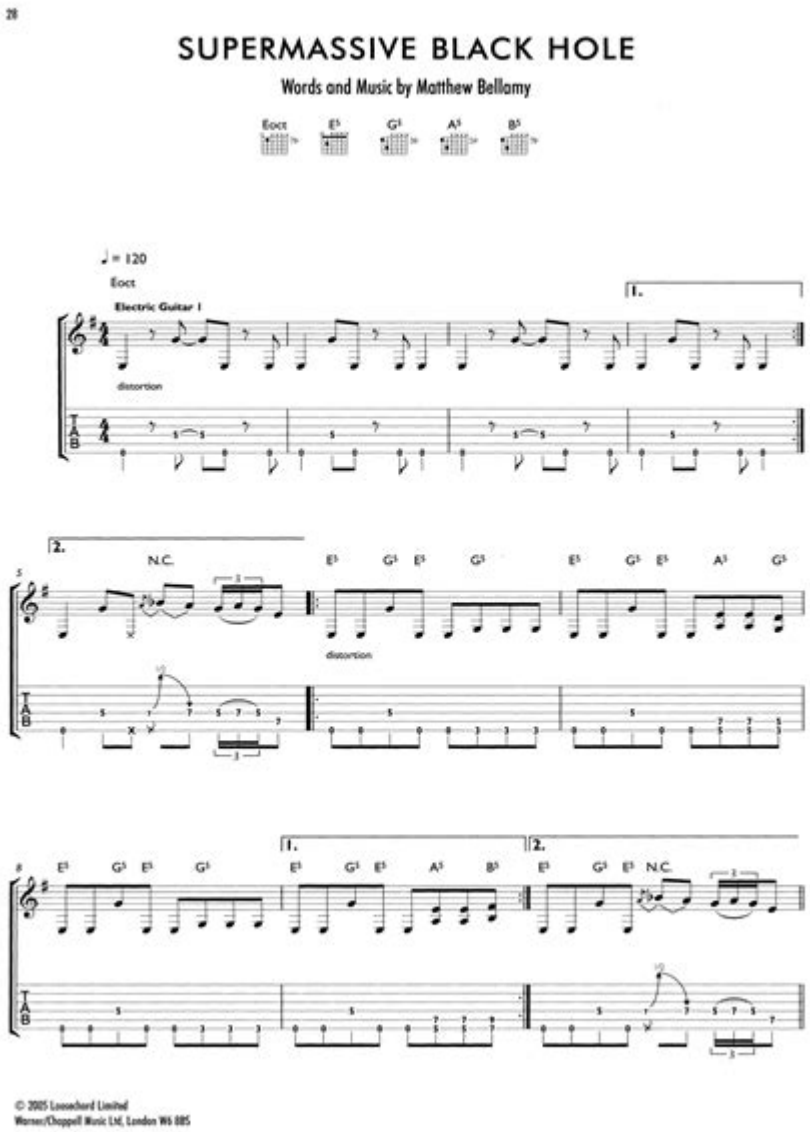
Supermassive Black Hole Tab



Supermassive Black Hole Tab: Unveiling the Mysteries of the Cosmos, One Click at a Time

Ever wondered about the colossal forces shaping our universe? Imagine a tab on your browser that instantly transported you to the heart of a supermassive black hole, allowing you to explore its mysteries. While a literal "supermassive black hole tab" doesn't exist (yet!), this blog post dives deep into the fascinating world of these cosmic behemoths, exploring their formation, properties, and the ongoing scientific quest to understand them. We'll navigate the complexities of these enigmatic objects, providing a comprehensive overview that leaves you feeling like you've taken a virtual journey into the abyss.

What Exactly is a Supermassive Black Hole?

A supermassive black hole (SMBH) is a type of black hole with a mass millions or even billions of times that of our Sun. Unlike stellar-mass black holes formed from the collapse of massive stars, the origins of SMBHs remain one of the most intriguing puzzles in astrophysics. Their immense gravitational pull dominates their galactic environments, shaping the structure and evolution of entire galaxies.

How Do Supermassive Black Holes Form?

