



## VII. History of astronomy for the year 1799

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VII. *History of Astronomy for the Year 1799.* By JEROME LALANDE. *Read at the Lyceum on the 26th of December.*

**T**HIS year will be memorable on account of the total completion of that immense operation respecting the size of the earth, which lasted seven years. Those able astronomers, Delambre and Mechain, who finished it, arrived in the month of November 1798, and by the month of January were able to give us the value of the degrees between Dunkirk and Barcelona. But, as these degrees did not follow an uniform progress, it was soon found, that, to deduce from them the value of the metre, or the new French measure, a discussion was necessary, on the oblate form of the earth, to be adopted. Had they adhered to the arc measured between Dunkirk and Barcelona, they would have had  $\frac{1}{15}$ , or nineteen leagues, for the flatness at the poles; but, by comparing it with the degree measured under the Equator, they found only nine leagues and a half.

On the 8th of April, after a long discussion, they adopted the latter quantity, and the new metre was determined to be 36 inches 11.296 lines, and the flatness of the earth  $\frac{1}{33\frac{1}{3}}$ .

On the 5th of May C. Van Swinden, a celebrated Dutch philosopher, made a definitive report on the grand labour of the meridian and the metre, which was afterwards read in a public sitting of the Institute.

On the 22d of June the Institute presented to the two councils the original standards of the metre and kilogramme of platina, which were placed in the magnificent depot of the national archives in the national palace, formerly the Thuilleries.

On the 17th of November the consuls proposed a law to declare that the metre and the kilogramme are the definitive standards of France, and to cause a medal to be struck in commemoration of this grand undertaking. On one side is to be represented the Republic holding the metre and the kilogramme, with this inscription, "To all ages and all nations;" and on the exergue, "French Republic, year 7." The figure will be on a plinth of five centimetres. The reverse will exhibit

hibit the globe of the earth, a pair of compasses extended from the Equator to the Pole, the constellation of the Lesser Bear, and the following inscription—"Unity of measures, ten millionth part of a quarter of the meridian." The diameter of the medal will be two inches, and will be executed by C. Joffroy. It was proposed in a report presented to the Institute on the 20th of October, by C. David, Moitte, Leblond Mongez, Laplace, Delambre, Leveque and Gosselin, and was adopted by a law of December 10.

By reducing these measures to the temperature of ten degrees, which is the mean degree of the heat at Paris, and that in the caverns below the observatory, I find the 45th degree to be 57012 toises, instead of 57031 which I had adopted in my astronomy. This is 19 toises less; the mean radius of the earth 3268159 toises, less by 1323 toises than my table, which hitherto has served as a rule in books of natural philosophy. This, without doubt, is very little in regard to the extent of the earth: we are therefore pretty well acquainted with its size, but we are not sufficiently acquainted with its irregularities; and this, at any rate, is one important result from this new labour.

This year has furnished three new comets. On the 6th of December 1798, C. Bouvard discovered, at the observatory, a small one in the constellation of Hercules; it was seen only during six days, and disappeared on the 11th of December in Aquarius, but C. Burckhardt calculated its orbit with all the precision possible\*.

C. Mechain, to whom we are already indebted for the discovery of so many comets, found one on the morning of the 7th of August, which is the 90th according to the general catalogue in the third edition of my Astronomy. It was very small and without any tail, but exceedingly clear; it was above the Lynx, in the constellation which Hell formed in 1790, under the name of the Grand Telescope of Herschel. At three o'clock in the morning it had  $107^{\circ} 47'$  of right ascension, and  $43^{\circ} 54'$  of north declination. It was among the stars which C. Lefrançois observed on the 9th of March 1794, so that very exact positions were immediately obtained.

\* *Connaissance des Temps*, an. 10. p. 380.

C. Mechain

C. Mechain and C. Burckhardt each calculated the orbit with that ardour and readiness which are natural to these able astronomers: C. Messier followed its progress, according to his usual custom, with indefatigable assiduity, for more than two months, till the 25th of October, when it disappeared on the eastern knee of Ophiuchus. During this long appearance our collection of 50,000 stars has often furnished important points for the reduction of these observations. On the last day it was near a star of the sixth magnitude, the position of which I have given in the *Connoissance des Temps* for the year 10. All the observations of C. Mechain and Messier will be published in detail: some of them have a wonderful degree of perfection, because they were made by means of an excellent meridian telescope, at the *Maison du Champ de Mars* (Military School) by C. Lefrançois and Burckhardt.

