SAMPLE

Cosmos Unveiled: The Big Bang

The Beginning of the Universe

Aira Astralis

Free sample: Introduction & Chapter 1

putrabooks.github.io

Buy the full book:

Carousell carousell.sg/p/cosmos-unveiled-the-big-bang-ebook-pdf-1468097284

Payhip

Contents

Introduction

Chapter 01: The Collapse of the Static Universe

Chapter 02: The Galaxies Are Running Away

Chapter 03: The Shape and Content of Space

Chapter 04: The Rival Without a Beginning

Chapter 05: The Afterglow of the Beginning

Chapter 06: The First Three Minutes

Chapter 07: The Timeline of Everything

Chapter 08: Inflation, the Theory of the Starting Gun

Chapter 09: From Ripples to Galaxies

Chapter 10: The Runaway Universe

Chapter 11: The Pillars and the Balance Sheet

Chapter 12: What Came Before, and Other Open Questions

Chapter 13: The Idea in the Culture

Chapter 14: The Next Fifty Years

Conclusion

This free sample contains the Introduction and Chapter 1. The complete book contains the full contents above.

Introduction

Every civilization has had a story about how the world began, but only ours has had a story backed by equations, telescopes, and particle accelerators. The Big Bang is that story: the account, built over a century of observation and argument, of how everything we can see, the galaxies, the stars, the elements, the light filling space, emerged from a hot, dense beginning nearly fourteen billion years ago. It is the strangest idea ever to become establishment science, a claim about the origin of space and time themselves, and it is now as solidly established as anything in astronomy.

The idea's route to acceptance was long and contested, and this book tells it honestly. For most of the twentieth century the Big Bang faced a serious rival, the Steady State theory, which held that the universe had no beginning, that new matter formed continuously as space expanded, and that the cosmos had existed in the same state forever. The rivalry ended in the 1960s, when two lines of evidence, the abundance of helium and the discovery of a faint microwave glow filling the sky, came down decisively on the side of a hot beginning. Since then, the theory has been refined into a precise quantitative framework, the Lambda-CDM model, which fits data from the entire observable universe with a handful of measured numbers.

This book walks the reader through the whole structure. It begins with the history: the collapse of the static universe, the discovery that the galaxies are rushing away from us, and the two men, one Russian and one Belgian, who took Einstein's equations at their word and found a universe that could not stand still. It follows the great debate with Steady State, and the discovery that settled it. It then turns to the physics: what expansion actually means, what happened in the first minutes when the universe cooked the light elements, what the afterglow of the beginning tells us, and how tiny ripples in that afterglow grew into the galaxies.

The modern chapters carry the story to the frontier. The universe's expansion is accelerating, driven by something called dark energy that no one understands. The earliest instant, the one the name Big Bang points at, remains beyond the reach of tested physics, hidden behind a singularity and possibly smoothed over by a burst of cosmic inflation whose details are still contested. And the theory's parameters are measured to percent precision while one of them, the present expansion rate, refuses to agree with itself between two careful methods, a live crack in the edifice that keeps the field honest.

A word about the name, which was originally an insult. The astronomer Fred

Hoyle, Steady State's champion, coined Big Bang in 1949 on a BBC radio broadcast, meaning to make the rival idea sound ridiculous, a colossal explosion at a single point. The name stuck, and it misleads: the Big Bang was not an explosion in space, it was the rapid expansion of space itself, and it happened everywhere at once. There is no empty center, no edge, no point where it went off. One of this book's quiet projects is to fix the mental picture the name gives, because nearly every popular misconception about the theory comes from picturing a bomb when the mathematics describes something else entirely.

The final framing thought belongs to the reader's own position. The Big Bang is the only origin story in history whose evidence is visible to anyone with an old television set: a small fraction of the static on a detuned analog TV was, literally, the afterglow of the beginning, arriving from all directions, passing through every room. The universe's own past pervades the present, and the theory that describes it is not remote laboratory arcana but the large-scale truth about where everything, including the reader, came from. That is a story worth having straight.

The reader deserves one framing fact before the chapters begin, because the theory's name misleads. The Big Bang was not an explosion into space; it was the expansion of space itself, a stretching of the distance between every point and every other point, with no center and no edge, and the proof the book will present, the redshifts, the afterglow, and the cooked elements, is evidence not of a detonation but of a history, a time when the universe was hot, dense, and young. The reader who holds that correction from the first page will find every later chapter easier, and the reader who forgets it should return here, because the name is the worst thing about the theory.

Chapter 01: The Collapse of the Static Universe

For nearly all of human history, the universe in the minds of astronomers was fixed in extent. Aristotle's cosmos was a sphere of stars with a sharp edge; medieval cosmology kept the architecture and Christianized it; Newton's infinite space was at least static, a stage on which the stars stood still. The assumption of an unchanging universe was not a considered position but a background condition, so deep that when Einstein finished his theory of gravity in 1915, he found to his alarm that his own equations refused to support it.

