SAMPLE

Cosmos Unveiled: Baryogenesis

Why Matter Won

Aira Astralis

Free sample: Introduction & Chapter 1

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Contents

Introduction

Chapter 01: The Perfect Mirror

Chapter 02: The Missing Half

Chapter 03: The Arithmetic of Survival

Chapter 04: Sakharov's Three Conditions

Chapter 05: The Broken Symmetry

Chapter 06: The Grand Designs

Chapter 07: The Electroweak Window

Chapter 08: The Neutrino Road

Chapter 09: The Relic Ledger

Chapter 10: The Antimatter Hunters

Chapter 11: The Laboratory Mirror

Chapter 12: The Frontier Names

Chapter 13: The Meaning of Existence

Chapter 14: The Standing Questions

Conclusion

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

Introduction

This volume is the case file of the missing half of everything. The universe began, by the record's standing account, with matter and antimatter in nearly perfect balance, and the two destroy each other on contact; a perfect balance would have left a universe of light with nothing in it, and yet the reader holds a book made of matter, on a planet of matter, orbiting a star of matter. Somewhere in the first fractions of a second, the balance tipped, by one part in a billion, and that single tilt is the reason anything exists at all. The case of the missing antimatter is the detective story this volume tells from its evidence to its suspects to the honest verdict: unsolved, pursued, and the most consequential open file in the particle cosmologist's cabinet.

The method entry names the inquiry's own structure. The case is built like a courtroom file: the observations entered as evidence, the Sakharov conditions entered as the law the mechanism must satisfy, and the candidate mechanisms entered as the suspects, each weighed at the record's own confidence and none convicted. Whoever carries the case to its end will have walked the file from the equations' perfect symmetry to the sky's imperfect asymmetry, the central contradiction held plainly from the first page to the verdict's edge.

The border entry names the neighboring files before the case opens. The Big Bang itself owns its own volume, the nucleosynthesis that fixed the surviving matter's recipe owns its own, and the microwave background that counts the photons owns its own; this case keeps the asymmetry alone, pointing to those shelves at every deep dive instead of restating their cargo. The record's honesty terms hold here as everywhere: every figure entered at the published weight, every contest carried as a contest, and the verdict left exactly where the record leaves it.

The standing entry sets the file's place in the series plainly: the missing-antimatter case is the asymmetry's own volume, the Big Bang account, the primordial cooking, the background radiation, the inflationary smoothing, and the neutrino background each owning separate files on the neighboring shelves, and this book keeping the tilt alone with its borders flagged throughout. The place is filed at the series' own architecture, the case's scope stated once at the door and maintained to the verdict.

The chronology entry names the case's own schedule plainly. The theft, whatever it was, happened inside the universe's first second, the imbalance locked in before the great wash ran its course, and the evidence the case works with is all aftermath: the surviving leftovers, the photon receipts, and

the laboratory mirror's own behavior. The schedule's asymmetry, a moment of crime and an eternity of receipts, is the case's own shape, filed at the door and kept through the file.

The reader entry adds the file's own intended companion plainly: the reader who wants the tilt's deep particle machinery will meet it here in the suspects' chapters, and the reader who wants the surrounding epochs, the inflation, the cooking, and the background, holds those accounts at the flagged shelves, the file's scope fenced once at the door. The companions are named at the series' own architecture, the fences maintained to the verdict's line, held.

The honesty entry closes the door chapter with the case's own first exhibit of candor: the record's honest state on the missing half is a measured theft without a named thief, the confidence entered as high on the observation and open on the mechanism, and the two confidences kept distinct through every page that follows. The candor is the file's own first promise, kept from the door to the verdict.

The difficulty entry sets the case's own demands. No mathematics is asked of the reader, the particle physics carried in plain description, and the one skill the chapters drill is the balance-sheet eye: the habit of asking every process what it leaves behind and whether the leftovers match. The case's arithmetic is simple enough to carry in the head, and its stakes, the reason the reader exists to read about it, are stated at the door and never inflated beyond what the record earns.

Open with the subject's standing question, felt before the physics arrives. Baryogenesis is the book of the universe's unbalanced ledger: the matter being made of exists, the antimatter that should have cancelled it does not, and the surplus, a part in a billion of the original collision, is everything; the reader is opening the subject of existence in its most literal sense, the question being not philosophical but bookkeeping, and the book's whole arc, from the perfect mirror to the standing questions, is the field's attempt to find the entry where the universe's books were cooked, the reader's own body being the surviving residue of a war the universe fought with itself and barely won.

Hold the reader's stake up next, stated plainly. Every atom in the reader's body is a surplus: the reader's carbon, the reader's iron, the reader's ocean's water, all descendants of the tiny excess the early universe kept, and the book the reader is opening is accordingly a family history, the reader being the beneficiary of the oldest inheritance there is; hold the stake's inversion as the book's engine, that the subject is not an abstract corner of particle physics but the accounting of why there is anything to be abstract about, the universe's

whole material estate being the interest on the billionth-part surplus, the reader included.

The book also carries a method, its own working convention, stated plainly here before the physics gets under way. The chapters keep the mathematics to the arithmetic the reader can follow, the ratios and the timelines at the field's settled round values, and the book's candidates being graded by the evidence rather than the elegance; read the book as the case's briefing, the standard one of this series, and the promise is the standing one: anyone who finishes can follow the decade's announcements, the neutrino results and the decay's nulls and the hum's limits, with the checklist in hand, the subject being one the reader can watch being argued in the journals' public pages.