This day also, December 26, 1799, at half after five in the morning, C. Mechain discovered a new comet in Ophiuchus, which will be the 91st. It had about  $269^{\circ}$  of right ascension and  $5^{\circ}$  of northern declination. It appeared to the naked eye as a star of 5th and 6th magnitude in the telescope. Its nucleus was exceedingly luminous, and almost bounded: it had a very narrow tail, of a pretty intense light, and about  $7^{\circ}$  in length. It advanced towards the south so rapidly that it was apprehended it could not long be observed, unless it should appear in the west after having traversed a part of the southern hemisphere.

As the most defective part of astronomy at present is what relates to comets, I must recommend them to all our correspondents. The Bureau des Longitudes has sent a night telescope to C. Flaugergues at Viviers, who has promised to make use of it.

C. Mongin, in the department of Doubs, has promised the same thing; but, being a priest, he was obliged to quit La Grand 'Combe-des-Bois, where he was curé, and where, since 1766, he had made many observations and calculations, and had been banished to a hollow valley where he could no longer have a proper view of the heavens. The government has thought proper to suffer him to resume his labours, and

to return to his ancient habitation, which is more convenient for searching out comets.

To render this search more successful, I have proposed to mount a Newtonian telescope in such a manner as to be moveable around the eye-glasses, by means of a handle, without changing the place of the eye. M. Von Zach has caused this machine to be engraved, and I hope that, at a more favourable period, it will be executed, and be the means of discovering new comets. If, in the course of forty-three years, the same number has been discovered by searching for them with plain telescopes without any support, how many ought we not to find by the method I propose, which will not suffer the least portion of the heavens to escape observation?

C. Piçet, the celebrated professor of natural philosophy at Geneva, and director of the observatory, has sent us the drawing of an English telescope, which, with a hinge and small arch of copper, becomes parallaëtic, and proper for following the stars, and for making the greater part of astronomical observations. I hope opticians, who make stands for telescopes, will take advantage of this hint, since mere amateurs, with an achromatic telescope, will thus be enabled, without farther expence, to find out and to follow stars in the open day, and to search for comets, of which we at present stand in need.

The great work on the stars, which I began in 1789, has been carried by C. Lefrançois to nearly 50,000, notwithstanding the unfavourableness of the seasons, which has rendered this year one of the most disagreeable and unfruitful seen at Paris. These stars have been already printed in my *Histoire Cèleste*, the first volume of which, as well as my *Bibliographie Astronomique*, will appear as soon as the state of the finances will admit of funds being applied to the printing-house of the Republic. C. Burckhardt has continued to make, with C. Lefrançois, a great number of important observations on the planets and stars; for, as there are two excellent instruments at the Maison du Champ de Mars, these are sufficient to employ those two able astronomers.

Madam Lefrançois has made for the *Connoissance des*

*Tems* of the year 10, which has just appeared, and that of the year 11, now printing, catalogues of 3000 stars reduced and calculated: she has therefore given us in the whole 10,000. But C. Burckhardt has made tables of a new form, which will enable him to calculate with ease the whole of the 50,000 stars which have been observed.

The obliquity of the ecliptic being one of the fundamental objects of astronomy, we have continued to observe it at the two solstices of this year. We found it in the month of June 5" more than what is given in my table; but C. Mechain, in the month of December, found it 8" less than in my table. This difference arises probably from the refraction in winter, which is not yet sufficiently known. This question we hope to resolve in the present year by comparing better the two solstices.

The observatory was in want of good instruments, but we have at length been able to obtain some. The large mural quadrant of C. Lemonnier, which General Bonaparte procured for us, has been erected, as well as that of five feet, which C. Lemonnier lent me in 1751 to observe the moon with at Berlin, and an excellent meridian telescope executed by C. Lenoir, with an object-glass by C. Caroché. The latter made also the large speculum of the twenty-two feet telescope which was at La Muette, and which was equal to that of Herschel of the same length. The telescope of platina, which they wished to take from us, has been secured to the observatory by a decision of the minister of the interior. Thus nothing is wanting to the most beautiful observatory in the world, to render it at the same time the most useful.

