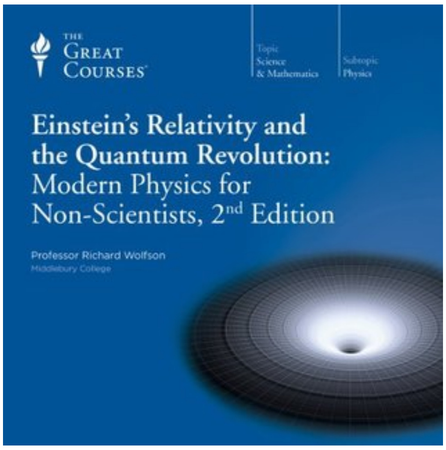

Einstein's Relativity and the Quantum Revolution: Modern Physics for Non-Scientists

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Profound ... Beautiful ... Relevant

Why should you care about these landmark theories? Because relativity and quantum physics are not only profound and beautiful ideas in their own right, they are also the gateway to understanding many of the latest science stories in the media. These are the stories about time travel, string theory, black holes, space telescopes, particle accelerators, and other cutting-edge developments. Consider these ideas:

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The Hubble Space Telescope is providing some of the most striking confirmations of the theory, including certain evidence for the existence of black holes, objects that warp space and time so that not even light can escape.

Also, the expansion of the universe predicted by the theory of general relativity is now a known rate. General relativity also predicts an even weirder phenomenon called "wormholes" that offer shortcuts to remote reaches of time and space.

According to Einstein's theory of special relativity, two twins would age at different rates if one left on a high-speed journey to a distant star and then returned. This experiment has actually been done, not with twins, but with an atomic clock flown around the world.

Another fascinating experiment confirming that time slows as speed increases comes from measuring muons at the top and bottom of mountains.

A seemingly absurd consequence of quantum mechanics, called "quantum tunneling," makes it possible for objects to materialize through impenetrable barriers. Quantum tunneling happens all the time on the subatomic scale and plays an important role in electronic devices and the nuclear processes that keep the sun shining.

Some predictions about the expansion of the universe were so odd that Einstein himself tried to rewrite the mathematics in order to eliminate them. When Hubble discovered the expansion of the universe, Einstein called the revisions the biggest mistake he had ever made.

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From Aristotle to the Theory of Everything

Professor Wolfson begins with a brief overview of theories of physical reality starting with Aristotle and culminating in Newtonian or "classical" physics. Then he outlines the logic that led to Einstein's theory of special relativity, and the simple yet far-reaching insight on which it rests. With that insight in mind, you move on to consider Einstein's theory of general relativity and its interpretation of gravitation in terms of the curvature of space and time. Professor Wolfson then shows how inquiry into matter at the atomic and subatomic scales led to quandaries that are resolved-or at least clarified-by quantum mechanics, a vision of physical reality so at odds with our experience that it nearly defies language. Bringing relativity and quantum mechanics into the same picture leads to hypotheses about the origin, development, and possible futures of the entire universe, and the possibility that physics can produce a "theory of everything" to account for all aspects of the physical world.

Fascinating Incidents and Ideas

Along the way, you'll explore these fascinating incidents and ideas: In the 1880s, Albert Michelson and Edward Morley conducted an experiment to determine the motion of the Earth relative to the ether, which was a supposedly imponderable substance pervading all of space. You'll learn about their experiment, its shocking result, and the resulting theoretical crisis. In 1905, a young Swiss patent clerk named Albert Einstein resolved the crisis by discarding the ether concept and asserting the principle of relativity-that the laws of physics are the same for all observers in uniform motion. Relativity implies that the time order of events can be different in different reference frames. Does this wreak havoc with cause and effect? And why does Einstein assert that nothing can go faster than light? Shortly after publishing his 1905 paper on special relativity, Einstein realized that his theory required a fundamental equivalence between mass and energy, which he expressed in the equation E=mc2. Among other things, this famous formula means that the energy contained in a single raisin could power a large city for a whole day. Historically, the path to general relativity followed Einstein's attempt to incorporate gravity into relativity theory, which led to his understanding of gravity not as a force, but as a local manifestation of geometry in curved spacetime. Quantum theory places severe limits on our ability to observe nature at the atomic scale because it implies that the act of observation necessarily disturbs the thing that is being observed. The result is Werner Heisenberg's famous "uncertainty principle." Are quarks, the particles that make up protons and neutrons, the truly elementary particles? What are the three fundamental forces that physicists identify as holding particles together? Could they be manifestations of a single, universal force?

