

P H I L O S O P H I C A L
T R A N S A C T I O N S:

**On a Method of Describing the Relative
Positions and Magnitudes of the Fixed Stars;
Together with Some Astronomical
Observations. By the Rev. Francis Wollaston,
LL.B. F. R. S.**

Francis Wollaston

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XVII. *On a Method of describing the relative Positions and Magnitudes of the Fixed Stars; together with some Astronomical Observations.* By the Rev. Francis Wollaston, LL.B.
F. R. S.

Read February 5, 1784.

FROM some alterations which have of late years been discovered, in the relative positions and apparent magnitudes of a few of the stars we called fixed, it seems not unreasonable to conclude, that there may be many changes among others of them we little suspect. This thought has led me into a wish, that some method were adopted whereby to detect such motions. The first idea which occurred to me was, to make a proposal to astronomers in general; that each should undertake a *strict* examination of a certain district in the heavens; and, not only by a re-examination of the catalogues hitherto published, but by taking the right ascension and declination of every star in their several allotment, to frame an exact map of it, with a corresponding catalogue; and to communicate their observations to one common centre. This is what I could be glad to see begun. Every astronomer must wish it, and therefore every one should be ready to take his share in it. Such a plan, undertaken with spirit, and carried on gradually with care, would, by the joint labours and emulation of so many astronomers as are now in Europe, produce a celestial Atlas far beyond any thing that has ever yet appeared.

But this would be a work of time, and not within the compass of every one. What I mean now to propose is more immediate; and not out of the reach of any who amuse themselves with viewing the heavenly bodies.

Meridian altitudes and transits can be taken but once in 24 hours; and, though accurate, are therefore tedious. Neither can any re-examination of them be made, but with the same labour as at the first. Equatorial sectors are in the hands of few; and require great skill. Some more general method seemed wanting; to discover variations, which, when detected or only surmised, should be consigned immediately to a more strict investigation.

Turning this in my thoughts, I considered, that the noting down at the time the exact appearance of what one sees, would be far more simple, and shew any alterations in that appearance more readily, than any other method. A Drawing once made would remain, and could be consulted at any future period; and if it were drawn at first with care, a transient review would discover to one, whether any sensible change had taken place since it was last examined. Catalogues, or verbal Descriptions of any kind, could not answer that end so well.

To do this with ease and expedition was then the requisite: and a telescope with a large field, and some proper sub-divisions in it, to direct the eye and assist the judgement, seemed to bid most fair for success.

The following is the method which, after various trials, I have adopted, and think I may now venture to recommend.

To a night-glass, but of DOLLOND's improved construction, which magnifies about six times, and takes in a field of just about as many degrees of a great circle, I have added cross wires, intersecting each other at an angle of 45° . More wires

may be crossed in other directions; but I apprehend these will be found sufficient. This telescope I mount on a polar axis. One coarsely made, and without any divisions on its circle of declination, will answer this purpose, since there is no great occasion for accuracy in that respect: but as the heavenly bodies are more readily followed by an equatorial motion of the telescope, so their relative positions are much more easily discerned when they are looked at constantly as in the same direction. An horizontal motion, except in the meridian, would be apt to mislead the judgement. It is scarcely necessary to add, that the wires must stand so as for one to describe a parallel of the equator nearly. Another will then be a horary circle; and the whole area will be divided into eight equal sectors.

Thus prepared, the telescope is to be pointed to a known star, which is to be brought into the centre or common intersection of all the wires. The relative positions of such other stars as appear within the field, are to be judged-of by the eye: whether at $\frac{1}{2}$, or $\frac{1}{3}$, or $\frac{1}{4}$ from the centre towards the circumference, or *vice versa*; and so with regard to the nearest wire respectively. These, as one sees them, are to be noted down with a black lead pencil upon a large message card held in the hand, upon which a circle, similarly divided, is ready drawn. (One of three inches diameter seems most convenient.) The motion of the heavenly bodies in such a telescope is so slow, and the noting down of the stars so quickly done, that there is most commonly full time for it without moving the telescope. When that is wanted, the principal star is easily brought back again into the centre of the field at pleasure, and the work resumed. After a little practice, it is astonishing how near one can come to the truth in this way: and, though neither the right ascensions nor the declinations are laid down

by

by it, nor the distances between the stars measured; yet their *apparent* situations being preserved in black and white, with the day and year, and hour if thought necessary, written underneath, each card becomes a register of the then appearance of that small portion of the heavens; which is easily re-examined at any time with little more than a transient view; and which yet will shew on the first glance, if there should have happened in it any variation of consequence. It is obvious, that very delicate observations are not to be made in this way.

In order to explain my meaning more fully, a card so marked shall accompany this paper (see tab. V. fig. 1.). What I first happened to pitch upon was the constellation of Corona Borealis, which then fronted one of my windows; and which I have since pursued throughout in this method; making the stars α , β , γ , δ , ϵ , ζ , η , ι , κ , π , ρ , σ , and τ , successively central; together with one or two belonging to Bootes, for the sake of connecting the whole together. These I have transferred since on a sheet of paper, to try how well they would unite into one map; which they have done with very little alteration. A copy of that shall also be laid before this Society (fig. 2.).

