SAMPLE

Worlds Beyond Earth: Mars' Moons

Phobos and Deimos

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

Mars keeps two moons, and neither behaves like the one the reader grew up with. Phobos, the larger, races around the planet three times a day, rises in the west, sets in the east, and is falling. Deimos, the smaller, drifts so slowly that a patient observer on the Martian surface could watch it cross the sky for the better part of three days, and it is leaving. Both are lumpy, dark, cratered chips of rubble, both small enough that a walk around either would take an afternoon, and both carry one of the solar system's oldest open questions in their stones: did Mars capture them, or did it build them?

The file that follows is small in objects and large in stakes. Two moons, discovered in a single August in 1877, weigh on the origin of the planet's own great impact basin, on the fate of every satellite that spirals too close to its planet, and on the question of how a debris disk turns into solid worlds. The sample mission now bound for the larger moon will read the answer directly, and this book is the file before the reading: what is known, how it was learned, and what remains open.

The file's scope is worth one border note. This is a book about two moons: their history, their physics, their coming sample, and their place in the census of small moons. It is not a book about Mars, whose own file fills libraries, and the planet appears here only as the moons' host, their furnace, their jailer, and their heir. The border is honest and it is strict: everything on the Mars side of the line is cited only where the moons' file needs it, and the reader who wants the planet's own story is pointed to the trade's Mars shelf, gladly.

The sorting used throughout is the honest one. The certain: the orbits, the sizes, the densities, the spiral. The well-evidenced: the rubble-pile interiors, the surface ages, the meteorite cousins. The argued: the origin, the grooves, the ring to come. Every entry carries its evidence, the instrument or the arithmetic that earned it, and the reader is invited to check each claim against its strength rather than against its confidence.

One caution is offered at the door. The two moons have attracted speculation since before they were found, and the literature is full of voices that mistook imagination for measurement. Swift's invented moons, the canal-building Martians of a later century, the hollow Phobos of a Soviet-era rumor: all are part of the file's history, and all are marked as what they are.

The errors' teaching value, stated once and used throughout. The file keeps its history of wrong readings, the hollow moon, the confident capture verdict, the Swift forecast, because each one shows a working boundary: imagination without measurement, measurement without mechanics, pattern without

physics. The trade's discipline is not the absence of error but the correction of it, in public, with the wrong version preserved beside the right. The reader who meets the discipline here will recognize it in every later chapter, and will meet it once more when the trade's current favorite, the impact story, is either confirmed or entered beside its predecessors. The atlas carries them because the file's errors teach the method, and the method is the book's real subject.

The chapters run from the ground up. The discovery first, then the speculators who preceded it, then the orbits, the spiral, the surfaces, the interiors, the two origin arguments, the missions that have read the moons, the moons as seen from Mars, the sample mission, the small-moon census, the reading methods, and the open questions. The beauty here is in the strangeness: a moon that outruns the planet's spin, a moon that will become a ring, a pair of worlds whose biography may be the biography of the planet's worst day. The reader who follows the numbers will find the strangeness is arithmetic, and the arithmetic is the wonder.

The atlas's own honesty is the last thing offered at the door. Every number in the file was earned by someone: a night at the eyepiece, a bend in a radio signal, a clock reading taken twice. The reader is invited to distrust any sentence here that does not show its earning, and the chapters that follow are built to survive that invitation. A file about two small moons has no right to the reader's attention except by being exact, and exact is the whole plan.

Chapter 01: The Discovery

The discovery is a story of a stubborn man, a good telescope, and one week of August. Asaph Hall was a mathematician at the United States Naval Observatory, working nights with the great 26-inch refractor then the most powerful instrument of its kind, hunting for anything orbiting Mars. The planet's close approach of 1877 was the best chance in years, and Hall swept the space around the reddish disk night after night.

The work nearly stopped before it started. Mars was brilliant, and near the planet the glare made faint objects almost invisible. Hall later recorded that he had half decided to give up, and that the decision was argued out at home. His wife, Angeline Stickney, told him to try one more night, and the story has entered the file because the largest crater on Phobos now carries her name: an amateur's urging preserved as the moon's most prominent scar.

