XXV. *Remarks on the Parallax of α Lyræ. By* J. BRINKLEY, *D. D. F. R. S. &c. Andrew's Professor of Astronomy in the University of Dublin.*

Read March 11, 1824.

THE Paper of the Astronomer Royal on the parallax of α Lyræ, in the first part of the Transactions for 1823, from the manner in which the subject is there treated, appears to me likely to mislead as to the actual state of the question relative to the existence, or non-existence, of visible parallax in α Lyræ.

I have exerted myself to the utmost of my power in examining this question by observations and deductions therefrom. In stating these observations and deductions, I am not conscious of having in any manner related them, so that they may have greater weight than they are entitled to, and I am certain that Mr. POND conceives he has done the same. But we are apt on occasions of this kind to deceive ourselves.

I am desirous of seeing my own endeavours more exactly represented, and I wish the Greenwich observations should be considered as opposing mine to the extent only, that they actually do oppose them, and no further.

In the view which Mr. POND has taken of the question, some important circumstances of my observations are so imperfectly related, that I am apprehensive the Greenwich results will appear to possess a weight beyond what a close examination will show belongs to them.

From the facts that I shall produce, I think a more correct estimate may be formed of the relative merits of the Dublin and Greenwich circles.

The subject divides itself into two parts.

1. On the difference of parallax between γ Draconis and α Lyræ.

2. On the absolute parallax of α Lyræ.

I shall remark on each separately.

Mr. POND observes "It is impossible to conceive a more "simple process that that of determining with the mural "circle the difference of polar distance between these stars "(γ Draconis and α Lyræ). From their proximity in right "ascension, the operation is the same as that of measuring "the angular distance of two terrestrial objects about 12° "asunder, with a theodolite surrounded by six microscopes: "for the mural circle, in principle, exactly resembles a ver-"tical theodolite; with this difference, that its microscopes, "instead of being placed on a frame-work of brass, are se-"curely fixed on a stone pier. Now I find that the angular "distance *thus* measured in winter, does not differ one-tenth "of a second from the same angular distance measured in "summer; and therefore, that the difference of parallax "between the two stars is absolutely a quantity too small "to be measured."

With this passage I shall also take the following from the Philosophical Transactions, 1817, Part I, page 166. "—— "α Lyræ and γ Draconis have been observed *together* for "five successive years. Above three hundred observations "of each star have been made *in opposition*, and as many *in* "*conjunction*, and I find the difference of parallax, from the

" mean of all these observations, to be about 0″,25, which " quantity, by the French refraction, would be reduced one " half, or to an insensible quantity."

Now any person reading these passages might understand, that Mr. Pond means, by the angular distance *thus* measured, the angular distance measured on the same day; not one star observed on one day, and the other on another; and that in the latter passage he means the same by the words " observed together."

Yet on examining the observations it will be found he cannot mean this, for his Table XI. shows the contrary, the number of observations of each star being there unequal; and it will also be found that the days in the five years (1812 to 1816 inclusive) on which both stars were observed, only amount to about 337, not reckoning about 40 in 1812 and 1813, rejected or not used by Mr. Pond. Of these 337 observations, 146 were in summer (in opposition), and 87 in winter (conjunction), and 100 in autumn (in quadrature).

These observations however would be quite sufficient for the purpose, if they admitted of the exactness which they seemed to promise. But if the results obtained be compared, it will be found surprising, that so simple an operation, performed by such an instrument as the Greenwich mural circle, could furnish such discordant results.

The observations of these five years have been long before the public, and were made at a time when the circle was considered in its best state. The results of each day's observation are now also here placed before them.

The differences of N. P. distance, or intercepted arch between these stars, will be found in Table I. for each of the

337 days of observation, reduced to January 1, 1815. The results for 1812 and 1813 are deduced immediately from Mr. POND's reductions* of his observations published with the observations for 1814. The others I have calculated from the observations.

