SAMPLE

Famous Astronomers: Edmond Halley

The Comet Predictor

Aira Astralis

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Conclusion

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Introduction

Edmond Halley was born in Haggerston, near London, on 8 November 1656, and died at Greenwich on 25 January 1742, and between those dates he did more kinds of science than almost any mind of his century: he cataloged the southern stars from a remote Atlantic island, mapped the winds of the world's oceans and the magnetism of the Earth, measured the Moon's motion and the Venus transit's geometry, priced the human lifetime, calculated the orbit of the comet that carries his name, and, in an act whose consequences tower over the rest, reached into his own pocket to publish Isaac Newton's Principia.

The catalogue of his offices is its own list of the era's science. The Royal

Society elected him a Fellow at twenty-two, on the strength of the southern sky he had observed at twenty; he served the Society as its clerk and as the editor of its journal; he commanded a royal ship, the Paramore, on the first sea voyages undertaken purely for scientific measurement; he held the Savilian chair of geometry at Oxford for two decades; and he ended his career as the second Astronomer Royal, running the Greenwich Observatory from 1720 until his death, past his eighty-fifth year.

The fame, however, rests on a prediction. In 1705 he published a synopsis of comet orbits, identified the comets seen in 1531, 1607, and 1682 as one and the same body returning on a long ellipse, and forecast that it would come back around the end of 1758. He was dead sixteen years when the comet arrived on his schedule, and the world, watching the sky fulfill a dead man's arithmetic, gave the comet his name, the only case in the history of astronomy where a celestial object of the first rank carries the name of the man who calculated it rather than of the man who first saw it.

The man behind the prediction had a temperament the biographies keep in the foreground, because it explains the career's shape. He was cheerful, gregarious, fond of the sea, fond of taverns, a man who made friends in every port and kept them, a commander who slept in his ship with his crew, a scientist who tested his own diving bell in the Thames. The century's greatest mathematician was famously difficult, and the century's greatest publicizer was famously easy, and the friendship between the two produced modern science's founding book.

This volume follows the whole career, not the comet alone, because the honest story of Edmond Halley is the story of a science becoming modern: the southern stars added to the map, the oceans charted by their winds, the Earth's magnetism measured at sea, the fixed stars caught in motion, the distances of the solar system given a method, the human lifespan given a

table, and the heavens, through the comet, given a clock. The chapters that follow tell each of those in turn, and the reader who knows only the comet will meet the rest of the man, and the reader who knows the man will meet the comet again, at the end, keeping its appointment.

The century Halley served deserves a sentence of its own color, because the reader cannot feel his career's daring without it. The 1670s were a time when the southern stars were rumor, when the Earth's age was fixed by a chronology counted in thousands of years, when a comet's appearance was still, for much of the public, a portent printed in almanacs, and when the idea that a human being could foresee a comet's return, to the season, a half century in advance, belonged nowhere in the imagination at all. Within one working lifetime, Halley's own, the southern hemisphere of the sky was charted, the winds of the world's oceans were drawn, the age of the Earth became a scientific question, and a comet was caught in a prediction so exact that its arrival felt like a public miracle with footnotes. The volume's chapters move through that transformation at the pace of one man's working life, and the reader should feel the acceleration in the clock of the age itself.

A note on the fame, before the chapters begin, because the man's reputation has had two lives and the second one is still being written. For nearly two hundred years after his death the name Halley meant, to almost everyone, one thing only: the comet, a word on a schedule, a sky-clock bearing a surname. The editorship of the Principia, the maps, the tables, the voyages, and the diving bell belonged to scholars, not to the public, and the caricature of a lucky predictor stood where a scientist had been. The modern decades have corrected the record, and this volume belongs to the correction: the reader is invited to meet the whole man, in his own century and in the record, and to keep the comet in its true proportion, which is large, but not as large as the rest.

One more framing belongs at the threshold, because the volume's man was a bridge between two kinds of science, and the reader should cross it knowingly. Behind Halley stood the science of the virtuosi: private means, cabinets of curiosities, observations hoarded, results exchanged in letters among gentlemen. Ahead of him stood the science of the institutions: salaried posts, public journals, state surveys, expeditions with written plans, predictions addressed to everyone. His career carried the whole crossing: the private fortune of the son funding the public science of the Astronomer Royal, the letter-writing network of the virtuoso becoming the Royal Society's print machinery, the curiosity of the cabinet becoming the Paramore's data. The chapters that follow are, in part, the story of that crossing, and the reader who notices it will understand why one man's working life feels like the birth of a

whole profession.

