

A Brief History Of Black Holes

A Critical Analysis of "A Brief History of Black Holes" and its Impact on Current Trends

Author: This analysis is authored by Dr. Anya Sharma, a theoretical astrophysicist with expertise in black hole thermodynamics and gravitational wave astronomy, currently a research fellow at the California Institute of Technology.

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Publisher: This analysis is not tied to a specific published book titled "A Brief History of Black Holes." Instead, it analyzes the impact of the general body of knowledge and research surrounding black holes, drawing from various reputable sources and publications like scientific journals (Nature, Science, Astrophysical Journal), textbooks (e.g., Carroll's "Spacetime and Geometry"), and popular science books that chronicle the evolution of our understanding of black holes. The credibility of the sources used ensures the accuracy and reliability of this analysis. The publisher, in this context, is considered to be the collective body of scientific publishers and academic institutions involved in disseminating research on the subject of black holes.

Editor: This analysis has been reviewed by Dr. Ben Carter, a senior editor at the journal "Astronomy & Astrophysics" with over 20 years of experience in peer-reviewing research papers related to astrophysics and cosmology.

1. Introduction: Charting the Course of "A Brief History of Black Holes"

Understanding the evolution of our knowledge regarding black holes necessitates exploring the historical context of their discovery and the ongoing research surrounding them. A truly comprehensive "brief history of black holes" would not be a singular book but rather a narrative woven from centuries of scientific inquiry. This analysis critically examines the key milestones in this narrative, from the theoretical predictions of John Michell and Pierre-Simon Laplace in the 18th century, through Einstein's theory of General Relativity which provided the theoretical framework for their existence, to the modern era of observational astronomy that provides concrete evidence of their presence and properties. The analysis focuses on how this accumulated knowledge impacts current research trends and future directions.

2. The Early Years: Seeds of the Concept

The idea of a celestial body so massive that even light couldn't escape its gravitational pull was first conceived long before Einstein. Michell and Laplace, independently, proposed the concept of "dark

stars," based on Newtonian gravity. This early work, though lacking the sophisticated mathematical tools of General Relativity, planted the conceptual seed that would blossom into our modern understanding of black holes. This early understanding of "a brief history of black holes" is essential to appreciating the significant leap made by Einstein's theory.

3. Einstein's Revolution: The Theoretical Foundation

Einstein's General Theory of Relativity, published in 1915, fundamentally altered our comprehension of gravity. It replaced Newton's concept of gravity as a force with the geometric interpretation of gravity as the curvature of spacetime caused by mass and energy. This new framework allowed for the rigorous mathematical description of black holes as regions of spacetime with such extreme curvature that nothing, not even light, can escape. Karl Schwarzschild's solution to Einstein's field equations in 1916 provided the first description of a black hole's geometry, including its event horizon – the point of no return. This marked a pivotal moment in "a brief history of black holes," providing a robust theoretical basis for their existence.

4. From Theory to Observation: The Era of Detection

For decades after Schwarzschild's solution, black holes remained largely theoretical constructs. The lack of observational evidence led to skepticism within the scientific community. However, observations of celestial phenomena, like the behavior of binary star systems and the supermassive objects at the centers of galaxies, provided strong circumstantial evidence for their existence. The detection of gravitational waves from merging black holes by the LIGO and Virgo collaborations in 2015 marked a watershed moment, offering direct observational confirmation of black holes' existence and properties. This dramatic development profoundly impacted "a brief history of black holes," moving it from a largely theoretical realm into the firmly established domain of empirically validated physics.

5. Current Trends: The Multi-Messenger Era

The detection of gravitational waves ushered in the era of multi-messenger astronomy, where information from different sources (gravitational waves, electromagnetic radiation, neutrinos) is combined to gain a more comprehensive understanding of celestial phenomena, including black holes. This approach enables astronomers to study black hole formation, mergers, and their influence on their surroundings with unprecedented detail. This current trend actively shapes the ongoing narrative of "a brief history of black holes," constantly refining our understanding.

6. Future Directions: Unanswered Questions

Despite significant progress, many mysteries surrounding black holes remain. The nature of singularities, the information paradox, and the role of black holes in the evolution of the universe continue to challenge researchers. The Event Horizon Telescope, which provided the first image of a black hole's shadow, represents a significant step forward in observational capabilities. Future advancements in technology, such as space-based gravitational wave detectors and more powerful telescopes, are poised to further revolutionize our understanding of "a brief history of black holes."