Let us consider each of these five years separately. In the year 1812, the days of double observation were 69; but of these 23 were rejected or not used by Mr. POND in his "reductions" above mentioned. There then remained 46; but we find that during the time these observations were made, the position of the telescope was changed five times. This therefore may account for part of the discordances which will be found in the measures of the intercepted arc, if the observations of each day are examined. It also renders the observations less fit for the investigation of parallax. I have however calculated from these observations, and find the constant of parallax $= 0'',28$. Mr. POND, in his Table XI. makes the difference between the summer and winter obser-

* These reductions are computed by BRADLEY's refractions, and therefore I have computed the rest by the same refractions. By BRADLEY's refraction, as is well known, a greater allowance is made for change of temperature than is now generally admitted. BRADLEY's table supposes the refraction is increased $\frac{1}{400}$ part, by diminishing the temperature 1°. The more exact quantity appears to be $\frac{1}{480}$ part. The difference is $\frac{1}{2400}$ part for 1°. The effect of using $\frac{1}{400}$ part is to make the arc between γ Draconis and α Lyræ appear larger in winter than in summer, and therefore more in favour of parallax. Between July and November, an interval particularly considered hereafter, the difference is insensible.

I may remark here, that Mr. POND, Philosophical Transactions, 1817, p. 163, appears to have erred in estimating the effects of the French refractions in his results for α Lyræ. He seems not to have considered that many of the southern stars he used for the index error were farther from the zenith than α Lyræ; hence, instead of diminishing the quantity he had found in favour of parallax, he should have increased it.

vations only + 0″,25. The observations of the same day give it + 0″,54 in favour of parallax.

From June, 1813, to February, 1814, the telescope remained fixed, and six microscopes were used, so that the most uniform results might be expected. But we shall find the mean of 22 observations in June and July is half a second less than a mean of 17 in August. As six microscopes were used, the errors of reading must have been absolutely nothing. The same may be nearly said of the bisections of the stars. The observations were made within half an hour of each other, and the arc intercepted, between γ Draconis in the zenith, and α Lyræ, was less than 13°. All these circumstances would have led us to expect, provided there were no parallax, an agreement to less than $\frac{1}{10}$ of a second.

This induced me to make further examination of the observations of this year, and I found by 61 days, from June to December inclusive, in which both stars were observed, and for which the reductions are given by Mr. Pond,

the constant of parallax = + 0″,42.

The circumstance I have now to mention is remarkable:—Mr. Pond considers the interval between the beginning of July and the 14th of November, as sufficient for, and favourable to this enquiry: I therefore omitted the last 5 of the preceding 61 days of observation, and then found the

constant of parallax = + 0″,89, really differing little from my parallax.

I next reduced the only 5 double observations in January and February, 1814, and added them to the former 61 reduced by Mr. Pond, and now found

the constant of parallax = + 0″,18;

what then must we think of the discordances of the above intercepted arcs, when 5 observations *taken from* or *added to* 61, should occasion results so different?

If we proceed to the subsequent years, we shall find, in 1814, 15, the observations on 76 days, with two microscopes,

give the constant of parallax $= + 0'',35$;

but if we use only the 63 observations between July, and November 14, we shall find

the constant of parallax $= + 0'',71$.

Here 13 observations in 76 make this great difference.

In 1816, 17, observations on 58 days, with two microscopes, give the constant of parallax $= + 0'',08$;

and the 40 days of observation between July and November 14, give constant of parallax $= + 0'',78$.

From hence it might be stated, that the intercepted arcs between α Lyræ and γ Draconis, observed at Greenwich 159 times in 3 years, from beginning of July to 14 November, (the interval approved of by Mr. Pond) give a parallax $= \frac{3}{4}$ of that which I have found by the observations with the Dublin circle.

But all that is intended to be shown by these results, is, that they disprove the degree of exactness attempted to be established by Table XI. of Mr. Pond's paper.

To say that the angular distance (the intercepted arc), measured in summer, does not differ one-tenth of a second from the same angular distance measured in winter, must tend to give a notion of exactness that, it now appears, cannot be attained to by the Greenwich circle.

By way of contrast I beg to state, that the mean of all the double observations, 85 in number, in June and July, during

the five years, gives $12° 53' 48'',93 + 0,83$ p
the mean of all the 337 observations, gives $12° 53' 49'',29 + 0,12$ p

Thus, from the Greenwich observations, the parallax of α Lyræ is half a second greater than that of γ Draconis.

It may be safely asserted, that this conclusion is entitled to more weight than any thing in Table XI. of Mr. POND's paper.

We have not yet considered the year 1815. In this year the discordances will be found greater than in either of the other years, if we except 1812, when the position of the telescope was varied.