We hope at the Peace to have a telescope of forty feet, with specula of platina. On the 7th of August, 7th year, a decree was made by the Institute that the platina we have should be reserved for the large telescope until we obtain from Spain a greater quantity. We have already 200 pounds, but we must procure at least 2000 for the speculum, which the intimate connection between France and Spain gives us reason to hope will be the case.

Mr. Brown, an ingenious optician of London, has made telescopes,

telescopes, the tubes of which always remain horizontal, and in which the image of the object is thrown on the eye-glass by means of a plain speculum.

The Minister of the Marine has augmented the salary of the Astronomers of the Marine at Marseilles, and C. Thulis has resumed his observations with new zeal. The observatories of C. Darquier at Touloufe, Duc-la-Chapelle at Montauban, and Flaugergues at Viviers, have furnished us with many useful observations.

The grand and important work of C. Laplace, entitled *La Mécanique Céleste*, expected with so much impatience, appeared on the 6th of September. In that work will be found the methods and noble analysis which led the author to the important discoveries which I have several times announced and extolled in this history.

C. Burckhardt translated it into German with explanatory notes, at the same time that he read the proofs of the French edition, and went over all the calculations. No author ever had, or was more worthy of having, a translator of so great merit. The *Bureau des Longitudes*, who had long known the zeal and ability of C. Burckhardt, have unanimously elected him to a place vacant three years, though it had been solicited for by several men of letters, of approved talents, and natives of France. But C. Burckhardt has got himself adopted by France; he has preferred it to his own country, which he will no less honour by labouring with us. In the last century, Cassini, Huyghens, Romer, and Maraldi, came in like manner to reinforce astronomy in France; but at that period it had more need of such assistance. There were then only two or three French astronomers; at present we have seven or eight.

M. Schubert has published in German, at Petersburg, a work on Physical Astronomy in two volumes quarto, in which are found calculations of the perturbations of all the planets.

C. Caussin has finished the translation of the Arabic manuscript of Ibn Iunis. In this work there are more than a hundred observations, thirty of which are of eclipses. I had found a fragment of it among the manuscripts of Joseph de Little, my old master.

The Institute decreed, on the 2d of December, that the Minister for Foreign Affairs should be requested to borrow at Leyden the manuscript of Ibn Iunis, in order that the Arabic text might be printed; and we have reason to believe that this request will be granted.

C. Bouvard has calculated the Greek and Arabic eclipses, and found that  $3' 13''$  must be added to the anomaly,  $8' 30''$  to the secular movement of the anomaly of the moon, and a minute to the supplement of the node for 1790, and that its secular movement must be diminished  $2' 48''$ .

C. Laplace has determined by theory two equations of the moon. Two long memoirs, transmitted to the Institute in consequence of the prize we proposed, contain many observations and calculations on the same subject. This part of our tables, therefore, so interesting to navigation, has acquired this year a new degree of perfection.

On the 8th of May we observed, for the 17th time, the transit of Mercury over the Sun's disk. It is the first ever completely observed at the descending node, and there will not be another of the same kind till the expiration of thirty-two years. It was impatiently expected by all the astronomers. It was observed throughout all Europe; and C. Delambre has drawn up a work, with new formulæ, in order to deduce from the transits of Mercury all the consequences thence resulting.

C. Vidal, our real Hermophilus, has made at Mirepoix a new series of observations of Mercury in all parts of his orbit; so that we want nothing more in regard to this planet, so difficult to be seen in our climates. This astonishing observer has sent us observations also of more than a thousand austral stars, which can scarcely be seen at Paris on account of their small elevation.

The Ephemerides of Milan for 1799 have furnished us with a new series of observations of Mercury by C. Cefaris. In these I have the pleasure of finding that the errors of my tables are almost insensible. I have had the same satisfaction in regard to the digression of Mercury in his aphelion on the 12th of August. The distance of the sun, and the eccentricity



eccentricity of that planet, were found to correspond with my tables, except a few seconds.

