

THE PICTURE OF THE SALA MERIDIANA OF THE PADUA OBSERVATORY

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ABSTRACT. The picture of the Sala Meridiana of the Padua Observatory represents the state of the solar system and its components at the date of June 11, 1766. This picture has had a didactic character.

1. The picture

During the works of restoration of the Specola of Padua, some years ago, a picture with an astronomical and didactic character has appeared on the east wall of the Sala Meridiana. The picture, made by Giacomo Ciesa from Vicenza (1733-1790?) belongs to the period in which the Specola is built from 1767 to 1777. The first director of this observatory, Father Giuseppe Toaldo, built two principal rooms for the observation of the sky: the upper observatory, that is the actual "Sala delle Figure", in which there are some big windows for the observations, and the lower observatory, the actual "Sala Meridiana", in which he built a sundial with a gnomonic hole to check the clocks and has placed also a big mural quadrant of Ramsden for the observations of the coordinates of the stars.

During the first period of the activity of the Specola, the director teaches the students of Padua University lessons of astronomy in the observatory.

The picture of the "Sala Meridiana" (3.40 m x 3.25 m) represents the map of the solar system with all the planets as far as Saturn, with their satellites. The map is limited by a big circle (2.20 m of diameter) divided into 360 parts. In another external ring there are represented the names of the zodiacal constellations and their limits. The map of the systems of Jupiter and Saturn are represented in the upper part of the picture at the two sides of the map of the solar system. In the lower part there is represented also the orbit of the Halley comet with all the vectors that limit the positions in the orbit of the celestial body, year by year, during the period between 1760 and 1834 (there is also indicated the transit for the aphelium in 1797). The images of the planets with also some particular aspects of their surface are represented in the lower part of the picture.

The Earth and Moon system with their umbral cones is represented at the lower left side of the map of the solar system.

2. The map of the solar system

The accurate drawing of the solar system, and also the systems of Jupiter and Saturn, suggests the suspect that the picture represents a particular state of these systems in a definite date of the period of the life of Father Toaldo. In this perspective we have made a series of measurements of the positions of the planets and of the other celestial bodies represented in this picture. The date of the planetary configuration of the picture probably is limited between 1684, the date of the discovery of Dione and Thetis that are represented in the Saturn system, and the date of the discovery of Uranus (1781), the planet that is absent in the planetary configuration. The painter Giacomo Ciesa besides has worked in the Specola during the period from September 1772 to August 1773, as

follows by the documents of the archives of the University (see also G. Lorenzoni 1921).

The positions of the planets in their orbits enable us to determine the probable date of the planetary configuration of the picture. The measurements of the heliocentric longitudes of each planet and the same elements of the ascending node, made in the painting, are given in Table I in which L_p is the planet longitude and L_n the longitude of its ascending node.

TABLE I

planet	L_p	L_n
Saturn	69°	113°
Jupiter	149	98
Mars	283	46
Earth	249	
Venus	308	70
Mercury	290	42

The position of the Earth and also the fact that the Sun is in tenth degree of Gemini, suggests that the probable configuration correspond to the date around the last May or the first of June.

An important date is the position of Saturn because the long period of revolution of this planet, enable us to consider only some years at a distance on time of 29.4 years one by other. For this reason we have calculated the mean heliocentric longitudes of the planets on the epochs preceding the 1781 with intervals of about 29.4 years, that is 1795, 1766, 1737 and 1707. The correspondence of the positions calculated and the ones represented in the picture is in accord only which the first days of June 1766. The differences between the calculated and the measured longitudes are of few degrees (1° - 7°) for the external planets and of 16° - 19° degrees for Venus and Mercury.

These differences could be ascribed to the difficulty of the painter to determine with the drawing the positions of the planets when the orbits have a little radius in comparison with the radius of the external circle in which there is the division into degrees of the ecliptic.

The date of 1766 possibly is also confirmed by the position of the Halley comet in its orbit. In the drawing on the right of the solar system, on the elliptic orbit of this comet, there is represented (only in this occasion) a little image of the celestial body in correspondence of the median point of the segment of the orbit corresponding to the year 1766.

This confirmation of the year suggests also another test, that is the position of the satellites of Jupiter and Saturn in this date.

By the paint, that represents the configuration of the Jupiter satellites system, seen as in a map, we have determined the positions of the galileian satellites as we can see in their system from the Earth. With a computer program for the determination of the positions of the galileian satellites we have tested all the possible configurations during the period between May 1 and July 1, 1766. With a number of experiments we have found that the data corresponding to June 11 made best fitting. On Table II there are listed the positions of the satellites on the picture, and on Table III we can see the calculated positions during three particular hours of June 11, 1766.

TABLE II

Io	x = -4	Jupiter radii
Europa	x = 9	“ “
Ganimede	x = -17	“ “
Callisto	x = -12	“ “

TABLE III

	June 11, 1766		
	19 ^h	20 ^h	21 ^h
Io	x = -3.4	-2.6	-1.9
Europa	x = 8.7	8.9	9.1
Ganimede	x = -15.3	-15.0	-14.7
Callisto	x = -7.2	-7.6	-8.0

The best fitting with the configuration of the painting is the one of the 20 hours of June 11, 1766.

For the satellites system of Saturn it is very difficult to identify, on the painting, their exact positions.

In conclusion all the elements derived by the measurements made on the painting suggest that the planetary configuration represented the state of the solar system around the *early June 1766*.

3.- Conclusion

What is the reason for a choice of this date? Probably this choice has been made by Giuseppe Toaldo, the director of the Specola and also the professor of astronomy in Padua University. But what this data does represent? Is it a casual choice or does it remember an interesting moment on the life of the new Specola?

The answer to this question is merely hypothetical, but it is possible nevertheless, to consider some events that occurs in this date. On January 23, 1766 Father Joseph Liesgaing gives the director Toaldo its approvation to the project of the construction of the Specola, and this project has been given to the “Riformatori dello Studio di Padova”.

On March 5 of this year, the University gives to the mathematical Giuseppe Rossi, the task of evaluation of the possibility of the works of the Specola in the tower of the castle of Ezzelino.

On May 25, 1766 the “Riformatori dello studio di Padova” have established the collection of the money (1000 ducats a year), for the works of the Specola, by the “cassa delle Matricole”.

Perhaps these events, for Toaldo, have been very important moments of the life of the new Specola.

The map of the solar system painted in the Sala Meridiana of the Padua Observatory is not a paint of artistic quality, but the clarity of the drawing is very interesting especially for the didactic training. On the drawing of the orbit of Halley comet, for exemple, we have the possibility to verify the second Kepler law, and on the solar system map we have the possibility to verify the positions of the planets in the sky during the night of the date of the painting. We have also the possibility of a clear vision of the relative sizes of the planets and their telescopic apparence. Toaldo, the first director of the Specola of Padua, has had, surely, a particular attention to the didactic of the astronomy.

References

- G. Lorenzoni. 1921. "I primordi dell'Osservatorio Astronomico di Padova". Contributo del R. Istituto Veneto di Scienze, Lettere ed Arti alla celebrazione del VII centenario dell'Università di Padova.

Fig.1. The painting of the Sala Meridiana of the Specola of Padua.

