

GIOVANNI DOMENICO CASSINI (June 8, 1625 – September 14, 1712)

by HEINZ KLAUS STRICK, Germany

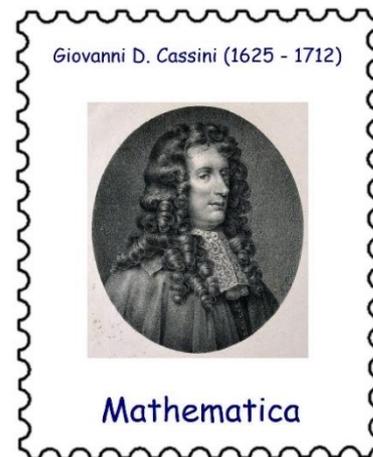
Born in Perinaldo, a small town in the Republic of Genoa, GIOVANNI DOMENICO CASSINI initially grew up in the care of an uncle. Later he attended the Jesuit College in Genoa, where his scientific curiosity and special interest in poetry, mathematics and astronomy were noticed.

Actually, it was more astrology that fascinated him, even though he was convinced that astrological predictions lacked a scientific basis.

However, his extensive knowledge of astrology helped him to find his first job. The wealthy marquis CORNELIO MALVASIA offered him a position at an observatory in Bologna, which he was having built. CASSINI was supported by the two famous astronomers of the Jesuit order, GIOVANNI BATTISTA RICCIOLI and FRANCESCO MARIA GRIMALDI. The latter, incidentally, was the first to publish a paper on the wave character of light and the phenomenon of light diffraction (1662).

These two role models shaped CASSINI's lifelong claim to increase the accuracy of observations by constantly improving observation and measuring instruments. However, they also contributed to CASSINI's distrust of new theories until the end of his life.

For example, he considered the teachings of NICOLAUS COPERNICUS to be wrong until the end, and was more inclined towards TYCHO BRAHE's compromise model, in which the moon and sun revolved around the earth and the planets around the sun. He also rejected the existence of a gravitational force.



Thanks to MALVASIA's influence, CASSINI was appointed professor of mathematics and astronomy at the University of Bologna in 1650, taking over BONAVENTURA CAVALIERI's chair, which had been vacant for three years.

In the following years, CASSINI was particularly concerned with the observation of comet orbits and measurements of the position of the sun in the course of the year.

In this context, he had an opening made in the wall of the Basilica of San Petronio in Bologna, the fifth largest church in the world (and the largest of all brick churches), in the manner of a pinhole camera, so that a sharply framed image of the sun appeared on the church floor. News of this sight, which now made it possible to measure the sun's orbit with unprecedented precision, spread CASSINI's reputation as a scientist.

Pope ALEXANDER VII asked him to mediate between the cities of Bologna and Ferrara, which were in dispute over the regulation of the river Reno.

After this successful mission, CASSINI was even appointed papal overseer of the fortifications of the Papal States and commissioner for water issues. However, he refused a permanent position in the papal service, as he was more interested in astronomical questions.

Thanks to a greatly improved telescope, he was able to make sensational observations from 1664 onwards. He discovered the strong oblateness of Jupiter at the poles as well as the coloured bands and spots on the surface (he described the large red spot almost at the same time as ROBERT HOOKE). He measured the duration of the planet's rotation around its axis of rotation (in later years he noticed that the layers of the atmosphere had different rotation speeds).

CASSINI measured the orbital periods of Jupiter's moons and compiled extensive tables that made it possible to predict their visibility. However, deviations of up to 17 minutes occurred – depending on whether the planet was observed in the direction of the sun (i.e. "behind" the sun) or in the opposite direction. CASSINI initially assumed that the reason for this was that light takes different amounts of time to travel the different distances, but then rejected the idea that the speed of light was finite, because this did not correspond to traditional doctrine.

It is an irony of history that in 1676 his own assistant OLE CHRISTENSEN RØMER drew the right conclusion from CASSINI's measurement data.

In 1666, CASSINI published his extremely precise values of the rotation period of Mars and his observations regarding the changes on the surface of this planet, especially the white polar caps (a millennium event - see stamp on the right).



Due to the sensational discoveries, CASSINI received an invitation to Paris from King LOUIS XIV to support the establishment of the new observatory there. The Senate of Bologna and the Pope had no objections to such a trip, as they assumed that CASSINI appreciated the existing work opportunities in Italy.

