SAMPLE

Worlds Beyond Earth: The Terrestrial Planets

Mercury, Venus, Earth, and Mars Compared

Aira Astralis

Free sample: Introduction & Chapter 1

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

Introduction

This volume is the family portrait of the four rocky worlds. Mercury, Venus, Earth, and Mars share one recipe, silicate rock over an iron heart, one birthplace, the warm inner disk of the young solar system, and one address, the band inside the giant planets' ice line; and from that shared beginning the four have produced four utterly different outcomes, a scorched cannonball, a boiling greenhouse, a water world with life, and a frozen desert. The comparative method is the volume's spine: the four are best understood together, each one's features explained by the others' contrasts, and the reader who finishes the fourteen chapters will have walked the whole family, the same start, four fates, held in one album.

The method entry names the science this volume practices. Comparative planetology, the reading of one world through another, grew into a discipline as the spacecraft data arrived, and the four rocky planets are its original laboratory: the Earth's plate tectonics makes sense against Venus's absence of plates, Mars's dry riverbeds make sense against the Earth's water cycle, and Mercury's oversized core makes sense against the Moon's small one. The method's entry is logged plainly: this volume compares first and narrates second, every chapter setting the four side by side before it tells any single world's story, the family read as a set.

The border entry names the neighboring shelves before the album opens. Each of the four owns a deeper portrait on its own shelf, Mercury, Venus, Earth, and Mars each carrying a full volume of their own, and this book's chapters flag those shelves at every deep dive rather than repeating their cargo; the wider family of the rocky worlds beyond the solar system, the super-Earths and the exoplanet rocks, keeps its own volume too, carried here only at the comparative lesson's edge. The border rule is stated at the door and enforced through all fourteen chapters: the family album carries the comparisons, the member portraits carry the individual biographies.

The difficulty entry sets the album's own demands honestly. No mathematics is required of the reader, the four worlds' physics arriving in plain descriptions, and the one habit the chapters build is the comparative eye, the willingness to hold two or three worlds in mind at once and let the contrasts do the teaching. The reader who acquires the eye will find the family's story among the most legible in all the planetary sciences, the demands priced at their true, modest weight, the promise kept that nothing here was simplified into falsehood.

The itinerary entry names the album's own order. The chapters run from the family's definition through its birth, its shared architecture, the four member

portraits in solar order, the feature comparisons, the definitional border, the robot census, the exported lessons, and the standing questions, the sequence built so each comparison lands after the reader has met the members it compares. The reader wanting a single member first can take the portrait chapters alone, every chapter built to stand with its flags intact, the itinerary's courtesy kept through all sixteen legs.

The standing entry sets the album's place in the series plainly: this is the family's comparative volume, the member biographies and the wider rocky-class story living in their separate volumes, and whoever wants the four worlds' shared physics, shared birth, and divergent fates in one frame holds that frame here. The place is logged at the series' own architecture, the album's standing stated once at the door and kept to the final line, the colors maintained throughout.

The record entry names the album's own sources plainly. Every entry rests on the published record, the standing measurements and mission reports of the planetary sciences, and the album's honesty terms bind each figure to its record's confidence, the reader directed to the member volumes' own sources for the paper trails; the entry logs the provenance at its standing convention, the album's evidentiary basis stated once at the door, held to the final line.

The method entry sets the album's honest rules. Every portrait that follows is logged at its standing measurements, its documented features, and its accepted explanations, with the confidence stated rather than implied, and the record's open questions kept visible; the entry logs the method at the record's own standards, the book entered as a catalog of findings rather than a tour of opinions, the family's album opened with its evidence attached.

The comparison entry states the book's organizing bet. Planets read most honestly side by side, the four as one experiment run four ways, each member's strangeness made visible by the others' company; the entry logs the plan at its four-way design, the chapters entered as shared properties compared rather than four separate biographies, the album built on the record's own best instrument, difference.

The contract entry sets the honesty terms once at the door. Every figure in the album carries the confidence the published record earns, the densities and radii and pressures taken from the standing measurements, the contested histories of Venus's face and Mars's methane carried openly as contests, and any reader who checks an entry against its source will find the album's weights true. The terms are the album's compact with its reader, logged at the door and maintained to the last chapter, the record's own colors kept through every page of the four worlds' shared story.

Chapter 01: The Family Defined

The name entry opens the album with the label itself. A terrestrial planet is a world built of rock and metal rather than gas and ice, the term descended from the Latin names for the Earth, Terra and Tellus, and the family's roster in the dynamical census runs Mercury, Venus, Earth, and Mars, the four inner planets inside the giant planets' orbit; the name's entry is logged plainly, the label entered at its etymology and its roster, the family defined before any member speaks.

