CERES FERDINANDEA

The discovery of the first asteroid (now dwarf planet) in the historical collections of the Palermo Observatory

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Front cover: Engraving from Piazzi's catalogue (see record **L.2**)

INAF- OSSERVATORIO ASTRONOMICO DI PALERMO

CERES FERDINANDEA

The discovery of the first asteroid (now dwarf planet) in the historical collections of the Palermo Observatory

edited by Ileana Chinnici

Palermo

2015

Catalogue of the exhibition "Cerere Ferdinandea" realized on the occasion of the event "Cerere ieri e oggi: da Piazzi a Dawn" (April 10 – May 8, 2015)

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Preface

Modern science is inseparably linked to ancient science. The new discoveries are the outcome of a long path in which each step is a necessary phase to get today's results. Today science can carry out endeavors we could not even imagine until a few years ago, such as approaching or even landing on bodies of the solar system other than Earth. But the path that led to this goal has been very long and has required an evolution of philosophical and scientific thought throughout the ages.

A certain number of space missions today aims to the exploration of asteroids and comets, objects in our solar system that have physical conditions very similar to those that were at the time of formation of our planetary system. The Palermo Astronomical Observatory has played a fundamental role in the development of knowledge in this field. It is therefore a source of pride to me presenting the catalogue of the exhibition "Ceres Ferdinandea", held at the Astronomical Observatory on the occasion of probe Dawn's approach to Ceres, the first asteroid, now dwarf planet, discovered right in Palermo by the Abbot Piazzi, founder of the Palermo Astronomical Observatory.

The exhibition gathers together original tools and documents which were stored at the Observatory, belonging to Piazzi or otherwise relevant to the history of the discovery of Ceres. The instrument that has enabled the discovery, the famous Ramsden Circle, still stands at the site where the discovery was made, and it is interesting to discover that, now as then, astronomy needs the latest technology for its discoveries. In fact, the Circle represented an instrument very advanced at the time, the realization of which aroused interest (and envy) among the major European astronomers of the time.

It is equally interesting to find how even then scientific discoveries were being debated in the scientific community, surely by much slower means than today, such as publications and letters, but certainly with the same or even greater

vehemence and heated debates. The case of the discovery of Ceres, described by the correspondence of the time, is a case in point: Piazzi discovers a new celestial object and triggers a debate about its nature, just as the "missing planet" in an intermediate orbit between Mars and Jupiter was being looked for, corresponding to the area where Piazzi's "star" seemed to be placed.

Mostly beautiful were indeed the illustrations which accompanied and celebrated the most important discoveries, such as the representations with Ceres's carriage and the symbols of Palermo and Sicily, including the Genius of Palermo and Mount Pellegrino.

The exhibition gathers together examples of all these aspects and, thanks to the choices and the work done by Dr. Chinnici and his collaborators, traces the history of the discovery of Ceres and the foundation of the Observatory to which the discovery is closely linked.

Today the Observatory is a modern research institute that is part of the National Institute of Astrophysics. It manages and improve the invaluable heritage, owned by the University of Palermo, with which the Observatory closely cooperates. The coexistence between historical and modern aspect is a constant stimulus for our activity.

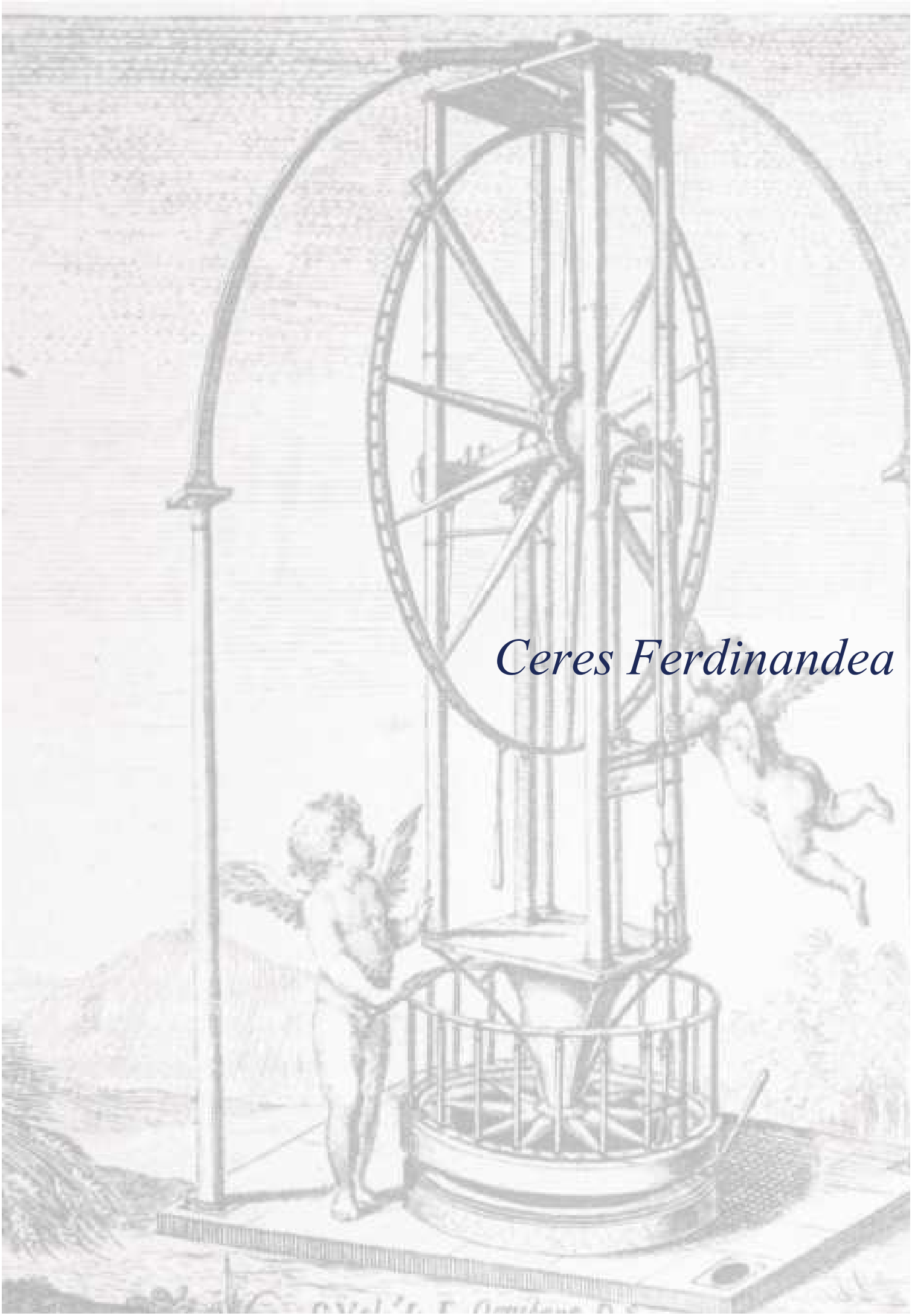
Giusi Micela

Director of the Palermo Astronomical Observatory

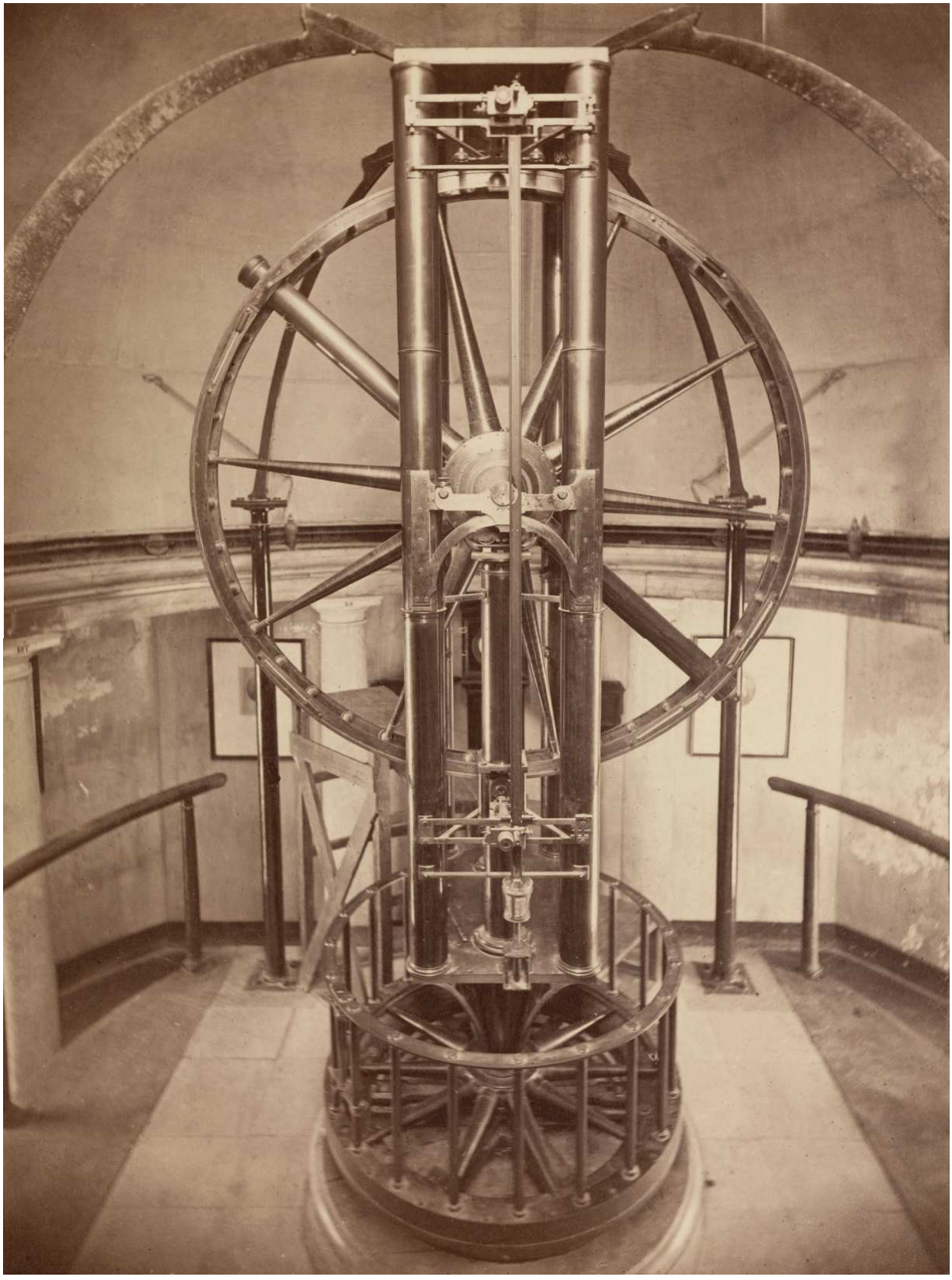
Ceres from Piazzi to Dawn: Ceres was the first asteroid to be discovered by Piazzi at Palermo Observatory (Italy) in 1801 and the Dawn mission is exploring it more than 200 years after its discovery. As Piazzi started a new era in the solar system studies, Dawn unveils Ceres' secrets, opening new scenarios for the next decades.

Maria Cristina De Sanctis

INAF-IAPS, PI of the VIR instrument onboard Dawn mission



Ceres Ferdinandea



The Ramsden Circle, the instrument by which Ceres was discovered,
in a rare picture of 1876 (Science Museum, London)

CERES FERDINANDEA

On the night of 1 January 1801, the director of the Palermo Astronomical Observatory, Giuseppe Piazzi, observed for the first time what later would turn out to be the first asteroid, today considered a dwarf planet. The discovery of Ceres was an important event in the history of Astronomy because it paved the way for a whole field of research which is still current, as evidenced by the launch of the Dawn space mission.

The *Ceres Ferdinandea* exhibition is aimed at making available to the public a part of the historical heritage (instruments, books, archival papers) significantly linked to the complex history of the discovery of this celestial body orbiting between Mars and Jupiter, and which is the largest in the main asteroid belt.

Giuseppe Piazzi and the Palermo Observatory

In 1786 the mathematician Giuseppe Piazzi (cf. **Q.2** record) was appointed to the chair of Astronomy in the newborn *Accademia dei Regj Studi di Palermo* (Palermo Academy of Royal Studies) despite his lack of specific experience in the practice of this discipline. The viceroy of Sicily, Francesco D'Aquino, Prince of Caramanico (fig. 1) and enlightened reformist, wanted to promote the development of science in Sicily and he obtained that an Astronomical Observatory (fig. 2) be associated to the chair of

Fig. 1 – Portrait of Prince of Caramanico (Museo della Specola, INAF-Palermo Observatory – from now on, INAF-OAPa)

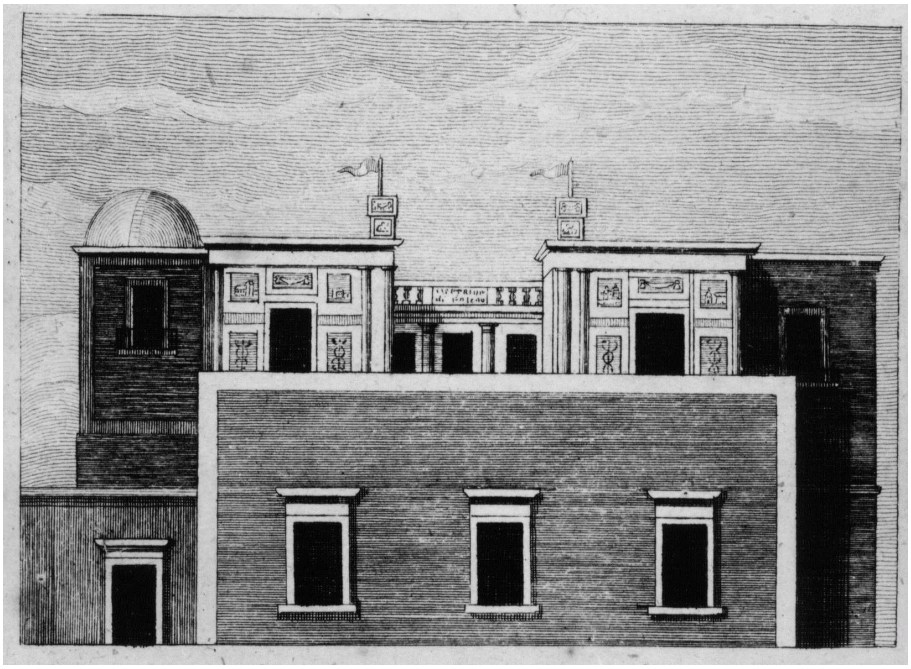


Fig. 2 – The Palermo Astronomical Observatory in 1801 (credit: Bode, 1802)

astronomy. He then took action to provide Piazzi with the resources and support necessary for the task entrusted to him, namely to build, equip and manage the new Observatory (cf. record **S.1**). Mostly thanks to a long preparatory journey to France and England, in the years 1787-1789, Piazzi was able to get in touch with the leading astronomers of the time, such as Jérôme de Lalande and Jean-Baptiste Delambre in Paris, Nevil Maskelyne and William Herschel in London (cf. records **Q.4** and **L.10**), and discuss with them the best equipment for the new observatory and the scientific program to be carried out. There he managed to purchase valuable instruments (cf. records **S.2** and **S.4**) and cutting-edge telescopes, such as the well-known Ramsden Circle (cf. records **Q.1** and **Q.5**). With this jewel of the technology of the time, Piazzi intended to start an ambitious program of revision of the existing star catalogues. Once back in Palermo, Piazzi chose the top of the pisan tower of the Royal Palace as the most suitable place to build the Observatory, because it satisfied the requirements of solidity, stability and elevation. King Ferdinand I of Bourbon gave his approval and in 1790 signed the decree of foundation of the Observatory. Thus Piazzi began to work on his program to compile an extensive catalogue of star positions (cf. record **L.1** and **L.2**), based on

a very meticulous method which consisted of repeated observations of the same star on different nights. The discovery of Ceres was in fact a by-product of the work on the catalogue, as stated by Piazzi himself: *had I not been in the state of observing the same star, four, five, six times, and even more, I would have not discovered this star of mine for sure*.