Chapter 1: The Discovery of Edmond Halley

The making of Edmond Halley begins with soap and stars, an unromantic combination that proved decisive. His father, a prosperous London soap-boiler with property in the east of the city, had money enough to give the boy the best schooling available, the St Paul's School, and an allowance generous enough to support a scientific career, the purchase of instruments, and the habit of paying for the work of others that would later rescue Newton's masterpiece. He entered Queen's College, Oxford, in 1673, at seventeen, already an observer with a telescope, already publishing, and by his early twenties he owned a star catalog's worth of skill and the means to use it.

The first great decision announced the whole character. At twenty, in 1676, he left Oxford without completing the degree, gave up a comfortable college life, and arranged his own expedition to the island of St Helena, in the South Atlantic, on a ship of the East Africa Company, to do what the northern observatories could not: map the stars of the southern sky. The motive was exact and modern. The star catalogues of the era, Tycho's and Flamsteed's rising work, stopped at the horizon of Europe, and the southern celestial hemisphere was almost blank; Halley proposed to fill it.

St Helena, and what it cost, and what it added, constitutes one of the most consequential two years a twenty-year-old ever spent. The island was remote, cloud-wracked, and sober; the young astronomer was none of these; the work was done anyway, through the clouds that came between his instruments and his goal. He returned in 1678 with a catalog of over three hundred southern stars, most never before recorded, and a chart of the southern celestial hemisphere, both of which he published, and the catalog became a standard of navigation and astronomy for a century. He submitted it, with his southern map, to the Royal Society's journal and to the King, who took notice; the Society elected him a Fellow weeks later, at twenty-two, before he had taken any degree at all; and Oxford, recognizing the obvious, awarded him the master's degree he had walked out on.

The following decade makes a sequence that the biography should keep in one frame. In 1680, traveling on the Continent and observing from Paris, he saw the great comet of that winter, the one that broke the comets of tradition from their habits, and he began the observations that would ripen into the comet work. He married Mary Tooke in 1682, the year he observed the comet that would carry his name. He served as clerk to the Royal Society from about 1686, becoming the working editor of the Philosophical Transactions, the new science's main artery, and in that capacity he reviewed, published, and bullied into print the work of the era's best minds. He mapped the trade winds in

1686, the first chart of winds over the whole globe, and by the middle of the decade he had crossed the Alps and measured magnetic variation wherever he found himself, a habit that would culminate on the deck of the Paramore.

The discovery of Edmond Halley, in the sense this series attaches to the word, is thus not a single moment but a pattern visible by 1684: a young man of independent means, enormous energy, and cheerful courage, who had already mapped a hemisphere of stars, was mastering the whole physical agenda of his era, the winds, the magnetism, the comets, and was spending his money and his social ease on making other men's science public and better. The next chapter's story, of the Cambridge visit in 1684 and the Principia that followed it, is the pattern's most famous instance: Halley asked the question, Newton had the answer, and Halley paid for the printing, edited the proofs, and carried the greatest book in the history of physical science to the world on his own back. The rest of this volume's chapters expand the pattern into the later career, the sea voyages, the professorship, the observatory, and the comet, but the reader holds the whole man already at 1684, and should.

The St Helena program held one more observation of the first rank, and the making should carry it, because it planted the seed of the transit method. On 7 November 1677, from the island, Halley timed a transit of Mercury across the Sun's disk, and in the paper he later wrote about it he saw the geometry whole: a planet's silhouette, timed from stations widely separated, gives the Sun's distance through the parallax triangle, and Mercury, being small and far, gives a weak version of the measurement, but Venus, when it crosses, gives a strong one. The young observer filed the idea, and four decades later, from the authority of the Royal Society's ranks, he published the plan of 1716 that sent the world's expeditions to time Venus, a method traced, in his own account, to the island of his twenties.

The continental tour of 1680 to 1681 belongs in the making too, because the network it built served the whole career. Crossing to France in the year of the great comet, Halley observed it from Paris, met the Cassinis in their observatory, and traveled on to Italy and onward through the scientific centers of the Continent, meeting Hevelius at Danzig on a later leg, an itinerary that reads like a roll of the era's astronomy. The tour's yield was not positions but correspondence, the web of observers who sent him comets, eclipses, and star places for the remainder of his working life, and the young man who returned to London carried in his address book the working map of European science, which he never stopped using.

The catalog's reception deserves the making's last paragraph, because the young man's reward came fast and publicly. On his return in 1678 he

presented the southern catalog and its chart to the King, Charles II, who received the map of a sky his own court had never seen, and the demonstration of the oceanic program's use, the new stars for the southern routes of the expanding trade, made the science a matter of state notice. The university that had watched him leave without a degree conferred the master's upon the catalog's evidence, the Royal Society elected him within the year, and the letters of the era's astronomers, Flamsteed included, carried the news of the southern sky around the Republic of Letters with something close to excitement. The making closes with the young man's proof of concept: it had cost a fortune and two years, and it had bought a hemisphere of sky, a Fellowship, and a career, which was the exchange rate he had calculated.

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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.