My design was, after marking down all such stars as are visible with so small a magnifier, to go over the whole again with another telescope of a higher power, divided in the same way; and after that, with a third and a fourth; so as to comprehend every star I could discern. That would discover smaller changes: but it must be a work of time, if attempted at all. After such a rough map of the constellation is made, the endeavouring to ascertain the right ascensions and declinations of these, may perhaps be adviseable in the next place, rather than searching for more.

In observing in this way it is manifest, that the places of such stars as happen to be under or very near any one of the wires, must be more to be depended upon, than of what are in the intermediate spaces, especially if towards the edges of the field: so also what are nearest to the centre, because better defined, and more within the reach of one wire or another. For this reason, different stars in the same set must successively be made central, or brought towards one of the wires, where any suspicion arises of a mistake, in order to approach nearer to a certainty: but if the stand of the telescope be tolerably well adjusted and fixed in its place, that is soon done.

In such a glass it is very seldom that light is wanting sufficient to discern the wires. When an illuminator is required, I find, that for this purpose, where you wish to see every small star you can, a piece of card or white paste-board, projecting on one side beyond the tube, and which may be brought forward occasionally, is better than one of any other kind. By cutting across a small segment of the object-glass, it throws a sufficient light down the tube, though a candle is at a great distance; and one may lose sight of that false glare when one pleases, by drawing back the head, and moving the eye a little side-ways, and then one sees the smaller stars just as well as if no illuminator were there.

This then is the method I would recommend to the practical astronomer, for becoming acquainted with the appearance of the stars, and setting a watch over the heavenly motions. After a very few trials, every one would find this easy. And if each person of every rank among astronomers would take a constellation or two under his care, the numbers who could undertake it in this way would compensate for the defects of a plan which cannot aspire at great accuracy. The labour of

it, even at first, is but little. It has cost me more time indeed than I ought commonly to allot to mere amusement; because I had my apparatus to contrive, and several different and fruitless schemes to try, before I could satisfy myself. But a quarter, or at the most half, an hour is generally sufficient for the marking of one pretty full card in this way: and when once the cards are marked, and a general map of the constellation is formed, a little time given to it in a fine evening, to examine whether the stars on such or such a card remain in their former position, is little trouble indeed. Perseverance is most likely to be wanting, and therefore must be determined upon; because, after finding things time after time just as they were, one's hopes of discovering any thing new will slacken. But the different state of the air, or of one's own eye, will frequently occasion a fresh star to become visible, or a small one which had been noted down to seem to have disappeared; and such a mere accident will serve to re-kindle the desire of pursuing it. Besides, if we observe no change after a tolerable interval of assiduous search, we may at any time turn to another constellation: yet ought we never to abandon the former entirely, after having once publicly undertaken it, without giving notice of our so doing.

In the cards or maps, it may be observed, I have not marked the respective sizes of the stars. Nor have I distinguished them in any way, excepting a few of them with BAYER'S Greek letters. It was because I have not hitherto satisfied myself how to do it. Some method must be used by every one, to describe to himself what he means; but, in laying any thing before the public, a deference ought to be paid to what has been done by others. The calling any star by a new name would breed confusion: and as I was desirous this should appear before this

Society

Society in its first rude form, that a judgement might be made from it how far such a scheme would promise success, I was unwilling to look into catalogues or capital maps for the numbers or names of the stars, lest I should be tempted to adapt the positions of what I had observed to what I there found set down by more able astronomers. Nothing, therefore, but a hemisphere of SENEX has been consulted, just for knowing how far the constellation is usually reckoned to extend, and what are BAYER's references.

Should this plan meet with approbation, I shall be happy to have proposed it; and will endeavour to forward it in any way that shall be judged proper: or should any other be preferred, which is within the abilities and leisure of one who is engaged in another profession, I shall be as happy to lend what assistance I can to it. My aim is only, to render such observations as I am capable of making, useful to science.

Before I conclude on this head, give me leave to add a few hints. Whether this method be followed, or any other, if a *general plan* be set on foot, whoever undertakes a constellation, or district, should determine to examine it with as great accuracy as he can; yet never be ashamed to let others know of his mistakes. The error of one proves a caution to another. Such a rough sketch, once made, will be found of great use to most of us, in knowing which star next to examine with greater care. He who can do no more than this, will do a useful work by going thus far: and his frequently sweeping over his district in this way, may lead him to a discovery which might escape a more regular astronomer. But whoever can, ought to do more. By degrees the exact positions of every star he has noted down may be ascertained, by the method practised by Mr. DE LA CAILLE in his Southern Hemisphere, or by any

other which shall be esteemed more convenient. Every one, indeed, must use such instruments as he can procure: but assiduity can do more with indifferent ones, than will ever be accomplished with the very best without it. Whatever references are made for one's own convenience, when a map and catalogue are given to the public stock, the old letters and numbers should be retained as far as they go: though yet notice should be taken, where the magnitudes of the stars at present do not appear to correspond with the order in which they have been laid down.