There are several leading theories about SMBH formation, none definitively proven:

Direct Collapse: This theory suggests that SMBHs formed directly from the collapse of massive gas clouds in the early universe, bypassing the stellar-mass black hole stage.
Seed Black Holes: This posits that smaller, stellar-mass black holes merged over billions of years, gradually accumulating mass to become supermassive.
Hierarchical Mergers: Galaxies merging brings together their central black holes, leading to a collision and subsequent merger into an even larger SMBH.

The exact mechanism, or combination of mechanisms, that leads to the formation of these giants continues to be a subject of intense research and debate.

The Observable Effects of Supermassive Black Holes

Although invisible themselves, SMBHs leave an undeniable mark on their surroundings:

Accretion Disks: As matter spirals into an SMBH, it forms a superheated accretion disk, emitting intense radiation across the electromagnetic spectrum, from radio waves to X-rays. This radiation is often the primary way we detect SMBHs.
Jets and Outflows: Some SMBHs launch powerful jets of energized particles that can extend for thousands of light-years, influencing the evolution of their host galaxies.
Galactic Structure: The gravitational influence of an SMBH is crucial in shaping the distribution of stars and gas within a galaxy. It acts as a gravitational anchor, regulating galactic dynamics.

Observing Supermassive Black Holes: A Technological Challenge

Detecting and studying SMBHs requires powerful telescopes and sophisticated techniques:

Gravitational Wave Detection: The collision of SMBHs generates gravitational waves, ripples in

spacetime, detectable by instruments like LIGO and Virgo.
Electromagnetic Observations: Observing the radiation emitted from accretion disks and jets allows astronomers to infer the presence and properties of SMBHs.
Spectroscopy: By analyzing the light emitted from nearby stars, scientists can determine their orbital velocities, revealing the presence and mass of a central SMBH through its gravitational influence.

The Future of Supermassive Black Hole Research

The quest to understand SMBHs is far from over. Future research directions include:

Improving observational techniques: More powerful telescopes and advanced instruments will provide higher-resolution images and more detailed spectral data.
Developing more sophisticated theoretical models: Refined simulations and theoretical frameworks will help to unravel the complexities of SMBH formation and evolution.
Exploring the connection between SMBHs and galaxy evolution: Understanding the intricate interplay between SMBHs and their host galaxies is vital to comprehending the overall evolution of the universe.

Conclusion

The "supermassive black hole tab" may not be a reality yet, but the ongoing research into these fascinating cosmic objects is providing us with an increasingly detailed picture of their nature and influence on the universe. From their formation mechanisms to their impact on galactic evolution, the study of SMBHs remains a vibrant and crucial area of astrophysical research, constantly pushing the boundaries of our understanding of the cosmos. Each new discovery brings us closer to unlocking the secrets held within these enigmatic giants at the heart of galaxies.

FAQs

1. Can we travel to a supermassive black hole? No. The gravitational forces near an SMBH are so intense that any spacecraft would be torn apart long before it could reach the event horizon.

2. What happens if you fall into a supermassive black hole? According to our current understanding of physics, you would be stretched and compressed into an infinitely small point, a process known as spaghettification.

3. Are supermassive black holes dangerous to Earth? The nearest SMBH is at the center of our Milky Way galaxy, millions of light-years away. It poses no direct threat to Earth.

4. How are supermassive black holes measured? Their masses are estimated through observations of the orbital velocities of stars and gas orbiting them.

5. What is the largest known supermassive black hole? The current record holder is TON 618, with an estimated mass of 66 billion times that of our Sun. However, new discoveries are constantly being made.

supermassive black hole tab: Measuring the Angular Momentum of Supermassive Black Holes Laura Brenneman, 2013-06-26 Measuring the spin distribution of supermassive black holes is of critical importance for understanding how these black holes and their host galaxies form and evolve over time, yet this type of study is only in its infancy. This brief describes how astronomers measure spin in supermassive black holes using X-ray spectroscopy. It also reviews the constraints that have been placed on the spin distribution in local, bright active galaxies over the past six years, and the cosmological implications of these constraints. Finally, it summarizes the open questions that remain in this exciting new field of research and points toward future discoveries soon to be made by the next generation of space-based observatories.