The recipe entry carries the shared construction. All four are made of the same two stuffs in the same two layers: silicate rock, the mantles and crusts, over iron-bearing metal, the cores, with the Earth running the densest of the four at roughly five and one half grams in each cubic centimeter and Mars the lightest at about four; the recipe's entry is logged at the standing measurements, the family's shared physics entered at its documented densities, the four worlds' common architecture held up as the album's first fact.

The definition entry adds the family's own definitional split. The astronomical definition counts by orbit, the four inner planets qualifying by their clear lanes around the sun, while the geophysical definition counts by construction, and under it the Earth's Moon and Jupiter's Io qualify as terrestrial worlds by their rock-and-metal bodies, with Europa a borderline ice-cased member and the big asteroids Vesta and Pallas argued at the edge; the entry carries both definitions at their documented terms, the split entered honestly, the family's boundary flagged as a live disagreement rather than a settled line.

The census entry adds the family's official standing. The four inner planets hold their seats under the astronomical union's dynamical rules, the orbits clear and the lane around the sun unshared, while the geophysical count runs by construction alone, the definitional split the album's eleventh chapter carries at its border; the entry carries the census at its documented rules, the roster entered with both counts named, the family defined once and its boundary flagged at the door.

The address entry adds the family's standing in the wider neighborhood. The four rocky worlds hold the inner band of a solar system that is mostly not like them, the giants' bulk and the ice worlds' distance dwarfing the rocky quartet's warm little corner, and the album's standing lesson opens with the address: the family is the exception's warmth, the quartet living where the system's water boiled away; the entry enters the address at its documented standing, the neighborhood entered at its true proportions, held.

The history entry adds the label's own working life. The family's terms run

from the formal terrestrial and telluric to the working rocky, the labels all naming the same recipe across the record's registers, and the album's own usage stated at the door: the formal term entered first, the working term used after, the family's naming carried with its own honest variety, kept.

The scale entry adds the family's own size ordering plainly. The quartet runs from Mercury's thirty-eight percent of the Earth's radius through Mars's fifty-three, Venus's ninety-five, and the Earth's own hundred, the family spanning a factor of nearly three in radius from its smallest to its largest member; the entry logs the ordering at the standing measurements, the sizes entered as the album's own ruler, the family's spread stated in one line, kept.

The gravity entry adds the family's own weight order. The quartet's surface gravities follow the sizes, Mercury and Mars running near two-fifths of the Earth's, Venus matching the Earth's within a few percent, and the ordering entering the escape chapter later as the air-retention physics' own cause; the entry logs the weights at their standing values, the gravities entered as the album's own first cross-reference, kept.

The magnetism entry adds the family's own invisible comparison. Two of the four still run dynamos, the Earth's strong field standing as the family's working shield while Mercury's weak one runs as the smallest member's surprise, and the two dead dynamos, Venus's absent and Mars's vanished, entering the eighth chapter's stripping physics; the entry logs the four magnetic states at their documented standings, the invisible comparison opened early and flagged to its full chapter, kept.

The neighborhood entry adds the family's own address. The four orbit inside the snow-deprived inner disk, close to the sun and close to each other, all within a distance the giant planets dwarf with a single lap; the entry logs the address at the system's measured architecture, the family entered as the system's inner compact quarter, the four-planet definition carried with its geography attached.

The roster entry adds the family's own arithmetic. Four members, zero disputes: no astronomer argues Mercury out or a fifth rocky world in, the roster the most stable in the planetary catalog; the entry logs the census at its settled state, the family entered as the one planetary grouping the definitional wars never touched, the album's roster carried as the record's quiet agreement.

The label entry adds the naming's own honesty. The word terrestrial, Earth-like in its bare translation, names the family by its composition rather than its likeness, the rocky worlds standing closer to the Earth's recipe than to the

giants' but by no means copies of the baseline; the entry logs the name at its historical coinage, the label entered with its meaning clarified, the family carried by a word that flatters only one member.

The weight entry adds the family's combined arithmetic. Taken together, the four worlds mass barely two Earths, the whole album outweighed by Jupiter a hundred and sixty times over and by the Sun a hundred sixty thousand times over; the family photo is, in the ledger of the system, a rounding error with a viewpoint. The number is worth one paragraph because it sets the family's true standing in the neighborhood: the rocky worlds are where the mass is not, and everything the album values, the water, the air, the only known life, rides on a sliver of the system's substance. The weight carried plainly as the album's own proportion.

The meaning entry closes with the family's standing contrast. The four rocky worlds are defined against the giant planets as much as by themselves: no deep hydrogen envelopes, solid ground at the surface, the land standing where the giants' clouds begin, and the contrast is the family's signature; the closing entry logs the definition by opposition at its documented terms, the album opened with the four named, their recipe stated, their boundary argued, and their signature drawn, held.

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.