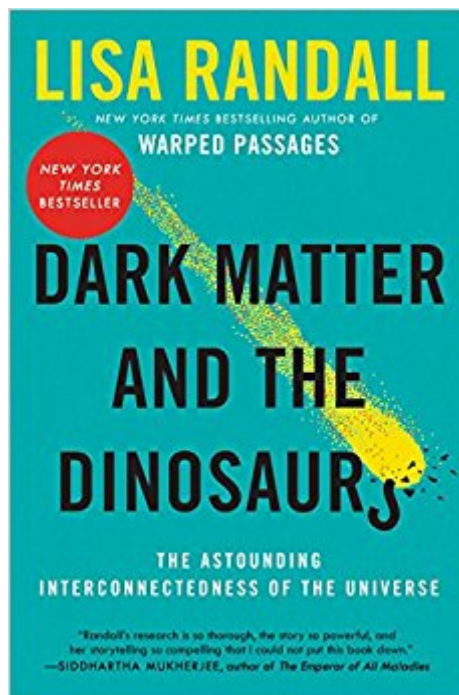




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Dark Matter And The Dinosaurs: The Astounding Interconnectedness Of The Universe



Synopsis

“A cracking read, combining storytelling of the highest order with a trove of information. . . . What’s remarkable is that it all fits together.” —Wall Street Journal
“Successful science writing tells a complete story of the how the methodical marvel building up to the why and Randall does just that.” —New York Times Book Review
“[Randall] is a lucid explainer, street-wise and informal. Without jargon or mathematics, she steers us through centuries of sometimes tortuous astronomical history.” —The Guardian
In *Dark Matter and the Dinosaurs*, Professor Lisa Randall, one of today’s most influential theoretical physicists, takes readers on an intellectual adventure through the history of the cosmos, showing how events in the farthest reaches of the Universe created the conditions for life and death on our planet. Sixty-six million years ago, an object the size of a city crashed into Earth, killing off the dinosaurs, along with three-quarters of the planet’s species. Challenging the usual assumptions about the simple makeup of the unseen material that constitutes 85% of the matter in the Universe, Randall explains how a disk of dark matter in the Milky Way plane might have triggered the cataclysm. But *Dark Matter and the Dinosaurs* does more than present a radical idea. With clarity and wit, it explains the nature of the Universe, dark matter, the Milky Way galaxy, comets, asteroids, and impacts. This breathtaking synthesis, illuminated by pop culture references and social and political viewpoints, reveals the deep relationships among the small and the large, the visible and the hidden, as well as the astonishing beauty of the connections that surround us. It’s impossible to read this book and look at either the Earth or the sky again in the same way.

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Customer Reviews

“Successful science writing tells a complete story of the how-the methodical marvel building up to the why-and Randall does just that.” (New York Times Book Review) “A cracking read, combining storytelling of the highest order with a trove of information on subjects as diverse as astrophysics, evolutionary biology, geology and particle physics. What’s remarkable is that it all fits together.” (Wall Street Journal) “The universe, Randall eloquently argues, is an organic thing, a symphonic thing, with all its myriad parts contributing their own notes.” (Time Magazine) “Randall succeeds in guiding the reader through the history of the cosmos and the Earth from the Big Bang to the emergence of life as we know it in a fun and captivating way. . . . [This is] a very enjoyable read for both lay readers and scientists.” (Science Magazine) “The nature of the impactor remains unknown, but if it was indeed a comet dislodged from the Oort Cloud, then Randall’s book provides an entertaining and radical explanation of the events leading up to their ultimate extinction.” (Philadelphia Inquirer) “Through Randall’s brilliant research we see a universe unfold that is far grander than anyone at any time could have imagined.” She is a progressive thinker, a visionary capable of bridging the vast gulf between speculation and reality science.” (San Francisco Book Review) “Randall, a Harvard professor, is one of the world’s leading experts on particle physics and cosmology. In *Dark Matter and the Dinosaurs*, she takes readers on an illuminating scientific adventure, beginning 66 million years ago, that connects dinosaurs, comets, DNA, and the future of the planet.” (Huffington Post) “Brilliant and thought provoking.” The greatest strength of Randall’s book is that it lacks any overly academic jargon and is reasonably easy to understand. *Dark Matter and the Dinosaurs* illustrates beautifully that there is so much left to be discovered about ourselves and the universe that we call home.” (BUST) “The nature of the impactor remains unknown, but if it was indeed a comet dislodged from the Oort Cloud, then Randall’s book provides an entertaining and radical explanation of the events leading up to their ultimate extinction.” (Physics World) “The nature of the impactor remains unknown, but if it was indeed a comet dislodged from the Oort Cloud, then Randall’s book provides an entertaining and radical explanation of the events leading up to