A Teaching Legend

On his own Middlebury College campus, Professor Wolfson is a teaching legend with an infectious enthusiasm for his subject and a knack for conveying difficult concepts in a way that fosters true understanding. He is the author of an introductory text on physics, a contributor to the esteemed publication Scientific American, and a specialist in interpreting science for the nonspecialist. In this course, Professor Wolfson uses extensive illustrations and diagrams to help bring to life the theories and concepts that he discusses. Thus we highly recommend our DVD version, although Professor Wolfson is mindful of our audio students and carefully describes visual materials throughout his lectures.

Professor Richard Wolfson on the Second Edition of Einstein's Relativity:

"The first version of this course was produced in 1995. In this new version, I have chosen to spend more time on the philosophical interpretation of quantum physics, and on recent experiments relevant to that interpretation. I have also added a final lecture on the theory of everything and its possible implementation through string theory. The graphic presentations for the DVD version have also been extensively revised and enhanced. But the goal remains the same: to present the key ideas of modern physics in a way that makes them clear to the interested layperson."

Einstein's Relativity and the Quantum Revolution: Modern Physics for Non-Scientists Details

Date	:	Published 2000 by The Great Courses
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Author	:	Richard Wolfson
Format	:	Audio CD
Genre	:	Science, Nonfiction, Physics, Audiobook

From Reader Review Einstein's Relativity and the Quantum Revolution: Modern Physics for Non-Scientists for online ebook

Lynn says

I listened to the 24 lectures on my ipod. It also came with a little booklet that outlined each lesson and provided visuals. It was really well done since Wolfson is a physics professor and, therefore, teaches this stuff regularly. And I think I'm finally understanding this stuff... It's very fascinating to me, but unfortunately people generally don't want to discuss curved space time or the path an electron takes over dinner.

Matt Musselman says

A terrific intro to 20th and 21st century physics (Einstein and later).

Despite having taken two years of honours high school physics and reading a number of books on the topic, there were a number of concepts about relativity and quantum mechanics I still grasped only loosely.

Professor Wolfson has a way of explaining difficult concepts simply and very visually that really "clicks" with my mind: time dilation, relativistic frames of reference, etc. I wish I'd had this background from the beginning.

Guy says

Overall, the lectures feel rushed with Wolfson gushing information unnaturally quickly as if he were on some sort of timed game show. It's not the speed of information that is a problem, but the frantic tone he takes making it feel like we're bothering him with questions he is good enough to answer, but he really must get going out the door.

The first half of this series is the sort of thing you get from watching any Discovery Channel show about the galaxy or the universe, which I suspect you are likely to have done if you are interested in this sort of thing. Actually, you are probably better off to do that, since there have been many such shows since this series was recorded that are more up-to-date.

The second half is an unsatisfying gloss over quantum physics. For example, Wolfson mentions the "Copenhagen Interpretation" a few times like a finger waggling dismissal of any questions that may arise from his hurried, vague description. "Most physicists" subscribe to this interpretation, he says, so we are to suppose that is good enough, as if science and the machinations of matter and energy are governed by a democracy. What is that interpretation, specifically or even in general? What others are there? What are the main criticisms of the interpretation? Wolfson never tells.

Ellis says

This installment of the "Great Courses" series gives a nice and simple overview of Einstein's Relativity theories (both Special and General) and the coming, at the time, Quantum Revolution. Dr. Wolfson does an excellent job of introducing important theories conceptually in a way that makes them accessible (I think) to non-technically-trained listeners. This is a great introduction for curious people without a background in Physics, or a fun review for people who just can't get enough of this stuff.

Honestly, I got a serious case of the chills all over my body when Dr. Wolfson told the story about how Einstein realized the true nature of time in the universe. Of course, the fact that I listened to that section as I was 5 sweaty miles into a 6 mile run, at twilight, on a snowy mountain during January in Utah may have had something to do with my chills. Let's just say it was a good listen....