The background of the discovery

Astronomical research in the eighteenth century was characterized by the development of astrometry. It was the century of star catalogues, like those of John Flamsteed and James Bradley, which led to the discovery of phenomena such as the aberration of light (1726) and the nutation of the Earth's axis (1740). It was also the century of the triumph of celestial mechanics, and the construction of the world of Pierre Simon de Laplace: the astronomers' attention seems to have pointed toward a description of the observable universe that was as complete as possible. In France and England, stellar coordinates were being measured in order to determine proper motions and stellar parallax.

In England, however, someone deviated from the current line of research: it was William Herschel who, from his peculiar standpoint as astronomer-cosmologist, was looking for distant objects like nebulae. Herschel was also credited with the discovery of

Distance from the Sun (Titius-Bode law)

(in tenths of A.U.)

Mercury	4	4
Venus	7	(4+3)
Earth	10	(4+6)
Mars	16	(4+12)
?	28	(4+24)
Jupiter	52	(4+48)
Saturn	100	(4+96)
Uranus	196	(4+192)

The corresponding arithmetic progression is: $a_k=4+3k$ (k=0 first term, then $k=2^n$ where n = 0,1,2 …)

Fig. 3 - Franz Xaver von Zach and Johann Elert Bode, two of the most active members of the Lilienthal Society, that played a crucial role in the complex story of the discovery of Ceres (credit: Wikisource).

the first "telescopic" planet, Uranus, which he had observed upon the end of the century, in 1781, thus adding a seventh planet to the solar system, as known up until then.

The discovery of Uranus marked the extraordinary validation of the Titius-Bode empirical law (1768), which well described the progression of the distance from the sun of the planets known at the time (see table). However, there was a gap between Mars and Jupiter whereas, on the contrary, this law provided for the existence of a planet. In 1800, under the impulse of Johann Elert Bode (fig. 3), a group of German astronomers, many of whom non-professional ones, decided to establish a scientific society in Lilienthal that would conduct an observational campaign of the stars in the zodiacal belt. Twenty-four observers put themselves to work to find the missing planet between Mars and Jupiter.

The Lilienthal Society, chaired by the astronomer Johann Hieronymus Schröter, had as secretary Baron Franz Xaver von Zach (fig. 3), director of the Duke Ernst II of Saxe-Coburg-Gotha's Observatory in Seeberg. Von Zach was one of the staunchest supporters of the existence of the missing planet, which he had

been hunting for over thirteen years, and to which he *in pectore* had already given the name of Hera, as suggested by the Duke of Gotha.

The "new star" observed by Piazzi

Among the astronomers invited to join the society and to whom some of the observational work would be assigned, were Barnaba Oriani (fig. 4), an astronomer at Brera, and Giuseppe Piazzi; the latter, however, did not receive the invitation - which Oriani was supposed to send him - because it reached Oriani when Ceres had already been spotted.

In fact, a few months after the establishment of the society, Piazzi, while engaged in the preparation of his star catalogue, came across the much sought after planet: *While much zeal animated Europe, Germany in particular, being myself separated from the mainland, only supported by a few and rare knowledgeable letters due to the calamitous circumstances of the time; by all means unaware of the established society, and of the honor of having been included on the list of twenty-four cooperating Astronomers; guided only by the method embraced to observe unwittingly, without thinking, I opportunely spotted the coveted Planet.*

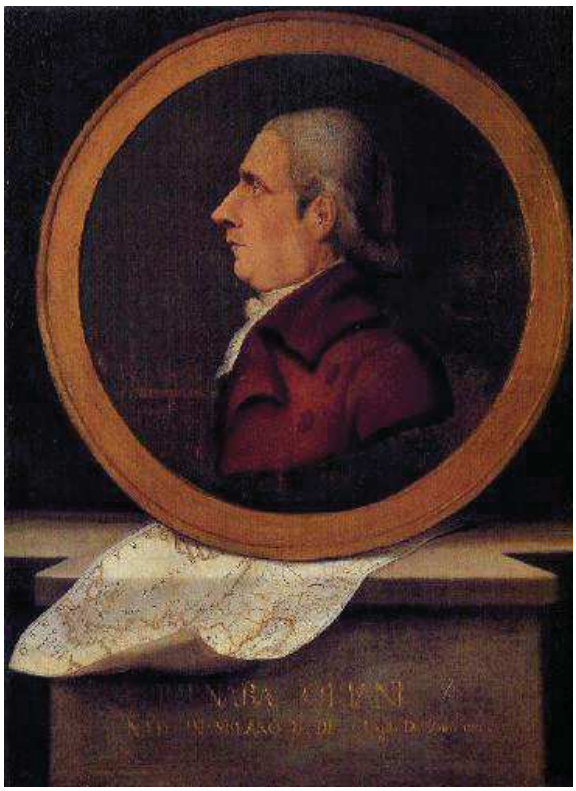


Fig. 4 – Portrait of Barnaba Oriani (Museo della Specola, INAF-OAPa)

Piazzi himself described that first observation with these words:

After over nine years of hard work in verifying the positions of the Stars, which are collected in a number of

Astronomers' Catalogues, on the night of 1 January of this year, among many others, I sought for the 87th Star of the Zodiac Stars Catalogue of Abbot la Caille. I saw then that it was preceded by another one, which according to my habit I decided to observe again, even more so as it was not hindering the main observation. Its light was a little faint and colored as Jupiter, but similar to many others that are usually classified in the eighth magnitude. Thus no doubt at all arose about its nature. On the night of 2nd I repeated my observations, and having found that neither time nor distance from the Zenit corresponded, I doubted at first of some error having occurred in the preceding observation: strong suspicion I had that it could be a new object after all. On the night of 3rd my suspicion became certainty, having ensured that it was not a fixed Star. Nevertheless, before undisclosing this matter, I waited for the night of 4th, when satisfaction I had of seeing that it had moved according to the same law followed in the previous days.

In order to be certain of the object's position, he observed it also with a transit instrument (cf. record **L.7**); however, despite repeated attempts of his assistants, observation out of the meridian with an achromatic telescope (cf. record **S.3**) was unsuccessful. On 24 January 1801, Piazzi decided to disclose his discovery to his friend Barnaba Oriani and also to Bode, who was a popularizer of the famous law which hypothesized the existence of a planet between Mars and Jupiter, and to whom Piazzi seemed to have sent a veiled suggestion. In his letter to Oriani, Piazzi indicated the location of the new body and described its motion:

I have presented this star as a comet, but owing to its lack of nebulosity, and to its motion being so slow and rather uniform, I feel in the heart that it could be something better than a comet, perhaps. However, I should be very careful in passing this conjecture to the public. When I have a greater number of observations, I will try to calculate its elements.

In fact, Piazzi had meanwhile announced to the press that he had found a comet, without providing the data from his observations: a decision dictated by excessive caution that would backfire on him, drawing criticism from the

astronomical community of the time. In late February Piazzi was no longer able to observe the object, as he would later declare, because of a sudden illness - but probably also owing to the pressure he was under, to complete the meridian line of the Cathedral of Palermo, which would be opened in the summer of 1801. Meanwhile the object had got so close to the Sun that it was no longer observable, thus vanishing before others could get a chance to observe it.

The international "hunt" for the new object

In the meantime, the news about the "comet" had been spread by the newspapers, and at the end of February Lalande (fig. 5) from Paris asked Piazzi for the data from his observations, in order to calculate the orbit. In April, when he recovered, Piazzi sent them to him. In fact he was not in a position to deny them, as he owed the French astronomer many favors, as well as for the consideration he had to give to the Grand Master of a Masonic lodge, as Lalande was, being Piazzi himself affiliated. Lalande passed the data to one of his pupils, Jean-Charles Burckhardt (Fig. 6), to enable him to calculate the orbital elements: the young mathematician soon realized that the data were not compatible with the orbit of a comet, while they would fit better a circular orbit instead. He even tried to determine an elliptical orbit, though with some difficulty, since Piazzi's data were too close.

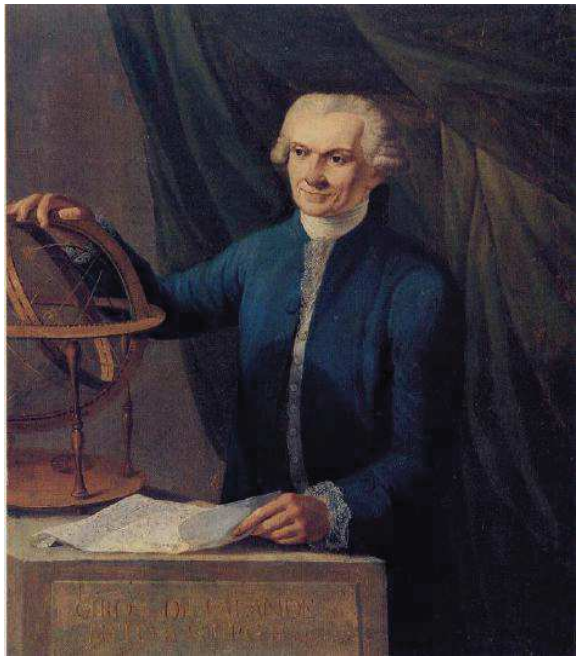


Fig. 5 – Portrait of Jérôme de Lalande (Museo della Specola, INAF-OAPa)

Meanwhile, Bode had received Piazzi's letter in late March, with a delay of about a month because of the

Fig. 6 – Jean-Charles Burckhardt (credit: Wikipedia)

Napoleonic wars (the letter to Oriani had the same fate). Bode took Piazzi's veiled hint about the missing planet, and by using the predictions derived from Titius law, he attempted a first calculation of the orbit, which he announced to von Zach in April:

... I found that both the observations of January 1 and 23 as well as the stationary position of January 11, agreed perfectly with the hypothesis that this star was not a comet, but the planet which had so far remained unknown between Mars and Jupiter ...

Actually Bode was so convinced that it was the missing planet, that he decided to give some public announcement, without informing Piazzi, who remained pending an answer, whilst continuing to refer to the object as a "comet". We can only imagine how anxious Piazzi must have been while awaiting the confirmation, from Oriani at least, that he had discovered a new planet. To urge the latter, on April 11 he decided to send him all of his observations of the "comet", asking not to publish them but only to try to calculate the orbital elements. In the meantime, Oriani had received Piazzi's letter with the announcement of the discovery, and had roughly calculated the orbital elements of the object, in the hypothesis that it could be a planet. Then, without wasting any time - and without consulting Piazzi - on April 7 he was quick to break the news to Baron von Zach, undismayed hunter of the missing planet and secretary of the Lilienthal Society, asking him to publish the news on his well-known astronomical monthly journal, the *Monatlische Correspondenz*, as soon as possible. Oriani's move was really timely: knowing Piazzi's nature, he probably realized that he would go on hesitating in the uncertainty whether it was a planet or not, while others might "steal" the discovery. Only on April 15 would Oriani send the long-awaited answer

Fig. 7 – Seeberg Observatory, directed by Baron von Zach (credit: Wikipedia)

to Piazzi, welcoming the discovery of the new object, perhaps a planet, and informing him of having spread the news to von Zach.

The crucial letter that Oriani was quick to send to the director of the Seeberg Observatory (Fig. 7) was as follows:

I am right now in possession of a letter by Piazzi from Palermo, which contains a notice that must be taken into serious account by you and all astronomers. He reports of having observed a star of magnitude between 8 and 9 on January 1, 1801 in the shoulder of Taurus. [...] He also writes of having initially announced this star as a comet, and only after regularly observing that it had no nebulosity and very slow motion, had he repeatedly come to the result that it could actually be a planet.

Unfortunately this letter, written on January 24, has been travelling for 71 days; it was therefore difficult to estimate the position of this new moving object, only by those two mesurements given by Piazzi. Meanwhile, I tried to take advantage of the fact that on January 10 this object from being retrograde resumed its forward motion, and, in the hypothesis of it having a circular orbit, I found its

distance from the sun to be equal to three semi-diameters of the Earth's orbit, hence ***this star could well be a new planet whose orbit would lay between that of Jupiter and Mars****. The orbit of this planet, just like that of all others, is likely to be significantly eccentric [...] and therefore my hypthesised circular orbit is likely to be inadequate to determine correctly its motion and its geocentric position after all this time.*

We must therefore wait for further observations that Piazzi has done for sure. Since the arrival of Piazzi's letter, the sky has been constantly cloudy here, hopefully you can count on a much better sky for astronomical observations. [...]

In the meantime, I hope you receive this letter early, hopefully before the star gets lost in the sunlight; perhaps, thanks to your finer instruments, you will be fortunate enough to locate it, and inform me with more accurate news.

Meanwhile though, the news of the discovery had been spread through newspapers by Bode, drawing von Zach's suspicions. In a letter to Oriani, he accused the German astronomer of being disingenuous for having concealed the hypothetical planetary nature of the new body in order to be considered the first to identify it as the missing planet. In the meantime, the Baron continued his "hunting":

... dear friend, I have been looking for the planet based on the orbital elements you sent me, but unfortunately it is too late and the Object is already immersed into sunlight and in the horizon's haze. In vain I attempted on several fine nights, and Bode tells me that he was not more fortunate either [...] Please send me new orbital elements as soon as you get more accurate ones for it will be difficult to find such a small body at dusk, if its location is not certain and it will be necessary to wait too long to observe it again at the meridian, while I would like to catch it up soon as possible.

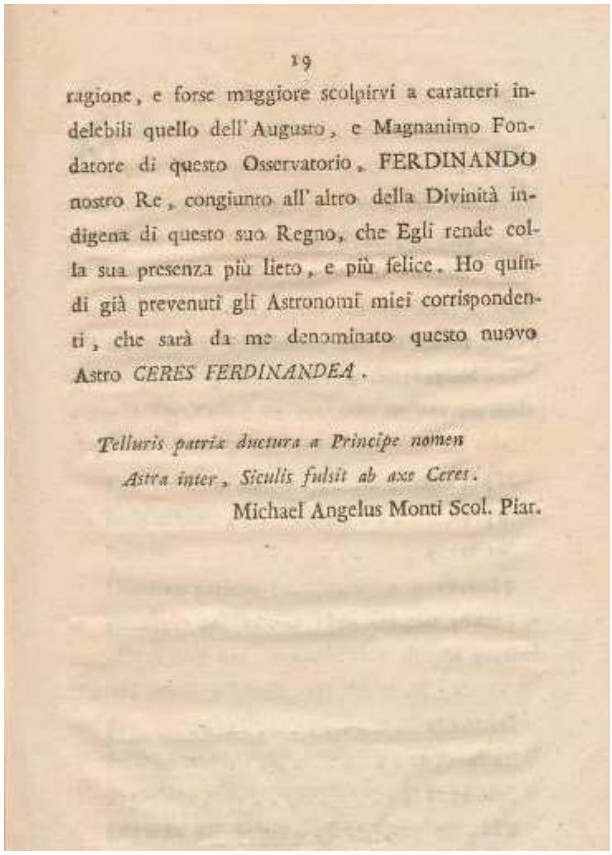
The news was already on everyone's lips. Several astronomers, such as von Zach, Bode, Heinrich Wilhelm Olbers (fig. 8) - also a member of the Lilienthal Society - Oriani and Burckhardt were all engaged in the calculation of orbital elements, whereas Piazzi continued not to publish anything, but went on privately sending further corrections to its observations, so that Lalande could not help but comment that Piazzi had made a third edition of the observations. Von Zach, as well as his French colleagues and the British Maskelyne, considered as inexcusable Piazzi's lack of communication and non-release of the data of the discovery, more so because it was then hard to confirm it, having the object been "lost" among others.