supermassive black hole tab: *Muse - Bass Tab Collection* Muse, 2014-04-01 (Bass Recorded Versions Persona). Celebrate the stylings of Chris Wolstenholme, bassist for this popular British alt-rock band with this collection of bass transcriptions with tab. Includes: Feeling Good * Hysteria * Knights of Cydonia * Madness * Muscle Museum * New Born * Panic Station * Plug in Baby * Resistance * Starlight * Supermassive Black Hole * Supremacy * Time Is Running Out * Uprising.

supermassive black hole tab: High Energy Radiation from Black Holes Charles Dermer, Govind Menon, 2009-10-11 Beginning with Einstein's special and general theories of relativity, the authors give a detailed mathematical description of fundamental astrophysical radiation processes, including Compton scattering of electrons and photons, synchrotron radiation of particles in magnetic fields, and much more.

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supermassive black hole tab: Einstein's Shadow Seth Fletcher, 2018-10-09 Einstein’s Shadow follows a team of elite scientists on their historic mission to take the first picture of a black hole, putting Einstein’s theory of relativity to its ultimate test and helping to answer our deepest questions about space, time, the origins of the universe, and the nature of reality Photographing a black hole sounds impossible, a contradiction in terms. But Shep Doeleman and a global coalition of scientists are on the cusp of doing just that. With exclusive access to the team, journalist Seth Fletcher spent five years following Shep and an extraordinary cast of characters as they assembled the Event Horizon Telescope, a worldwide network of radio telescopes created to study black holes. He witnessed the team’s struggles, setbacks, and breakthroughs, and, along the way, Fletcher explored the latest thinking on the most profound questions about black holes: Do they represent a limit to our ability to understand reality? Or will they reveal the clues that lead to the long-sought theory of everything? Fletcher transforms astrophysics into something exciting, accessible, and immediate, taking us on an incredible adventure to better understand the complexity of our galaxy, the boundaries of human perception and knowledge, and how the messy endeavor of science really works. Weaving a compelling narrative account of human ingenuity with excursions into cutting-edge science, Einstein’s Shadow is a tale of great minds on a mission to change the way we understand our universe—and our place in it.

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supermassive black hole tab: 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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supermassive black hole tab: Alternative Rock Sheet Music Collection Hal Leonard Corp., 2020-11-01 (Piano/Vocal/Guitar Songbook). This updated edition features 40 of the most enduring hits of the alternative rock genre in arrangements for piano, voice and guitar with chord symbols, guitar chord frames and full lyrics. Includes: Bittersweet Symphony (The Verve) * Crazy (Gnarls Barkley) * How You Remind Me (Nickelback) * Mr. Brightside (The Killers) * One Week (Barenaked Ladies) * Radioactive (Imagine Dragons) * Seven Nation Army (White Stripes) * Use Somebody (Kings of Leon) * We Are Young (fun.) * Wonderwall (Oasis) * and more.

supermassive black hole tab: Muse the guitar songbook : [guitar tab edition] : [the very best guitar anthems] Muse (groupe musical), 2013-10-28

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another group of astronomers is performing a similar experiment on a much larger scale. The Event Horizon Telescope, a globe-spanning array of radio dishes, is examining space surrounding Sagittarius A*, the supermassive black hole at the center of the Milky Way. As Ron Cowen recounts, the foremost goal of the experiment is to determine whether Einstein was right on the details. Gravity lies at the heart of what we don't know about quantum mechanics, but tantalizing possibilities for deeper insight are offered by black holes. By observing starlight wrapping around Sagittarius A*, the telescope will not only provide the first direct view of an event horizon—a black hole's point of no return—but will also enable scientists to test Einstein's theory under the most extreme conditions. Gravity's Century shows how we got from the pivotal observations of the 1919 eclipse to the Event Horizon Telescope, and what is at stake today. Breaking down the physics in clear and approachable language, Cowen makes vivid how the quest to understand gravity is really the quest to comprehend the universe.

