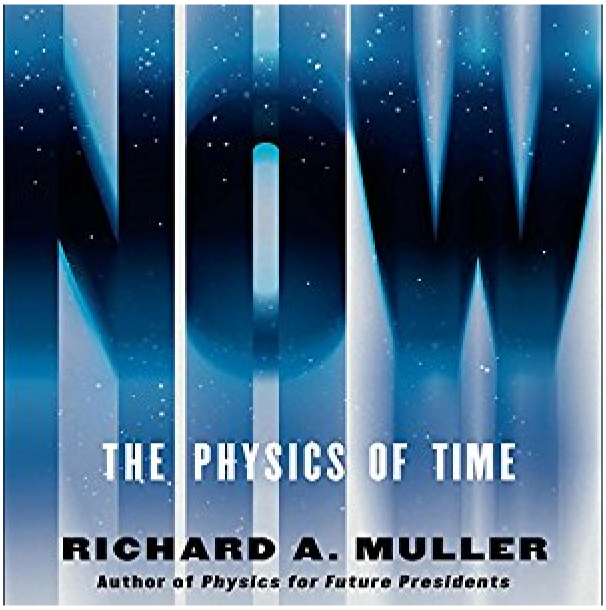
Now: The Physics Of Time - And The Ephemeral Moment That Einstein Could Not Explain



Synopsis

You are reading the word now right now. But what does that mean? What makes the ephemeral moment now so special? Its enigmatic character has bedeviled philosophers, priests, and modern-day physicists from Augustine to Einstein and beyond. Einstein showed that the flow of time is affected by both velocity and gravity, yet he despaired at his failure to explain the meaning of now. Equally puzzling: Why does time flow? Some physicists have given up trying to understand and call the flow of time an illusion, but eminent experimentalist physicist Richard A. Muller protests. He says physics should explain reality, not deny it. In Now, Muller does more than poke holes in past ideas; he crafts his own revolutionary theory, one that makes testable predictions. He begins by laying out - with the refreshing clarity that made Physics for Future Presidents so successful - a firm and remarkably clear explanation of the physics building blocks of his theory: relativity, entropy, entanglement, antimatter, and the big bang. With the stage thus set, he reveals a startling way forward. Muller points out that the standard big bang theory explains the ongoing expansion of the universe as the continuous creation of new space. He argues that time is also expanding and that the leading edge of the new time is what we experience as now. This thought-provoking vision has remarkable implications for some of our biggest questions, not only in physics but also in philosophy, including the ongoing debate about the reality of free will. Moreover, his theory is testable. Muller’s monumental work will spark major debate about the most fundamental assumptions of our universe and may crack one of physics’ longest-standing enigmas.

Book Information

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Customer Reviews

This book by Berkeley physicist Richard Muller is a combination of very interesting and disappointing. The main goal of the book is to provide an overview of a new theory of the generation of time that Muller has proposed. According to Muller, just like space expands as the universe expands, so does time. Thus, when the Big Bang occurred, along with new space new time was also created, and new time continues to be created even as the expansion of the universe is accelerating.This is a very interesting and in fact fascinating hypothesis. Muller even provides some preliminary, testable experimental hypotheses of the hypothesis: always a mark of a good scientist. Unfortunately this theory constitutes only about 30% of the book. The rest of the book is devoted to building up to the theory and then indulging rather superficially in philosophical concepts that don’t really seem to have much of a connection to the main thesis.The first part of the book which explains relativity, thermodynamics and quantum theory is on a sound footing. What I like about Muller is that he is not afraid to be opinionated and to point out common misunderstandings that both students and experts have (for example, he dispels the common misunderstanding that in relativity, different observers "disagree" on the properties of different events). The part on thermodynamics is actually quite illuminating, especially when Muller comes down hard on Arthur Eddington’s thesis that entropy drives the arrow of time from the past to the future. Muller tells us that the connection between entropy and time both increasing has been presented to us by biased events like eggs and teacups breaking. But as he says, teacups can also be built up, and even this event - which involves a decrease and not increase in entropy - is correlated with an increase in time. Thus, Eddington’s correlation between entropy increase and time is just that, a correlation that does not have experimental support and does not make testable predictions. Eddington seems to have misled several generations of science writers, students and physicists. I had not quite appreciated this fact.So far so good, but the last third of the book then sort of unravels as Muller flits from one philosophical topic to another. Many of these seem dimly connected to the book’s main proposal, and I also found some of the sentence constructions rather clumsy. These include free will, souls and empathy, and Muller mostly recycles stuff that other people have said (the one interesting thing that he says is that faster-than-light travel would violate free will because effects could then precede causes); his treatment of these topics is rather superficial in my opinion and the style is quite rambling. He comes back to what he calls the ’4D Big Bang’ suddenly at the end of the book.Overall I think this book is valuable and at times even highly provocative for its presentation of the uncertain connection between entropy and the ’arrow of time’ and for its novel idea of the creation of new time. Those chapters are very much worth reading. But the rest of the book is more like a haphazard stream of consciousness exploring topics whose connection to the physics is not really clear. Muller is a truly outstanding scientist who has massively contributed to physics and physics education (several of his students have won Nobel Prizes) over three decades, a restless intellect and a fine teacher, but this book may not showcase the best of all these qualities.