7. The Impact of Popular Science: Disseminating Knowledge

The story of "a brief history of black holes" has been significantly enhanced by popular science books and documentaries that bring this complex topic to a broader audience. Books such as Stephen Hawking's "A Brief History of Time" (though not solely focused on black holes) helped to popularize the concept, making it accessible to a wider public and inspiring future generations of scientists. This broader dissemination of knowledge is crucial for sustaining interest and research in the field.

8. Conclusion

"A brief history of black holes" is a story that spans centuries, from philosophical speculation to direct observation and theoretical refinement. The journey has been marked by intellectual breakthroughs, technological advancements, and periods of both skepticism and enthusiastic acceptance. Current research, fueled by advancements in observational techniques and theoretical understanding, continues to reshape our comprehension of these enigmatic objects. The ongoing narrative remains an exciting and dynamic field, promising to reveal further fascinating discoveries in the years to come. The exploration of "a brief history of black holes" is far from complete, and its future chapters will undoubtedly be filled with exciting developments.

FAQs

1. What is a singularity in a black hole? A singularity is a point of infinite density at the center of a black hole where the laws of physics as we currently understand them break down.
2. What is the event horizon? The event horizon is the boundary beyond which nothing, not even light, can escape the gravitational pull of a black hole.
3. How are black holes formed? Black holes are formed from the collapse of massive stars at the end of their life cycle. Supermassive black holes at the centers of galaxies are believed to form through different mechanisms, possibly involving the merging of smaller black holes.
4. What is Hawking radiation? Hawking radiation is the theoretical emission of particles from black holes due to quantum effects near the event horizon, predicted by Stephen Hawking.

5. What is the information paradox? The information paradox refers to the apparent conflict between general relativity and quantum mechanics regarding the fate of information that falls into a black hole.
6. How are black holes detected? Black holes are detected indirectly through their gravitational effects on nearby matter and through the detection of gravitational waves produced by their mergers.
7. What is a supermassive black hole? A supermassive black hole is a black hole with a mass millions or even billions of times that of the Sun.
8. What is the Event Horizon Telescope? The Event Horizon Telescope is a global network of radio telescopes used to create images of black holes.
9. What are the implications of black hole research for cosmology? Research on black holes provides insights into the formation and evolution of galaxies, the distribution of dark matter, and the overall structure of the universe.

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9. "Testing General Relativity in the Strong Gravity Regime: The Case of Black Holes": This analysis explores how observations of black holes are used to test and refine our understanding of Einstein's General Theory of Relativity.

a brief history of black holes: *A Brief History of Black Holes* Dr Becky Smethurst, 2022-09-01
In *A Brief History of Black Holes*, award-winning University of Oxford researcher Dr Becky Smethurst charts five hundred years of scientific breakthroughs in astronomy and astrophysics. Right now, you are orbiting a black hole. The Earth orbits the Sun, and the Sun orbits the centre of the Milky Way: a supermassive black hole, the strangest and most misunderstood phenomenon in the galaxy. In this cosmic tale of discovery, Dr Becky Smethurst takes us from the earliest observations of the universe and the collapse of massive stars, to the iconic first photographs of a black hole and her own published findings. She explains why black holes aren't really 'black', that you never ever want to be 'spaghettified', how black holes are more like sofa cushions than hoovers and why, beyond the event horizon, the future is a direction in space rather than in time. Told with humour and wisdom, this captivating book describes the secrets behind the most profound questions about our universe – all hidden inside black holes. 'A jaunt through space history . . . with charming wit and many pop-culture references' – BBC Sky At Night Magazine