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supermassive black hole tab: Superstrings, P-branes and M-theory ,

supermassive black hole tab: *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 corol laries 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.

supermassive black hole tab: Minding the Heavens Leila Belkora, 2002-12-01 Today, we accept that we live on a planet circling the sun, that our sun is just one of billions of stars in the galaxy we call the Milky Way, and that our galaxy is but one of billions born out of the big bang. Yet as recently as the early twentieth century, the general public and even astronomers had vague and confused notions about what lay beyo

supermassive black hole tab: *The End of Everything* Katie Mack, 2020-08-04 A NEW YORK TIMES NOTABLE BOOK OF 2020 NAMED A BEST BOOK OF THE YEAR BY * THE WASHINGTON POST * THE ECONOMIST * NEW SCIENTIST * PUBLISHERS WEEKLY * THE GUARDIAN From one of the most dynamic rising stars in astrophysics, an "engrossing, elegant" (The New York Times) look at five ways the universe could end, and the mind-blowing lessons each scenario reveals about the most important concepts in cosmology. We know the universe had a beginning. With the Big Bang, it expanded from a state of unimaginable density to an all-encompassing cosmic fireball to a simmering fluid of matter and energy, laying down the seeds for everything from black holes to one rocky planet orbiting a star near the edge of a spiral galaxy that happened to develop life as we know it. But what happens to the universe at the end of the story? And what does it mean for us now? Dr. Katie Mack has been contemplating these questions since she was a young student, when her astronomy professor informed her the universe could end at any moment, in an instant. This revelation set her on the path toward theoretical astrophysics. Now, with lively wit and humor, she takes us on a mind-bending tour through five of the cosmos's possible finales: the Big Crunch, Heat Death, the Big Rip, Vacuum Decay (the one that could happen at any moment!), and the Bounce.

Guiding us through cutting-edge science and major concepts in quantum mechanics, cosmology, string theory, and much more, The End of Everything is a wildly fun, surprisingly upbeat ride to the farthest reaches of all that we know.

supermassive black hole tab: An Introduction to Active Galactic Nuclei Bradley M. Peterson, 1997-02-13 How can we test if a supermassive black hole lies at the heart of every active galactic nucleus? What are LINERS, BL Lacs, N galaxies, broad-line radio galaxies and radio-quiet quasars and how do they compare? This timely textbook answers these questions in a clear, comprehensive and self-contained introduction to active galactic nuclei - for graduate students in astronomy and physics. The study of AGN is one of the most dynamic areas of contemporary astronomy, involving one fifth of all research astronomers. This textbook provides a systematic review of the observed properties of AGN across the entire electromagnetic spectrum, examines the underlying physics, and shows how the brightest AGN, quasars, can be used to probe the farthest reaches of the Universe. This book serves as both an entry point to the research literature and as a valuable reference for researchers in the field.

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supermassive black hole tab: How the Universe Got Its Spots Janna Levin, 2023-01-10 Is the universe infinite, or is it just really big? Does nature abhor infinity? In startling and beautiful prose, Janna Levin's diary of unsent letters to her mother describes what we know about the shape and extent of the universe, about its beginning and its end. She grants the uninitiated access to the astounding findings of contemporary theoretical physics and makes tangible the contours of space and time—those very real curves along which apples fall and planets orbit. Levin guides the reader through the observations and thought-experiments that have enabled physicists to begin charting the universe. She introduces the cosmic archaeology that makes sense of the pattern of hot spots left over from the big bang, a pursuit on the verge of discovering the shape of space itself. And she explains the topology and the geometry of the universe now coming into focus—a strange map of space full of black holes, chaotic flows, time warps, and invisible strings. Levin advances the controversial idea that this map is edgeless but finite—that the universe is huge but not unending—a radical revelation that would provide the ultimate twist to the Copernican revolution by locating our precise position in the cosmos. As she recounts our increasingly rewarding attempt to know the universe, Levin tells her personal story as a scientist isolated by her growing knowledge. This book is her remarkable effort to reach across the distance of that knowledge and share what she knows with family and friends—and with us. Highly personal and utterly original, this physicist’s diary is a breathtaking contemplation of our deep connection with the universe and our aspirations to comprehend it.