In 1815, by 13 days observation in July, the mean intercepted arch, January 1, 1813 - - $= 12° 53' 55'',59$
by 18 days in August - $= 12\ 53\ 57,14$
by the standard catalogue $= 12\ 53\ 56,97$.

The difference of the two former quantities will appear almost incredible, if we merely consider the circumstances favourable for obtaining exactness. If, of the 31 observations in July and August, we compare the first 15 with the first 13, in winter, from the beginning of November, we shall find

the constant of parallax $= + 0'',72$.

The following 16 in summer, compared with 16 in winter immediately following the above 13, give

the constant of parallax $= - 0'',58$.

This seems fully to prove the imperfection of results from which such consequences are deduced.

The conclusions relative to the parallax of α Lyræ, which Mr. POND deduced from his observations of that star and γ Draconis, *formerly* appeared to me more adverse than any thing else to my results.

When, some time ago, in examining the Greenwich observations, I found that a comparison of the intercepted arcs of the mural circle between Polaris and α Lyræ, in summer and winter, gave a parallax for α Lyræ equal to what I had found by the College circle, I considered that Mr. Pond's argument from γ Draconis was greatly weakened, and this more recent examination has reduced its force comparatively to almost nothing.

An unsteadiness evidently exists in the Greenwich instrument, and it is impossible to say to what extent it may have gone in opposite seasons. Circumstances would lead to the supposition that some cause diminishes the measure of the intercepted arc between γ Draconis and α Lyræ in winter, and so conceals the parallax of α Lyræ.

The effect of some existing cause of error will appear still more plainly if we take an exact mean of all the observations in July, made during the five years, and compare them with the mean of all the observations in August.

By 83 days of observation in July -	12° 53′ 56″,33
63 - - - - - - in August	56 ,84.

Now it is impossible, if there were no cause for the difference of the results obtained under such favourable circumstances, but the ordinary errors of observation, that it should have been so great. Parallax being admitted, would only do away part of the discordance. Mr. Pond has, in Table XI, counted on the agreement of sets of observations less in number, and made under less favourable circumstances, to a tenth of a second.

Part of the above difference of half a second in July and August, must arise from some change in the measure of the arc, and the change may take place to a much greater extent between winter and summer.

Mr. POND mentions the precautions he took to avoid errors from the effects of unequal temperature. That the utmost pains were taken to reduce the temperature of the Observatory to that of the open air, the difference throughout the year not exceeding one degree. This latter part is not quite plain. It can scarcely be meant that there was never throughout the year a greater difference between the internal and external thermometers than one degree. It appears nearly impossible that this would generally take place on *clear* nights, after sun-set, from the beginning of July to the beginning of October, when these stars pass the meridian.

Mr. POND, indeed, expressly mentions, that the weather was so mild and uniform on the winter nights of 1822-23, that he was enabled to reduce the external and internal temperatures to the greatest uniformity. But this has nothing to do with the observations in question. In winter, γ Draconis and α Lyræ pass in the middle of the day; and then, except in rare cases of extreme cold, here, and also at Greenwich, as will be seen by a reference to the observations, the internal and external temperatures are generally nearly the same.

In the last paragraph of this part of Mr. POND's paper, in alluding to my instrument, he seems to consider it as only having two microscopes instead of three, which is a difference of great importance.

On the absolute parallax of α Lyræ.

Mr. POND commences his observations in July, and communicates his results to the Royal Society, November 14 following, six weeks before the winter maximum of parallax. He says, these observations indicate, in the most decided manner, that the parallax of α Lyræ cannot exceed a very small fraction of a second.

Let us consider the nature of this investigation.

It consists in this. He measures the angular distance between the direct and reflected images of α Lyræ, an arc exceeding 154°. The observations are necessarily made on different days. Let the circumstances of this process be contrasted with the observations of measuring, within the space of half an hour, the meridional angular distance less than 13° between γ Draconis and α Lyræ. We have seen the discordances that have taken place between the results of a greater number of observations of this kind.

We have seen that 159 observations, made with the mural circle in the interval between July and November 14, give a parallax of α Lyræ, exceeding that of γ Draconis by $\frac{3}{4}$ of the parallax I had found for α Lyræ.