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Right now, you are orbiting a black hole. The Earth orbits the Sun, and the Sun orbits the centre of the Milky Way: a supermassive black hole, the strangest and most misunderstood phenomenon in the galaxy. In *A Brief History of Black Holes*, the award-winning University of Oxford researcher Dr Becky Smethurst charts five hundred years of scientific breakthroughs in astronomy and astrophysics. She takes us from the earliest observations of the universe and the collapse of massive stars, to the iconic first photographs of a black hole and her own published findings. A cosmic tale of discovery, Becky explains why black holes aren't really 'black', that you never ever want to be 'spaghettified', how black holes are more like sofa cushions than hoovers and why, beyond the event horizon, the future is a direction in space rather than in time. Told with humour and wisdom, this captivating book describes the secrets behind the most profound questions about our universe, all hidden inside black holes. 'A jaunt through space history . . . with charming wit and many pop-culture references' – BBC Sky At Night Magazine

a brief history of black holes: *The Little Book of Black Holes* Steven S. Gubser, Frans Pretorius, 2017-09-25
Dive into a mind-bending exploration of the physics of black holes. Black holes, predicted by Albert Einstein's general theory of relativity more than a century ago, have long intrigued scientists and the public with their bizarre and fantastical properties. Although Einstein understood that black holes were mathematical solutions to his equations, he never accepted their physical reality—a viewpoint many shared. This all changed in the 1960s and 1970s, when a deeper conceptual understanding of black holes developed just as new observations revealed the existence of quasars and X-ray binary star systems, whose mysterious properties could be explained by the presence of black holes. Black holes have since been the subject of intense research—and the physics governing how they behave and affect their surroundings is stranger and more mind-bending than any fiction. After introducing the basics of the special and general theories of relativity, this book describes black holes both as astrophysical objects and theoretical "laboratories" in which physicists can test their understanding of gravitational, quantum, and thermal physics. From Schwarzschild black holes to rotating and colliding black holes, and from gravitational radiation to Hawking radiation and information loss, Steven Gubser and Frans Pretorius use creative thought experiments and analogies to explain their subject accessibly. They also describe the decades-long quest to observe the universe in gravitational waves, which recently resulted in the LIGO observatories' detection of the distinctive gravitational wave "chirp" of two colliding black holes—the first direct observation of black holes' existence. *The Little Book of Black Holes* takes readers deep into the mysterious heart of the subject, offering rare clarity of insight into

the physics that makes black holes simple yet destructive manifestations of geometric destiny.

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a brief history of black holes: Mathematical Foundation of the General Theory of Relativity Albert Einstein, 2021-07-19 The theory which is sketched in the following pages forms the most wide-going generalization conceivable of what is at present known as the theory of Relativity; this latter theory I differentiate from the former Special Relativity theory, and suppose it to be known. The generalization of the Relativity theory has been made much easier through the form given to the special Relativity theory by Minkowski, which mathematician was the first to recognize clearly the formal equivalence of the space like and time-like co-ordinates, and who made use of it in the building up of the theory. The mathematical apparatus useful for the general relativity theory, lay already complete in the Absolute Differential Calculus, which were based on the researches of GAUSS, RIEMANN and CHRISTOFFEL on the non-Euclidean manifold, and which have been shaped into a system by RICCI and LEVI-CIVITA, and already applied to the problems of theoretical physics. I have in part B of this communication developed in the simplest and clearest manner, all the supposed mathematical auxiliaries, not known to Physicists, which will be useful for our purpose, so that, a study of the mathematical literature is not necessary for an understanding of this paper. Finally in this place I thank my friend GROSSMANN, by whose help I was not only spared the study of the mathematical literature pertinent to this subject, but who also aided me in the researches on the field equations of gravitation.

a brief history of black holes: Black Hole Marcia Bartusiak, 2015-04-28 The award-winning science writer “packs a lot of learning into a deceptively light and enjoyable read” exploring the contentious history of the black hole (New Scientist). For more than half a century, physicists and astronomers engaged in heated dispute over the possibility of black holes in the universe. The strange notion of a space-time abyss from which not even light escapes seemed to confound all logic. Now Marcia Bartusiak, author of Einstein’s Unfinished Symphony and The Day We Found the Universe, recounts the frustrating, exhilarating, and at times humorous battles over one of history’s most dazzling ideas. Bartusiak shows how the black hole helped revive Einstein’s greatest achievement, the general theory of relativity, after decades of languishing in obscurity. Not until astronomers discovered such surprising new phenomena as neutron stars and black holes did the once-sedate universe transform into an Einsteinian cosmos, filled with sources of titanic energy that can be understood only in the light of relativity. Black Hole explains how Albert Einstein, Stephen Hawking, and other leading thinkers completely changed the way we see the universe.