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structure and reviewing the status of test-experiments for Einstein's theory of gravitation. The range of topics is broad, going from the more abstract classical theory, quantum gravity and strings, to the more concrete relativistic astrophysics observations and modeling.The three volumes of the proceedings of MG12 give a broad view of all aspects of gravitational physics and astrophysics, from mathematical issues to recent observations and experiments. The scientific program of the meeting includes 29 plenary talks stretched over 6 mornings, and 74 parallel sessions over 5 afternoons. Volume A contains plenary and review talks ranging from the mathematical foundations of classical and quantum gravitational theories including recent developments in string theories, to precision tests of general relativity including progress towards the detection of gravitational waves, to relativistic astrophysics including such topics as gamma ray bursts, black hole physics both in our galaxy, in active galactic nuclei and in other galaxies, neutron stars, pulsar astrophysics, gravitational lensing effects, neutrino physics and ultra high energy cosmic rays. The rest of the volumes include parallel sessions on dark matter, neutrinos, X-ray sources, astrophysical black holes, neutron stars, binary systems, radiative transfer, accretion disks, alternative gravitational theories, perturbations of collapsed objects, analog models, black hole thermodynamics, cosmic background radiation & observational cosmology, numerical relativity & algebraic computing, gravitational lensing, variable ';constants'; of nature, large scale structure, topology of the universe, brane-world cosmology, early universe models & cosmic microwave background anisotropies, inhomogeneous cosmology, inflation, gamma ray burst modeling, supernovas, global structure, singularities, cosmic censorship, chaos, Einstein-Maxwell systems, inertial forces, gravitomagnetism, wormholes & time machines, exact solutions of Einstein's equations, gravitational waves, gravitational wave detectors & data analysis, precision gravitational measurements, history of relativity, quantum gravity & loop quantum gravity, Casimir effect, quantum cosmology, strings & branes, self-gravitating systems, gamma ray astronomy, cosmic rays, gamma ray bursts and quasars.

supermassive black hole tab: Analogue Gravity Phenomenology Daniele Faccio, Francesco Belgiorno, Sergio Cacciatori, Vittorio Gorini, Stefano Liberati, Ugo Moschella, 2013-08-13 Analogue Gravity Phenomenology is a collection of contributions that cover a vast range of areas in physics, ranging from surface wave propagation in fluids to nonlinear optics. The underlying common aspect of all these topics, and hence the main focus and perspective from which they are explained here, is the attempt to develop analogue models for gravitational systems. The original and main motivation of the field is the verification and study of Hawking radiation from a horizon: the enabling feature is the possibility to generate horizons in the laboratory with a wide range of physical systems that involve a flow of one kind or another. The years around 2010 and onwards witnessed a sudden surge of experimental activity in this expanding field of research. However, building an expertise in analogue gravity requires the researcher to be equipped with a rather broad range of knowledge and interests. The aim of this book is to bring the reader up to date with the latest developments and provide the basic background required in order to appreciate the goals, difficulties, and success stories in the field of analogue gravity. Each chapter of the book treats a different topic explained in detail by the major experts for each specific discipline. The first chapters give an overview of black hole spacetimes and Hawking radiation before moving on to describe the large variety of analogue spacetimes that have been proposed and are currently under investigation. This introductory part is then followed by an in-depth description of what are currently the three most promising analogue spacetime settings, namely surface waves in flowing fluids, acoustic oscillations in Bose-Einstein condensates and electromagnetic waves in nonlinear optics. Both theory and experimental endeavours are explained in detail. The final chapters refer to other aspects of analogue gravity beyond the study of Hawking radiation, such as Lorentz invariance violations and Brownian motion in curved spacetimes, before concluding with a return to the origins of the field and a description of the available observational evidence for horizons in astrophysical black holes.

supermassive black hole tab: Formation Of The First Black Holes Muhammad Latif, Dominik Schleicher, 2019-04-26 The formation of the first supermassive black holes is one of the main open questions in our understanding of high-redshift structure formation. In this book, we aim

to provide a summary of state-of-the-art modern research on this topic, exploring the formation of massive black holes from a fluid-dynamical, stellar-dynamical and chemical perspective. The book thus presents a solid theoretical foundation, a comparison with current observations and future observational perspectives with upcoming missions such as the Square Kilometre Array, the European Extremely Large Telescope, the Euclid satellite as well as possible detections via gravitational waves.