Hence, then, on how slender a foundation rests the assertion of Mr. POND, "that these observations indicate, in the most decided manner, that the parallax of α Lyræ cannot exceed a very small fraction of a second?"

But, by confining ourselves to this interval, we lose the great advantage that might be expected to be derived from the winter observations near the maximum of parallax. Mr. POND accounts for his having taken so short a period:—

"Although this period embraces only half the interval in "which the greatest change, or double parallax, is effected, "a circumstance which at first may appear very disadvan-"tageous, yet that is more than compensated, in my opinion, "by the number of observations, and by a uniformity of "temperature, such as never can be expected in the extreme "seasons of winter and summer."

On the contrary, it appears to me, that inconvenient circumstances occur in this interval, comprising the latter part of summer and the commencement of autumn. The star then passes the meridian after sun-set, at which time, often the greatest difference exists between the external and internal temperatures.

At that time of the year, on *clear* nights, after sun-set, great degrees of cold often suddenly take place in the open air, and it is almost impossible to equalize the temperature. In winter, when α Lyræ passes in the middle of the day, there is seldom, as has been before said, much difference of external and internal temperature, except in extreme cold.

To which may be added another point of importance: it is much more difficult to bisect α Lyræ when it passes after sun-set, than when it passes in day-light

But the real strength of the argument, from these new observations of α Lyræ, lies in comparing those made after the paper was read, with those made in July and August, Here the Dublin and Greenwich instruments are completely at variance.

The Dublin instrument has shown, by a great number of observations, continued for several years, the double zenith distance (about 30°) of α Lyræ 3″ greater in the beginning of December or February than in the beginning of August (these are about the middle times of the winter and summer observations). The Greenwich instrument finds, by twenty observations in summer, and twenty in winter, the double altitude (about 154°) of α Lyræ *exactly* the same.

Comparing these naked facts together, the first impression would be, notwithstanding the greater number of observations at Dublin, that the Greenwich result is more likely to be right, because it is more likely that two angles, that are really equal, should be found equal, than that two angles, really unequal, should be found equal, by the errors of observation.

This is all the admission, that it appears to me, can be made. When the collateral circumstances are examined, unless I greatly deceive myself, the probability will be found in favour of the exactness of the Dublin results; and I cannot but feel surprised, considering the experience Mr. POND has had of the Greenwich circle, that he should attribute such weight to these results by reflection.

But the circumstance which I am going to mention, will make it appear certain that the consistency of the Greenwich instrument cannot be depended on, to the degree of exactness, that these observations of α Lyræ appear to show. It even renders it probable that it cannot be depended on even to a degree of exactness sufficient to confirm, or refute, the parallax which I have found by the Dublin instrument.

In the year 1813, 1814, and 1815, the Greenwich instrument was considered in a perfect state.

The difference of the polar distances of Polaris and α Lyræ (an arch of only about 50°) was observed in three successive winters; and the reduction to January 1, 1815, will be found in Tab. II. The number of observations of each star are quite sufficient to obtain an exact result, did not other errors than the ordinary errors of observation interfere. These observations were made at the *same* seasons, and therefore the effects of different temperatures not likely to appear.

It may be objected, indeed, that the telescope did not remain in the same position. It remained in the same position in 1813 and 1814, but not in 1815; and in 1814 and 1815 only two microscopes were used. But the result of 1815 differs 4 seconds from the standard catalogue; a difference far beyond any thing that could arise from errors of division, which are thought scarcely to exist in this instrument.

Mr. Pond appears to consider it of great importance that, in the direct and reflected observations of α Lyræ, six microscopes were used. An inspection of Tab. III. will show an extreme unsteadiness in the microscopes when six were used in the year 1813, either arising from an unsteadiness in the circle, or in themselves. In what way this unsteadiness will affect the parallax, it is impossible to conjecture; but we may safely conclude, that where discordances, amounting even to 15″ or 20″, take place in the relative position of two microscopes, that the results, founded on these observations, cannot be depended on to a single tenth, or even to many tenths of a second.

I shall now beg leave to make one or two remarks relative to the collateral circumstances, which appear to add very considerable weight to my explanation by parallax of the discordances I have met with, and I feel it the more necessary to do this, because, in Mr. POND's paper, they are either partially, or inaccurately stated.