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wirrow wirrow says

(non of my reviews will be eloquent)

i think wolfson pulled off a masterwork of condensing the history of physics theory into a few weeks of reading/listening for people who have little or no physics history.

there's seriously nothing boring here, every step of the way is fascinating.

the maths is there and you can follow along but it really doesn't matter that much if you don't. i highly recommend it to anyone interested in classical physics and quantum theory but doesn't know where to start.

also recommend it to any creative writers looking to venture into sci-fi.. there is no way you will get through this without a constant flow of inspiring ideas.

Clícia says

Very well explained. It summarized all the history of modern physics. It is great for non-scientist as well as for scientists who want to remember how things happened and why. It helps to understand what was the chronological order of events which culminated in our current knowledge about the universe and nature.

Rafid Al-Humaimidi says

Good introduction to Relativity and Quantum Mechanics, with a quick introduction to Particle Physics towards the end. I listened to the Audio book, which is narrated by Professor Wolfson himself. His narration is awesome, with amazing, attention-grabbing, fluency. If you are into Physics, you will love this book. It should be pointed out, though, that this book is only conceptual, with almost no mathematical equation. So if you are expecting to be able to solve the equations, then this book is not for you.

Maurício Linhares says

Great review of modern physics, but make sure you have the PDF around because there's a lot of stuff to look at and it's unlikely you'll be able to understand or imagine the concepts by listening alone, this one wasn't really made with listening in mind.

Professor Wotlfson goes through great lengths explaining Newtonian physics, then special relativity, how they relate to one another and why we can still explain most of what we interact with with the old theories. Then he goes about general relativity and quantum theory (ending with a string theory chapter) that broadens the subject a bit, but has he explains those last two are a bit more complicated and would need books on their own.

Great refresher if it's been a while or if you haven't been following physics since school. The classes were recorded before LHC came into action and the Higg's boson was detected so he talks about this subject in the future, it would be nice to have had an extra chapter about it.

Still, great read!

Chris says

Very good course for non-scientists on Einstein's Theories of Relativity and Quantum Physics. The first few lectures focus on the history of how theories on gravity and motion developed. We are given a good review Copernicus, Kepler, Galileo, and Newton's contributions as well as Michelson and Morley's 1887 experiment, which was conducted to determine the Earth's motion relative to the supposed "Ether". These lectures set the stage for why Einstein was pondering gravity and motion at the turn of the 20th Century. The next several lectures do an excellent job of explaining his Theory of Special Relativity.

The second half of the course covered Einstein's General Theory of Relativity and then delved into an overview of Quantum Physics. This portion of the series felt a bit rushed to me, but even so, was worth the listen. Note that if you are listening to the audio version, the instructor discusses illustrations included in the Course Guidebook. It helps to refer to these as he is discussing them.

An Nguyen says

I really enjoyed listening to this. The structure of the course eases you into the fundamental concepts of Newtonian physics and then makes its way through Einsteins Special and General Relativity before finishing with Quantum Mechanics and just a smidge of String Theory. The math behind the concepts are seldom brought up, usually only to show the beauty of a simple equation, which makes the book more accessable to people who aren't directly working in physics.

Some of the more dense ideas covered are still a bit confusing but I think that's due to their inherently complexity. The author's passion towards the subject is both obvious and contagious which made the entire experience much more enjoyable for a topic many consider dry.

Karsten Speckmann says

This is fascinating! A 12 hour deep dive into Physics, historic, current and future.
If you are curious in general, and in how the bigger (and tinier) universe work, this is a course for you.
I got myself the updated version through The Great Courses on Audible.
I am deeply impressed by Professor Wolfson's ability to explain these complex matters to laypersons like me.

Pinar says

Bu esere ba?lad???mda gerçekten çok e?lenceli bulmu?tum. Hatta her dersi sindire sindire geçeyim, tavsiye edilen ara okumalar? yapay?m niyetiyle ba?lad?m. Keyifli de gidiyordu. Ama sonra çe?itli nedenlerle uzun ara verdim. Aradan sonra bitireyim art?k diye tekrar ba?lad???mda, konuyla ilgili ba?ka kitaplar okumu?, ba?ka online e?itimlere kat?lm??t?m. Ve eseri biraz s?k?c?, örnekleri çok kli?e ve genel anlamda konu takibini zor buldum..

Bunun yerine Stephen Hawking'in The Illustrated A Brief History of Time/The Universe in a Nutshell'i tavsiye ederim.