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supermassive black hole tab: *Black Hole Blues and Other Songs from Outer Space* Janna Levin, 2016-03-29 The authoritative story of the headline-making discovery of gravitational waves—by an eminent theoretical astrophysicist and award-winning writer. From the author of How the Universe Got Its Spots and A Madman Dreams of Turing Machines, the epic story of the scientific campaign to record the soundtrack of our universe. Black holes are dark. That is their essence. When black holes collide, they will do so unilluminated. Yet the black hole collision is an event more powerful than any since the origin of the universe. The profusion of energy will emanate as waves in the shape of spacetime: gravitational waves. No telescope will ever record the event; instead, the only evidence would be the sound of spacetime ringing. In 1916, Einstein predicted the existence of gravitational waves, his top priority after he proposed his theory of curved spacetime. One century later, we are recording the first sounds from space, the soundtrack to accompany astronomy’s silent movie. In Black Hole Blues and Other Songs from Outer Space, Janna Levin recounts the fascinating story of the obsessions, the aspirations, and the trials of the scientists who embarked on an arduous, fifty-year endeavor to capture these elusive waves. An experimental ambition that began as an amusing thought experiment, a mad idea, became the object of fixation for the original architects—Rai Weiss, Kip Thorne, and Ron Drever. Striving to make the ambition a reality, the original three gradually accumulated an international team of hundreds. As this book 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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dark galaxy. Beautifully illustrated in full colour throughout Supplementary web site with many additional full colour images, content, and latest developments.

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supermassive black hole tab: Mapping the Heavens Priyamvada Natarajan, 2016-04-28 A theoretical astrophysicist explores the ideas that transformed our knowledge of the universe over the past century. The cosmos, once understood as a stagnant place, filled with the ordinary, is now a universe that is expanding at an accelerating pace, propelled by dark energy and structured by dark matter. Priyamvada Natarajan, our guide to these ideas, is someone at the forefront of the research—an astrophysicist who literally creates maps of invisible matter in the universe. She not only explains for a wide audience the science behind these essential ideas but also provides an understanding of how radical scientific theories gain acceptance. The formation and growth of black holes, dark matter halos, the accelerating expansion of the universe, the echo of the big bang, the discovery of exoplanets, and the possibility of other universes—these are some of the puzzling cosmological topics of the early twenty-first century. Natarajan discusses why the acceptance of new ideas about the universe and our place in it has never been linear and always contested even within the scientific community. And she affirms that, shifting and incomplete as science always must be, it offers the best path we have toward making sense of our wondrous, mysterious universe. “Part history, part science, all illuminating. If you want to understand the greatest ideas that shaped our current cosmic cartography, read this book.”—Adam G. Riess, Nobel Laureate in Physics, 2011 “A highly readable, insider’s view of recent discoveries in astronomy with unusual attention to the instruments used and the human drama of the scientists.”—Alan Lightman, author of The Accidental Universe and Einstein's Dream

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supermassive black hole tab: *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

supermassive black hole tab: Science With The New Generation Of High Energy Gamma-ray Experiments: The Variable Gamma-ray Sources: Their Identifications And Counterparts - Proceedings Of The Fourth Workshop Marco Maria Massai, Nicola Omodei, Gloria Spandre, 2007-10-02 The research program in gamma-ray astronomy focuses on increasing our knowledge of the nature and origin of galactic and extragalactic gamma rays, and understanding high-energy processes in the Sun, celestial objects, interstellar medium, and extragalactic space.This book not only provides an overview of the latest research and future plans for space-borne and ground-based experiments dedicated to the observation of the gamma-ray sky, but also addresses the topic of variable gamma-ray sources from the perspective of their identification and counterparts at different wavelengths. It further gives an overview of the theory related to the most qualified emission processes that take place in these sources and of the nature of their variability.

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