This is an excellent book, and I particularly recommend it in combination with Sean Carroll’s recently publishedÂ The Big Picture. Both books cover the modern understanding of the nature of reality with precision and without jargon; at a level that intelligent non-specialist readers can readily understand; and incorporate historical perspectives that clarify the accounts. Remarkably, there is very little overlap between the two books. Moreover, in addition to teaching some fundamental physics, the two books have opposing philosophic points. Carroll argues for naturalism, while Muller makes the case against physicalism (naturalism and physicalism are not entirely synonymous, but the main historical difference is philosophers invented naturalism to make philosophy more scientific, while scientists invented physicalism to oppose philosophies not reducible to scientific terms, therefore they are constructive versus destructive approaches to the same issue).Carroll is the better writer, there is more pleasure in reading his book. Muller’s style is clear but wooden, despite some lame attempts to work in quotations, popular culture and professor jokes; he also has a tendency to repeat himself, and to promise frequently that ideas will be explored further later, more frequently than the promises are kept. A minor point is I couldn’t figure out his attitudes toward other people. He makes a number of cryptic comments that could be taken as criticisms, but could just be clumsy formulations, and he mentions some names that are considerably less relevant than ones he leaves out. He invariably precedes mentions of Luis Alvarez with "my mentor," which makes him sound a bit likeÂ Mr. Collins.On the other hand, Carroll’s verbal skill is used to conceal some of the important nuts and bolts of his arguments, while Muller is meticulous about working through to the actual equations and principles. It is quite an accomplishment to keep the discussion at the high theoretical level he maintains, while limiting the math to tenth-grade algebra and geometry. I find it ironic that the naturalist is more willing to rely on intuition and suggestion, while the anti-physicalist is rigorous about measurement and quantities.As you would guess from the title, "now" is an essential concept to Muller. He rejects the common (but to my mind incoherent) view that the arrow of time is determined by increasing entropy since the Big Bang. If that were true, now would have no special status, it would just be the measurement of distance from the Big Bang. But Muller believes now is happening, while the past is frozen and the future has not yet happened. Now is when the wheel is in spin, we placed our bets in the past, and will reap the payoff in the future. He sketches some possible experimental tests of this idea, for example measuring the rate of time in distant galaxies, but also makes some non-physical arguments for it.These latter points concentrate on what I consider the easy part; how non-physical forces could affect the physical universe; not the hard part; what the non-physical forces are). He is correct that most physicists reject non-physical arguments because they can be used to support anything. But if there is structure to the non-physical forces, like consciousness and free will, then I think few people would have difficulty with the idea that they affect the physical world through manipulating quantum effects that appear random in experiments. I have a problem with conceptualizing a non-physical computer capable of not only choosing actions, but of manipulating wave function collapses in order to affect atoms in molecules in neurons in a brain with a predictable macro result, like a person pulling a trigger or not. Nevertheless, until consciousness and free will (or their illusions) are explained, there is room for antiphysicalists.Another weakness in Muller's argument is that he only considers a naive physicalism. Carroll argues that the things Muller wants to preserve, like virtue and beauty, are emergent properties; real and important even though they are not reducible to physical measurement (but Carroll cannot save free will, which matters a lot to Muller, although he does not claim to know whether or not it exists). Muller wants room for a God outside the physical universe, not a creator or object of worship, but a moral referent. Carroll is happy to accept that kind of God, but only as emergent from physical reality.I do have one technical gripe. Muller refers to a two-standard deviation result as meaning there is a 95% chance that an experimental indication is true, and a 14 standard deviation event as having 10^-44 probability of occurring by chance. The nature of randomness is at the heart of his topic, since what distinguishes now from past and future is the possibility of multiple outcomes--deterministic, random or some non-physical third way. The meaning of a two standard deviation result on the probability of an assertion depends on the prior probability you assigned to the assertion plus all relevant alternatives.And there are many types of 14 standard deviations events with different probabilities. Muller is thinking of something like flipping a fair coin and getting 14^2 = 196 heads in a row. N^2 heads in a row is an N standard deviation event. In this case that has a 10^-59 probability, the 10^-44 comes from assuming a Gaussian distribution. But it is also an N standard deviation event to get N^2 heads in a row if you picked a coin at random from a pile with 1 two-headed coin and N^2 two-tailed coins. That event has probability 1/(N^2 + 1) or 1/197. It might seem unfair to pick on such a common error, but Muller is strict about his math, so he can be held to a strict standard.I think Muller overstates the significance of GÃ¶del's incompleteness theorems for physicists. We have no reason to believe that ordinary mathematics contains physically important non-provable truths, or even if it does, that we can't easily get by with two or a few different mathematical schemes. Similarly, I would deny that the irrationality of the square root of two could never be determined physically. It’s true that a naive approach of measuring isosceles right triangles could never be done accurately enough to prove irrationality. But there are constructive proofs. For example, you can demonstrate physically that if you have two identical squares made up of uniform square tiles, and you try to arrange the tiles into one large square, you will always have at least one tile left over, or be at least one tile short.On the other hand, there are theorems that have no constructive proofs, but I don’t think these demonstrate that there is something beyond physical reality. Aces beat Kings in poker, and you can’t prove it with physics, but I don’t see how that alters my fundamental view of the universe. I don’t see how mathematical statements with no physical referents are any different from other consistent arbitrary rules made up by people.Despite these minor carps, this is an excellent book, both for learning basic modern cosmology and for pondering some of the implications. It is written by a great physicist who is also a great educator, if not a great writer.

