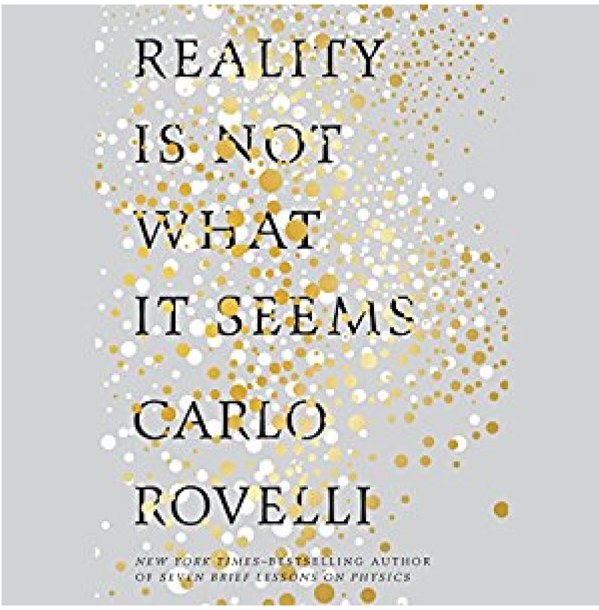
Reality Is Not What It Seems: The Journey To Quantum Gravity



Synopsis

From the New York Times best-selling author of Seven Brief Lessons on Physics, a closer look at the mind-bending nature of the universe. What are time and space made of? Where does matter come from? And what exactly is reality? Theoretical physicist Carlo Rovelli has spent his whole life exploring these questions and pushing the boundaries of what we know. Here he explains how our image of the world has changed over the last few dozen centuries. In elegant and accessible prose, Rovelli takes us on a wondrous journey from Aristotle to Albert Einstein, from Michael Faraday to the Higgs boson, and from classical physics to his own work in quantum gravity. As he shows us how the idea of reality has evolved over time, Rovelli offers listeners a deeper understanding of the theories he introduced so concisely in Seven Brief Lessons on Physics. His evocative explanations invite us to imagine, beyond our ever-changing idea of reality, a whole new world that has yet to be discovered.

Book Information

Audible Audio Edition
Listening Length: 6 hoursÂ andÂ 7 minutes
Program Type: Audiobook
Version: Unabridged
Publisher: Penguin Audio
Audible.com Release Date: January 24, 2017
Language: English
ASIN: B01N49GVM1
Best Sellers Rank: #2 inÂ Books > Science & Math > Physics > Gravity #4 inÂ Books > Science & Math > Physics > Waves & Wave Mechanics #6 inÂ Books > Audible Audiobooks > Science > Physics

Customer Reviews

This book is a book of two halves. The first is a history of physics and in particular the twin pillars of modern physics: The General Theory of Relativity and Quantum Theory. The second is a journey through Quantum Gravity.Making sense of modern physics can be hard, very hard, for the non scientist. For many years I have read many books grappling with the subject, some good and some not so good. Rovelli’s book is a game changer The title of my review refers to the shining of light in dark places because that’s how I felt when I read it. Concepts and theories that I’d struggled with through many of those previous books suddenly made sense. The descriptions of Quantum theory and Quantum mechanics were wonderful. I experienced at least three genuine aha moments, moments when you close your eye, lay the book on your lap and breathe slowly with the shear joy of understanding.As well as the explanations there is also the joy of the writing. Rovelli says on page 88 that "great science and great poetry are both visionary..." There are times when his writing is poetic and it adds to the book’s majesty.This book is a marvel. It is highly recommended.

Carlo Rovelli continues the tradition from his earlier book, "Seven Brief Lessons on Physics" of combining sparkling descriptions of physical phenomena with a sensitive understanding for the form of physics and the greatness of its practitioners. This book which builds on Rovelli’s own work can be divided into two parts.The first part is a brief history of physics starting with the Greek philosophers Democritus and Anaximander and continuing all the way through Galileo, Newton, Einstein, Feynman, Heisenberg and Dirac. As in his previous book, Rovelli has elegant descriptions of the two great pillars of physics: quantum mechanics and general relativity. He briefly introduces us to the central ideas of both disciplines and emphasizes how fantastic, improbable and yet true they are. Rovelli especially does a good job describing the three main features of the quantum world: granularity, indeterminacy and relationality. He then talks about particle physics and the Standard Model of particle physics and brings us up to speed to the present day.This sets up the book for the second part, which is a theory of quantum gravity called loop quantum gravity. After explaining how quantum mechanics and general relativity disagree with each other in situations where it matters, Rovelli leads us through the main concepts of loop quantum gravity. Loop quantum gravity imagines spacetime as a set of interlocked loops. This tessellated structure means that spacetime cannot be divided infinitely into smaller and smaller pieces. There is an unimaginably small but still finite dimension called the Planck length beyond which one cannot divide spacetime. According to Rovelli, the finiteness of this division enables the theory of loop quantum gravity to escape some of the ugly infinite solutions that results when one tries to combine the mathematics of standard quantum mechanics with that of general relativity. The chapters at the end introduce thermodynamics and information into gravity. This part is fascinating and Rovelli is definitely pushing the frontiers here, although they are not as clearly written as the earlier ones in my opinion. The book ends with a homage by Rovelli to the constant sense of wonder and uncertainty in science that make it such a powerful intellectual and practical edifice.The reason why I give the book less than five stars is because it is big on the language but relatively uneven on the physics. Some of the physics is quite good: for instance Rovelli gives a simple explanation based on Heisenberg’s uncertainty principle for illustrating why space cannot be infinitely divisible which I found illuminating. But the problem is that he needs to cover a lot of ground before he can prepare the reader for loop quantum gravity. Unfortunately his descriptions of this material are cursory and impressionistic rather than comprehensive and clear. The language is often eloquent and simple and Rovelli clearly appreciates the beauty inherent in physical law. The occasional analogies such as Rovelli's analogy between Dante's circles and Einstein's model of a finite but unbounded universe are revealing and novel, but the explanatory treatment in general is slim. Certain important topics like quarks, inflation and quantum field theory are almost completely left out. Any theory of quantum gravity will need to expound on these concepts before it can clearly reveal itself. I also find it interesting that string theory which is loop quantum gravity's main rival gets little more than a paragraph, so it's still not clear why one would clearly prefer loop quantum gravity over string theory. If one compares this book to volumes by Max Tegmark, Sean Carroll, Brian Greene and John Gribbin, the paucity of explanation should become clear. The treatment in Rovelli's earlier book was also impressionistic, but in that case the nature of the book ("Seven Brief Lessons") lent itself well to that format.I would thus recommend the book if you want further examples of Rovelli's impressionistic style. As a leisurely walk through certain old and new concepts of physics it offers an elegantly worded guide. But if you want to understand modern physics in general and quantum gravity in particular, you will probably have to look elsewhere.

