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Famous Astronomers: Giovanni Cassini

Mapping the Rings of Saturn

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

In the year 1669, the most powerful king in Europe sent for an Italian mathematician he had never met. Louis XIV of France, on the advice of his minister Colbert and his new Academy of Sciences, wanted the best astronomer alive to direct the observatory he was building in Paris, and the name that kept coming back from every informed source was the same: a forty-four-year-old professor from Bologna named Giovanni Domenico Cassini. Cassini came, stayed for the rest of his long life, became a French subject under the name Jean-Dominique, and built at the Paris Observatory the first great scientific dynasty in history. For four generations, a Cassini sat at the head of French astronomy, and the first of them, the subject of this book, filled the sky with discoveries that still carry his name.

He was, by any measure, one of the most productive observers who ever lived. He discovered four moons of Saturn and the great gap in its rings that we still call the Cassini Division. He measured the rotation of Jupiter and Mars, charted the shape of Jupiter's flattened globe, and made the first serious map of the Moon. He turned the moons of Jupiter, timed at their eclipses, into a longitude machine that remade the map of France, and used the opposition of Mars, timed simultaneously from Paris and far-off Cayenne, to measure the distance of the Sun itself, the first reasonably accurate figure for the scale of the solar system ever obtained. He found the zodiacal light, explained its cause, and wrote the three laws of the Moon's rotation that still bear his name.

He was also, in equal measure, a man of his time and its limitations. Cassini never accepted Kepler's ellipses, promoting instead his own curve, the ovals of Cassini, and he died resisting the Newtonian gravitation that would eventually explain nearly everything he had observed. He was a faithful Catholic astronomer in a France where heliocentrism was still officially suspect, and his caution on the great cosmological question ran ahead of his instruments. His career is therefore a study in a particular kind of scientific greatness: the observer who extends the reach of measurement far beyond the theories he is willing to hold.

This book tells the story in full. It follows the boy from the small hill town of Perinaldo, through his apprenticeship in the private observatory of a Bolognese marquis, to his measurements in the great church of San Petronio and his call to Paris. It explains his science, the geometry of parallax, the arithmetic of the moons of Jupiter, the lunar laws, and his instruments, above all the extraordinary long-focus telescopes with which he harvested the sky. It sets him among his contemporaries, Hooke and Hevelius, Picard and Romer, Richer and La Hire, and against his successors, from his own son to Newton and the

age of gravitation. And it follows his name down the centuries, to the ovals of the mathematicians, the craters on the Moon and Mars, and the spacecraft that arrived at Saturn in 2004 and spent thirteen years among the moons that Giovanni Domenico Cassini was the first human being to see.

Why the man is worth a whole book, and not just a chapter in a history of telescopes, can be said briefly. Most of the names that dominate the story of seventeenth-century science, Galileo, Kepler, Descartes, Newton, Huygens, were theorists of the new world-picture; Cassini was the measurer who met their picture with numbers and, in a few famous cases, refused it while feeding it. The age's astronomy advanced on two legs, the physical hypothesis and the exact observation, and the observer's leg has too often been treated as the shorter. In Cassini's career, measured in its own coin, in satellites found, degrees measured, laws stated, institutions built, and the entire scale of the solar system fixed, the observer's leg carried the whole body, and the picture of the century looks different when he is given his weight in it.

The story begins, as it should, in a village in the hills above the Ligurian coast, with a boy counting the stars that sailors of that coast steered by.

Chapter 1: The Discovery of Giovanni Cassini

Giovanni Domenico Cassini was born on June 8, 1625, in Perinaldo, a small town in the hills of the Ligurian hinterland, then part of the Republic of Genoa, now in the Italian province of Imperia. The village sits high enough that the Mediterranean shimmers below it, and the boy grew up in a landscape of terraced slopes and sea horizon, under a sky that coastal sailors had read for their whole history. His family were not scientists but not poor: his father was a miller and his mother a merchant's daughter from nearby, and the family's standing allowed the talented boy an education. His first teacher in astronomy was an amateur, a lawyer named Cornelio Malvasia, but that name belongs later in the story; at Perinaldo, the future astronomer's first discovery was simply the sky.

The boy's talent carried him out of the hills. He was educated at Genoa, where a Jesuit mathematician gave him access to books and instruments, and then, from about 1646, at the abbey of San Fruttuoso, where he read deeply under the guidance of a Benedictine scholar. The early sources disagree about details of his schooling, a warning that his biography rests partly on the testimony of a dynasty that honored its founder, but the pattern is stable: a provincial boy of unusual mathematical gifts, taken up by clerical scholars, trained in the mixed learning of the age, geometry, geography, astrology, and astronomy, in an Italy where the four subjects still shared a curriculum.