Now: The Physics of Time - and the Ephemeral Moment That Einstein Could Not Explain Einstein Already had it, But He Did not See it: Part 0: The Discarded Term from the Einstein-Hilbert-Action (Einstein had it Book 1) What’s Up with Richard?: Medikidz Explain Leukemia (Medikidz Explain [Cancer XYZ]) What’s Up with Lyndon?: Medikidz Explain Osteosarcoma (Medikidz Explain [Cancer XYZ]) What’s Up with Jo?: Medikidz Explain Brain Tumors (Medikidz Explain [Cancer XYZ]) Einstein’s Cosmos: How Albert Einstein’s Vision Transformed Our Understanding of Space and Time: Great Discoveries Ephemeral Histories: Public Art, Politics, and the Struggle for the Streets in Chile Screendance: Inscribing the Ephemeral Image How Einstein gives Dirac, Klein-Gordon and SchrÃ¶dinger: Deriving the SchrÃ¶dinger, Dirac and Klein-Gordon Equations from the Einstein-Field-Equations via an Intelligent Zero Self Help: How To Live In The Present Moment (Self help, Self help books, Self help books for women, Anxiety self help, Self help relationships, Present Moment, Be Happy Book 1) Mindfulness: How To Be In The Present Moment Everywhere In Your Everyday Life, 2.0 (FREE Bonus Included) (Mindfulness For Beginners, Meditation, Finding Peace, Present moment) Frank Einstein and the Electro-Finger (Frank Einstein series #2): Book Two Frank Einstein and the EvoBlaster Belt (Frank Einstein series #4): Book Four Frank Einstein and the BrainTurbo (Frank Einstein series #3): Book Three Frank Einstein and the Antimatter Motor (Frank Einstein series #1): Book One The Road to Relativity: The History and Meaning of Einstein’s "The Foundation of General Relativity", Featuring the Original Manuscript of Einstein’s Masterpiece Einstein: A Life of Genius (The True Story of Albert Einstein) (Historical Biographies of Famous

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