To render this more complete, it were to be wished, that each should give in a copy of his original observations, with an account of the instruments he used; since they ought to be preserved as data from whence his deductions were made, which may then be re-examined at any future time. Yet must it be desired, that no one would trust himself without carrying on his calculations as fast as the observations are made: they will otherwise multiply upon his hands till the labour will dishearten him from attempting it at all. A heap of crude, undigested observations would be an unwelcome present to the public.

Having thus stated this Proposal, I shall leave it to be proceeded upon, or not, as shall be seen proper: And will now only subjoin a List of such occasional observations as I have had opportunity of making, since the last which I communicated to this Society. I find, indeed, that it is much longer than I had apprehended: but as I perceive some astronomers abroad have referred to a few of those which have been honoured with a place in our Transactions, it may be as well to follow it up. An observation retained among one's own private papers I hold to be of little use.

One thing let me desire Foreigners to remark: that the registers I gave of the going of my clock were meant only as the relations of a *mere fact*; that a clock, of such a construction, kept or altered its rate *so* or *so*. They seem to have understood it as an account of a capital clock, by valuing themselves upon some of theirs going better. The time-keepers in most of our Observatories are far more accurate; but, excepting those of the Royal Observatory at Greenwich, their accuracy is not made public.

Another remark it may also be proper to make; that, since my former papers, the longitude of this place has been ascertained by comparative observations on the bursting of some rockets, let off on purpose; which, on a mean of several, turns out to be $19'',02$ in time E. of Greenwich Observatory; that is, it may hereafter be considered as $19''$, instead of $18',6$ as I had before calculated it trigonometrically from the bearings.

Observations made at Chislehurst, in Kent, longitude 19'' in time East of the Royal Observatory at Greenwich, and latitude 51° 24' 33'' North.

Eclipse of the moon, 3 July 30, 1776: observed with a $3\frac{1}{2}$ feet achromatic telescope, and a power magnifying 29 times (that is, a single eye-glass belonging to the day-tube) the aperture of the telescope being reduced to $1\frac{1}{2}$ inches. The night very clear and still.

Apparent time.

h. ' "

The beginning not properly observed.

10 11 31 Grimaldus touched by the shadow.

10 12 49 ——— covered.

10 14 5 Galilæus covered.

10 19 36 Aristarchus covered.

10 26 0 The spot in Kepler bisected.

10 24 25 Schikardus (but 2.) touched.

10 25 52 - - - - - bisected.

10 27 19 - - - - - covered.

10 28 15 Copernicus touched.

10 29 49 - - covered.

10 31 22 Helicon (but 2.) covered.

10 37 9 Plato touched.

10 37 54+ - covered.

10 38 55 Tycho touched.

10 39 39 - - bisected.

10 40 25 - - covered.

Apparent time.

- | | | | |
|----|----|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| h. | ' | " | |
| 10 | 43 | 16 | Manilius covered. |
| 10 | 46 | 51 | Mænelaus covered. |
| 10 | 48 | 5 | Dionysius covered. |
| 10 | 55 | 4 | Cenforinus covered. |
| 10 | 58 | 57 | A point (Promontorium acutum, I believe) touched. |
| 11 | 0 | 21 | A spot between M. Fœcunditatis and M. Nectaris touched. |
| 11 | 0 | 23 | M. Crisium touched. |
| 11 | 3 | 55 | - - - covered. |
| 11 | 7 | 57 | The eclipse seemingly total. |
| 11 | 11 | 11 | The moon covers a small star near her south limb. |
| | | | The star hangs on the limb, before it disappears. |
| 11 | 28 | 17 | She covers another star a little south of her centre. |
| | | | This vanishes instantaneously. |
| | | | These occultations were observed with another power of the same telescope; which is usually reckoned 100, and which I have formerly so called; but which on an accurate examination really magnifies almost 75 times. |
| | | | The emersions of these stars were not observed. |
| 12 | 43 | 0 | I judge the beginning of the emersion to be about this time; but cannot be certain. |
| 12 | 48 | 1 | Grimaldus quitted by the shadow. |
| 12 | 58 | 25 | Aristarchus quitted. |
| 12 | 59 | 22 | Kepler bisected. |
| 13 | 0 | 15 | Tycho begins to emerge. |
| 13 | 1 | 9 | - - bisected. |
| 13 | 1 | 53 | - - emerges. Till this time I had used the whole aperture (3,6) having forgotten to reduce |

Apparent time.

h. ' "

it, till the moon's brightness reminded me. Same power as at first ; that is, 29.

- 13 6 51 Copernicus begins to emerge.
- 13 7 20 - - - seemingly bisected.
- 13 8 19 - - - emerges.
- 13 10 27 Helicon emerges.
- 13 15 26 Plato begins to emerge.
- 13 16 31 - - emerges.
- 13 21 30 Manilius emerges.
- 13 23 54 Dionysius emerges.
- 13 24 57 Menelaus emerges.
- 13 29 47 Cenforinus emerges.
- 13 31 21 The spot by M. Fœcunditatis emerges.
- 13 35 31 The point of Prom. Acutum emerges.
- 13 37 21 + M. Crisium begins to emerge.
- 13 40 26 - - - quitted by the shadow.
- 13 42 0 The end of the eclipse.