Fig. 8 – Heinrich Wilhelm Olbers (credit: Wikipedia)

However Piazzi, who had not been able to calculate the object's orbit as yet, was still keeping an ambiguous attitude: on the one hand, he had reported to Oriani of his doubts on its being a planet, and on the other hand, he had informed him of his intention to call the new star Ceres Ferdinandea, had it been a planet.

The choice of a name

It was only late in July that Piazzi finally got engaged in calculating a parabolic orbit first, then a circular one, and published a memory (cf. record **L.3**), finally making public the series of observations which he had carried out from January 1 through February 11, and officially giving the "new star" the name of *Ceres Ferdinandea* (fig. 9).



19

ragione, e forse maggiore scolpirvi a caratteri indelebili quello dell'Augusto, e Magnanimo Fondatore di questo Osservatorio, FERDINANDO nostro Re, congiunto all'altro della Divinità indigena di questo suo Regno, che Egli rende colla sua presenza più lieto, e più felice. Ho quindi già prevenuti gli Astronomi miei corrispondenti, che sarà da me denominato questo nuovo Astro *CERES FERDINANDEA*.

Telluris patriæ ductura a Principe nomen
Astra inter, Siculis fulsit ab axe Ceres.

Michael Angelus Monti Scol. Piar.

*Fig. 9 – The star's name is announced by Piazzi in this page (cf. record **L.3**).*

Piazzi's decision to disclose the name he had attributed to the new body came from the fact that other names were already around: Juno, upon Bode's proposal; Hera, according to the Duke of Gotha's suggestion; Piazzi, as Lalande called it. In France, even Pierre-Simon de Laplace and Napoleon Bonaparte had spoken in favor of the name Juno. Slightly embittered by these choices, Piazzi declared:

I, though, will always consider its name to be Ceres Ferdinandea, nor will I suffer, by calling it differently, of being scolded of ingratitude towards Sicily, and to his Sovereign, who so zealously protects the sciences, and the arts [...] It is not a matter of flattery, indeed it is a tribute, a fair and deserved homage.

Piazzi's choice was an act of homage towards Sicily and its king: Ceres, in fact, goddess of harvest and agriculture, was the patron deity of the island in Roman mythology. In order to avoid any further misunderstanding, Piazzi decided to inform Bode about the name he had chosen; name that Bode immediately greeted favorably:

I accept with great pleasure the name of Ceres Ferdinandea [...] You have discovered it in Taurus, and it was reobserved in Virgo, Ceres of the old times. These two constellations are the symbol of Agriculture. This occurrence is quite unique.

Taking this analogy, in 1802 Bode proposed that the astronomical symbol of the new planet be a stylised sickle, represented by a letter C with a cross below (fig. 10).

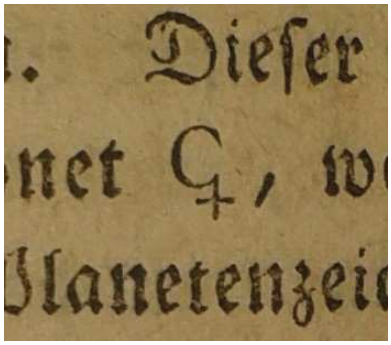


*Fig. 10 - Detail of the page where Bode proposed the astronomical symbol of Ceres (cf. record **L.9**).*

The finding of Ceres

Although by the end of July 1801 the astronomical community was largely convinced of the planetary nature of the new object, the final confirmation of this hypothesis could only come from its finding. It was therefore crucial to be able to calculate an elliptical orbit that would best fit Piazzi's observations, in order to deduce the planet's ephemeris and derive its position. The solution to this mathematical problem was not trivial at the time, given the few observations available and the small arc covered (3° only). The ellipse roughly calculated by Burckhadt was not satisfying indeed: there was no easy way out of this stalemate. The alternative, rather daunting if not desperate, was that of reobserving tens of thousands of stars in the zodiac belt, at least of the eighth magnitude, and measuring their relative positions. Hopefully the wanted star could be spotted through the type of motion it would show.

In the month of September Piazzi's complete observations were finally published in von Zach's *Monatliche Correspondenz*. This event would later turn out to be crucial, causing a breakthrough in the case. Here, in fact, Piazzi's "orbit" came across that of young mathematician Carl Friedrich Gauss (fig. 11), aged only 24 at the time. Both of them would later achieve international fame thanks to Ceres.

Gauss immediately understood he had the right chance to check out some mathematical methods which he had been thinking about for a long time, but had never applied.

Fig. 11 – Carl Friedrich Gauss (credit: Astronomische Nachrichten, vol. 7, 1829)

The confirmation of the experimental nature of his work comes from the fact that he would release his famous treatise *Theoria motus corporum Coelestium* eight years later, in 1809, upon developing what would be known as the method of least squares.

In October the man who, not by chance, will be defined *Princeps Mathematicorum* was already able to send the results of a first application of this method to von Zach. The ephemeris calculated on the basis of the orbit obtained by Gauss provided for the planet a different location, several degrees apart from the positions calculated until then. In November, von Zach hastened to convey to Bode the parameters of the orbit calculated by Gauss:

[These elements] are important because they show that the location of the planet differs 6° to 7° from the orbital elements so far obtained, as well as from Burckardt's ellipse. We just need to expand the exploration area in the sky as eastward as possible. As to being able to fitting Piazzi's data, then: *we can not say other than this ellipse is perfect.*

Von Zach quickly passed Gauss' results also to Lalande (cf. record **L.6**) as well as to Piazzi, via Oriani. Lalande appeared very skeptical: in early December nothing had yet been found; moreover, his pupil Piazzi had always spoken of a comet and, although his data had failed to agree with a parabolic orbit, he was more inclined to believe that it was a comet whose motion had been perturbed by the gravitational pull of other celestial bodies. In general, Gauss' calculations did not

seem to have received particular attention in France. The home of celestial mechanics, where the laplacian approach was very deep-rooted, did not give much credit to Gauss, whose results had been obtained through a truly innovative method. In fact they preferred to believe that Piazzi's observations were inaccurate. As a matter of fact, the German astronomers were the first ones to get to work on the basis of the new orbital elements (cf. record **L.8**), convinced by the excellent agreement between the orbit calculated by Gauss and Piazzi's observations. Their confidence in Gauss's calculations was repaid.

On the night of December 7, 1801, in fact, thanks to the orbital parameters obtained by Gauss, von Zach was the first to observe Ceres again, followed by Olbers, who found it on the following January 1, and by Bode (cf. record **L.9**), who observed it on January 15: in February 1802 Ceres was also observed in Paris by Méchain and Délambre. Thanks to the elements determined by Gauss, Piazzi himself would finally reobserve Ceres on February 23: the "fugitive" had been caught up, and its discovery finally confirmed (fig. 12).

*Fig. 12 – Ceres welcomed among the planets of the solar system (credit: Bode, 1802 - detail of frontispiece; cf. record **L.9**)*


DELLA SCOPERTA

DEL NUOVO PIANETA

CERERE FERDINANDEA

OTTAVO TRA I PRIMARJ DEL NOSTRO SISTEMA SOLARE.

PALERMO

1802

NELLA STAMPERIA REALE.

*Fig. 13 – Frontispiece of Piazzi's booklet of 1802 (cf. record **L.4**). In the engraving, a little angel observes Ceres's charriot with a small telescope; on the background, Palermo's harbour.*

In 1802 Piazzi was then able to publish an essay on the discovery of Ceres Ferdinandea (fig. 13, cf. record **L.4**), where the tribute to the King returned to his advantage, as he wrote to Oriani:

In the past days I have published a brief history of my discovery, to the country's satisfaction. His Majesty rewarded me of a 200 uncias pension. See, the name of Ceres Ferdinandea was well suited?

The discovery of Ceres and the next two editions of his star catalogue earned Piazzi (fig. 14) various awards, both scientific (cf. record **L.5**) and literary, with several odes and poems dedicated to him.

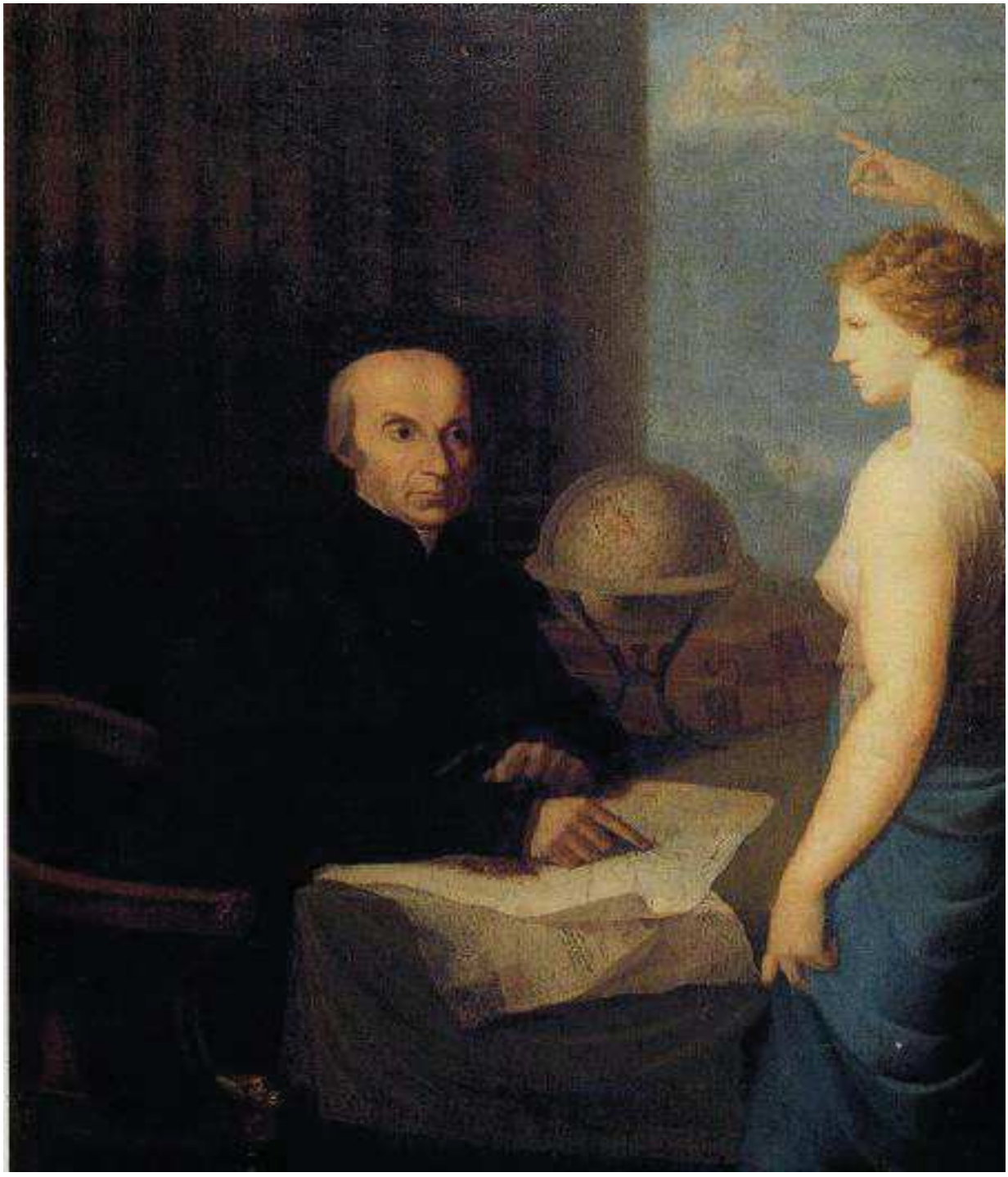


Fig. 14 – Portrait of Piazzi with Urania pointing out Ceres's charriot; on the table, the catalogue volumes with a celestial globe (Museo della Specola, INAF-OAPa)

Planet or asteroid?

A few months after the discovery of Ceres, on March 28, 1802, Olbers in Bremen discovered the second asteroid, Pallas, which had Ceres-like features, but a higher eccentricity. Someone figured to be facing a new class of solar system objects, which we now know to be very wide: it was William Herschel, whose genius is herewith confirmed. In May of that year, he presented to the Royal Society an essay (cf. record **L.11**) in which he described his observations of the two objects. After comparing their nature to that of planets and comets, he announced that it was a new type of celestial bodies.

On May 22 he sent to Piazzi a reprint of that essay, explaining the reasons that had led him to such a conclusion, and congratulating Piazzi for what he considered a doubly meritorious discovery, able to prove the existence of a new class of objects:

Planets move in the zodiac belt. Comets have a visible coma. These new objects get confused with the small fixed stars of the sky, and resemble them so much that even with a good telescope they cannot be distinguished. From this asteroidal appearance I take the name and call these new celestial bodies Asteroids (TN: from the latin word "astrum", object)*: thus Planets, Asteroids and Comets will form three different types of celestial bodies. My definition for this additional type is the following. Asteroids are small celestial bodies that move in orbits around the sun having low or high eccentricity; the planes of their orbits can be tilted to any angle with respect to the ecliptic. Their motion can be direct or retrograde, they may or may not have substantial atmosphere, tiny halo discs or nuclei. [...] The inclination of Pallas's orbit is large enough to prove its nature as an asteroid [...] And Ceres, which is actually out of the zodiac now, and it is such a small body as to have a stellar appearance, cannot be separated by any means from his companion for any characteristics. Moreover, if we called it planet, it*

would not fill the space between Mars and Jupiter with the dignity required by that position.

Aside of this sentence, in the copy of the letter that he sent to Oriani (cf. record L.12) requesting his comment, Piazzi noted rather disappointed: *we will soon see counts, dukes and marquises in the heavens*. He did not understand Herschel's intuition about the real importance of his own discovery of the first and new population of objects, believing instead that the discoverer of Uranus wanted to diminish the value of his finding. In transmitting to Oriani the text of Herschel's letter, which he termed *bizarre*, Piazzi added in fact:

Fig. 15 – Emblem of the Lilienthal Society, 1805 (credit: Gerdes, 1990); at centre, the three celestial bodies discovered between 1802 and 1804: Ceres, Pallas and Juno; all around, zodiac signs and motto: NON FRUSTRA SIGNORUM OBITUS SPECULAMUR ET ORTUS (Not in vain do we watch the setting and rising of the [zodiac] signs).