The argument from the solar nutation loses half its force, if it be not joined with that deduced from the aberration.

There are three equations depending on the place of the sun; the aberration, of which the maxima are at the end of September and end of March; the solar nutation, of which the maxima are at the end of March, end of June, end of September, and end of December; the parallax, of which the maxima are at the end of June and end of December.

*333 Observations of α Lyræ, reduced by the method of making the sum of the squares of the errors a minimum, give

The const. of aberration	- =	20″,35
The const. of solar nutation	=	0 ,51
The const. of parallax	- =	1 ,14.

The constant of solar nutation is certainly exact to $\frac{1}{10}$ of a second; and there cannot be any doubt that the constant of aberration is exact to less than a $\frac{1}{4}$ of a second. The conclusion therefore must be, that the constant of parallax is exact in the same degree.

Mr. POND, however, conceives that the disengagement of the constant of parallax only proves the existence of a regularly recurring cause acting with greatest effect at the extreme seasons. This hypothesis will be very difficult to

* I beg to refer here to my paper on Solar Nutation, in the 14th Vol. of the Transactions of the R. I. Academy, about to be published. Copies of the paper have been in the hands of several persons since July, 1822.

to support when the circumstances relative to Aldebaran, β Tauri, &c. are considered, to which stars I shall presently allude.

Mr. Pond says, "with respect to the zenith point, his (the "Dublin) instrument, like every one of a similar construc-"tion, is a perfect instrument. No portion of the arc is "employed, nor can temperature have occasioned any error "by its changes. As the star to be examined recedes from "the zenith, the instrument becomes less and less perfect, "and Dr. Brinkley finds a small parallax in α Cygni, a "larger in α Lyræ, and oftentimes a still larger in stars more "remote from the zenith."

Had the names of the stars which appeared to show, and which appeared not to show parallax, been adverted to, this argument would have been seen to be of no avail. By a reference to my Paper in the Philosophical Transactions, 1821, it will be found that I observed, at the opposite seasons, Aldebaran, β Tauri, α Orionis, Castor, Procyon and Pollux, all considerably more distant from the zenith than α Lyræ. All the observations of these stars, in summer, amount to above 300, and in winter to nearly 400, and no perceptible differences were found at the two seasons. Here temperature must have had a much greater effect than with respect to α Lyræ. These stars pass late in the evening in winter, and near noon in summer, and certainly the difference of temperatures is then much greater than between midnight in summer and noon in winter.

But this is only a small part of the force of the argument that may be deduced from the observations of these stars.

Had these or any other stars exhibited a negative parallax exceeding a small fraction of a second, it would have been decisive against parallax, or had *these* exhibited any discordances, it could not have been from parallax, as the effect of parallax in declination for these stars is a very small part of the whole. The observations of the Pole Star also point out no parallax for that star. They have been very numerous and made at the same time as the observations of α Lyræ, and therefore, according to the hypothesis of Mr. POND, they should have exhibited a discordance even greater, this star being so much further from the zenith than α Lyræ. But no such thing takes place either with respect to the observations above or below the Pole.

I ought, perhaps, to apologize to the Society for repeating these circumstances; they are fully stated; and the very objections that have been brought forward, in the paper under consideration, have been anticipated in my Paper in the Philosophical Transactions, 1821.

If it should appear hereafter, by any decisive observations, that I have been mistaken in having attributed the differences of the zenith distances which I have met with in several stars, to parallax, I trust I shall not be found to persevere in the opinion I at present hold. Recent circumstances have led me to adhere more strongly to that opinion. The alleged permanency of the arc between γ Draconis and α Lyræ, seemed to furnish a powerful argument against me, and I have heretofore represented it as such; now, I consider the Greenwich observations of this arc, if not favourable, certainly not adverse to parallax.

The appearance of parallax which I had found in observations of several stars in the same part of the Heavens, also might be thought to afford considerable probability that the explanation by parallax was not the true explanation.

The argument furnished by solar nutation, seems to produce such additional weight, that, at this time, I consider the evidence in favour of parallax greater than ever.

Mr. Pond, in the concluding paragraph of his Paper, has stated, in very strong terms, his opinion of the comparative merits of the two instruments; but I have little doubt that opinion will be found quite incorrect, with a reference to this point.