General relativity describes spacetime as a dynamic thing, curved by mass and energy, and when Einstein applied it to the universe as a whole, the solutions expanded or contracted. A static cosmos, the equations said, would not stay put: gravity would pull everything together, and something had to hold it up. Einstein's response was the pragmatic fix that would haunt and then vindicate him: he added a term to the equations, the cosmological constant, a built-in repulsion tuned to exactly balance gravity, and published the static universe in 1917, later calling the move the biggest blunder of his career, though the phrase, attributed to him by a colleague's recollection, may itself be legend.

While Einstein was balancing his static universe on a knife edge, others took the equations seriously as physics. In Russia, Alexander Friedmann, a meteorologist and mathematician in Saint Petersburg, solved the equations of the expanding universe in 1922, without the cosmological constant, publishing a family of solutions: universes that expand forever, universes that expand and recollapse, universes that begin at a singularity. Einstein initially dismissed the work as mathematically suspect, then withdrew the objection, and

Friedmann died in 1925, of typhus, before any observation could confirm him.

In Belgium, Georges Lemaitre, a Catholic priest, physicist, and veteran of the First World War, arrived at the same solutions independently in 1927, and went further: he connected the expansion to the observed redshifts of the nebulae, deriving a linear relation between a galaxy's distance and its recession velocity, two years before Edwin Hubble published the relation that bears his name. Lemaitre's 1927 paper, published in French in an obscure journal, was famously undertranslated into English in 1931, the paragraphs deriving the expansion rate cut by the translator, and the history of the constant named for Hubble has been partially rewritten by that editorial accident. Lemaitre went furthest of all: in 1931, he proposed that the universe began as a primeval atom, a single quantum of matter-energy that expanded and decayed into everything, the first scientific formulation of what would become the Big Bang.

The two men themselves deserve a closing portrait, because the contrast between them is the theory's early history in miniature. Friedmann was a meteorologist by trade, a wartime aviator, and a polymath who died at thirty-seven, never seeing his equations vindicated, and his work reached the west slowly, partly through Einstein's changing assessments. Lemaitre lived to 1966, two months past the discovery of the microwave background he had predicted in essence, and his career spanned the whole arc: the obscure journal paper of 1927, the primeval atom of 1931, the papal honors, and the quiet insistence, delivered in person to Pope Pius XII, that the church should not tie doctrine to his physics, since the physics might change. Between them they did what Einstein had declined: they took the equations at face value and read off a universe with a history.

The intellectual atmosphere around these ideas deserves emphasis, because it was hostile. The 1920s and 1930s saw serious discomfort with a universe that had a beginning, from physicists who suspected the equations were being misapplied, from philosophers of science who saw the beginning as suspiciously theological, and from astronomers who thought the receding nebulas were unproven. Lemaitre himself, sensitive to the theological smell, insisted on keeping his physics and his faith in separate boxes, and his insistence is part of the story: the Big Bang was not smuggled in by religion, it was resisted for partly religious-seeming reasons and forced on the field by data.

One more historical thread belongs here, because it rounds out the cast: the observer who did not believe his own data. Hubble, whose name the law carries, remained publicly agnostic about the expansion interpretation for decades, referring to the redshifts as recession velocities with editorial caution and never fully endorsing the expanding-universe reading in print, partly from scientific conservatism and partly from the observational caution of a man whose calibration had been wrong before. The lesson is double: the data do not interpret themselves, and the theory that won was won by the community, not by its most famous name, whose name the theory borrowed anyway.

The chapter's hinge is 1930, the year the dam broke. At a meeting of the Royal Astronomical Society, Eddington and de Sitter, the two most influential cosmologists alive, publicly conceded that the static universe was untenable, de Sitter abandoning his own alternative model, and within a few years Einstein accepted the expanding solutions and dropped the cosmological constant, calling it theoretically unsatisfactory. The stage was then set, though nobody yet knew it, for the empirical fight: two theories, one with a beginning and one without, and a universe full of evidence waiting to be gathered.

The collapse also had a disciplinary side effect worth recording: it moved cosmology from philosophy into physics. The static universe had been a metaphysical preference, defensible either way in the absence of data, and its fall demonstrated that questions once considered beyond measurement, does the universe have an age, did it have a start, could it be observed at all, answer to instruments like any other. The generation that watched the change wrote about it explicitly, and the trade's self-image since, a field that asks the oldest questions and settles them with spectra, was forged in this collapse. The chapter's parting thought is that the discovery of the beginning was also the discovery that no question is permanently philosophical, only temporarily so.

End of free sample. The full book is available at putrabooks.github.io

ABOUT THE AUTHOR

Aira Astralis is a science writer specializing in astronomy and space exploration. Her work spans the full breadth of humanity's relationship with the cosmos -- from the earliest naked-eye observations to the engineering marvels of modern space missions.

Her books are built on a foundation of primary sources: peer-reviewed research, mission archives, and direct engagement with the scientific community. She writes for readers who want to understand not just what we know about the universe, but how we came to know it.

She believes that the most important frontier is not out there but in the gap between what scientists discover and what the public understands. Her books exist to close that gap.