Be they called planetoides or cometoides then, but never asteroides. [...] If an Asteroid Ceres must be called, so must also be called Uranus.

The discovery of Juno and Vesta, in 1804 and in 1807 respectively (Fig. 15; cf. records **S.5** and **L.13**), confirmed the validity of Herschel's opinion and the term "asteroid" was still adopted for this class of celestial objects which Ceres belonged to, until a few years ago. The discovery of Ceres had in fact opened a new branch in astronomy research. The "hunt" begun with Ceres took a sudden restart around the middle of the century - 33 new asteroids were discovered just in the decade 1845-1855, and at the end of the nineteenth century the balance was 452 known asteroids - and is still ongoing. Today thousands of asteroids are known, whose orbit is enclosed between those of Mars and Jupiter, but there is also a number of them whose orbits cross that of the Earth, and they are constantly kept under surveillance. Ceres, the largest celestial object in the main asteroid belt, was

meanwhile upgraded to "dwarf planet" in 2006, when the definition of these celestial objects was introduced by the International Astronomical Union: heaven knows whether Piazzi would have liked this definition or found it even more "discriminating"!

Conclusions

In the story of the discovery of Ceres, there are characters involved whose behavior may appear rather bizarre. Yet Piazzi's hesitation, Bode's hurry, von Zach's suspicions, Oriani's reluctance, Lalande's doubts, Gauss's genius, Herschel's intuition, all are features belonging, then as now, to human nature.

It is still worthy to spend a few words about the behavior of the protagonist of the story, that is Piazzi. His reluctance to inform the astronomical community about his observations, his recommendations not to publish them, his uncertainties between comet and planet, are all elements that can perhaps be explained bearing in mind a couple of important considerations.

The first one concerns his education as an astronomer. As it is known, Piazzi was in fact far from being a skilled astronomer or mathematician. During his sojourns in France and in England he had been able to seize quickly and fully the observational techniques, becoming one of the most skilled observers of his time, being able as well to provide the Palermo Observatory with the most advanced instruments of the time. However, he lacked a solid theoretical knowledge of astronomy that would allow him to quickly calculate an orbit.

The second consideration is about the local conditions in which Piazzi had to act. In 1795 Piazzi had lost his most powerful "protector", the Viceroy Prince of Caramanico. He then found himself at the mercy of "academic envy" that, after the discovery of Ceres, would reach its apex in the rumour being spread that *Piazzi was discovered by Ceres*. In a context other than Sicily, Piazzi could have "dared" for sure, presenting his planetary hypothesis at the international astronomical

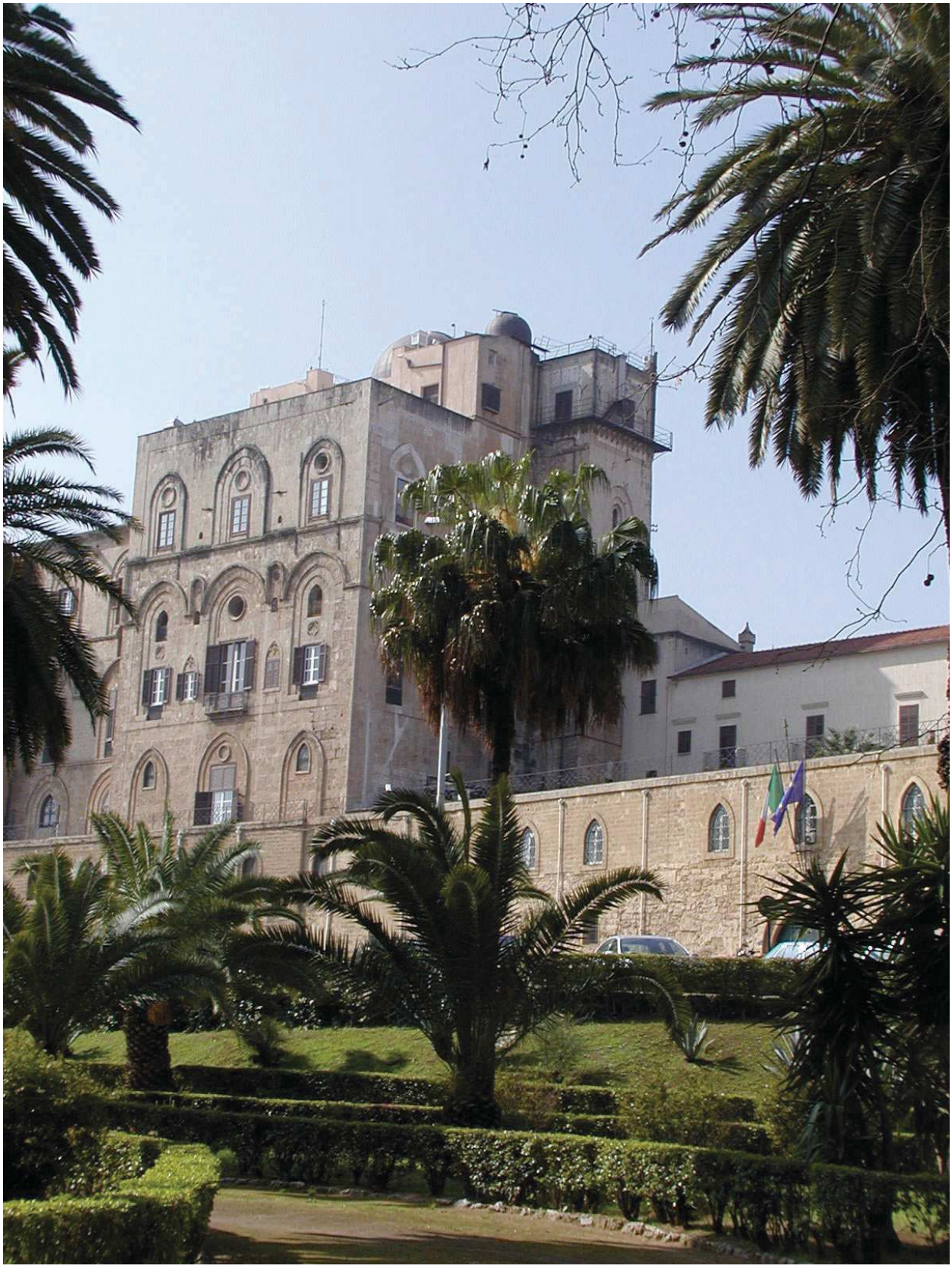
community at once, and giving immediate release of his observations. In the local context this kind of actions seemed extremely risky, not only for his credibility, but also for the very survival of the Observatory, which at that precise moment in history, coincided in practice with his own person. In fact, once the discovery was confirmed, the Palermo Observatory gained international credit, and the discovery of Ceres would be long remembered as its main scientific success (figs. 16, 17).

Fig. 16 – Ceres's charriot in the stamp used for the library of the Palermo Observatory in mid-nineteenth century.

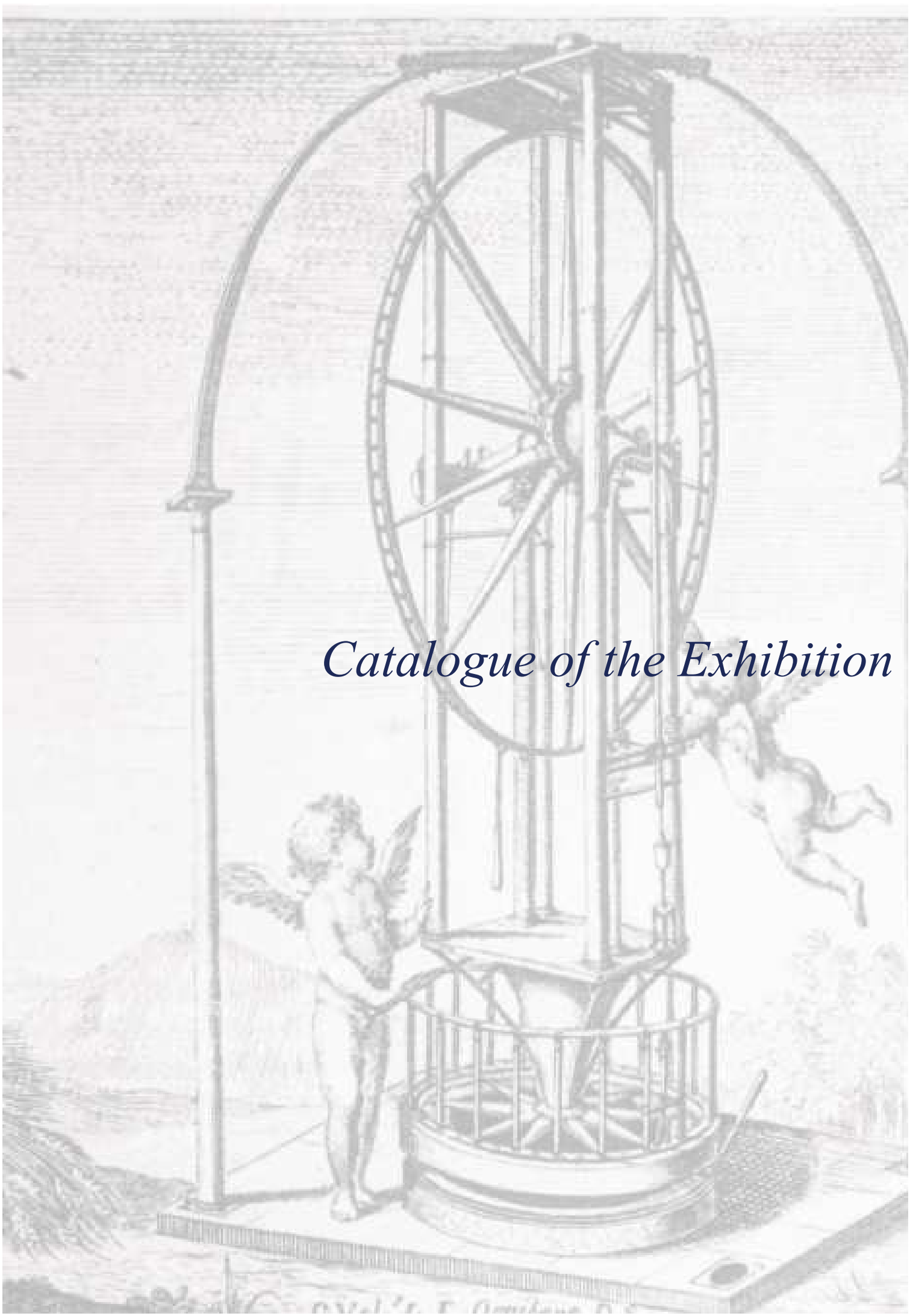
But there is a third consideration worth making. German astronomers "believed" in the existence of the planet, and in a decisive and determined way this belief led them towards the confirmation of its existence. They were ready to spend time and energy looking for a mysterious planet because they were strongly motivated, ideally even more than scientifically. They believed in a mathematical law able to describe nature which could not fool them. Without the firm determination of Bode, Olbers and von Zach, Piazzi's discovery would have been, at best, that of a lost comet, if not a true fantasy. Once lost, nobody would have been interested anymore. It was due to the Germans' determination to find again the star that Piazzi would be given his deserved glory. Bode and the others were driven by the strong motivation of finding confirmation to some world architecture described by a "law" they believed in. On the contrary, Piazzi seems to have lacked powerful motivations. In between doubt and uncertainty, he seemed more convinced of others' conviction: indeed it was the fact that the others believed in the discovery, which intimidated him on the one hand, but confirmed his initial intuition on the other. This case, like many others in the history of science, shows how important personal convictions are in scientific

Fig. 17 – Ceres's charriot in the letterhead used by the Palermo Observatory in mid-nineteenth century.

research. The scientist is often motivated by the search for confirmation of an internal structure of nature in which he or she "believes" and of which he or she is convinced, and that makes him or her look in one direction rather than another. Finding or not confirmation of one's theories is the most fascinating adventure men (and women) of science can live. The credit for the discovery of Ceres belongs indeed to Piazzi, but also to all those who stubbornly put efforts into seeking confirmation.

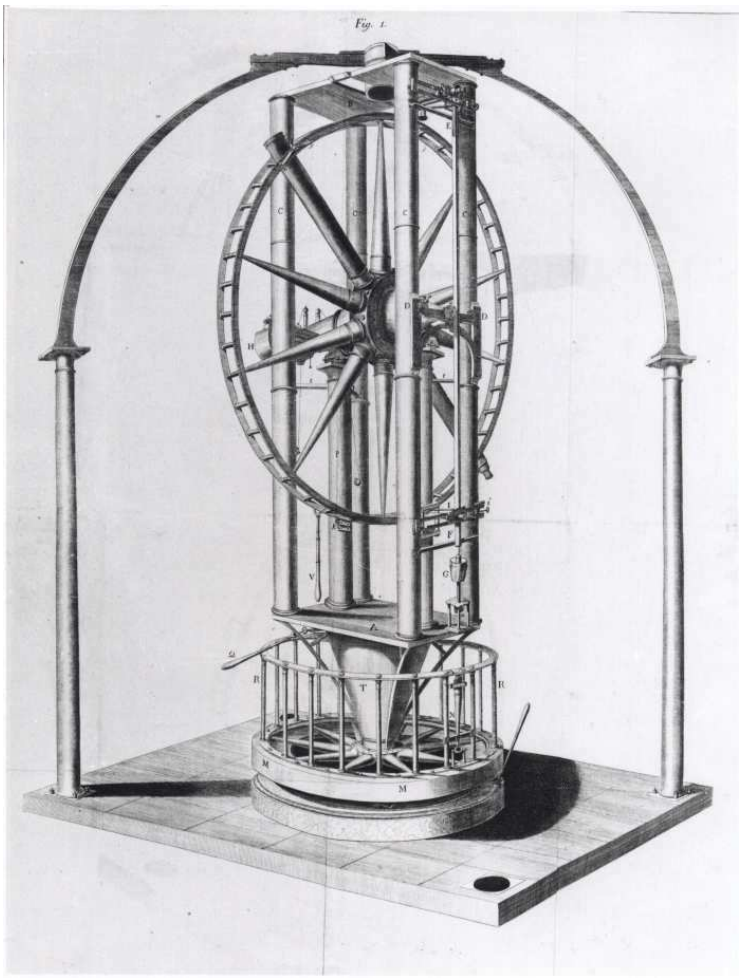


The Palermo Observatory as it is today (INAF-OAPa archives)



Catalogue of the Exhibition

Paintings and portraits



Q.1 - Ramsden Circle

Jesse Ramsden, London, 1787-89

total height = 280 cm

horizontal circle diameter = 90 cm

vertical circle diameter = 150 cm

telescope aperture = 7,5 cm

(photo enlargement 206 x 163 cm from: G. Piazzi, *Della Specola Astronomica*, Palermo, 1792)

The Ramsden Circle is by far the most famous and important instrument in the collection of the Palermo Astronomical Observatory. It was built by the renowned British manufacturer Jesse Ramsden for the newborn Palermo Observatory between January 1788 and August 1789 forming, along with other instruments, the initial equipment of the Observatory. Its history is intimately linked to the early life of this institution, and it was for nearly sixty years the main telescope, along with the Transit Instrument made by Ramsden, which is now lost. With these instruments, in fact, Giuseppe Piazzi carried out the observations for the two editions of his well-known star catalogue, published respectively in 1803 and in 1814. With the Circle he also discovered the first asteroid, Ceres Ferdinandea, on the night of January 1, 1801.