The appointment as a member of the *Académie Royale des Sciences* and his appointment as director of the Paris Observatory combined with generous financial soon led to a change of heart: CASSINI took French citizenship and changed his first name to JEAN-DOMINIQUE.

Through his marriage to GENEVIÈVE DE LAISTRE, who came from a wealthy family, he became the owner of a castle, which he used as a summer residence.

The series of sensational discoveries continued in Paris. He discovered the first four moons of Saturn and the gap in the planet's ring system (the so-called CASSINI division). The accuracy of his drawings of the lunar surface has only been surpassed after the invention of photography.





CASSINI's data on the orbits of Jupiter's moons could be used to determine the longitudes of various locations on Earth. From the comparison of the measurement data concerning the position of the planet Mars by JEAN RICHER in French Guyana and in Paris, an approximate value of the mean distance between the Earth and the Sun could be determined for the first time.

RICHER concluded from the fact that the period of a pendulum in Cayenne was shorter than one in Paris that this was connected with the flattening of the Earth at the poles, which would correspond to the observations with Jupiter. CASSINI did not accept this and stuck to the opinion also held by DESCARTES that there was – if at all – a peaking at the poles.

Surveys along the longitude running through Paris were to provide clarity but the project had to be abandoned in 1685 for financial reasons. It was not until 1700 that the entire route from Amiens to Perpignan was triangulated. It turned out that the actual area of France was considerably smaller than previously estimated, which prompted LOUIS XIV to say: "CASSINI has taken more from my kingdom than I have gained by conquest."

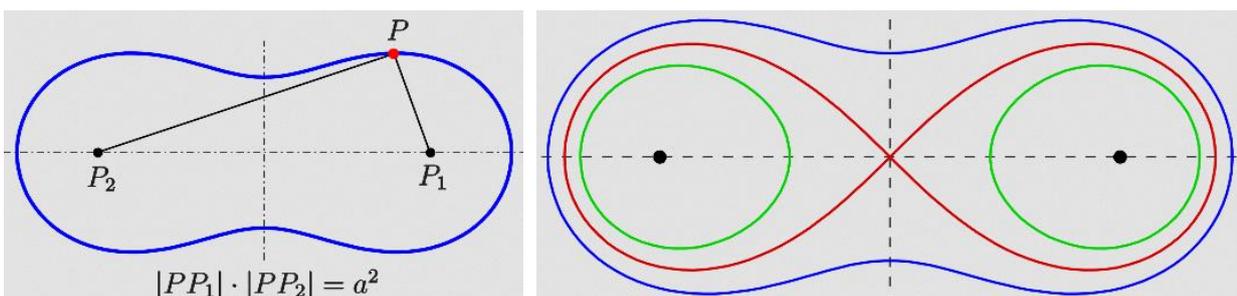
CASSINI saw in the measurement results a confirmation of his ideas about the shape of the Earth. Today we know that the data were too inaccurate to draw any conclusions from them. It was not until the Great Geodetic Expedition of 1736 that more clarity was achieved.



Around 1680 CASSINI investigated a special type of curves defined by the following property: Each point $P(x, y)$ of the curve has the property that the product of the distances to two given points $P_1(+c, 0)$ and $P_2(-c, 0)$ is equal to a constant a^2 ($a, c \geq 0$). This definition gave rise to the following relation between the coordinates x, y :

$$(x^2 + y^2)^2 - 2c^2(x^2 - y^2) = a^4 - c^4, \text{ cf. the Wikipedia figure on the left.}$$

The figure on the right shows the three possible cases $a < c$ (green), $a = c$ (red) and $a > c$ (blue).



CASSINI considered the first, oval type of curves to be suitable for describing the movement of the sun around the earth, i.e. unlike KEPLER, who assumed an elliptical shape on the basis of his measurements.

From 1709, CASSINI's eyesight deteriorated and he eventually went blind. His son JACQUES succeeded him as director of the Paris Observatory – as did JACQUES' son and grandson thereafter.

This dynasty (CASSINI I to IV) did not end until the French Revolution.

The stamp on the right commemorates the CASSINI-HUYGENS mission (1997-2017) to Saturn.



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Supplement: The stamp on the right was edited in 1968 in commemoration of the visit of JEAN DOMINIQUE CASSINI (CASSINI IV), who landed on St Pierre Island (Newfoundland) on 31. July 1768 to make an exact measurement of longitude.

The stamp designer swapped the two digits (1678 instead of 1768) and also used the wrong portrait – it shows CASSINI I, the great-grandfather.