1. In Table III. will be found the differences between the microscope A and each of the microscopes of the Greenwich circle for every other observation of α Lyræ made during seven months. In that time no cause is mentioned in the observations for any derangement having taken place. The telescope remained in the same position on the circle. In the Table IV. will be found the differences between the bottom microscope and each of the side microscopes of the Dublin circle for an equal period. Nothing can be more remarkable than the comparative steadiness of the Dublin, contrasted with that of the Greenwich instrument.

2. The discordances in the Polar distances of the stars determined by the Greenwich instrument at different times, have long excited notice, and lately Mr. Pond has considered these discordances as really existing in the stars, and not arising from the observations or the instrument. The contrary has, I think, been sufficiently shown in a preceding

paper. In addition, the N. P. distances of certain stars, of which more numerous observations have been made here on account of my enquiries relative to the parallax, are given in Table VI. These show a consistency in my instrument, for which we shall look in vain among the observations of the Greenwich circle under similar circumstances.

TABLE I.

The Differences of the Polar Distances of γ Draconis and α Lyræ, observed at Greenwich, and reduced to January 1, 1815=12° 53′ +

1812	″	1813	″	1813	″	1814	″	1815	″	1815	″	1816	″
July 6	49,21	June 25	47,79	Oct. 1	50,45	Aug. 27	49,96	July 11	48,75	Oct. 4	50,27	July 20	48,21
7	50,20	27	48,91	13	49,29	28	47,95	12	49,02	7	47,24	21	48,40
9	51,38	28	49,60	19	49,24	29	49,63	16	50,02	8	48,72	23	48,25
10	49,38	July 5	49,34	31	50,31	Sept. 1	48,82	20	46,91	9	49,07	24	48,63
14	49,17	6	50,38	Nov. 3	49,86	3	49,44	21	47,40	16	48,10	25	48,16
17	47,33	10	48,50	11	49,74	5	50,23	26	47,32	17	50,09	26	49,49
21	45,95	11	48,92	18	49,70	6	51,56	27	48,10	21	49,65	28	48,72
22	48,15	12	48,59	20	47,81	7	48,31	28	48,81	24	49,53	30	49,39
28	49,50	13	48,86	27	48,36	8	50,13	31	50,18	25	48,07	Aug. 3	48,45
30	50,73	16	49,99	Dec. 15	50,19	11	48,50	Aug. 1	49,65	26	49,87	7	49,42
31	49,08	17	49,66	31	50,29	12	49,31	3	49,17	Nov. 3	50,05	8	48,19
Aug. 1	49,69	18	48,94	1814		13	49,76	4	49,64	5	47,64	21	46,84
				Jan. 12	49,92								
12	49,67	19	49,74	29	48,93	15	48,15	7	49,39	13	49,07	28	48,75