In a letter to the *Deputazione de' Regj Studj*, sent from London in 1789, Piazzi announced that the work on the Circle was finally finished:

... I am happy to announce through this very respectful letter that the work on the instrument is accomplished. The Circle, or more precisely the vertical and azimuthal Instrument, is a masterpiece, embracing the best that can be done or imagined in Optics, in Mechanics, in Astronomy: the most educated people in London [...] could not help but confess that nothing has ever been done that can match it.

The making of the Palermo Circle paved the way to a new generation of astronomical instruments, based on a circular scale. They allowed, in the late eighteenth and early nineteenth century, the accuracy of astronomical measurements to be improved by a factor of about ten.

In February 1791, when the construction of the Observatory on the tower of St. Ninfa at the Royal Palace was completed, the instrument was placed in the "Round Room", designed by the architect Giuseppe Venanzio Marvuglia, and embellished by a circular temple with white marble doric columns. The instrument was fixed at a circular stone base (still in place), which laid on a pre-existing pillar reaching down to the foundations, and it was chained to the walls of the tower to guarantee stability. A walnut dais, surrounded by a columned balustrade, allowed the astronomer to carry out the observations by moving around the Circle without disturbing the stability of this very sensitive instrument.

The instrument total height is about 280 cm; the vertical circle has a diameter of 150 cm, the horizontal is about 90 cm, while the telescope has an aperture of about 7.5 cm. The Circle was restored at the Opificio delle Pietre Dure in Florence around 1990. In 2001, on the occasion of the Museum opening and of the bicentennial of the discovery of Ceres, it was put back in the original round room. The Museum is now closed, so the Circle cannot be visited: a detail of the descriptive table is herewith exhibited, as published by Piazzi in his book *Della Specola Astronomica* (Palermo, 1792).

Q.2

Q.2 - Bust of Giuseppe Piazzi

[Villareale School], plaster, early second half of XIX century

height = 60 cm

The astronomer is here represented as a Greek hero, following a neoclassical style: on the right side, the shallow bas-relief of the Ramsden Circle can be noticed. Neither the commissioner nor the author of the sculpture are known; its style allows us to date the work to the mid-nineteenth century. It could be a copy of the bust be placed in the church of St. Dominic, the pantheon of Palermo, commissioned in 1867 by the poet Agostino Gallo, one of Piazzi's students.

Q.3 - Portrait of Piazzi pointing at Ceres

[G. Velasco], oil on canvas, ca. 1804-1807

Dimensions = 88 x 73 cm

The painting was probably donated to Piazzi from friends or students to celebrate the discovery of Ceres. Piazzi is here represented at the age of about sixty, wearing the dress of Theatins, the religious order to which he belonged. With his right hand, he is pointing at a stellar object, Ceres, represented with an arc of its orbit. Under his left arm, he is carrying a large volume, probably his star catalogue, whose first edition dates back to 1803, and during the preparation of which the discovery occurred. Alternatively, it could be a book of astronomy, depicted there to indicate his speculative activity. The painting can still be dated to the first decade of the nineteenth century and attributed to the school of Velasco.

Q.4

Q.4 - Portrait of William Herschel

G. Velasco, oil on canvas, 1791

Dimensions = 142 x 69 cm

The portraits of Herschel and Ramsden were commissioned to Joseph Velasco (1750-1827), a famous painter of the time, and a friend of the Prince of Caramanico, and carried out between May and July 1791. Piazzi liked to surround himself with portraits of his friends and colleagues he had met during his journeys. He would later write to one of these, Barnaba Oriani, in 1804: *Since I can only have but a faint hope of seeing you again, at least I want your portrait in my room, just as I have those of La Lande, Herschel and Ramsden. And then: These are well worth the ones of saints and ancestors.*

Piazzi met Herschel during his trip to London; the latter was already at the height of his fame, having discovered Uranus (1781) and having already published his catalogues of double stars (1784) and nebulae (1786). Piazzi wanted Herschel to be represented in his left profile, with his bust surrounded by laurel branches; below, a celestial globe and a book of astronomy representing respectively his observational and speculative activities. The inscription in the scroll reads "GUGLIELMO HERSCHEL NATO IN HANNOVER nel 1738 / SCOPRI' IL NUOVO PIANETA li 13 Marzo 1781" (in English: "WILLIAM HERSCHEL BORN IN HANNOVER 1738 / DISCOVERED THE NEW PLANET ON 13 MARCH 1781"). At that time Piazzi could not imagine he would be the next one to discover a "planet", in 1801, and that Herschel would invent the term "asteroid" to refer to this new type of celestial objects.

A detail of the scroll with the globe.

Q.5 - Portrait of Jesse Ramsden

G. Velasco, oil on canvas, 1791

Dimensions = 142 x 69 cm

Ramsden's role in providing the instrumental equipment for the newborn Palermo Observatory was crucial. Piazzi did not hesitate to turn to whom was recognized as the best manufacturer of scientific instruments of the time, to get the equipment he needed, aware of the risk he would incur by having to do with Ramsden's well-known character, whose distraction often led him to forget commissions and sell instruments already booked by other customers. During his long stay in London, Piazzi used to go in person and check the progress of work on his instruments. The main historical source about Ramsden's workshop today is actually a letter that Piazzi wrote to Lalande, published in 1788, in which he described the famous manufacturer's activities. Thanks to his perseverance, Piazzi

obtained Ramsden altazimuth Circle in less than two years, opening the way for a new generation of astronomical instruments, those based on a circular scale.

The portrait is a mirrored copy of that of Herschel. Ramsden is depicted in his right profile, with the bust framed by laurel branches; below, a theodolite built by Ramsden for the geodetic operations of connection between English and French triangulation networks, carried out by General William Roy. It is the most important instrument built by Ramsden before the Palermo Circle. Piazzi wanted it to be depicted in the portrait probably because it was considered a prototype of the Circle (it is Ramsden's first instrument based on a large circular scale), but also as a personal memory, having witnessed the Anglo-French geodetic operations. The inscription under the bust shows the name, place and date of birth: "GESSE RAMSDEN BORN IN HALIFAX / ON October 6, 1730" (TN: in English).

A detail of the scroll with the theodolite.

S.1- Reflector Telescope

James Short, London, 1765 ca.

tube length = 45 cm

base width = 35 cm

This telescope is certainly the oldest in the collection of the Palermo Observatory. It was donated to Piazzi by the Viceroy Francesco D'Aquino Prince of Caramanico, as it can be seen from the inscription on the base:

EX DONO FRANCISCI DE AQUINO - PRO REGIS - 1793.

Caramanico, Viceroy from 1786 to 1795, honored Piazzi of his personal esteem and friendship, and had a major role in the foundation of the Palermo Astronomical Observatory. This is a further proof of the close relationship between Piazzi and the Viceroy.

It is a Gregorian telescope made by British manufacturer James Short (1710-1768). On the tube's support, an inscription reads:

JAMES SHORT LONDON 104/726 = 18.

The ratio 104/726 indicates that it is the 104th 18-inch telescope manufactured by Short out of a total of 726 telescopes made until then. From these

data it is possible to deduce an approximate dating around 1765. The instrument, restored around 1990, is devoid of the metal mirror and eyepieces.

S.2 - Sextant

Jesse Ramsden, London, 1787

radius = 33,5 cm

box width = 38 cm

Although Hadley's sextant, or reflection sextant, is not an instrument which may have a great use in an observatory, having the opportunity to get one from Ramsden's, I decided to purchase it.

Giuseppe Piazzi, in his second book on the Astronomical Observatory, justified with these words the purchase of a sextant made by the famous British manufacturer Jesse Ramsden (1737-1800). It also appears in a handwritten paper by Piazzi himself entitled: *Nota degli stromenti provvisti in Londra dal P. Piazzi per l'Osservatorio di Palermo co' loro prezzi.* A very accurate description of this instrument is found in one of Ramsden's booklets, published in London and undated.

Piazzi used it to take a first set of measurements between 1790 and 1792. He wished to determine Palermo's latitude, set at 38 ° 06'44 ", with a correction of almost 4' from the value generally accepted at the time.

The instrument was accompanied by several accessories now lost, and today it is preserved in its original mahogany case. At the center of the scale are the names:

Ramsden London

and engraved on the back the serial number 966, which allowed us to date to early 1788.

S.3 - Achromatic Telescope

Jesse Ramsden, London, 1787

focal length = 72 cm

objective aperture = 5 cm

This instrument was part of the Observatory initial equipment. In fact, it is included in the *Nota degli Stromenti provvisti in Londra dal P. Piazzi per l'Osservatorio di Palermo co' loro prezzi* (TN: List of the instruments purchased in London by Piazzi for the Palermo Observatory along with prices). Here is the description given by Giuseppe Piazzi in his book *Della Specola Astronomica*:

The achromatic telescope is composed of two objective lenses of 25 inches focus, and two and a half inch aperture. It has non-ordinary clarity and neatness,

and is equipped with five different eyepieces, four of which showing objects in their natural position, and another one upside-down. The latter gives a 76 times magnification, the others ranging from 36 up to 200 times. Observing Venus with the 200 magnification eyepiece is better than with any other, the Moon is still very well visible, but it is not applicable to other objects. With the 76 times magnification eyepiece I have been able to spot up to three of Saturn's satellites, and I sometimes distinguish up to 4 Jupiter's bands. Occultations of Jupiter's moons usually can be observed 10 to 12 seconds before appearing in the circle's telescope.

The telescope has been restored in the 90's of the past century. The objective lens and one of the eyepieces are the original ones. The finderscope and the brass tripod got lost, the latter having been rebuilt based on the model of a similar telescope by Ramsden. The engraving on the tube reads

Ramsden London

Piazzi's assistants, Niccolò Carioti and Niccolò Cacciatore, tried unsuccessfully to search for Ceres out of the meridian.

Maker's signature (credit: Wikipedia)

S.4 - Herschel Mirror

William Herschel, London, 1790

diameter = 16 cm

edge thickness = 2,5 cm

This is what remains of a reflector telescope purchased by Piazzi and arrived in Palermo in December 1790. One year earlier Piazzi had asked the *Deputazione dei Regi Studi* the necessary funds to buy some instruments he thought absolutely necessary for the observatory, in addition to those he had purchased during his journey to England and France (March 1787-August 1789). Among other equipment, Piazzi requested a 6-feet focus reflection telescope. The instrument was ordered to William Herschel, known as well for his skills in making reflector telescopes, whom Piazzi had met during his stay in London. As soon as the new telescope arrived, Piazzi, eager to test it, made some observations of Saturn: *although it was not very high in the sky, nor being the night one of the finest, I could distinguish very clearly four of its satellites; and I also saw some nebulae, thus not having to go any further in judging the instrument's quality*.

Piazzi's observational program, however, involved the use of astrometry instruments, and thus Herschel reflector was little used. We do not know exactly when it was decommissioned. By the end of the last century it was already disassembled and in poor condition: in an inventory dated around 1890 a note reads *Herschel telescope's tube and tripod - unserviceable.*

The reflector octagonal tube, typical of herschelian telescopes, was made of mahogany; it was also accompanied by several accessories, a comet seeker, eyepieces and micrometers.

The mirror, the only surviving part, is contained in its original tin box, stored in a small wooden box which has recently been restored.

S.5 - Planetarium

Giuseppe Porcasi, Palermo, 1810 ca.

total height = 65 cm

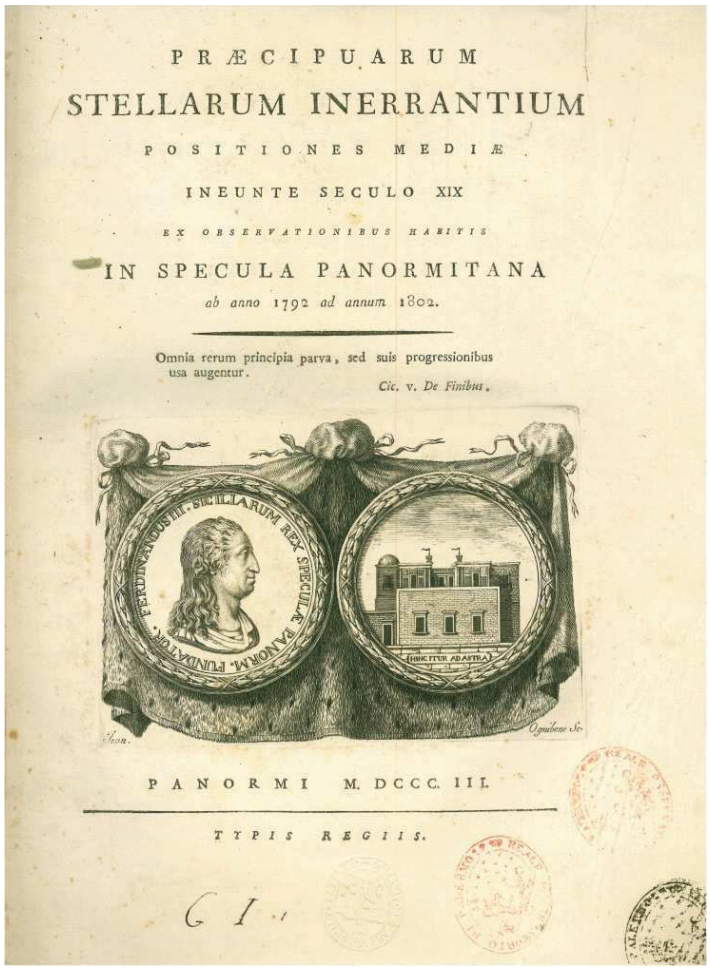
outer circles diameter = 38 cm

It is an educational instrument built by Giuseppe Porcasi, mechanic at the Palermo Observatory, around 1810, and it was designed by Piazzi. It is one of the

first planetariums to include asteroids, and it was probably made right to display positions and motions of the new bodies of the solar system.

The golden ball at the center, representing the sun, has a diameter of about 5.5 cm. The revolving metal arms carry cardboard discs which depict the planets known at the time and the relating astronomical data. After Mercury and Venus, an open circle made of wood and paper is the Earth's orbit; this is connected to a smaller open circle, representing the Moon's orbit. Mars follows with the four minor planets Vesta, Ceres, Pallas and Juno, then Jupiter, Saturn (shown with the ring), and finally Uranus, which appears under the name of Herschel, its discoverer. The two outer vertical circles represent the equinoctial colure (the celestial meridian passing through the two points of intersection between the celestial equator and the ecliptic) and the solstitial colure (perpendicular to the plane containing the above meridian); the horizontal circle represents the celestial equator.

The instrument is neither signed nor dated; inscriptions are in French though, so it is likely that the glued paper came from some manufacturer in France, and that the supplier was Lalande himself.



PRÆCIPUARUM
STELLARUM INERRANTIUM
POSITIONES MEDIÆ
INEUNTE SECULO XIX
EX OBSERVATIONIBUS HABITIS
IN SPECULA PANORMITANA
ab anno 1792 ad annum 1802.

Omnia rerum principia parva, sed suis progressionibus usa augentur.
Cic. v. De Finibus.

PANORMI M. DCCC. III.

TYPIS REGIIS.