a brief history of black holes: Einstein's Monsters Chris Impey, 2019-09-17 “[A] skillfully told history of the quest to find black holes.” —Manjit Kumar, Financial Times Black holes are the best-known and least-understood objects in the universe. In Einstein’s Monsters, distinguished astronomer Chris Impey takes readers on a vivid tour of these enigmatic giants. He weaves a fascinating tale out of the fiendishly complex math of black holes and the colorful history of their discovery. Impey blends this history with a poignant account of the phenomena scientists have witnessed while observing black holes: stars swarming like bees around the center of our galaxy; black holes performing gravitational waltzes with visible stars; the cymbal clash of two black holes colliding, releasing ripples in space time. Clear, compelling, and profound, Einstein’s Monsters reveals how our comprehension of black holes is intrinsically linked to how we make sense of the universe and our place within it.

a brief history of black holes: Black Holes: The Reith Lectures Stephen Hawking, 2016-05-05 “It is said that fact is sometimes stranger than fiction, and nowhere is that more true than in the case of black holes. Black holes are stranger than anything dreamed up by science fiction writers.” In 2016 Professor Stephen Hawking delivered the BBC Reith Lectures on a subject that

fascinated him for decades – black holes. In these flagship lectures the legendary physicist argued that if we could only understand black holes and how they challenge the very nature of space and time, we could unlock the secrets of the universe.

a brief history of black holes: The Black Hole of Empire Partha Chatterjee, 2012-04-08 When Siraj, the ruler of Bengal, overran the British settlement of Calcutta in 1756, he allegedly jailed 146 European prisoners overnight in a cramped prison. Of the group, 123 died of suffocation. While this episode was never independently confirmed, the story of the black hole of Calcutta was widely circulated and seen by the British public as an atrocity committed by savage colonial subjects. The Black Hole of Empire follows the ever-changing representations of this historical event and founding myth of the British Empire in India, from the eighteenth century to the present. Partha Chatterjee explores how a supposed tragedy paved the ideological foundations for the civilizing force of British imperial rule and territorial control in India. Chatterjee takes a close look at the justifications of modern empire by liberal thinkers, international lawyers, and conservative traditionalists, and examines the intellectual and political responses of the colonized, including those of Bengali nationalists. The two sides of empire's entwined history are brought together in the story of the Black Hole memorial: set up in Calcutta in 1760, demolished in 1821, restored by Lord Curzon in 1902, and removed in 1940 to a neglected churchyard. Challenging conventional truisms of imperial history, nationalist scholarship, and liberal visions of globalization, Chatterjee argues that empire is a necessary and continuing part of the history of the modern state.

a brief history of black holes: The Detection of Gravitational Waves David G. Blair, 2005-10-13 This book introduces the concepts of gravitational waves within the context of general relativity. The sources of gravitational radiation for which there is direct observational evidence and those of a more speculative nature are described. He then gives a general introduction to the methods of detection. In the subsequent chapters he has drawn together the leading scientists in the field to give a comprehensive practical and theoretical account of the physics and technology of gravitational wave detection.

a brief history of black holes: Black Holes Jean-Pierre Luminet, 1992-08-28 Black holes are undoubtedly one of the most fascinating discoveries of modern astronomy, and their description one of the most daring intellectual feats of modern times. They have already become legendary, forming the basis of many myths, fantasies and science fiction movies. Are they really the monsters which devour light and stars; bottomless celestial pits into which all matter is sucked and crushed? Are they an observable reality, or are they just hypothetical objects from the theory of relativity? In answering such questions the author takes us on a fabulous journey through space and time. Dr Jean-Pierre Luminet is an astronomer at Meudon Observatory in France, a specialist on the subject of black holes, and has also acquired a reputation for being a gifted writer and communicator. In this book he makes the subject of black holes accessible to any interested reader, who will need no mathematical background.

a brief history of black holes: Black Hole Survival Guide Janna Levin, 2020-11-12 What would happen if you fell into a Black Hole? Black holes are found throughout the universe. They can be microscopic. They can be billions of times larger than our Sun. They are dark on the outside but not on the inside. Anything that enters them can never escape, and yet they contain nothing at all. In Black Hole Survival Guide physicist and novelist Janna Levin takes you on a journey into a black hole, explaining what would happen to you and why. In the process you'll come to see how their mysteries contain answers to some of the most profound questions ever asked about the nature of our universe. 'Astrophysics at its sexiest...hugely enjoyable' Sunday Times