Motaz Alfarraj says

This lecture series presents in simple "words" theories in physics that everyone talks about without knowing the true meaning of, relativity theory and quantum mechanics. It is presented by one Professor Richard Wolfson, one of the brightest scientists in Physics. The series is divided into two parts:
1- Special and general Relativity theory by Albert Einstein:
Brief history about physics starting from Galilean physics, Newtonian physics, them finally, relativity physics and how Einstein was able to "unify" classic physics and opened a door to Modern physics of, mainly, macroscopic objects such as humans, planets, galaxies .. Etc

2- Quantum mechanics and quantized universe:
This parts goes deep inside what's called an atom, trying to apply relativity to these microscopic object and introducing, eventually, the quantum theory as a proposed solution to a contradiction when classical physics was applied!

In the very last part, a brief description of String theory and some speculations about it being the theory of everything!

Professor Wolfson has planned thus series so well that when you ask yourself the question " what if..? Or what happens ..?" The answers follows immediately in the series.

Mεδ Rεδ?α says

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David says

I was a little ambivalent about trying one of these "Great Courses" on audio, especially with references to diagrams and such, but the instructor promised at the beginning that you could follow along at home without needing the pictures, and he was right, though there are points at which it might benefit a listener to pause the lecture long enough to look up the diagram if you are having trouble visualizing what he describes.

This is a course on advanced physics for people who are not physics students. All that high-level stuff like General and Special Relativity, the three fundamental forces, quantum mechanics, why nothing can go faster than light, how time dilation works, what is really going on with black holes and whether "wormholes" really exist (answer: there is currently no actual evidence of them, we just know that the math supporting the possibility of their existence works) and a dozen other topics for any long-time science fiction reader.

And that is why I downloaded this course, because I haven't had a physics class since high school, and I've had only a brief survey course on quantum mathematics, but I wanted to understand the physics behind relativistic travel and the formation of the universe and quantum theory and all that jazz well enough to feel educated when I read science fiction that tries to be "hard" (and even to have a better grounding for any SF I might write myself...).

I would say this course works very well for that purpose. The professor promises that the math is minimal, so at several points he handwaves the formulas, saying "Trust me (but go look it up if you want to really understand it)" but assures us that the concepts he explains require no more than high school algebra, for the most part, and this was also true. So this is a very "math light" physics course for non-physicists, and thus for someone who is a veteran of hard SF there won't be much here in the way of new concepts - you have probably read Heinlein's *Time for the Stars* in which a pair of telepathic twins conduct the famous "twin experiment" with one twin staying on Earth getting old while the other twin sets off on a journey in a spaceship traveling at near-lightspeed. And you've read lots of stories about black holes and how they "slow time" as you approach the event horizon. (Go see *Interstellar* - it's a fantastic movie.) And you know that pure matter-energy conversion would be a billion times more efficient than nuclear fusion, if we could do it. And you've heard of Schroedinger's Cat and how supposedly we could use paired qubits to achieve faster-than-light communication (we can't). And gravity warps time and space, and light is a particle and a wave (and in fact so is all matter, really), and Einstein refused to believe God rolled dice with the universe.

All that is covered here, and at the end of it, you'll understand it better, conceptually, but obviously this cannot replace an actual physics course and if you want to really, really understand it, you'd have to actually get deeper into the math. I now have a better understanding of what physics *says* about General and Special Relativity and black holes and time travel and quantum entanglement. Do I really, thoroughly understand it? You'll probably find several points Professor Wolfson covers need to sit with you awhile, and some stuff you'll really have to read more deeply to fully "get it." But you can get the gist adequately from this course.

So, this course will not work as a substitute for taking an actual physics class. It probably won't even work very well as a primer. But if you're just a layman who already has some idea of the stuff you've been reading about in science fiction but you want to know more about it, you'll find this course quite valuable, and if you actually don't know *any* of this stuff, it will probably blow your mind.

The lecturer builds up his topics very carefully, starting with what ancient astronomers and physicists knew, all the way back to Aristotle. There is a lot of physics history here, so you'll get your Copernicus and Galileo and Newton and Maxwell and Bohr and of course Einstein, and that part is also quite interesting, as there is just a little bit of biographical information about each person, but more importantly, what exactly they figured out and how and how it changed what was known up to that point in time.

Overall, well worth the investment in listening to.