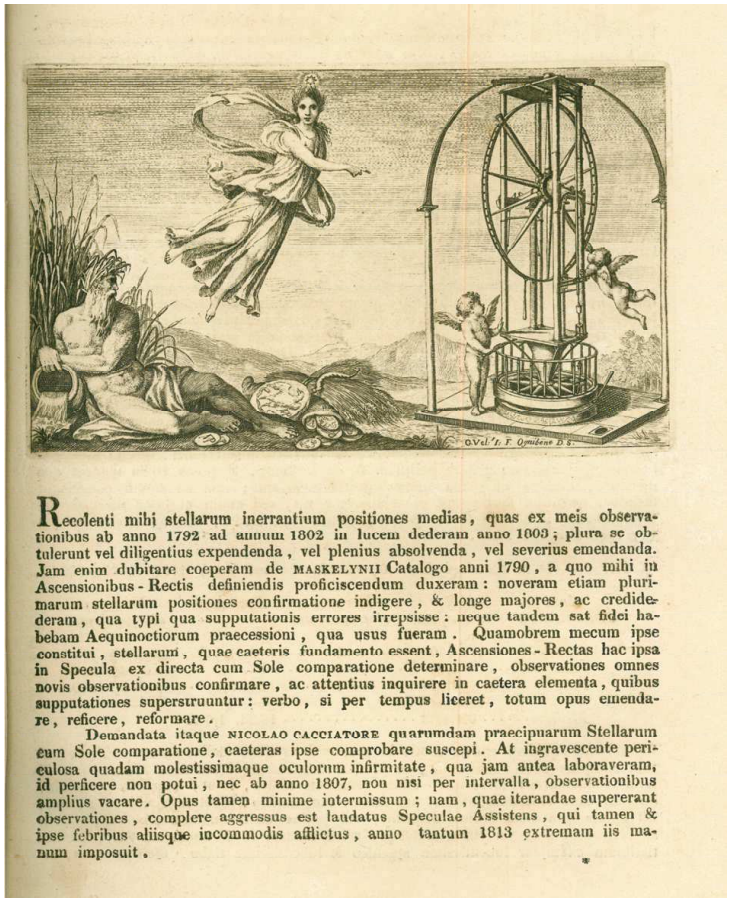
L.1 - PIAZZI, Giuseppe, 1746-1826

Praecipuarum stellarum inerrantium positiones mediae ineunte seculo XIX ex observationibus habitis in specula Panormitana ab anno 1792 ad annum 1802 / [Giuseppe Piazzi]. – Panormi : typis Regiis, 1803. – XL, [702], 76 p. ; fol. (32 cm)

Piazzi's catalogue of over 6500 stars was highly appreciated by the international scientific community, and earned him the medal of the *Académie des Sciences de l'Institute de France*. The astronomer compiled it, starting from 1792, repeating each observation several times through different nights. Thanks to this method, on the night of January 1, 1801 he was able to notice the presence of an unknown "object" in the sky, which he would later name *Ceres Ferdinandea*.

On the medallion to the left of the frontispiece engraving there is a profile of King Ferdinand III of Sicily and I of the Two Sicilies who, urged by the Viceroy Prince of Caramanico, had agreed to trust the scientific project of realizing the Observatory. The latter is depicted on the right medallion: note that the facade of the Observatory has a single dome (that of the Ramsden Circle).

L.2



Recolenti mihi stellarum inerrantium positiones medias, quas ex meis observationibus ab anno 1792 ad annum 1802 in lucem dederam anno 1803; plura se obtulerunt vel diligentius expendenda, vel plenius absolvenda, vel severius emendanda. Jam enim dubitare coeperam de MASKELYNII Catalogo anni 1790, a quo mihi in Ascensionibus-Rectis definiendis proficiscendum duxeram: noveram etiam plurimarum stellarum positiones confirmatione indigere, & longe majores, ac credideram, qua typi qua supputationis errores irrepsisse: neque tandem sat fidei habebam Aequinoctiorum praecessioni, qua usus fueram. Quamobrem mecum ipse constitui, stellarum, quae caeteris fundamento essent, Ascensiones-Rectas hac ipsa in Specula ex directa cum Sole comparatione determinare, observationes omnes novis observationibus confirmare, ac attentius inquirere in caetera elementa, quibus supputationes superstruuntur: verbo, si per tempus liceret, totum opus emendare, reficere, reformare.

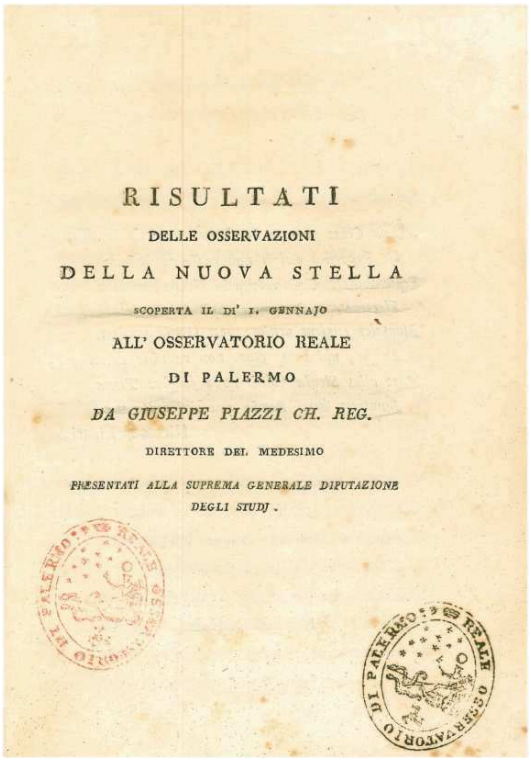
Demandata itaque NICOLAO CACCIATORE quarumdam praecipuarum Stellarum cum Sole comparatione, caeteras ipse comprobare suscepi. At ingravescente periculosa quadam molestissimaque oculorum infirmitate, qua jam antea laboraveram, id perficere non potui, nec ab anno 1807, non nisi per intervalla, observationibus amplius vacare. Opus tamen minime intermissum; nam, quae iterandae supererant observationes, complere aggressus est laudatus Speculae Assistens, qui tamen & ipse febribus aliisque incommodis afflictus, anno tantum 1813 extremam iis manum imposuit.

L.2 - PIAZZI, Giuseppe, 1746-1826

Praecipuarum stellarum inerrantium positiones mediae ineunte saeculo XIX ex observationibus habitis in specula Panormitana ab anno 1792 ab annum 1813 / [Giuseppe Piazzi]. – Panormi ex Regia typographya militari, 1814. – [10], 178, VII, [2] p. ; 4° (32 cm)

Second edition of Piazzi's catalogue, published in 1814. It is a revised and expanded edition of the 1803 catalogue, also awarded the medal of the *Académie des Sciences de l'Institute de France*.

The page on display shows an engraving depicting the spike-crowned Ceres who points at the Ramsden Circle, to emphasize the fact that the new star was discovered during the campaign of observations for the drafting of the catalogue. In the foreground, several symbols of the city of Palermo, including eagles and the Oreto river; in the background, mount Etna.



RISULTATI

DELLE OSSERVAZIONI

DELLA NUOVA STELLA

SCOPERTA IL DI' 1. GENNAJO

ALL' OSSERVATORIO REALE

DI PALERMO

DA GIUSEPPE PIAZZI CH. REG.

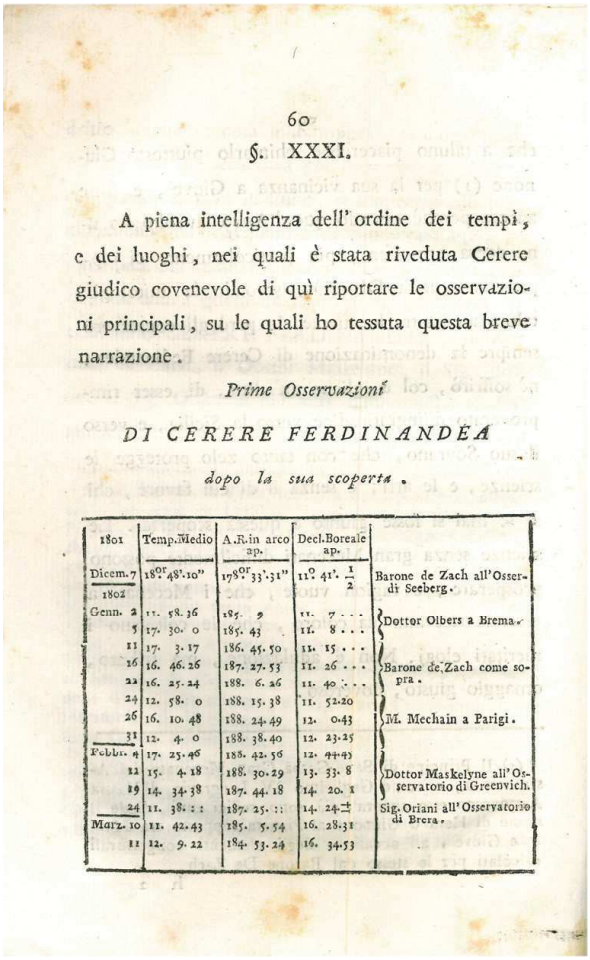
DIRETTORE DEL MEDESIMO

PRESENTATI ALLA SUPREMA GENERALE DIPUTAZIONE DEGLI STUDJ .

L.3 - PIAZZI, Giuseppe, 1746-1826

Risultati delle osservazioni della nuova stella scoperta il di' 1. Gennajo all'Osservatorio Reale di Palermo da Giuseppe Piazzi Ch. Reg. direttore del medesimo, presentati alla Suprema Generale Diputazione degli Studj / [Giuseppe Piazzi]. - In Palermo : nella Reale Stamperia, 1801. - 25 p. ; 4° (20 cm)

This booklet, published to inform the Deputazione de' Regj Studji in Palermo of the discovery of the planet, presents to the public the observations that the astronomer was initially very reluctant to spread. Piazzi did not dare to use the term "planet" in the title, preferring to still call it the "new star", though in the final part of the text he suggests that it might be a planet, under the name of "Ceres Ferdinandea ". The official name of the new star appears here for the first time.



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§. XXXI.

A piena intelligenza dell' ordine dei tempi, e dei luoghi, nei quali è stata riveduta Cerere giudico covenevole di quì riportare le osservazioni principali, su le quali ho tessuta questa breve narrazione.

Prime Osservazioni

DI CERERE FERDINANDEA

dopo la sua scoperta.

1801	Temp. Medio	A. R. in arco ap.	Decl. Boreale ap.	
Dicem. 7	18^{gr}.48'.10"	178^{gr}.33'.31"	11° 41'. 1/2	Barone de Zach all'Osservatorio di Seeberg.
1802				
Genn. 2	11. 58. 36	185. 9	11. 7 . . .	Dottor Olbers a Brema.
5	17. 30. 0	185. 43	11. 8 . . .	
11	17. 3. 17	186. 45. 50	11. 15 . . .	
16	16. 46. 26	187. 27. 53	11. 26 . . .	Barone de Zach come sopra.
22	16. 25. 24	188. 6. 26	11. 40 . . .	
24	12. 58. 0	188. 15. 38	11. 52.20	M. Mechain a Parigi.
26	16. 10. 48	188. 24. 49	12. 0.43	
31	12. 4. 0	188. 38. 40	12. 23.25	
Febbr. 4	17. 25. 46	188. 42. 56	12. 44.43	
12	15. 4. 18	188. 30. 29	13. 33. 8	Dottor Maskelyne all'Osservatorio di Greenvich.
19	14. 34. 38	187. 44. 18	14. 20. 1	
24	11. 38. : :	187. 25. : :	14. 24.±	Sig. Oriani all'Osservatorio di Brera.
Marz. 10	11. 42. 43	185. 5. 54	16. 28.31	
11	12. 9. 22	184. 53. 24	16. 34.53	

L.4 - PIAZZI, Giuseppe, 1746-1826

Della scoperta del nuovo pianeta Cerere Ferdinandea ottavo tra i primarj del nostro sistema solare / [Giuseppe Piazzi]. - Palermo : nella Stamperia Reale, 1802. - 65 p. ; 4° (21 cm).

In this essay, published about a year after the previous one [L.3], Piazzi speaks *with greatest simplicity, and truth about what this subject [the discovery of Ceres], here and there, as far as I know, was thought, tried, and made first, and thereafter*.

The page on display shows the table with the first observations of Ceres published by the astronomer. The exhibited copy lacks the title page illustration.

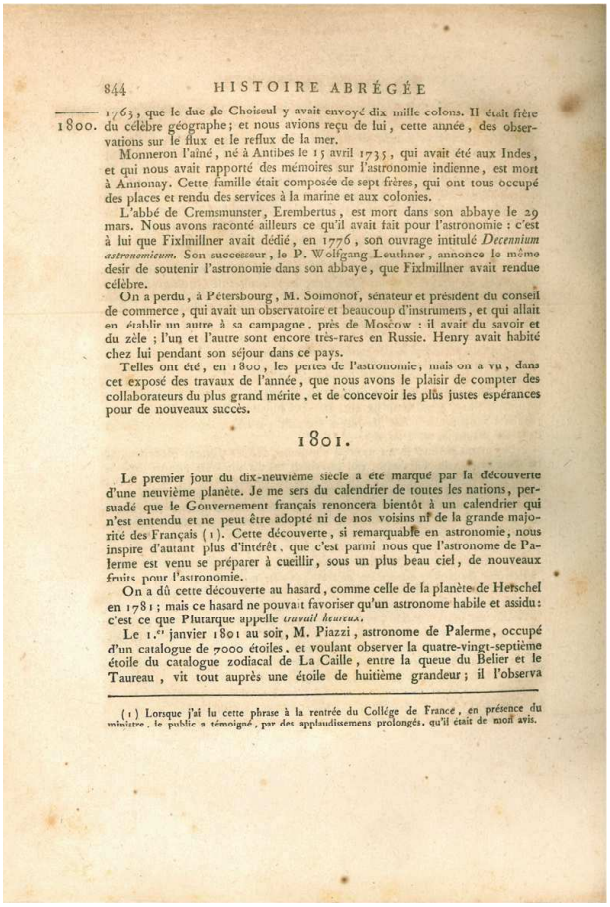
The booklet is bound in a miscellaneous collection, belonged to G. Piazzi.

L.5 - Diploma of election as honorary member of the *Accademia Gioenia di Scienze Naturali* in Catania, confered to Piazzi on 12 May 1824

Historical archives of the Palermo Astronomical Observatory, Series IX Fondi degli Astronomi, Cartella 75, Fasc. 21

Throughout his life, Piazzi received numerous awards and honors from national and international scientific academies, as well as having several literary works (poems and odes) dedicated to him. The Gioenian Academy of Catania, one of the oldest and most prestigious scientific institutions in the island, honored the astronomer by electing him to its membership, shortly after its foundation.

L.6



844 HISTOIRE ABRÉGÉE

1763, que le duc de Choiseul y avait envoyé dix mille colons. Il était frère
1800. du célèbre géographe; et nous avions reçu de lui, cette année, des observations sur le flux et le reflux de la mer.

Monneron l'aîné, né à Antibes le 15 avril 1735, qui avait été aux Indes, et qui nous avait rapporté des mémoires sur l'astronomie indienne, est mort à Annonay. Cette famille était composée de sept frères, qui ont tous occupé des places et rendu des services à la marine et aux colonies.

