SAMPLE

Famous Astronomers: Johannes Kepler

The Laws of Planetary Motion

Aira Astralis

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Conclusion

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

Introduction

The proper way to begin Johannes Kepler is with a courtroom, because the mind that gave the planets their laws was trained as a lawyer, and everything he ever did to the sky has the shape of a cross-examination. He was born in 1571 in Weil der Stadt, a small imperial town in the duchy of Wurttemberg, a sickly child who survived smallpox and fevers that left his hands weakened and his eyes scarred, and he rose through the charity of the duchy's Protestant schools to the university at Tubingen, where he was prepared for the ministry and taught, quietly and against the lecture-hall fashion, the Copernican arrangement of the heavens, and he turned from the pulpit to the mathematics classroom in 1594 by an accident of an empty teaching post in

Graz, and within two years he had published the first public defense of Copernicus founded on a physical hypothesis, and within eight he was imperial mathematician in Prague, holding the office that Tycho Brahe had held until Tycho's sudden death in 1601, and from that desk he did the work that ended the ancient sky: the planets do not ride circles, they ride ellipses, and they sweep equal areas in equal times, and their periods grow as the cubes of their distances, and the sky is not geometry alone but physics, a machine of forces, and the finding of that machine is the story this volume tells.

The courtroom is not a decoration. Kepler spent his life in litigation of one kind or another, arguing with a planet that kept missing its predicted places, arguing with the heirs of Tycho over data that were the most precious observational property in Europe, arguing with printers over costs and with the imperial treasury over a salary that arrived years late if at all, arguing with his own church to the point of excommunication rather than sign a document he believed false, and, at the climax of his middle years, arguing for the life of his own mother before a witch court in a German town that had already burned other women.

A weaker biography would treat the legal framing as metaphor, and this one will not, because the analogy is exact: a lawyer assembles evidence, tests it against the hostile version, abandons the case he cannot prove, and wins on the record, and that is a sentence-for-sentence description of the Astronomia Nova, and the Astronomia Nova is the greatest piece of advocacy the heavens have ever received.

The reader should also be told at the threshold what kind of man is behind the record. Kepler wrote more about himself, in prefaces and letters and furious marginal calculations, than almost any scientist before the modern age, and what he shows is a temperament foreign to the smooth marble of legend: he

was anxious, funny, devout to the point of tears, vain about nothing except truth, reckless in spending, sick in nearly every organ, and incapable of leaving an error unconfessed, including his own, which he published with an eagerness that sometimes alarmed his friends. He believed the universe was built on geometry by a God who wished to be known, he believed the copying of that geometry was worship, and he believed, in the teeth of every disappointment of his life, that the evidence would eventually compel agreement, and the belief proved right, though the agreement arrived mostly after his death, and this biography is part of the arriving.

The chapters that follow use the series' fixed road, discovery, understanding, characteristics, science, measurement, features, context, the moderns, research, discoveries, mysteries, the future, the fun, and the meaning, and the road suits this subject unusually well because Kepler's career happened in the order of a case: evidence gathered, hypothesis framed, hypothesis broken on eight minutes of arc, verdict delivered in three laws. The book ends where he ended, in Regensburg in 1630, with a fever caught on a journey to collect a debt, and with the epitaph he wrote for himself, that the skies had been his survey and the shadow of the Earth was now his yard, and the measuring of the shadows, in the end, was what the whole life had been: one long cross-examination, conducted by a sick lawyer with ruined eyes, against a sky that lied beautifully, and the sky confessed.

A word on the shape of the evidence is owed before the chapters begin, because the reader should know what the record contains. Kepler's books, manuscripts, computation sheets, and more than seven hundred surviving letters have been gathered into a great modern edition, and the edition means that this biography, unlike most lives of his predecessors, can quote him at the working level: not the polished verdicts only, but the complaints about the weather, the jokes about his salary, the marginal fury at his own arithmetic, the prayer of thanks after the ellipse, and the record is why the chapters that follow contain so much of his own voice, since a man who documents himself this thoroughly deserves to be heard, and the hearing is the biography's method.