The air was very clear and still the whole time : the shadow but ill defined. Indeed, it was little more than a penumbra ; the principal spots remaining always visible on the moon's dusky face.

Eclipse of the sun 8 June 24, 1778 : observed with a $3\frac{1}{2}$ feet achromatic telescope magnifying 75 times. The aperture reduced to two inches, to prevent breaking the smoked glasses.

- 3 41 33,5 Beginning. I suspect the minute to be mistaken, and that it should be 3 h. 40' 33'',5. The first impression

Apparent time.

h. ' "

impreſſion could not be 2'', I believe not 1'',
before I obſerved it.

5 25 24 End. An undulation on the ſun's limb; but the
obſervation pretty good.

Eclipse of the moon 8 November 23, 1779: obſerved with the
ſame teleſcope, magnifying 75 times. The aperture reduced
to two inches. Night clear and froſty. No wind.

The beginning not aſcertained.

6 13 19 Grimaldus touched by the ſhadow.

6 13 28 - - - covered.

6 17 29 Ariſtarchus covered.

6 20 46 Kepler biſected.

6 23 40 M. Humorū touched.

6 27 47 Helicon covered.

6 28 40 Copernicus and Timochariſ both biſected.

6 29 57 M. Humorū covered.

6 33 50 Plato touched.

6 34 27 - - covered.

6 41 52 Tycho touched.

6 43 8 - - covered.

6 47 11 Plinius (but 2.) covered.

6 59 1 M. Criſium touched.

7 3 16 - - - covered.

7 7 31 The eclipse total.

8 46 23 Moon's edge begins to emerge.

8 51 14 Grimaldus begins.

8 52 1 - - - emerges.

A haze comes on.

Apparent time.

h. ' "

9 2 23 :: Kepler bisected. This not clearly seen.

9 11 41 Plato begins to emerge.

9 12 35 - - emerges.

9 13 46 Tycho emerged.

The haze comes on again too much for the observation to be pursued any farther.

Eclipse of the sun 8 Oct. 16, 1781: observed with the same telescope and magnifying power.

The beginning not visible; sun too low.

20 22 13,5 The end. Good.

Eclipse of the Moon 8 Sept. 10, 1783: observed with the same telescope, *viz.* $3\frac{1}{2}$ feet achromatic, with the aperture reduced to two inches; but with a small magnifying power of 36 times, which I had made by Mr. DOLLOND for these observations, and which I found very convenient. Night a little hazy, but pretty favourable.

9 33 0 A duskiness comes on the moon.

9 45 35 The beginning of the shadow, I believe.

9 47 20 A haziness obscures the moon.

9 50 55 Aristarchus covered.

9 52 20 Kepler covered. So it is set down; but I do not recollect what I meant by this; whether it might not be only the spot in the centre, so that it might more properly be called bisected.

Gassendus

Apparent time.

h. ' "

- 9 57 57 Gassendus covered. I suspect the minute here; and
that it should be 56' 57".
- 9 59 41 Heraclides covered.
- 10 1 42 Copernicus touched.
- 10 3 5 - - - covered.
- 10 3 26 Helicon covered.
- 10 4 12 Bulialdus covered.
- 10 8 0 A hazinefs again.
- 10 8 57 Plato covered.
- 10 15 30 Manilius covered.
- 10 15 54 Tycho touched.
- 10 17 5 :: - - covered. This doubtful.
- 10 19 10 Menelaus covered.
- 10 21 38 Dionysius covered.
- 10 22 40 Plinius covered,
A hazinefs again.
- 10 28 25 Cenforinus covered.
- 10 34 34 M. Crisium touched.
- 10 39 45 - - - covered.
- 10 46 34 Total darknefs, as I judged it.

At 10 h. 41' the moon had grown reddish, and the eclipsed part become more visible than before. After some time, during the total darknefs, the moon was barely to be seen. In general, about the centre, it was darker than towards the circumference, which was ill-defined. About

- 12 0 0 The eastern limb became more visible, and better defined.

Apparent time.

h. ' "

- 12 14 o The light spreads a great way over the moon from
that side towards the centre, extending about
two-thirds of her circumference (see fig. 3.)
- 12 23 o The moon seems beginning to emerge.
- 12 25 o Emerfion certainly has begun.
- 12 28 21 Grimaldus emerged.
- 12 31 40 Galileus emerged.
- 12 33 52 Ariftarchus emerged.
- 12 37 26 Kepler (but 2. this as before).
- 12 39 36 Heraclides emerged.
- 12 42 56 Helicon emerged.
- 12 45 52 Copernicus emerged entirely.
- 12 47 22 Plato begins to emerge.
- 12 47 58 - - emerges.
- 12 48 30 Tycho begins to emerge.
- 12 49 58 - - emerges.
- 12 58 8 Manilius emerges.
- 13 1 40 Menelaus emerges.
- 13 3 18 Dionyfius emerges.
- 13 5 40 Plinius emerges.
- 13 11 22 Cenforinus (but 2.) emerges.
- 13 16 35 M. Crifum begins to emerge.
- 13 20 53 - - - emerges.
- 13 25 38 The fhadow quits the moon near Langrenus, be-
tween that and M. Crifum. The duskinefs does
not leave the moon till fome time afterwards, but
I did not wait to obferve it.
- The moon was darker during the eclipfe than ufual ;
but the air was not clear enough for any occulta-
tions of ftars to be obferved.