L'abbé de Cremsmunster, Erembertus, est mort dans son abbaye le 29 mars. Nous avons raconté ailleurs ce qu'il avait fait pour l'astronomie : c'est à lui que Fixlmillner avait dédié, en 1776, son ouvrage intitulé *Decennium astronomicum*. Son successeur, le P. Wolfgang Leuthner, annonce le même désir de soutenir l'astronomie dans son abbaye, que Fixlmillner avait rendue célèbre.

On a perdu, à Pétersbourg, M. Soimonof, sénateur et président du conseil de commerce, qui avait un observatoire et beaucoup d'instrumens, et qui allait en établir un autre à sa campagne, près de Moscow : il avait du savoir et du zèle ; l'un et l'autre sont encore très-rares en Russie. Henry avait habité chez lui pendant son séjour dans ce pays.

Telles ont été, en 1800, les pertes de l'astronomie; mais on a vu, dans cet exposé des travaux de l'année, que nous avons le plaisir de compter des collaborateurs du plus grand mérite, et de concevoir les plus justes espérances pour de nouveaux succès.

1801.

Le premier jour du dix-neuvième siecle a été marqué par la découverte d'une neuvième planète. Je me sers du calendrier de toutes les nations, persuadé que le Gouvernement français renoncera bientôt à un calendrier qui n'est entendu et ne peut être adopté ni de nos voisins ni de la grande majorité des Français (1). Cette découverte, si remarquable en astronomie, nous inspire d'autant plus d'intérêt, que c'est parmi nous que l'astronome de Palerme est venu se préparer à cueillir, sous un plus beau ciel, de nouveaux fruits pour l'astronomie.

On a dû cette découverte au hasard, comme celle de la planète de Herschel en 1781; mais ce hasard ne pouvait favoriser qu'un astronome habile et assidu: c'est ce que Plutarque appelle *travail heureux*.

Le 1.er janvier 1801 au soir, M. Piazzi, astronome de Palerme, occupé d'un catalogue de 7000 étoiles, et voulant observer la quatre-vingt-septième étoile du catalogue zodiacal de La Caille, entre la queue du Belier et le Taureau, vit tout auprès une étoile de huitième grandeur; il l'observa

(1) Lorsque j'ai lu cette phrase à la rentrée du Collége de France, en présence du ministre, le public a témoigné, par des applaudissemens prolongés, qu'il était de mon avis.

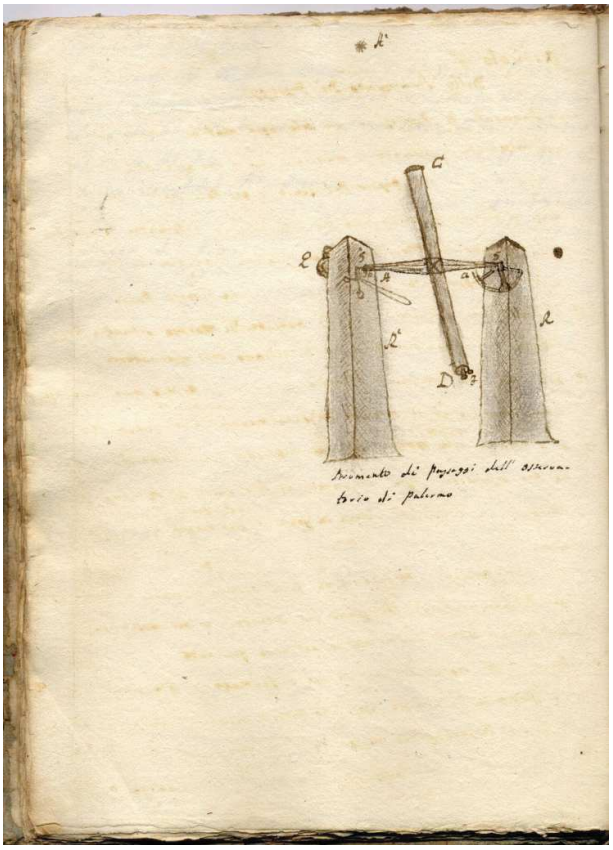
L.6 - LALANDE, Joseph Jérôme de, 1732-1807

Bibliographie astronomique : avec l'histoire de l'astronomie depuis 1781 jiusqu'à 1802 / par Jérôme de La Lande … – A Paris : de l'imprimerie de la République, an XI=1803. – [4], VIII, 915 ; 4° (27 cm)

This book contains a list of all astronomical works known up to 1803, and of the most distinguished astronomers, as well as a detailed history of astronomy from 1781 to 1802. It thus represents an important resource for astronomy historians.

The page is open on the first news of 1801, that is the discovery of Ceres.

Lalande had taught Piazzi the practice of astronomy in 1787, during his sojourn in Paris; the two always maintained close relations, considering each other respectively master and pupil. Another link between the two was the affiliation to Freemasonry.



L.7 – PIAZZI, Giuseppe, 1746-1826

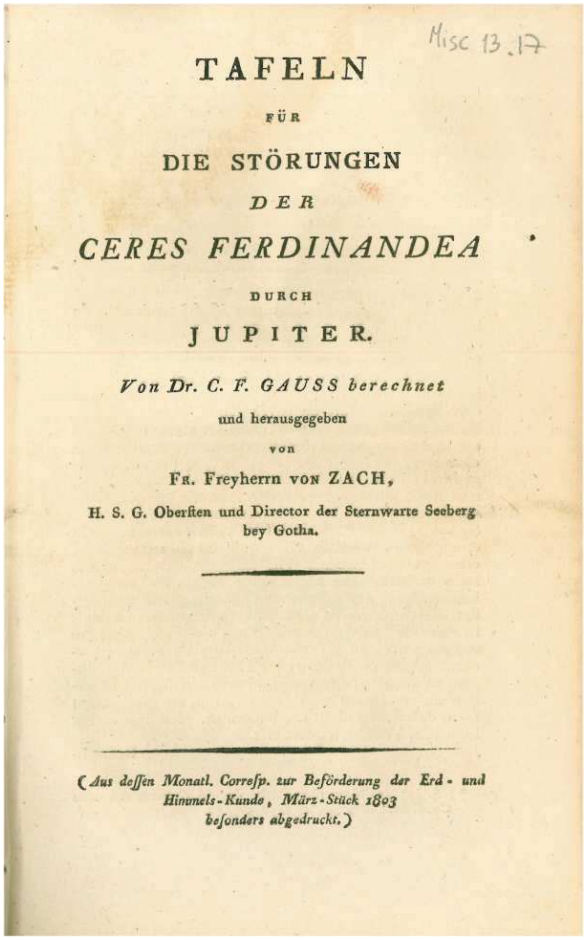
"Lezioni d'Astronomia del P. Don Giuseppe Piazzi C.R. e Reg.° Prof. di Astron.a. Libro II. Degli Stromenti coi quali debbansi fare le osservazioni, e delle correzioni, che le medesime esigono."

Historical archives of the Palermo Astronomical Observatory, Series IX Fondi degli Astronomi, Cartella 76, Fasc. 19

This manuscript contains a drawing of the transit instrument purchased for the Palermo Observatory by Piazzi at Jesse Ramsden's workshop in London.

The drawing, made by Piazzi, was to accompany the text of a *Treatise on Instruments* which the astronomer failed to finish and the only remnants of it being this manuscript.

The instrument, which no longer exists, was used to determine more accurately Ceres's position, in the nights after its discovery.



TAFELN

FÜR

DIE STÖRUNGEN

DER

CERES FERDINANDEA

DURCH

JUPITER.

Von Dr. C. F. GAUSS berechnet

und herausgegeben

von

Fr. Freyherrn von ZACH,

H. S. G. Obersten und Director der Sternwarte Seeberg bey Gotha.

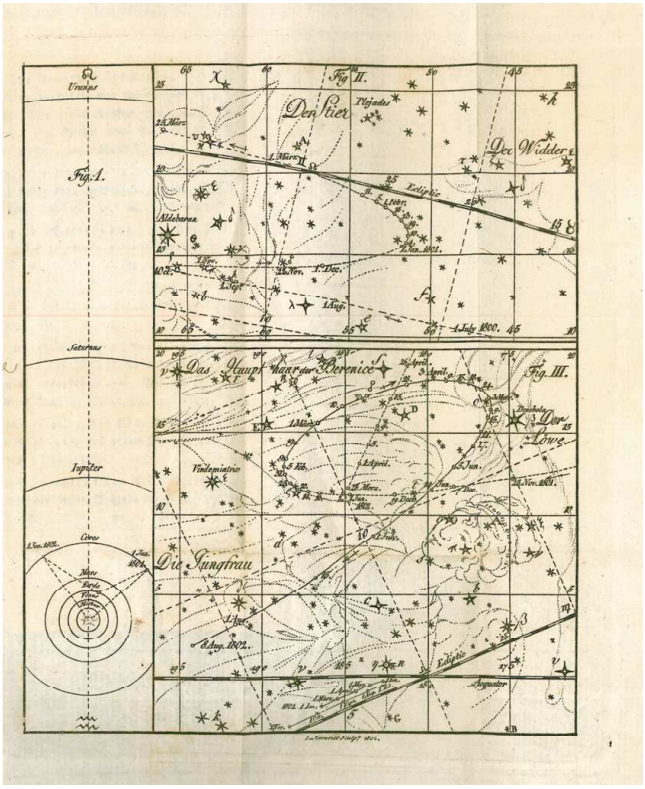
(Aus dessen Monatl. Corresp. zur Beförderung der Erd- und Himmels-Kunde, März-Stück 1803 besonders abgedruckt.)

L.8 - GAUSS, Karl Friedrich, 1777-1885

Tafeln für die Störungen der Ceres Ferdinandea durch Jupiter / von Dr. C.F. Gauss berechnet ; und herausgegeben von Fr. Freyherrn von Zach … – [S.l.] : [s.n.], 1803. – 16 p. ; 8° (19 cm)

The booklet is bound in one of the collections belonged to Piazzi, and it is extracted from the periodic Mönatliche Correspondenz, whose editos was the Baron von Zach.

The work contains tables of the perturbations of Ceres's motion due to the proximity of Jupiter. The German mathematician Gauss first determined Ceres's orbit, by using a method he had invented, and then refined in 1809, and known as the "least squares method". The difficulty in calculating the orbit originated from the fact that the data were very close together and included in a range of a few degrees. The orbit calculated by Gauss will be so correct that it would allow the discovery of Ceres in December 1801.



L.9 - BODE, Johann Elert, 1747-1826

Von dem neuen, zwischen Mars und Jupiter entdeckten achten hautplaneten des Sonnensystems / Johann Elert Bode. – Berlin : in der himburgischen Buchhandlung, 1802. – VI, 136, [2], [1] c. di tav. ripieg. : antip. ; 8° (18 cm)

The booklet is entirely dedicated to the discovery of Ceres, and tells the story of the complex case related to this important astronomical event. The given point of view is by one of the protagonists, namely the astronomer Johann E. Bode, a firm believer of the existence of a planet between Mars's and Jupiter's orbits.

The table exhibited presents *The orbit of Ceres according to the ellipse calculated by Gauss*. Thanks to the orbit calculated by Gauss, and the subsequent discovery of Ceres by different astronomers - Bode, Olbers, von Zach and Piazzi himself - Piazzi's discovery could be confirmed. On the booklet's frontispiece, the goddess Ceres is significantly represented while being welcomed among the stars.

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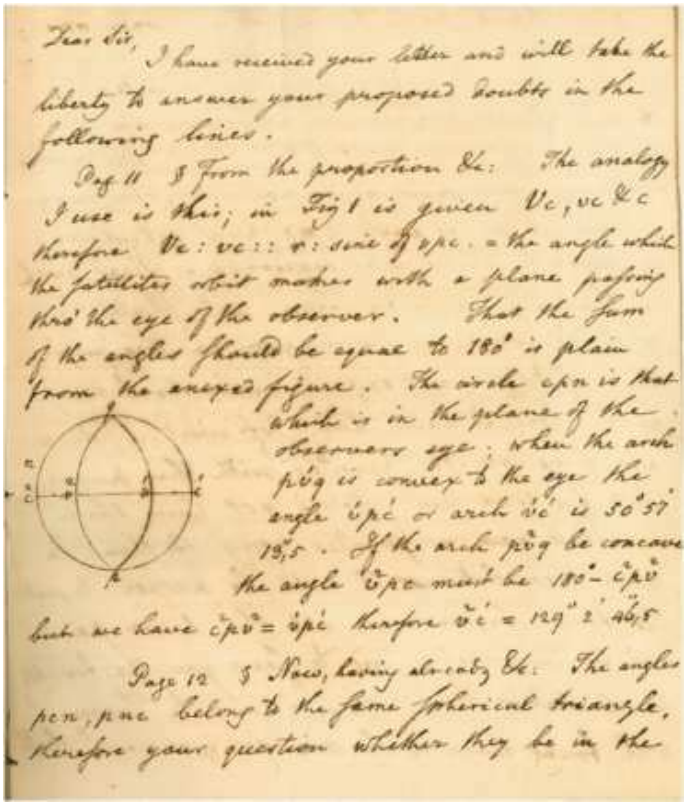
L.10


Dear Sir,
I have received your letter and will take the liberty to answer your proposed doubts in the following lines.
Pag 11 § From the proportion &c: The analogy I use is this; in Fig 1 is given Ve, ve & c therefore Ve : ve :: v : sine of vpe. = the angle which the satellites orbit makes with a plane passing thro' the eye of the observer. That the sum of the angles should be equal to 180° is plain from the annexed figure. The circle cpn is that which is in the plane of the observers eye; when the arch pvq is convey'd to the eye the angle v̂pć or arch v̂c is 50°57' 19,5. If the arch pvq be concave the angle v̂pc must be 180° - ĉpv̂ but we have ĉpv̂ = v̂pć therefore v̂ć = 129° 2' 46,5
Page 12 § Now, having already &c: The angles pcn, pnc belong to the same spherical triangle, therefore your question whether they be in the

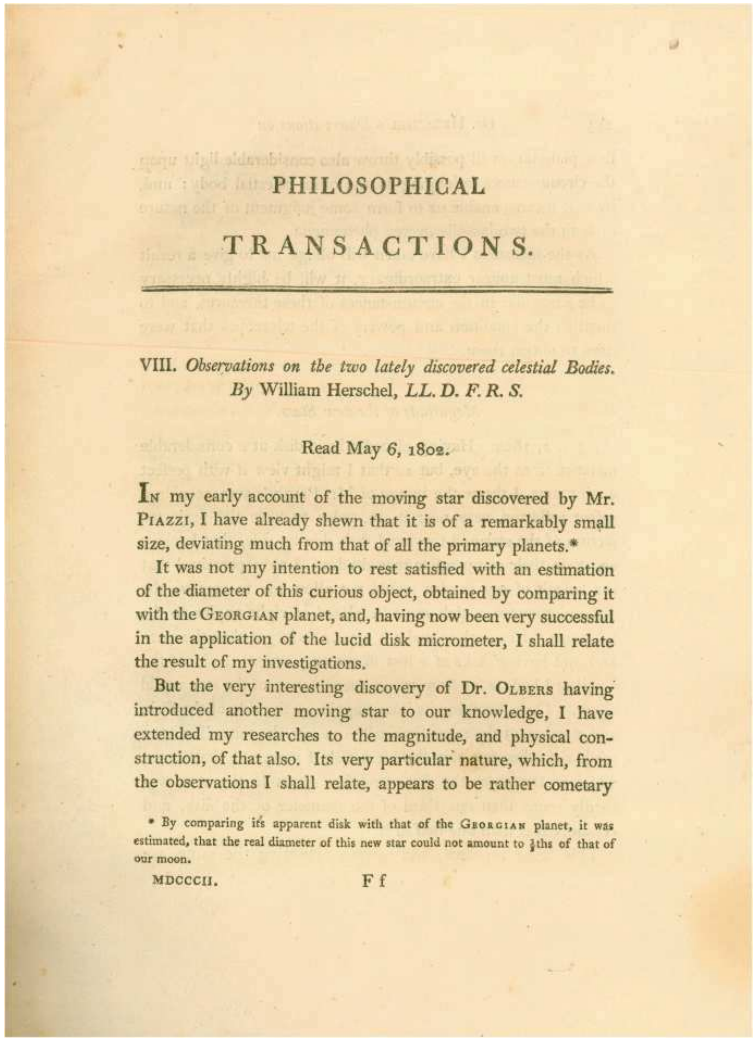
L.10 – Herschel, Frederick William, 1738-1822

Letter to Giuseppe Piazzi. London, February 8, 1789.