A last orientation for the reader new to him: the three laws are the destination, but the road is the reason this biography exists. Anyone can state the laws in three lines, and every textbook does, and the textbook version leaves out the man who spent a decade of sixty-hour arithmetic months to earn them, the era that tried him as it tried everyone, and the method that made the earning possible, and this volume restores the road, since the road is where the worth is, and the worth is the subject of every chapter ahead, and the chapters begin now.

Chapter 1: The Discovery of Johannes Kepler

The phrase the discovery of Kepler has two meanings, and both belong in this chapter. The first is the ordinary biographical one, the account of how a child of a declining artisan family in a declining imperial town was found, as one finds ore, by institutions designed to look: the ducal schools of Wurttemberg, which spotted the poor boy's talent, fed and housed him through grammar school and seminary, and pushed him up the ladder to Tubingen, where the system meant him for a pastor, and where the mathematician Michael Maestlin, teaching officially from Ptolemy, introduced his best student privately to Copernicus, and the introduction took hold like fire in dry grass.

In 1594 the Protestant seminary in Graz needed a mathematics teacher, and the drawing of lots among the Tubingen candidates fell to Kepler, and he went south into Catholic Austria as a young man of twenty-two to teach arithmetic and astrology to future schoolmasters, and the discovery, in this first sense, was the machinery of a pious state unearthing a genius it had designed for other purposes and then losing him to the sky.

The second meaning is the discovery that made him, which he made himself, and it happened in Graz in the winter of 1594 into 1595, and it concerned the spacing of the planets. The Copernican arrangement gave the order of the world but not its reason, and the young teacher, charged by his employers to produce the annual calendar of weather and portents, sat with the problem of why there should be six planets rather than five or fifty, and why the gaps between their orbits should be the sizes they are, and in the middle of a lecture, while drawing a diagram on the board, he saw the answer he had been circling for months: the orbits nest, and the spaces between them are exactly the spaces occupied by the five perfect solids of geometry, the tetrahedron between the spheres of Mercury and Venus, the cube between Venus and Earth, the octahedron, the icosahedron, and the dodecahedron, each inscribed in the next sphere and circumscribing the last, and the fit of the five solids into the six spheres was close enough to the known distances that the twenty-four-year-old declared the case closed by God.

He tested the nesting against the best numbers available, published it in 1596 as the Mysterium Cosmographicum, the Secret of the Universe, with an apology for his youth on the title page and a letter to Tycho Brahe, the greatest observer in Europe, asking for judgment on the numbers, and Tycho answered with the response that changed everything: the hypothesis is ingenious, and the numbers are wrong, and to fix them you must come to me.

The discovery of Kepler by the world proceeded from that letter. Tycho,

quarreling with his Danish patrons, had moved his observatory to the outskirts of Prague, and by 1600 the invitation had become employment, and Kepler arrived in February of that year to work on the orbit of Mars, the planet whose motions had defeated every predecessor, and within days the two difficult men were quarreling overlodging and data and religion, and within eighteen months Tycho was dead, and Kepler, thirty years old, was appointed imperial mathematician to Rudolf the Second in his place, inheriting the title, a modest salary that the imperial treasury paid erratically for the rest of his life, and, after a bitter negotiation with Tycho's heirs, the observations of Mars.

The chapter closes on the truest sentence of the discovery: what was found in Graz was a young man with a beautiful wrong idea and the honesty to test it, and what was found in Prague was the evidence that would break the idea and remake him, and the remaking is the next chapter's business. The chapter should close by naming the discovery that the age itself made of him, because the world's discovery of Kepler was slower than the text's and worth a paragraph. He was recognized early by those who could read him, praised by Galileo, consulted by princes, and made imperial mathematician at thirty, and he was also, in his own lifetime, banned, excommunicated, unpaid, and tried, and the contradiction is the discovery of the age: a civilization clever enough to employ the greatest astronomer alive and careless enough to starve him, and the biography does not resolve the contradiction, because the record does not, and the record is the standard here, and the standard has been stated.

The discovery chapter therefore reports two finds, a talent and a hypothesis, and asks the reader to notice which mattered, since the beautiful solids are museum pieces and the habit of testing them is the working science, and the habit was present from the first page of the first book, and the presence is the discovery that the whole biography rests on.

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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.