The inferior conjunction of Venus, on the 16th of October 1799, was a phenomenon also of importance for the theory of this planet. It takes place only every eight years in that part of her orbit. It was observed with as much assiduity as success by C. Lefrançois and Burekhardt, in my observatory at the *Maison du Champ de Mars*. I have compared it with that of 1751, which was in the same position, and for which I had made a great number of calculations, and I have found scarcely any thing to be changed in the elements which served for the construction of my tables of Venus, published in the third edition of my *Astronomy* in 1792. This labour will be inserted in the *Memoirs of the Institute*.

On the 23d of November this beautiful planet was eclipsed by the moon. This phenomenon would have attracted a number of eyes, had it not been at four o'clock in the morning. Jupiter, which is not so brilliant, drew together a great crowd at the *Palais Royal*, on the 14th of March 1788, to see him on the point of being eclipsed.

Observations of Jupiter have proved that about 30" are to be added to the tables, which shews that we ought to make a little addition to the mean motion: this I before proved in discussing the ancient observations in the *Almagest* of Ptolemy. The opposition of the 16th December 1799 gave me 30 seconds. C. Quenot, an able navigator, who has returned from Egypt, observed it with an astronomical circle, and obtained the same result. The latitude also was found too small by 15"; from which I conclude, that the longitude of the node of Jupiter, which is in the tables of C. Delambre, in the third edition of my *Astronomy*, ought to be diminished 10'.

The tables of Mars are those most deficient. C. Lefrançois, therefore, has been employed on them for some months. He has calculated all the oppositions and quadratures hitherto observed with accuracy, and the result will be tables more accurate than any ever yet given, in which there will be only a few seconds of uncertainty. C. Burekhardt has calculated the perturbations

perturbations of Mars by the action of Jupiter and the Earth, which Schubert and Oriani had before calculated, and without which we could not have hoped to carry our tables to the same degree of perfection.

The collection of observations made at Greenwich by the celebrated Bradley and his assistants between 1750 and 1762 has appeared in England, but I have not yet been able to procure it.

Mifs Herschel has published a volume on the stars, not of observations, but researches respecting the grand British catalogue of Flamsteed, and the observations of that celebrated astronomer; where she has found 500 stars which are not in the catalogue, as she has found many in the catalogue which are not in the observations.

C. Kramp, Professor at Cologne, has published an analysis of astronomical refractions, in which he has been able to determine the refraction accurately and algebraically without employing any hypothesis or approximation. This work leads us one step farther in this difficult part of astronomy. It was proclaimed, with the other important works of the year 7, at the last exhibition at the Museum.

The Academy of Stockholm has sent M. Swanberg to Lapland to find out the stations which served in 1736 for measuring a degree under the polar circle. He employed himself only in discovering their local situation; but he says he found two minutes error in the reduction of the stations to the horizon, which might have arisen from some defect in the instruments, or from terrestrial refraction. I have been informed in a letter from Sweden, that Maupertuis proposed to recommence the measurement at his own expence. This proves that he was not entirely satisfied with the result, which differs considerably from many other degrees that have been measured. The local inequalities of the ground, however, may have been the cause of this diversity.

C. Defortia, as well skilled in Greek as in Geometry, has made a new translation, with learned notes, of the book of Aristarchus of Samos, respecting the distance of the sun and the moon, collated with ten other manuscripts. This celebrated

brated work contains the noblest idea ever formed respecting the manner of finding the distance of the sun from the earth: an idea which, in my opinion, surpasses all those ever entertained by the greatest astronomers. I gave some account of it in the *Journal des Savans* for 1797 \*, of which only twelve sheets were published between the 5th of January and the 20th of August.

The Nautical Almanack for 1803 has been transmitted to us by the care of Sir Joseph Banks, President of the Royal Society, to whom we owe this public testimony, that since the commencement of the war he has maintained the intercourse of the sciences. His name, his credit, and his fortune, enabled him to overcome all obstacles, and to remove every political impediment; for we have asked nothing from him which he has not taken the earliest opportunity of granting. The Minister of the Marine renders the same testimony, and acknowledges the favours he has received from Sir Joseph Banks.

Five volumes of the Asiatic Researches have been published at London. They contain a great many observations made by the English in different parts of India; together with memoirs on the Indian astronomy, the lunar year, and the worship of the Indians.