In: Miscellanea Herschel.

The letter is bound in a collection belonged to Piazzi, containing a collection of scientific works by William Herschel.

Piazzi received the letter during his stay in London. Herschel provides in this letter some explanations about his paper entitled "On the Georgian planet and its satellites", published around 1788, attaching the printed errata sheet. By using the name "Georgian Planet", Herschel refers to Uranus, the planet he had discovered in 1781.



PHILOSOPHICAL

TRANSACTIONS.

VIII. *Observations on the two lately discovered celestial Bodies.* By William Herschel, *LL. D. F. R. S.*

Read May 6, 1802.

In my early account of the moving star discovered by Mr. Piazzi, I have already shewn that it is of a remarkably small size, deviating much from that of all the primary planets.*

It was not my intention to rest satisfied with an estimation of the diameter of this curious object, obtained by comparing it with the Georgian planet, and, having now been very successful in the application of the lucid disk micrometer, I shall relate the result of my investigations.

But the very interesting discovery of Dr. Olbers having introduced another moving star to our knowledge, I have extended my researches to the magnitude, and physical construction, of that also. Its very particular nature, which, from the observations I shall relate, appears to be rather cometary

* By comparing its apparent disk with that of the Georgian planet, it was estimated, that the real diameter of this new star could not amount to $\frac{1}{4}$ths of that of our moon.

MDCCCII. Ff

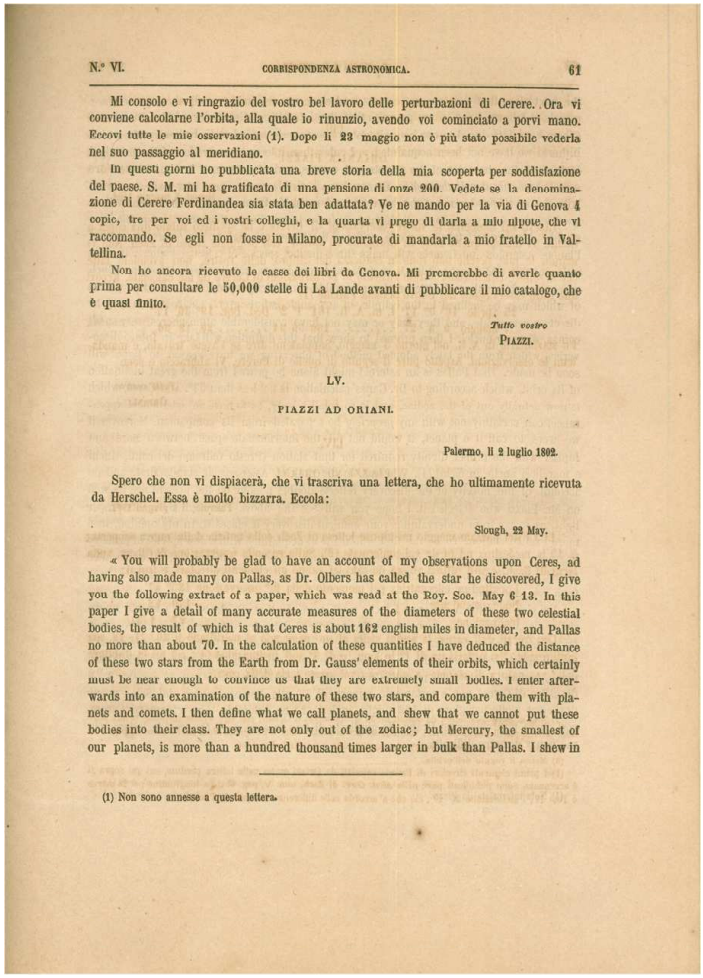
L.11 – Herschel, Frederick William, 1738-1822

Observations on the two lately discovered celestial bodies / read by William Herschel. - [London] : [s.n.], 1802. – P. 213-232 ; 4° (27 cm). – Extract from *Philosophical transactions of the Royal Society,* vol. 92, 1802.

In this paper, Herschel proposes to assign the name asteroid to the newly discovered celestial bodies (Ceres and Pallas), based on some common characteristics, and identifying them as belonging to a new class of celestial objects.

The scientific community did not accept Herschel's proposal at once: in the nineteenth century the name *asteroid* was only being used in English-speaking environment, as an alternative to *minor planet*; in France the term *petite planète* was preferred, *pianetino* in Italy.

L.12



N.° VI. CORRISPONDENZA ASTRONOMICA. 61

Mi consolo e vi ringrazio del vostro bel lavoro delle perturbazioni di Cerere. Ora vi conviene calcolarne l'orbita, alla quale io rinunzio, avendo voi cominciato a porvi mano. Eccovi tutte le mie osservazioni (1). Dopo li 23 maggio non è più stato possibile vederla nel suo passaggio al meridiano.

In questi giorni ho pubblicata una breve storia della mia scoperta per soddisfazione del paese. S. M. mi ha gratificato di una pensione di onze 200. Vedete se la denominazione di Cerere Ferdinandea sia stata ben adattata? Ve ne mando per la via di Genova 4 copie, tre per voi ed i vostri colleghi, e la quarta vi prego di darla a mio nipote, che vi raccomando. Se egli non fosse in Milano, procurate di mandarla a mio fratello in Valtellina.

Non ho ancora ricevuto le casse dei libri da Genova. Mi premerebbe di averle quanto prima per consultare le 50,000 stelle di La Lande avanti di pubblicare il mio catalogo, che è quasi finito.

Tutto vostro
PIAZZI.

LV.

FIAZZI AD ORIANI.

Palermo, li 2 luglio 1802.

Spero che non vi dispiacerà, che vi trascriva una lettera, che ho ultimamente ricevuta da Herschel. Essa è molto bizzarra. Eccola:

Slough, 22 May.

« You will probably be glad to have an account of my observations upon Ceres, ad having also made many on Pallas, as Dr. Olbers has called the star he discovered, I give you the following extract of a paper, which was read at the Roy. Soc. May 6 13. In this paper I give a detail of many accurate measures of the diameters of these two celestial bodies, the result of which is that Ceres is about 162 english miles in diameter, and Pallas no more than about 70. In the calculation of these quantities I have deduced the distance of these two stars from the Earth from Dr. Gauss' elements of their orbits, which certainly must be near enough to convince us that they are extremely small bodies. I enter afterwards into an examination of the nature of these two stars, and compare them with planets and comets. I then define what we call planets, and shew that we cannot put these bodies into their class. They are not only out of the zodiac; but Mercury, the smallest of our planets, is more than a hundred thousand times larger in bulk than Pallas. I shew in

(1) Non sono annesse a questa lettera.

L.12 – PIAZZI, Giuseppe, 1746-1826

ORIANI, Barnaba, 1752-1832

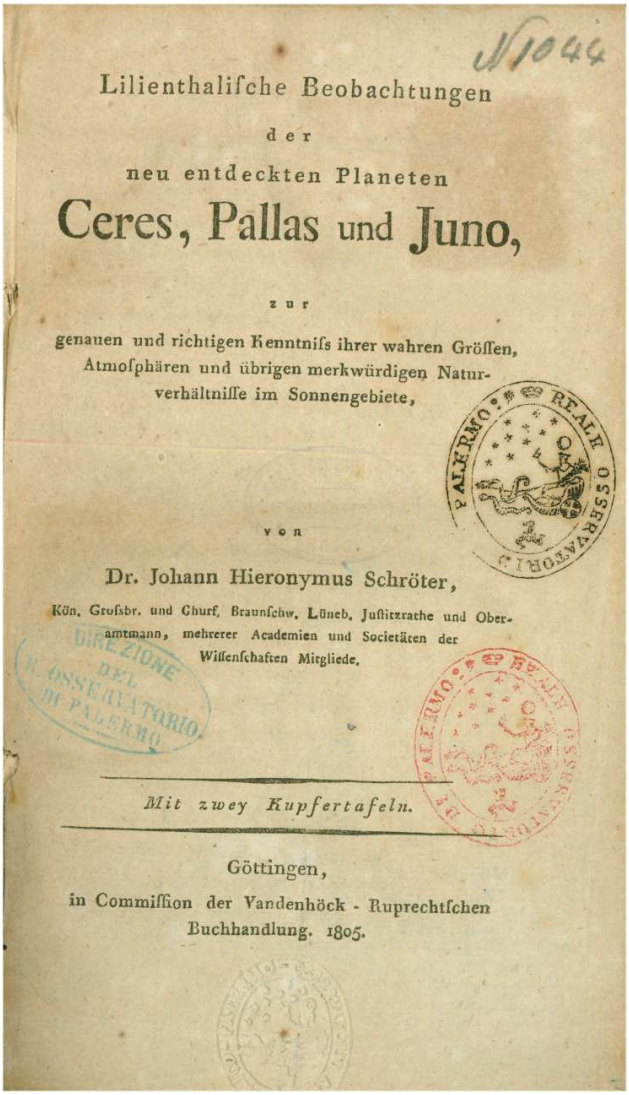
Astronomic correspondence between Giuseppe Piazzi and Barnaba Oriani published on order of the Ministro della Pubblicazione Istruzione. – Milano [etc.] : Ulrico Hoepli, 1874. – 204 p. ; 34 cm.

Extract from *Pubblicazioni del R. Osservatorio Astronomico di Brera in Milano*. N. 6.

The book contains the intense exchange of letters between Giuseppe Piazzi and Barnaba Oriani, a close friend and confidant of Piazzi's, and an astronomer at the Brera Observatory in Milan.

The two colleagues exchanged more than two hundred letters from 1791 to 1826, transcribed and published in the nineteenth century by Gaetano Cacciatore, Director of the Palermo Observatory, and Giovanni Schiaparelli, Director of the Brera Observatory.

The page contains a letter, dated 2 July 1802, in which Piazzi informs Oriani about having received a bizarre letter from English astronomer William Herschel, in which the latter sums up the contents of his essay (cf. L11) presented to the Royal Society in May 1802.



Lilienthalifche Beobachtungen

der

neu entdeckten Planeten

Ceres, Pallas und Juno,

zur

genauen und richtigen Kenntnifs ihrer wahren Gröſſen, Atmoſphären und übrigen merkwürdigen Naturverhältniſſe im Sonnengebiete,

von

Dr. Johann Hieronymus Schröter,

Kön. Groſsbr. und Churf. Braunſchw. Lüneb. Juſtitzrathe und Oberamtmann, mehrerer Academien und Societäten der Wiſſenſchaften Mitgliede.

Mit zwey Kupfertafeln.

Göttingen,

in Commiſſion der Vandenhöck - Ruprechtſchen Buchhandlung. 1805.

L.13 - SCHRÖTER, Johann Hyeronimus, 1755-1816

Lilienthalische Beobachtungen der neu entdeckten Planeten Ceres, Pallas und Juno … / von Johann Hieronymus Schröter … – Göttingen : in Commission der Vandenhöck …, 1805. – XXXVI, 378, [3] p., [1] c. di tav. ripieg. ; 8° (21 cm).

The work shows the observations made by the German astronomer Schroeter on the three asteroids Ceres, Pallas and Juno, respectively discovered by Giuseppe Piazzi, Heinrich Olbers and Karl Harding, one of Schröter's assistants at the Lilienthal Observatory, in 1801, 1802 and 1804. Schröter was president of the astronomical society constituted in Lilienthal in 1800 to find the "missing planet", and owned in his private observatory excellent instruments, with which he could study the first asteroids.

Bibliography

F. Angelitti, “Sulla scoperta del primo asteroide Cerere Ferdinandea”, *Memorie della Società degli Spettroscopisti Italiani*, XXX (1901), pp. 7-17.

F. Angelitti, “Per il centenario della morte dell'astronomo Giuseppe Piazzi”, *Memorie della Società Astronomica Italiana*, III (1925), pp. 369-375.

J. E. Bode, *Von dem neuen, zwischen Mars und Jupiter entdechten achten Hauptplaneten des Sonnensystems*, Berlino, 1802.

P. Brenni,I. Chinnici, G. Foderà Serio, "The restoration of three large telescopes of the Palermo Astronomical Observatory", *Bulletin of the Scientific Instrument Society*, 71, December 2001, pp. 11-16.

I. Chinnici, *I dipinti dell’Osservatorio Astronomico di Palermo: un primo studio* (Palermo, 2015: http://www.astropa.unipa.it/museo/quadreria-new.pdf)

I. Chinnici, G. Foderà Serio, P. Brenni, "The Ramsden's Circle at the Palermo Astronomical Observatory", *Bulletin of the Scientific Instrument Society*, 71, December 2001, pp. 2-10.

I. Chinnici & G. Foderà, “Cerere Ferdinandea, Palerme 1er janvier 1801”, *L'Astronomie*, 115 (2001), pp. 2-16.

C. J. Cunningham, B. J. Marsden and W. Orchiston, “Giuseppe Piazzi: the controversial discovery and loss of Ceres in 1801”, *Journal for the History of Astronomy*, xlii (2011), pp. 283-306.

G. Foderà & I. Chinnici, *L’Osservatorio Astronomico di Palermo. La storia, gli strumenti* (Flaccovio: 1997).

G. Foderà & I. Chinnici, “Cerere Ferdinandea”, *Giornale di Astronomia*, 28 (2001), pp. 8-23.

G. Foderà Serio, A. Manara, P. Sicoli, “Giuseppe Piazzi and the Discovery of Ceres” in: W. F. Bottke Jr., A. Cellino, P. Paolicchi, and R. P. Binzel, *Asteroids III* (The University of Arizona Press: 2002), pp. 17-24.

D. Gerdes, *Die Geschichte des Astronomischen Gesellschaft*, Heimatverein Lilienthal, 1990.

M. Hoskin, “Bode’s Law and the Discovery of Ceres” in: J. F. Linsky and S. Serio, *Physics of Solar and Stellar Coronae* (Springer: 1993), pp. 35-46.

G. Piazzi, *Risultati delle osservazioni della nuova stella scoperta il dì I. gennajo all’Osservatorio Reale di Palermo*, Palermo, 1801.

G. Piazzi, *Della scoperta del nuovo pianeta Cerere Ferdinandea*, Palermo, 1802.

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