13	50,60	23	48,91	30	49,27	16	48,79	8	50,65	18	49,74	29	50,09
15	48,75	24	48,53	Feb. 2	48,71	17	49,23	9	48,87	23	49,68	Sept. 5	49,52
17	49,99	25	48,32	14	47,34	18	47,49	14	49,47	27	47,94	10	50,57
20	50,99	27	50,00	June 30	50,82	19	48,53	16	50,41	Dec. 8	50,33	16	52,67
21	50,62	28	49,51	July 1	49,01	20	49,51	17	50,44	10	50,11	20	49,91
Sept. 15	49,43	29	48,71	2	47,58	Oct. 1	49,05	19	49,37	12	49,60	23	49,00
16	49,88	30	48,56	5	48,93	3	48,92	21	50,01	14	49,72	25	49,63
18	49,59	Aug. 5	48,58	6	49,04	4	49,73	22	50,05	23	48,74	26	49,62
19	49,18	7	50,90	10	46,54	5	49,32	24	47,94	1816		27	51,31
Oct. 1	50,07	9	49,36	11	50,18	7	49,05	25	49,67	Jan. 1	50,91	Oct. 8	48,85
3	49,43	10	49,55	15	48,73	8	49,42	26	50,77	2	49,59	16	49,77
										3	48,98		
5	49,19	11	50,31	16	49,29	10	50,98	27	48,56	6	48,65	20	49,95
8	49,21	12	49,23	17	48,42	13	51,41	29	49,81	9	49,52	23	49,33
9	49,91	13	49,08	18	48,84	16	49,19	31	50,64	15	48,93	26	49,42
15	49,81	15	49,59	22	48,23	23	50,77	Sept. 1	48,01	17	48,70	29	50,88
21	50,95	16	49,34	23	50,58	24	51,09	2	49,11	29	49,44	Nov. 3	49,17
24	49,54	17	49,30	24	48,61	Nov. 8	47,90	4	51,51	30	47,93	13	49,06
26	50,27	19	50,49	25	49,61	12	50,26	6	50,50	31	48,01	14	50,39
28	48,33	20	47,77	26	49,85	22	48,37	8	46,90	Feb. 9	49,95	15	49,38
29	49,73	21	48,71	27	49,87	28	49,28	10	48,31	11	48,45	22	47,19
31	50,44	23	49,86	29	50,26	Dec. 6	50,37	11	49,56	13	50,31	24	48,62
Nov. 3	50,91	24	50,74	30	49,08	30	49,03	12	47,76	16	49,21	29	49,54
8	49,41	30	49,83	31	47,90	1815		13	50,00	20	49,73	Dec. 6	49,91
						Jan. 2	48,97						
15	49,84	31	50,45	Aug. 1	49,34	8	50,09	14	50,40	23	47,15	10	48,86
19	48,34	Sept. 2	49,83	3	49,35	9	50,00	15	48,83	27	49,33	11	50,25
20	50,56	4	49,73	4	47,50	10	47,92	18	49,05	28	49,49	14	48,85
21	49,45	5	49,64	5	49,18	11	50,64	19	49,39	July 5	48,54	15	48,60
22	49,93	13	50,15	6	46,91	17	48,75	20	49,41	7	49,94	22	49,67
Dec. 6	48,48	14	51,03	8	47,66	18	49,07	21	49,17	9	49,88	1817	
												Jan. 1	49,67
8	49,17	17	50,40	9	49,41	Feb. 4	50,16	23	49,57	10	50,39	6	48,25
9	50,83	20	49,53	14	49,51	8	48,90	25	47,99	12	49,84	7	48,90
10	50,26	24	48,85	16	47,84	July 2	46,57	27	50,01	13	47,29	8	48,30
13	50,17	26	49,89	20	50,69	3	46,45	28	49,53	15	47,97	13	48,65
1813		27	48,29	22	50,19	5	49,63	Oct. 1	48,67	17	49,65	19	48,56
June 22	49,40	30	50,84	26	50,13	7	47,26	2	48,31	18	49,70	Feb. 4	48,35
24	49,60											15	49,75

