of this book looks like it will take a long time to digest, with the chapters on differential geometry looking like a few months of work and many secondary sources. Somebody without knowledge of those fields would have to treat the entire book that way. In short, the book is far less self-contained than it appears to be, and I would say less than the author thinks, as well. For example, in the second chapter he apologizes for having to use logarithms. This is in a book where, a dozen chapters later, we're taking the Lie derivative of tensors. Apologizing for using logarithms, yet somehow the reader is supposed to understand pseudo-Riemannian geometry a few hundred pages later. Either that's some sort of twisted joke or he really thinks that we can get it that quickly.For all the complaining about the difficulty of some parts of this book, it's still a good one to pick up: even somebody who has to skip a great deal of the math could still learn a lot about the state of modern physics through the more qualitative descriptions of reality. Maybe after putting a bit more time into really reading closely I'll find that I was being too harsh on it all along, but we'll see in a few months.

There are many excellent reviews here, and because I'm neither a mathematician nor a physicist there is little I can add. But for those like me who are smart, curious, and patient and who are wondering whether to have a go at this book, I say go for it. By the time you have labored your way to the end, you'll find that you have absorbed far more than you expected. When Penrose is not doing math, his voice and his prose are crystal clear. If Penrose loses you, sometimes taking a look at, say, the Wikipedia article on a particular subject will catch you up. If gaining a better understanding of physics is a longterm goal for you, then this book is a valuable reference.

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