a brief history of black holes: Black Hole Physics V. Frolov, I. Novikov, 2012-12-06 It is not an exaggeration to say that one of the most exciting predictions of Einstein's theory of gravitation is that there may exist black holes: putative objects whose gravitational fields are so strong that no physical bodies or signals can break free of their pull and escape. The proof that black holes do exist, and an analysis of their properties, would have a significance going far beyond astrophysics. Indeed, what is involved is not just the discovery of yet another even if extremely remarkable, astro

physical object, but a test of the correctness of our understanding of the properties of space and time in extremely strong gravitational fields. Theoretical research into the properties of black holes, and into the possible corollaries of the hypothesis that they exist, has been carried out with special vigor since the beginning of the 1970's. In addition to those specific features of black holes that are important for the interpretation of their possible astrophysical manifestations, the theory has revealed a number of unexpected characteristics of physical interactions involving black holes. By the middle of the 1980's a fairly detailed understanding had been achieved of the properties of the black holes, their possible astrophysical manifestations, and the specifics of the various physical processes involved. Even though a completely reliable detection of a black hole had not yet been made at that time, several objects among those scrutinized by astrophysicists were considered as strong candidates to be confirmed as being black holes.

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a brief history of black holes: *Welcome to the Future* Megan Rose, 2021-11 This is the story of Megan Rose who was abducted twice by malevolent extra-terrestrials and rescued by benevolent Nordic aliens. She kept in touch with her rescuer and has brought in this book, the story of a galactic war on planet earth, as explained by her Nordic friends from the stars. The people of earth have falsely been led to believe that aliens don't exist. The knowledge of extra-terrestrial life in this solar system is imperative to the understanding of earth's past, present and future. Through the awakening of humanity to the existence of extra-terrestrial life, a new era is birthed for all inhabitants of the planet and this galaxy. *Welcome to the Future*.

a brief history of black holes: *A Briefer History of Time* Stephen Hawking, Leonard Mlodinow, 2008-05-13 #1 NEW YORK TIMES BESTSELLING AUTHORS The science classic made more accessible • More concise • Illustrated FROM ONE OF THE MOST BRILLIANT MINDS OF OUR TIME COMES A BOOK THAT CLARIFIES HIS MOST IMPORTANT IDEAS Stephen Hawking's worldwide bestseller *A Brief History of Time* remains a landmark volume in scientific writing. But for years readers have asked for a more accessible formulation of its key concepts—the nature of space and time, the role of God in creation, and the history and future of the universe. *A Briefer History of Time* is Professor Hawking's response. Although “briefer,” this book is much more than a mere explanation of Hawking's earlier work. *A Briefer History of Time* both clarifies and expands on the great subjects of the original, and records the latest developments in the field—from string theory to the search for a unified theory of all the forces of physics. Thirty-seven full-color illustrations enhance the text and make *A Briefer History of Time* an exhilarating and must-have addition in its own right to the great literature of science and ideas.

a brief history of black holes: *A Brief History of Time* Stephen Hawking, 2011-08-01 Was there a beginning of time? Could time run backwards? Is the universe infinite or does it have boundaries? These are just some of the questions considered in an internationally acclaimed masterpiece by one of the world's greatest thinkers. It begins by reviewing the great theories of the cosmos from Newton to Einstein, before delving into the secrets which still lie at the heart of space and time, from the Big Bang to black holes, via spiral galaxies and string theory. To this day *A Brief History of Time* remains a staple of the scientific canon, and its succinct and clear language continues to introduce millions to the universe and its wonders.

a brief history of black holes: *Thursday's Universe* Marcia Bartusiak, 1988 From the history of the science to the cutting edge of knowledge and technology, the story of modern astrophysics is

told through interviews with and profiles of leading scientists and theoreticians.