Transit

Transit of Mercury over the sun's disk 8 Nov. 12, 1782: observed with the same telescope, and a power of 75 times. The aperture reduced to two inches.

Apparent time.

h. ' "

- 2 51 49 First impression observed. It could not be 2" sooner.
- 2 54 57 Thread of light completed; but seen through clouds. The planet seemed to hang on the sun's limb 30" at least.
- 4 6 0 Through a break in the clouds, of short duration, 8 seemed to have quitted the sun; but indeed the clouds were very unfavourable the whole time.

Occultation of Saturn by the moon, 1/2 February 18, 1775: observed with the same telescope; and, I believe, the same power, with the whole aperture of the object-glass 3,6 inches; but, I perceive, I have not set down these particulars.

- 9 5 39 Præc. ansa of the ring im,
- 9 6 9 Præc. limb of the planet im.
Subsequent limb not set down.
- 9 6 48 Subsequent ansa im.
The moon low at these immerfions, and much undulation. The emerfions lost by looking at a wrong part of the moon's disk, except
- 10 1 7 Subsequent ansa emerges.
Night very clear; but the observation on the whole imperfect.

Occultations

Occultations of stars by the moon: observed with the same telescope, and a power of 75 times, with the whole aperture of the object-glass.

		Apparent time.			
		h.	'	"	
1775.					
♂ Aug. 1.	♂ γ Virginis	7	48	17	Both stars visible when a cloud covered them.
		7	49	20	A short break; only one star visible.
		7	52	15	Another break; but before this the second star was immersed.
		8	48	58,5	First * em. good.
		8	49	6,5	Second * em. good.
	♂ a bright * N of γ Virginis	8	54	13	Im. good.
					Em. not till the moon was too low.
♂ Dec. 12.	♂ Regulus	10	5	46	Em. very good, though the moon low.
1776.					
☉ June 30.	☉ ι ad μ ♄	9	3	49	Im good; some flying clouds.
		10	6	38	Em.; perhaps sooner.
1777.					
♂ Aug. 23.	♂ μ Ceti	10	41	17	Im.: the moon low; night clear and still.
		11	32	10	Em.
♂ Nov. 15.	♂ ι ad δ Tauri				Im. not seen; undulation too great.
		7	22	56	Em. pretty good.
☉ Nov. 16.	♂ ζ Tauri	11	17	1,5	Im. good.
		12	23	28	Em. good.
					{ These were observed with a power of 67 times, and an oblique speculum.
1783.					
♀ May 16.	♂ π Scorpii	11	21	49	Im. } Night clear and still; the obser-
		12	31	49,5	Em. } vations good.
24 Jul 10.	♂ π Scorpii				Im. not seen for clouds.
		8	43	56	Em.; it might be 1" or 2" sooner; the moon's edge ill defined.
♂ Dec. 30.	♂ δ Piscium	8	3	13	Im. dark limb, very good.
		9	8	30	Em. good. It could not be above 1" sooner, if that. Night very clear and still; hard frost; therm. 13°½.

Eclipses of Jupiter's satellites: observed with the same telescope and power (that is, 75 times; called usually 100) and whole aperture.

				Apparent time.
				h. ' "
1775.				
2 Sept. 8.	1 Sat.	11 33 14	Im. flying clouds; observation doubtful.	
○ Oct. 1.	1 Sat.	11 51 1	Im. good; unless the minute be mistaken.	
24 Nov. 2.	1 Sat.	8 28 2	Im. good.	
24	16. 2 Sat.	9 0 13	Im. pretty good; air clear, but a cold in my eyes rendered the observation not satisfactory.	
1 Dec. 18.	1 Sat.	10 45 48	Em. good.	
	2 Sat.	11 2 0	Em. pretty good.	
2	27. 1 Sat.	7 3 48	Em. good.	
1776.				
○ Nov. 17.	3 Sat.	9 38 48,5	Im.; a scintillation for some seconds before it quite disappeared.	
1778.				
24 May 21.	1 Sat.	9 9 38	Em. good.	
	2 Sat.	10 10 ±	Em. so near the first satellite; as scarcely to be distinguishable from it for some minutes.	
24 June 11.	4 Sat.	9 52 4	Im. good for the fourth satellite, yet visible by fits for some seconds longer.	
2	13. 1 Sat.	9 19 6	Em. pretty good.	
1779.				
2 Mar. 9.	1 Sat.	6 59 19	Im.; that is, this was the last of my seeing it; but, though the night was clear, the satellite was too near Jupiter for the observation to be satisfactory.	
2 May 22.	2 Sat.	11 5 54	Em. good.	
1781.				
24 May 24.	1 Sat.	10 3 31	Em. very good.	
24	31. 1 Sat.	11 57 35	Em. pretty good.	
2 June 16.	1 Sat.	10 13 13	Em.; clouds, but pretty good.	
1782.				
2 July 20.	3 Sat.	9 6 42	Em. good.	
	2 Sat.	11 30 30	Em. good.	