The first catch came on August 12, when Hall found a small object near the disk and confirmed it moving with the planet. He had, he thought, a star to work with, and he was careful, checking again before he trusted it. The second came on August 17, when he asked a colleague to verify a new object, and the two agreed the moon was real. Hall found the inner, faster moon himself on August 18, the discovery that made the pair. Within the month, both had provisional numbers, and the Observatory had two moons to announce to the world.

The naming settled quickly for the age. Hall's suggestion, through a colleague, reached a schoolmaster with a taste for Homer, who took the names from the fifteenth book of the Iliad: the two sons of the war god, Fear and Dread, who drove his chariot into battle. Phobos, the fear; Deimos, the dread. The little moons took their places as the god's escorts, and the reader who knows the legend holds the whole book in one word: Mars rides to war, and panic runs before him.

The names' second life belongs in the entry too. A moon's name is its public face, and these two carry the most quoted parentage in the census: the fear and the dread that ran before the war god's chariot, named by a schoolmaster from a poem, adopted instantly, and never contested. The trade's note is that the naming, unlike most early nomenclature, stuck without a fight, and the moons entered the almanacs already legendary, the only pair in the census christened from the battlefield.

The reaction ran from celebration to disbelief. The announcement crossed the Atlantic quickly and was republished widely. Within a year the moons were in the almanacs, and astronomers across Europe were timing them to refine the

mass of Mars. But the pair also fed the older speculation, and the file must be honest about the noise: Asaph Hall's real moons, found with a real telescope at the edge of the planet's glare, landed on a public already primed to believe Mars kept companions, and the priming had been done by fiction.

The numbers the discovery fixed are the file's foundation. The inner moon circled the planet in under eight hours, faster than Mars itself rotated, which no moon then known did. The outer one took a little over thirty hours, a slow clock. The distances were startling: the inner moon orbited at about nine and a half thousand kilometers from the center of Mars, closer to its planet than any other known moon, a stone's throw in planetary terms. The sizes were disappointing to some and fascinating to others: the two moons were small, faint, and nothing like the dignified sphere the Earth keeps.

The discovery's legacy in the trade is the demonstration that a search justified by a good question is worth the weary nights, and the demonstration that the question was wrong in an instructive way. Hall found the moons, but he had not guessed their strangeness. The orbit under the synchronous line, the rise in the west, the coming fall of the inner moon: all of that was read out of the numbers after the fact, and the reading changed what the moons meant. The file opened in August 1877 with two moving points of light, and the points have been growing stranger for a hundred and fifty years.

The discovery week itself deserves one more entry, the trade's favorite detail in the whole file. Hall was working with a telescope meant for star parallax, a specialist's instrument borrowed for a planet, and the two moons were found in the hours he could steal between other duties. The file's honest reading is that the greatest small-moon discovery in the sky was made on borrowed time, and the note has encouraged every searcher since: the sky keeps its prizes for the stubborn, and the stubborn are often short of telescope.

The timing entry prices the discovery's own oddness. Asaph Hall's search came at the end of a century that had found moons around Jupiter and Saturn by the dozen, and Mars, the most watched planet in the sky, had kept its small companions hidden for two centuries of telescopes, a fact the file grades as the moons' first character card: they are simply too small, too faint, and too close to a bright planet for any earlier instrument to catch. The reader should carry the entry plainly, the planet, watched for centuries, the moons, invisible until the aperture and the patience aligned, and the oddness, the discovery file's own opening note.

The naming entry closes the discovery's own file. Hall named the moons for the Greek attendants of war, Fear and Dread, companions of the war god, and the account notes the naming's quiet aptness: the two small bodies were

found by an observer who nearly quit, at a fogged observatory, in the last week of a search he had steeled himself to abandon. The file keeps the human card plainly, the names, mythologically exact, the finder, at his last week of nerve, and the serendipity, the discovery file's own footnote, kept.

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.