The discovery of Cassini, in the sense that matters, was made by the Marquis Cornelio Malvasia, a senator of Bologna who maintained a private observatory near the city, at his villa of Panzano. Malvasia needed a computist, someone to calculate tables and reduce observations, and the young Cassini, recommended through ecclesiastical connections, took the post in about 1644 to 1648. Working at Panzano, Cassini learned the practical craft of the seventeenth-century astronomer: the handling of instruments, the casting of horoscopes, which paid, the timing of eclipses, and the patient correction of tables against the sky. The marquis's observatory was one of the best private ones in Italy, and the young man who learned astronomy there was learning it from the observational side, as a trade.

His first original work made his name. Cassini computed new tables of the Sun's motion, and an essay on the comet of 1652, then a matter of wide public interest, brought him to the attention of Bologna's scholars. In 1650, at the age of twenty-five, he was appointed to the chair of astronomy at the University of Bologna, one of the oldest universities in Europe, on the strength of his tables and his patron's influence. The appointment was contested by a rival candidate, and Cassini held the chair only after a public competition of

astronomical problems, a baroque custom that suited his talents: he computed faster and more accurately than his opponent, and the university chose the young man from Perinaldo.

In Bologna he settled into the working life that he would carry to France. The city gave him two gifts that shaped the whole career. One was the Jesuit community and the university, centers of mathematical learning where his work was read and argued. The other was the great basilica of San Petronio, whose vast unfinished nave had room for a meridian line, and where Cassini, in 1655, designed and installed a gigantic sundial in the floor: a hole high in the roof admitting the Sun's image onto a graduated meridian strip running hundreds of feet across the church. With this gnomon, a building become an instrument, Cassini measured the obliquity of the ecliptic, the angle at which the Earth's axis leans from the upright of its orbit, with a precision no portable tool allowed, timed the passage of the Sun across the meridian to refine the length of the year, and attempted, with inconclusive results, the Sun's parallax by the year-long variation of the image.

The Italy of Cassini's youth deserves one more look, because it explains the shape of his career in a way no chronicle of patrons can. The universities of the peninsula had been the hearth of Renaissance mathematics, and the tradition survived the Galileo affair in the peculiar form the case imposed: astronomy continued, at a high technical level, inside an ecclesiastical culture that had fenced off one cosmological conclusion. The astronomers of the generation between Galileo and Cassini were, many of them, churchmen, Jesuits, Benedictines, and cathedral canons, and their science had a specific cast: superb at observation and calculation, cautious in doctrine, and organized through the network of the Church's institutions, where a talented provincial could be found, educated, recommended, and placed.

Cassini was the supreme product of that system, the most gifted church-trained computist of the century, and when the French state, which had no such fences, offered him its new observatory, the offer was exactly what the Italian system could not match: money, instruments, freedom of program, and the King's warrant to pursue measurement wherever it led, without a doctrinal committee at the door. The move from Bologna to Paris is therefore not just a career step; it is the moment the center of gravity of European astronomy moved from the Church's institutions to the state's, and the young man from Perinaldo was the point of the transfer.

A date deserves recording for the flavor of the times: the public competition for the Bologna chair was a formal disputatio, with examiners, an audience, and astronomical problems set and solved on the spot, and Cassini, twenty-

five years old, won it in front of the university. The scene, an Italian professorship of astronomy contested like a tournament, with the young computist from the marquis's observatory carrying the day by calculation, is almost the last of its kind in the history of the profession; the science that followed was hiring by committee and publication, not by disputation, and the anecdote is worth keeping as the image of an old world promoting a man who would help build the new one.

One more scene from the Italian years belongs here because it shows the young astronomer's readiness for the career that followed. In 1664 and 1665 a great comet crossed the European sky, and Cassini, from Bologna, observed it with the Campani glasses, measured its positions against the stars night after night, and published his observations with a map of its path among the constellations. The work made his name among the astronomers of Italy at exactly the moment the comet's apparition had every court in Europe asking its astrologers what the visitor meant, and the young professor of Bologna answered the question in the manner that became his signature: with positions, timings, and a chart, and the doctrine left to others.

The comet of 1664 is therefore the first of his public campaigns, the moment the marquis's computist became, in the eyes of the Republic of Letters, an observing astronomer of the first rank, and it is a fair rehearsal of the whole career that followed: the sky offering a spectacle, and Cassini answering it with a table.

The Bologna years also produced the observations that called him to France: his campaigns on the moons of Jupiter. From 1664, using telescopes by the Roman optician Giuseppe Campani, whose lenses were the finest in Europe, Cassini timed the eclipses of Jupiter's satellites with a regularity no one had achieved before, and by 1668 he had converted the timings into the Ephemerides of the Medicean planets, tables predicting the eclipses months in advance. It was this book, more than any single discovery, that fixed his European reputation: with the tables, any observer with a telescope could find the local time of a satellite's eclipse, compare it with the table's Paris or

Bologna time, and read off his longitude, anywhere on Earth. In 1668 the King of France was building an Academy of Sciences from scratch, and the world's most famous table-maker was an Italian. The invitation crossed the Alps, and the history of astronomy turned toward Paris.

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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.