Chapter 01: The Perfect Mirror

The symmetry entry opens the case with the physics' own perfect bookkeeping. The record's equations treat matter and antimatter as exact mirror partners: every particle owns an antiparticle of identical mass and opposite charge, and the particles' creation and destruction run by the same rules in both directions; the entry files the mirror at its documented standing, the case opened at the very symmetry whose violation the rest of the file must explain, the perfect bookkeeping stated before the theft.

The discovery entry carries the mirror's own founding evidence. Paul Dirac's equation predicted the antiparticle in the late 1920s, and Carl Anderson's cloud chamber caught the positron in 1932, the antimatter mirror's first confirmed resident; the entry files the prediction and the catch at their dated record, the mirror entered as confirmed physics rather than speculation, the case's first exhibit a prediction that came true.

The annihilation entry adds the mirror's own consequence. Matter and antimatter destroy each other on contact, the pair converting wholly to light and leaving nothing behind, the process the record's accelerators confirm daily in their collision halls; the entry files the destruction at its documented physics, the mirror's fatal handshake entered as the case's own arithmetic, the perfect balance's outcome stated plainly: nothing.

The naming entry adds the mirror's own vocabulary. The antiparticle wears the mirrored signs: the positron carrying the electron's mass with the positive charge, the antiproton carrying the proton's opposite, and the antiatom running the whole architecture in reverse; the entry files the vocabulary at its documented definitions, the mirror's residents entered by name, the case's own cast listed before the plot begins, kept.

The converse entry adds the mirror's own completeness. The completeness runs deeper than the particle zoo's famous residents: every known particle owns its mirror partner, the antiatom and the antimolecule standing confirmed in the record's traps and beams, and the mirror's own universality entered as the case's own founding fact; the entry files the completeness at the record's documented coverage, the mirror entered whole, the chapter's bookkeeping closed at its true breadth, held.

The garden entry adds the mirror's own everyday reach. The positron appears in the record's own medicine, the hospital's scanning physics using the antimatter partner daily, and the annihilation the case treats as cosmic tragedy running in the clinic as routine light; the entry files the everyday reach at its documented use, the mirror entered at its familiar scale too, the case's

cast carried from the cloud chamber to the clinic, kept.

The theory entry adds the mirror's own description bookkeeping. The antimatter partner enters the record's theory as the same field read backward, the two mirror readings carrying identical physics in the theory's own terms, and the description's perfect bookkeeping standing as the case's own wall: the theory the laboratory confirms daily cannot itself produce the tilt; the entry files the wall at its documented standing, the mirror's perfection entered as the problem's own shape, held.

The partner entry adds the heavier mirror's own residents. The antiproton and the antineutron joined the positron as the accelerator era opened, the mirror's full cast confirmed across the particle zoo by the record's own collision halls, and the antiatom assembled from the mirror's residents in the modern traps; the entry files the residents at their dated confirmations, the cast entered across the zoo, the mirror's census carried to completion, held.

The mass entry adds the mirror's own equality at the deepest test. The particle and its partner carry identical masses to the record's finest comparisons, the traps and the rings weighing both sides to the published precisions, and the equality entering as the mirror's own strongest confirmed feature; the entry files the equality at its documented precision, the mirror weighed on both sides of the scale, the perfect bookkeeping carried to the record's own limits, held.

The production entry closes with the mirror's other hand. The same physics runs backward, the light of sufficient energy creating particle-antiparticle pairs from nothing but motion, and the young hot universe ran that direction constantly, the pairs forming and destroying in a standing wash; the closing entry files the wash at its documented operation, the chapter closed with the mirror running both ways and the case's question standing: how, from a wash that perfect, did anything survive, held.

Let the perfect mirror chapter close on the annihilation's completeness, the problem's foundation. The matter-antimatter collision was not a battle in any sense the reader's wars suggest: it was total, the pairs finding each other everywhere, the annihilation converting everything to light, and the completeness being the puzzle's cruelty, the universe having played the perfect game and somehow left a piece on the board; hold the completeness's arithmetic honestly, a billion pairs colliding to leave a single survivor, the survivor's descendants being the stars and the reader, the mirror having been perfect everywhere except in the one part in a billion that made this book possible.

A second mirror note belongs to the antiparticle's prediction, the subject's intellectual origin. The antimatter was a mathematics before it was a substance, the equation's negative-energy solutions being re-read as the mirror's particles, the prediction arriving on paper and being confirmed in the cosmic rays; feel the origin's lesson, that the universe's missing half was found in the mathematics first, the symmetry being the theory's own discovery, and the problem being accordingly the theory's own child, the physics having predicted the mirror that the universe then declined to keep, the book's whole question having been authored by the same mind that authored the mirror.

The mirror's economic footprint deserves its own note. The antimatter is the most expensive substance to make in any quantity, the production runs at particle factories being measured in nanograms per year and the cost per gram quoted in figures that make antimatter the luxury good of physics, the price being the problem's own irony: the substance the universe allegedly threw away by the galaxy-load is the hardest thing humans have ever bought, a few atoms at a time, and the bookkeeping of that scarcity is itself evidence, a universe that had a surplus would not be one where a nanogram makes headlines.

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.