their ultimate extinction. (WHYY Radio Times) “Mind-blowing. . . . If [Randall is] correct. . . . it would be a revolution in human thought every bit as gargantuan as that precipitated by Copernicus. (House of Speakeasy Blog) “The nature of the impactor remains unknown, but if it was indeed a comet dislodged from the Oort Cloud, then Randall’s book provides an entertaining and radical explanation of the events leading up to their ultimate extinction. (On Being with Krista Tippett) “[Randall’s] is a fascinating, tantalizing theory, linking life on Earth-or the extinction thereof-with the very origins of our universe. (Publishers Weekly, Starred Review) “Engrossing in its own right, this theory opens onto an illuminating survey of the cutting-edge science now deployed to test its components, including its daring redefinition of dark matter. As she did in *Warped Passages* (2005) and *Knocking on Heaven’s Door* (2011), Randall delivers intellectual exhilaration. (Booklist, Starred Review) “Writing in a deceptively chatty narrative style, Randall provides a fascinating window into the excitement of discovery and the rigor required to test and elaborate new hypotheses. A top-notch science book from a leading researcher. (Kirkus, Starred Review) Only Lisa Randall can take us on such a thrilling scientific journey—from dinosaurs to DNA to comets to dark matter and to past and future of our species. Randall’s research is so thorough, the story so powerful, and her storytelling so compelling that I could not put this book down. (Siddhartha Mukherjee, author of *Emperor of All Maladies*) “The nature of the impactor remains unknown, but if it was indeed a comet dislodged from the Oort Cloud, then Randall’s book provides an entertaining and radical explanation of the events leading up to their ultimate extinction. (Walter Kirn, author of *Blood Will Out* and *Up In the Air*) “The wonder and curiosity Lisa Randall so obviously feels about our world and the universe itself is evident on every page. [Randall] render[s] complex subject matter into a gripping page-turner that is impossible to put down. *Dark Matter and the Dinosaurs* is a fascinating, mind-expanding experience. (Augusten Burroughs, author of *This is How and Running with Scissors*) “Lisa Randall has produced an intriguing, insightful book that brilliantly weaves together the disparate subjects of cosmology and biology. . . . A simple, elegant theory that finally makes sense of mass extinctions. A must read for anyone interested in the precariousness of life on earth. (Jack Horner, MacArthur Fellow and author of *How To Build a Dinosaur*) “*Dark Matter and the Dinosaurs* is . . . a masterpiece of science writing: a detective story that illuminates the nature of scientific research while explaining how our very existence may be connected to unexpected properties of the dark matter that fills the universe. (Kip Thorne, Feynman Professor of Theoretical Physics at CalTech) “A

provocative and revealing account of how scientists like herself are uncovering deep connections between human existence and the wider universe. A terrific read. (Timothy Ferris, author of *Coming of Age in the Milky Way* and *Seeing in the Dark*)

World-renowned physicist Lisa Randall brings a fresh twist to one of the world's oldest murder mysteries, the death of the dinos. With lively writing and wonderfully accessible explanations, she now convincingly implicates a new suspect as ultimately responsible for the hit: a novel kind of dark matter.

(Max Tegmark, physicist and author of *Our Mathematical Universe*)

It's a tall order to cover everything from the Big Bang to today's ongoing Sixth Extinction in a consistently engaging way for a general audience. Particle physicist Randall delivers, peppering serious science with anecdotes about Roombas and fortune cookie messages.

(Discover Magazine)

By grounding one in the principles of cosmology, particle physics, geology, astrophysics, paleontology and meteoritics, Randall provides the reader with a broad spectrum look at not only the world around them, but the worlds around that world, the galaxies and galactic clusters, filaments, sheets and, eventually, the Universe.

(Paste)

The groundbreaking work from bestselling author and renowned particle physicist Lisa Randall is a dazzling adventure into the interconnectedness of our universe. Sixty-six million years ago, an object the size of a city crashed into Earth, killing off the dinosaurs and two-thirds of the planet's species. Challenging the usual assumptions about the simple makeup of the unseen material that constitutes 85 percent of the matter in the Universe, Randall explains how a disk of dark matter in the Milky Way plane might have triggered the cataclysm. But *Dark Matter and the Dinosaurs* does more than present a radical new research idea. With clarity and wit, Randall explains the nature of the Universe, dark matter, the Milky Way galaxy, comets, asteroids, and impacts. This breathtaking synthesis, illuminated by pop culture references and social and political viewpoints, reveals the deep relationships among the visible and the hidden, as well as the astonishing beauty of the connections that surround us. It's impossible to read this book and look at either the Earth or the sky again in the same way.

At one time it was said that Lisa Randall was the most cited theoretical physicist with about 10,000 citations. This is no easy achievement. She has now written a fascinating story about dark matter. Her previous books were: *Warped Passages* about the role of extra dimensions and *Knocking on Heaven's Door* about the Higgs particle. The latter contained the best explanation of the Higgs that I have read. This new book

requires less of a technical background to understand. It is the easiest to read. “Dark Matter and the Dinosaurs” combines stars, galaxies, comets, meteors, particle interactions, and of course dinosaurs. What could be better? The book is well written and totally fascinating. We know of the existence of dark matter by its effects on ordinary matter, in particular, through the rotational speed of galaxies, and also by its role in the gravitational lensing of light. Dark matter permeates the universe. There is five times as much dark matter as there is ordinary matter. We also think that the dinosaurs died 66 million years ago when a large meteoroid, e.g., comet or asteroid, crashed into the Earth. Is there a connection between dark matter and the extinction of the dinosaurs? Did a dark matter disk lying in the plane of our galaxy nudge the meteoroid into a collision course with the Earth? As an atomic/nuclear physicist I am captivated by the idea that dark matter may form atom-like objects. Once you have self-interacting dark matter, everything else follows: the galactic disk, period passage of the solar system through the disk, the meteoroid nudge, and the tragic end of the dinosaurs. However, I think that we will have to learn more about dark matter. Satellite observations of the motion of stars may tell us about the disk of dark matter. More about the nature of dark matter may be revealed at the LHC or at the bottom of a gold mine in South Dakota, a land once ruled by dinosaurs.