Apparent time.

h. ' "

☉ July 21. 1 Sat.	9 39 50	Emerfion; windy; but good.
♃ Aug. 29. 1 Sat.	8 20 15,5	Em.
♀ 30. 4 Sat.	8 52 19	Em.; fatellite feen then, but not diftinct for fome time.

1783.

♂ July 8. 1 Sat.	12 14 13	Im. pretty good.
♂ Aug. 2. 1 Sat.	9 10 31,5	Em. good.
♂ 25. 1 Sat.	9 28 54	Em.
♀ Sept. 26. 1 Sat.	6 19 44	Em. pretty good, but twilight ftrong.
♂ 30. 3 Sat.	10 3 24	Im. It was vifible only by fits for the laft 8". Jupiter near a tree.
♀ Oct. 3. 1 Sat.	8 18 0	Em. pretty good; but the moon below Jupiter.
☉ 26. 1 Sat.	8 39 17	Em. Jupiter low and near a tree; great undu- lation.

EXPLANATION OF THE FIGURES IN TAB. V.

- Fig. 1. α Cor. Bor. ♀ Aug. 6, 1783, per night-glafs. The * marked Sept. 24. was not obferved till that night, but has continued fince, and was only overlooked at firft.
- Fig. 2. A map of 107 ftars, befides thofe marked by BAYER, in the conftellation of Corona Borealis, or the Northern Crown; together with a part of Bootes: laid down from obfervations made 1783 with a night-glafs furnifhed with crofs-wires; as their relative pofitions were eftimated by the eye.
- Fig. 3. The moon as fhe appeared (inverted) ♀ Sept. 10, 1783, about a quarter of an hour before fhe began to emerge from total darknefs.



Fig. 1.

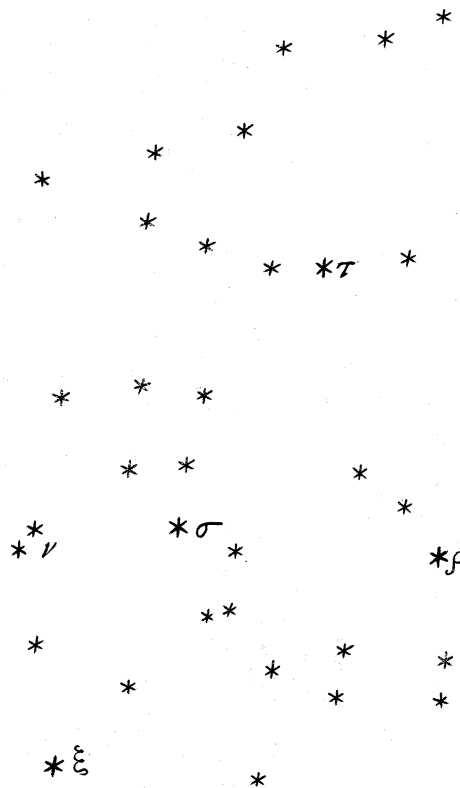
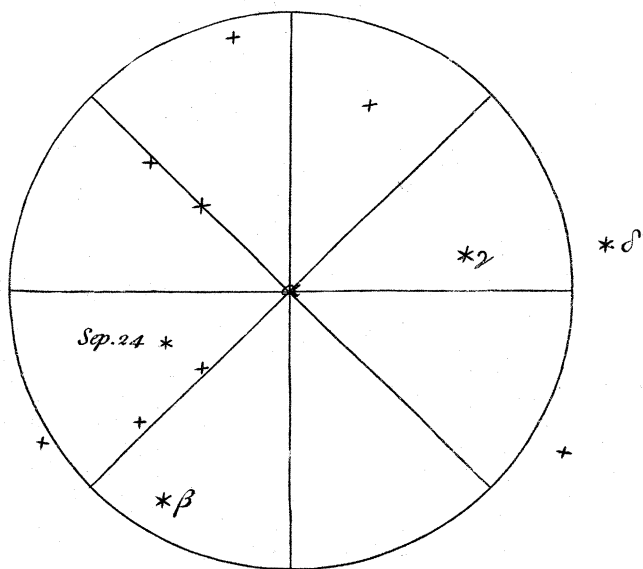


Fig. 3.