Review of: Ã¢Â ÂœREALITY IS NOT WHAT IT SEEMSÃ¢Â Â• by Carlo RovelliFor those who have an even casual interest in modern physics or Ã¢Â ÂœscienceÃ¢Â Â• this is a truly remarkable book. Rovelli is able to take highly complex problems and express them in a way which can make them accessible to even those who think that mathematics is simply something you use to figure out how much change you should get at the supermarket or doing the highly difficult calculation of how much to tip on a restaurant bill.Over the years I have read literally dozens of books written for the nonscientist about special and general relativity, quantum mechanics, Brane theory, String Theory, Information Theory and quantum loop gravity. This is the first time I have encountered one which makes some real sense about these abstract concepts and clearly answers a question which has bothered me throughout this quest for knowledge: Is there such a thing as quantum time or is time simply a construct, an invention we use to measure the concurrence between different events.Spoiler Alert. Not only does quantum time exist it appears to be a requirement for healing the conflict between relativity and quantum mechanics. As most readers are aware EinsteinÃ¢Â Â™s theories of both general and special relativity are remarkably accurate and have passed every test to which they have been subjected as long as they apply to very large things. Quantum mechanics, the strange physics of the very small, is also exceedingly accurate in its predictions as long as it stays within its Ã¢Â Âœrange.Ã¢Â Â• However these two great theories fail miserably when combined. This failure results from the combined mathematics giving results that result in answers that are infinite. A big no no in both mathematics and reality.According to Rovelli this can be overcome by the basic understanding that all Ã¢Â ÂœthingsÃ¢Â Â• are quantized. That is there is a smallest possible size for the most basic of concepts including space and time. You may of heard about something called ZenoÃ¢Â Â™s paradox. This can be stated in many ways but letÃ¢Â Â™s take something that we do every day. Most of us when we get out of bed go to the bathroom. A rather basic task, which some may find harder than others to achieve and yet we are almost always able to achieve that goal. So what is paradoxical about that?Well when I get up in order to get to the bathroom I have to go half way say to my chair. That seems easy enough. But then from my chair I once more have to go half way to my final goal, the bathroom. So far I am seem to be doing okay, but am I? Now, unfortunately, I start thinking; how many half ways are there from the point I have reached to that elusive bathroom? Oh oh I exclaim I can keep on cutting this distance in half an infinite number or times. If so not only can I not reach the bathroom I could not have even begun to get out of bed, the initial place I began.WhatÃ¢Â Â™s the solution? Am I forever stuck at one place and if not why not. The solution is the quantum of space. Space itself cannot be infinitely divided in half because there is indeed a smallest piece of space which is called the Plank length or unit. The Plank unit is very, very small but is greater than zero or in other words finite. No matter how hard I try to divide this unit it stays the same length and the concept of half of it is impossible and I am therefore not bound by infinity of lengths. I am free to do one of my most basic obligations of the day.Well if there is indeed a smallest possible piece of space how about time. Most of us have heard about the concept of space time. I had until recently mistakenly believed that the concept of space time was an invention of Einstein. It was actually proposed by another mathematician, Minkowski and is therefore referred to as MinkowskiÃ¢Â Â™s space time. The rational for this is highly complex but if this postulate had a bearing on reality could time itself actually be quantized. That would mean that time is not simply a way of measuring things but has a physical reality as well. I assume by now you have guessed that indeed there in a quantum of time beyond which there is no way to divide time. That length of time is the time it takes for a photon traveling at the speed of light (c) to travel on plank unit. A very, very, very small bit of time but a bit that is indeed finite.Thus we have removed from the equations of physics the two things that have always been considered infinite and make them finite. The result is that there are no infinities no matter what the conditions are in the universe, everything is finite. Whether at the Big Bank itself or at any place in the universe there are no infinities only finites are allowed.If you are interested in an accessible (understandable) description of how this comes about read Reality Is Not What It Seems. I doubt this will change anything in my life or yours except that I sleep better since I no longer have to worry about not being able to get to the bathroom the next morning.