Baron Humboldt has gone to Mexico with instruments and a chronometer by Berthoud, and we hope to receive from him interesting observations respecting the geography of a country almost unknown. He will employ himself also on natural history, a subject with which he is well acquainted †.

C. Nouet published in the *Decade du Caire* several observations made in Egypt; and general Bonaparte has caused them to be reprinted at Paris by Didot. C. Nouet informed me in a letter, that he was going to proceed up the Nile as far as the Tropic, where the famous wells of Syenê are situated, and where no shadow is observed in the day of the solstice. We shall therefore have a real geography, ac-

\* Page 106 and 203.

† Two letters from M. Humboldt will be found among the Intelligence for this month. EDIT.

accompanied with other observations of those famous countries which gave birth to astronomy, and where it has been forgotten for 2000 years.

C. Castéra has given us, in two volumes 8vo. a translation of the curious travels of Mungo Park into the interior parts of Africa; and we at length know the real direction of the Senegal and the Niger, of which, after six months research, I made only one river in my *Memoir on Africa*, printed among those of the Academy of Sciences for 1790, the last volume of that collection.

C. Montucla has given a new edition of his *History of the Mathematics*, enlarged by one-half, and in which astronomy occupies a considerable place.

In the National Library there has been found a manuscript on Optics by Ptolemy, which was supposed to have been lost. It is a Latin translation from the Arabic. C. Cauffin, by whom it was found, proposes to make known this valuable manuscript.

M. Bode has sent us from Berlin the remainder of his large and beautiful charts which represent the heavens. The great number of stars with which I furnished him, gave me a right to new constellations. To fill up the vacant spaces he had put thirty-three animals in the heavens; and I have added a thirty-fourth, *viz.* the Cat, on account of that charming poem, of which Desherbiers has published some fragments. This new constellation of the Cat is between Hydra and the Ship. It has been already engraved in Germany, and will be inserted in M. Bode's new *Celestial Atlas*, of which he has published twelve sheets.

M. Hobert and Ideler, of Berlin, have published *Logarithmic Tables* for the decimal fines, which will facilitate astronomical calculations, until the more extensive tables, which C. Proney caused to be calculated at the *Bureau du Cadastre*, and which began to be printed some years ago, are finished.

The stereotype edition of *Logarithmic Tables*, published four years ago by Didot and Callet, which ought at length to be free from all faults, has been corrected on the plates, and there is reason to think that they approach very near to perfection.

We wanted also small portable tables, and these C. Didot has undertaken. I have begun an edition of Logarithms carried to six decimal places, like those given by myself and Lacaille in 1760, which were published by Marie in 1768, and reprinted four times afterwards, but still with more faults than the first time. We at length, however, have a permanent edition, which it will not be necessary to reprint every ten years with more errors than those before discovered.

M. Bogdanich, assistant at the observatory of Buda, has made, in several cities of Croatia, observations of great importance to Geography.

[To be concluded in the next Number.]

VIII. *Description of a singular Phenomenon in a Thunder-Cloud.* By L. C. LICHTENBERG\*.

ON a summer's day, exceedingly hot and sultry, the barometer being at 27 inches seven lines, and Reaumur's thermometer at  $22\frac{1}{2}$ , there was formed, about three in the afternoon, to the north of Gotha, a dark thunder-cloud, having the appearance of rocks piled upon each other, and in shape almost like a mushroom. (Plate I. Fig. 1.) The magnificent spectacle exhibited by this immense mass floating in the blue expanse of the atmosphere excited my attention; and I soon observed, that, from the small part which represented the stem of the mushroom, there arose a fine bright vapour, which in a few moments formed a perfect ring around this part of the cloud. The ring seemed to be in violent agitation, by which it became always more enlarged, so that in the course of a minute it exceeded the greatest breadth of the upper part of the cloud. It then began to extend itself upwards and downwards, and in less than thirty seconds the whole cloud was enveloped in a transparent covering, (Fig. 2.) This phenomenon had scarcely continued a minute when the cloud began to extend itself, as if by a current of air forced from its interior, and to assume the form of a fan. It now lost its smooth rim, which terminated, as it were, in fringes,

\* From *Magazin für das Neueste aus der Physik*, Vol. I.