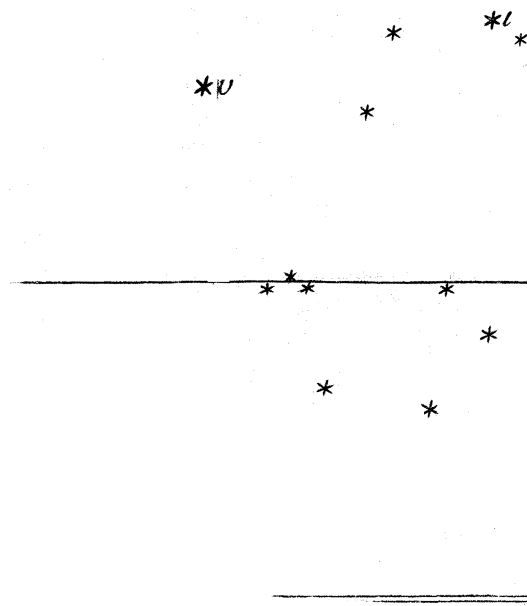
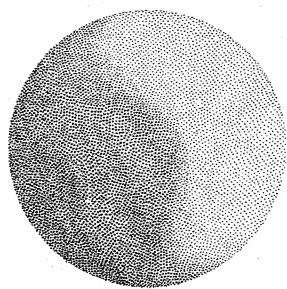


Fig. 2.

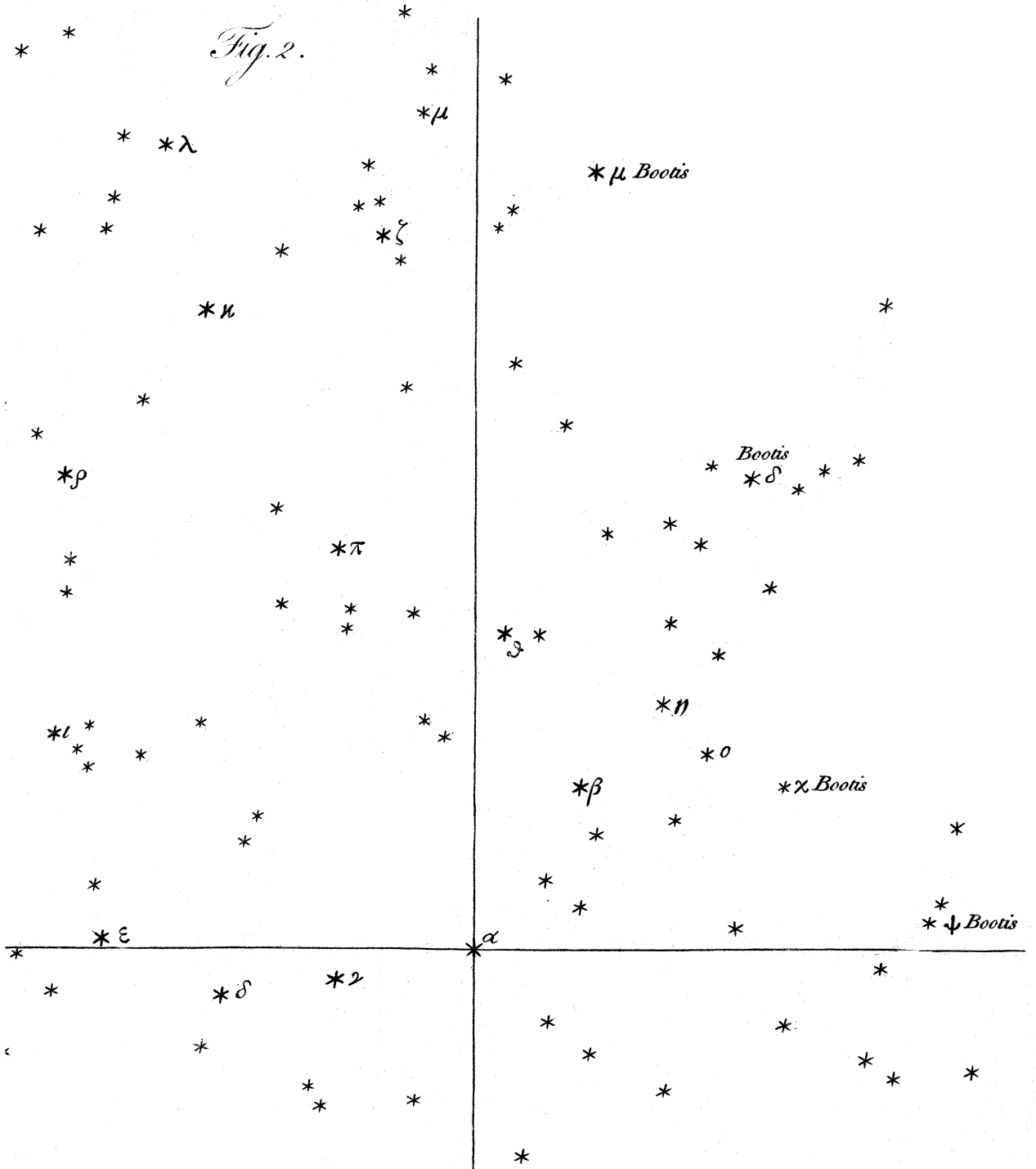


Fig. 1.