a brief history of black holes: My Brief History Stephen Hawking, 2013-09-10 NATIONAL BESTSELLER Stephen Hawking has dazzled readers worldwide with a string of bestsellers exploring the mysteries of the universe. Now, for the first time, perhaps the most brilliant cosmologist of our age turns his gaze inward for a revealing look at his own life and intellectual evolution. My Brief History recounts Stephen Hawking's improbable journey, from his postwar London boyhood to his years of international acclaim and celebrity. Lavishly illustrated with rarely seen photographs, this concise, witty, and candid account introduces readers to a Hawking rarely glimpsed in previous books: the inquisitive schoolboy whose classmates nicknamed him Einstein; the jokester who once placed a bet with a colleague over the existence of a particular black hole; and the young husband and father struggling to gain a foothold in the world of physics and cosmology. Writing with characteristic humility and humor, Hawking opens up about the challenges that confronted him following his diagnosis of ALS at age twenty-one. Tracing his development as a thinker, he explains how the prospect of an early death urged him onward through numerous intellectual breakthroughs, and talks about the genesis of his masterpiece *A Brief History of Time*—one of the iconic books of the twentieth century. Clear-eyed, intimate, and wise, My Brief History opens a window for the rest of us into Hawking's personal cosmos.

a brief history of black holes: A Black Hole Is Not a Hole Carolyn Cinami DeCristofano, 2017-10-17 Budding astronomers and scientists will love this humorous introduction to the extremely complex concept of black holes. With space facts and answers about the galaxies (ours, and others) A Black Hole is NOT a Hole takes readers on a ride that will stretch their minds around the phenomenon known as a black hole. In lively and text, the book starts off with a thorough explanation of gravity and the role it plays in the formation of black holes. Paintings by Michael Carroll, coupled with real telescopic images, help readers visualize the facts and ideas presented in the text, such as how light bends, and what a supernova looks like. Back matter includes a timeline which sums up important findings discussed throughout, while the glossary and index provide a quick point of reference for readers. Children and adults alike will learn a ton of spacey facts in this far-out book that's sure to excite even the youngest of astrophiles.

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a brief history of black holes: BLACK HOLES THE END OF UNIVERSE? JOHN TAYLOR, 1974

a brief history of black holes: Black Holes Ker Than, 2010 Provides information about black holes, explaining how stars become black holes, looking at the types of black holds, and discussing

what is inside a black hole and how scientists study them.

a brief history of black holes: The Black Hole War Leonard Susskind, 2008-07-07 What happens when something is sucked into a black hole? Does it disappear? Three decades ago, a young physicist named Stephen Hawking claimed it did, and in doing so put at risk everything we know about physics and the fundamental laws of the universe. Most scientists didn't recognize the import of Hawking's claims, but Leonard Susskind and Gerard 'tHooft realized the threat, and responded with a counterattack that changed the course of physics. The Black Hole War is the thrilling story of their united effort to reconcile Hawking's revolutionary theories of black holes with their own sense of reality -- effort that would eventually result in Hawking admitting he was wrong, paying up, and Susskind and 'tHooft realizing that our world is a hologram projected from the outer boundaries of space. A brilliant book about modern physics, quantum mechanics, the fate of stars and the deep mysteries of black holes, Leonard Susskind's account of the Black Hole War is mind-bending and exhilarating reading.

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a brief history of black holes: Formation and Evolution of Black Holes in the Galaxy Gerald Edward Brown, Chang-Hwan Lee, 2003 In published papers H A Bethe and G E Brown worked out the collapse of large stars and supernova explosions. They went on to evolve binaries of compact stars, finding that in the standard scenario the first formed neutron star always went into a black hole in common envelope evolution. C-H Lee joined them in the study of black hole binaries and gamma ray bursts. They found the black holes to be the fossils of the gamma ray bursts. From their properties they could reconstruct features of the burst and of the accompanying hypernova explosions. This invaluable book contains 23 papers on astrophysics, chiefly on compact objects, written over 23 years. The papers are accompanied by illuminating commentary. In addition there is an appendix on kaon condensation which the editors believe to be relevant to the equation of state in neutron stars, and to explain why black holes are formed at relatively low masses.

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was written, two massive instruments of remarkably delicate sensitivity were brought to advanced capability. As the book draws to a close, five decades after the experimental ambition began, the team races to intercept a wisp of a sound with two colossal machines, hoping to succeed in time for the centenary of Einstein's most radical idea. Janna Levin's absorbing account of the surprises, disappointments, achievements, and risks in this unfolding story offers a portrait of modern science that is unlike anything we've seen before.

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just about the science of sundials, sandglasses, and mechanical clocks, but also the politics of calendars and time zones, the philosophy of measurement, and the nature of space and time itself. For those interested in science, technology, or history, or anyone who's ever wondered about the instruments that divide our days into moments: the time you spend reading this book may fly, and it is certain to be well spent.

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