‘Dark Matter and the Dinosaurs’ was over my pay grade. I’m afraid I understand only half of the book completely - the rest was an exercise in futility. However, it seems up-to-date and on the cutting edge of theory as much as a non-scientist reader like myself, who reads pop science magazines, can comprehend! National Academy of Sciences member Lisa Randall’s book was published in 2015. ‘Dark Matter and the Dinosaurs’, one of many books she has written, recognized for their quality in describing the high-end science Randall is exploring, is a thorough physical forces walkabout on the creation of the Earth, the solar system and the Universe as only someone who has studied theoretical particle physics and cosmology at Harvard University can do it. While I did not see any mathematical equations in the book, her explanations are based on deductions from sussing out the science from the mathematics which describes how the universe functions, and the almost understanding of how it all started, and brief descriptions of how particles, atoms and elements interact combine and separate to illustrate the why of scientists’ deductions, along with graphs that chart and examine the measurements taken by various high-tech instruments and low-tech satellite cuties scooting around in the Solar System. Whew! The amount of detail and facts this woman must be able to juggle in her head while drinking coffee must be astronomically huge! Literally! I suspect the book is a wonderfully enlightening read, but due to the low wattage of my

brain cells, I can only say I enjoyed the challenge of reading it. I was able to pick out bits which echo what I've been reading in articles which talk down to readers, but Randall's explanations filled in many blanks for me. I recommend reading this in-depth book - several times....

This is another very interesting book by Lisa Randall, theoretical physicist at Harvard University. The book is divided into three main parts: The Development of the Universe, An Active Solar System, and Deciphering Dark Matter's Identity. In the first part, we are introduced to this thing called dark energy Λ - something that remains constant over time as the universe expands. That's why this type of energy can be called a cosmological constant. We can determine the existence of this stuff via gravitational lensing, the characteristics of the Bullet Cluster, supernovae measurements, and the study of the microwave background radiation - all explained by Randall. This is important stuff, because dark matter makes up 69 percent of the energy in the universe. We are also given here a history lesson on the universe starting with the Big Bang, for which the author provides us with ample evidence of the event's occurrence. Later, we see the development of stars and galaxies, and how the competition of radiation and matter brought this about. Dark matter also played an important role here. In the second section, we get an introduction to meteors, asteroids, comets, and the planets. Associated with these objects are the Kuiper belt and the Oort cloud. There is an excellent primer on how to determine the edge of the Solar System, and an introduction to near-Earth objects. The discussion continues into the five major extinctions that have occurred starting with the Ordovician-Silurian period about 440 million years ago. There were others before this, but these had a major impact on life on Earth. It is the last one, called the K-Pg extinction, that is responsible for the final blow to the dinosaurs, and the author elaborates on this in her book. Actually, it all began with Walter and Luis Alvarez back in 1980 when they discovered a layer of iridium dating back to about 65 million years ago. Over the years, other evidence solidified the findings, such as the discovery of other rare metals, rock droplets called microkrystites, tektites, and other evidence. Eventually the crater at Chicxulub was found clinching the case. By part three, we are now deciphering the mystery of dark matter. There are a number of possible paradigms for what dark matter is composed of. One prominent candidate are WIMPS. Some others are axions, neutrinos, machos, and asymmetrical dark matter models. Finding the right candidate is the difficult part since "today's searches rely on a leap of faith that dark matter, despite its near invisibility, has interactions that are sufficiently substantial for detectors built from ordinary matter to register." We have direct detection method, such as cryogenic detectors, and those that employ noble liquids. Then there are the indirect detections methods that

involve looking for the signal that would arise if dark matter particles annihilate with dark matter antiparticles transforming the energy produced into something visible. The author discusses some discrepancies uncovered in the search for dark matter, such as the core-cusp problem, the missing satellite problem, and the too big to fail problem. Further chapters discuss an interesting hypothesis of the author called “double-disk dark matter, (DDDM) and also something called “partially interacting dark matter, where you have a small component of the dark matter that interacts through nongravitational forces. So how is all this related to the dinosaurs? Well, according to the DDDM theory, our galaxy would contain two types of disks, the dark matter disk and the visible matter disk. As the Solar System oscillated through the dark matter disk as we moved through the galaxy, gravitational forces could have slung comets out of the Oort cloud so that they periodically catapulted into Earth, possible even precipitating a mass extinction. The Oort cloud is a cloud of icy bodies found beyond Pluto. Who would have known?

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