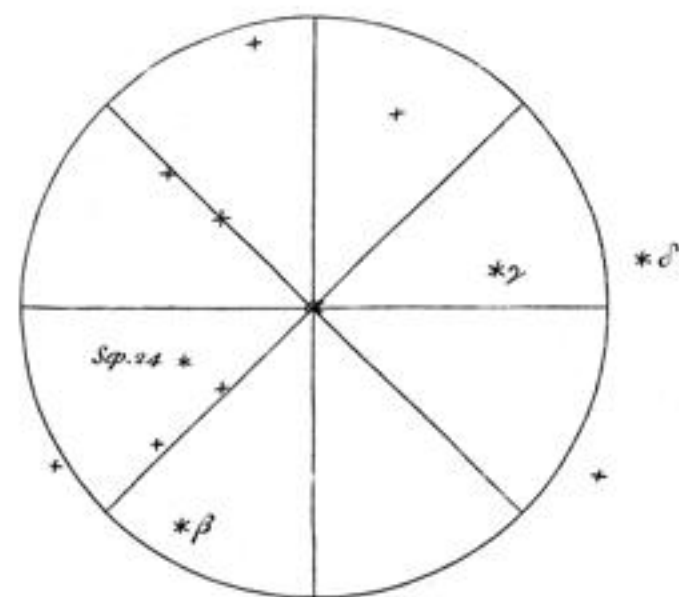


Fig. 2.

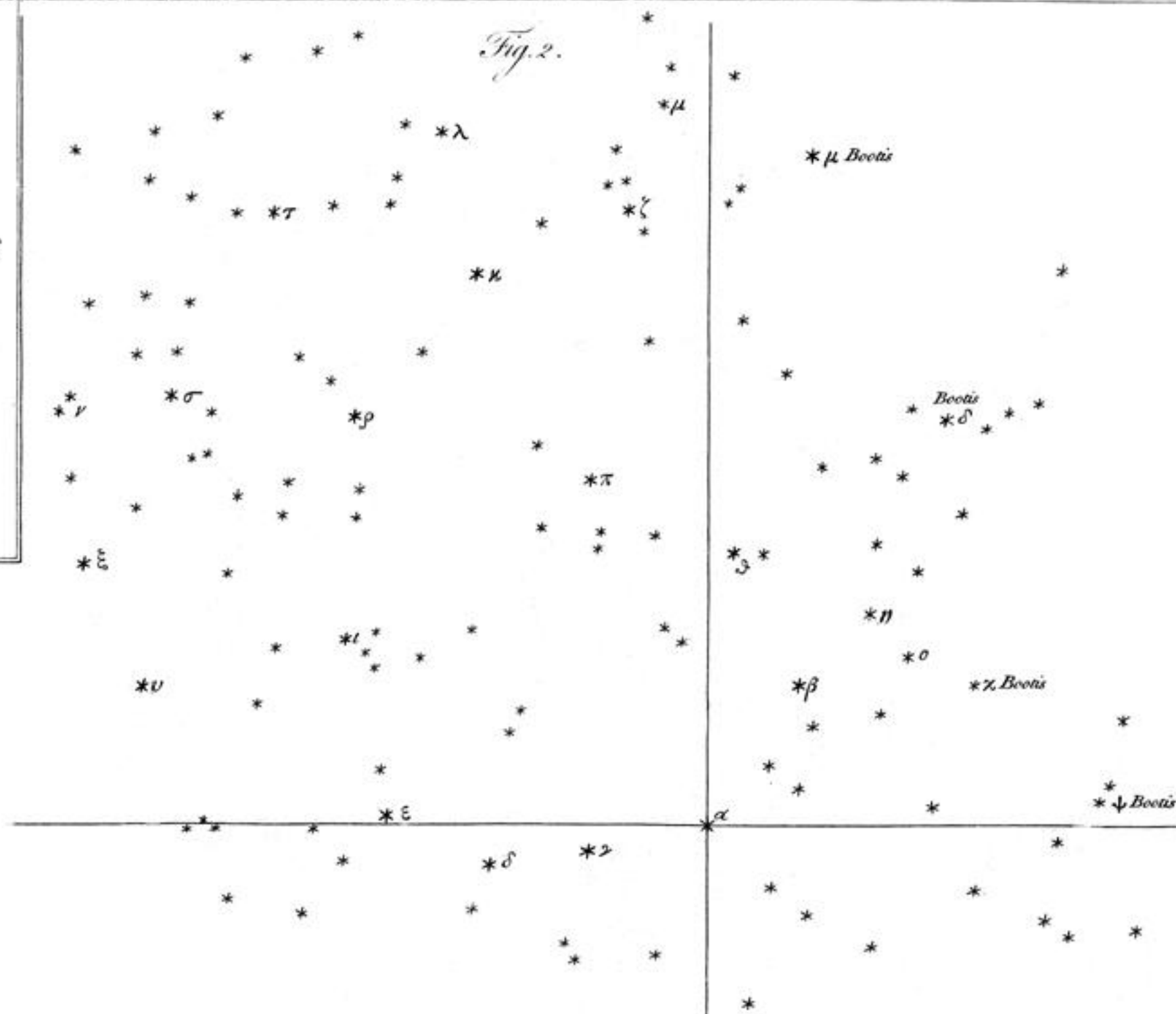


Fig. 3.