Table II. Greenwich Mural Circle.

Year of Observation. Winter.	Number of Observations by Mural Circle.		Diff. of the mean Polar distance of α Lyræ and Polaris, Jan. 1, 1815.
1813—14	α Lyræ	32	49° 42′ 12″,83
	Polaris	36	
1814—15	α Lyræ	33	14,27
	Polaris	31	
1815—16	α Lyræ	46	15,70
	Polaris	48	
	Standard Catalogue.		11,87

Table II. continued.

Table II. continued.	Jan. 1, 1815. Difference, 49° 42′
1815, Nov. 3	14″,68
14	16,49
18	16,05
23	15,63
26	15,41
27	14,93
Dec. 4	14,24
8	16,14
10	17,48
12	15,82
13	16,55
22	16,89
25	18,01
1816, Jan. 1	17,43
2	15,67
3	16,02
17	16,10
31	16,15
Feb. 7	14,89
8	12,84
11	15,27
13	19,53
23	13,47
Mean (23)	15,90

Table III. (1) Greenwich Mural Circle.
Differences between the Microscope A, and the Microscopes B, C, D, E, F, for α Lyræ.

1813.	A	B	C	D	E	F
July 5	0	−5,3	−2,7	−3,4	−4,5	−2,9
9	0	−5,8	−1,8	−3,2	−3,8	−0,7
11	0	−1,9	−0,7	−1,9	−2,5	−1,4
13	0	−1,2	0,0	−1,4	−1,7	−2,2
17	0	−2,8	+1,7	−2,3	−1,3	−4,2
19	0	−5,0	+1,0	−1,5	−5,3	−5,8
24	0	−1,8	+2,6	−0,5	−4,6	−4,7
27	0	−1,0	+4,3	+0,2	−1,5	−2,8
29	0	0,0	+5,0	+0,2	−4,2	−5,0
Aug. 1	0	−4,2	+3,3	+0,2	−4,5	−5,0
3	0	−1,0	+3,8	+0,8	−5,0	−4,9
7	0	−3,4	+4,0	+1,2	−6,2	−5,3
10	0	−3,0	+4,6	+1,7	−6,2	−5,3
12	0	−0,8	+4,7	+2,1	−5,6	−4,6
15	0	−3,0	+3,2	+1,3	−10,2	−8,2
17	0	−3,5	+4,0	+2,3	−8,1	−6,9
20	0	−8,2	+1,3	+0,2	−10,5	−8,0
22	0	−6,3	+1,3	+0,3	−9,9	−8,3
24	0	−7,4	+0,6	−0,8	−9,3	−7,9
30	0	−6,7	+0,1	−1,3	−8,5	−5,8
Sept. 2	0	−6,0	+1,0	−1,0	−7,9	−5,8
5	0	−4,9	0,0	−0,9	−6,2	−5,7
7	0	−5,7	−0,5	−2,5	−7,7	−7,8
10	0	−6,0	+0,5	−0,5	−9,4	−7,5
14	0	−6,8	−0,8	−1,0	−8,1	−6,2
17	0	−3,7	+2,0	−0,2	−6,6	−4,3
20	0	−5,4	+2,3	+0,4	−7,8	−11,2
26	0	−4,4	−3,7	−5,0	−1,7	−1,0
30	0	−8,0	−3,7	−4,8	−4,7	−6,8
Oct. 3	0	−6,5	+1,1	−0,3	−7,3	−9,5
13	0	−4,3	−2,8	−3,6	−1,7	−4,1
19	0	−4,6	−0,5	−2,3	−6,1	−9,3
22	0	−1,0	+4,0	+2,7	−3,2	−5,2
Nov. 1	0	−1,8	+8,8	+5,1	−8,7	−13,1
4	0	−2,6	+10,2	+7,0	−11,8	−14,5
8	0	+1,0	+8,5	+5,4	−5,0	−9,6
11	0	+0,2	+4,2	+0,3	−1,5	−1,0
20	0	+0,5	+7,0	+2,5	−3,0	−0,2
30	0	−3,2	+10,8	+9,1	−12,5	−10,9
Dec. 21	0	0,0	+7,5	+3,1	−5,2	−3,4
30	0	−0,2	+11,0	+5,0	−5,2	−4,7
1814, Jan. 11	0	0,0	+11,0	+4,2	−3,7	−2,2
16	0	−2,3	+5,7	+6,5	−5,7	+0,4
30	0	−0,8	+2,2	+4,0	−2,2	+2,8
Feb. 2	0	+0,5	+5,7	+7,0	−2,2	+3,2
6	0	−0,7	+5,6	+6,5	−4,8	+1,0
17	0	−2,3	+2,7	+3,4	−2,3	+2,4
20	0	0,0	+1,5	+1,7	−0,8	+4,8
22	0	−1,3	+1,7	+2,2	−0,7	+3,8
25	0	0,0	+11,5	+13,3	−8,9	−5,2
Extremes.		−8,2	−3,7	−5,0	−0,7	−14,5
		+1,0	+11,5	+13,3	−12,5	+4,8
	Diff.	9,2	15,2	18,3	11,8	19,3

Table III. (2) Greenwich Mural Circle.

July 30, 1813.

1813.	A	B	C	D	E	F	Therm. In.
☉	0	+3,2	+5,7	+5,0	—1,8	—4,8	72°
♀	0	+1,5	+4,5	+4,7	—2,3	—5,7	73
☿	0	+4,8	+6,4	+5,0	0,0	—6,2	74
α Ursæ Maj.	0	+2,2	+9,4	+8,0	—4,5	—6,0	74
γ Ursæ Maj.	0	+2,0	+8,2	+7,0	—0,2	—6,0	75
Polaris S. P.	0	—1,0	+7,2	+6,4	—4,6	—5,8	75
η Ursæ Maj.	0	+4,4	+7,4	+4,6	—1,8	—6,6	75
Arcturus	0	+2,7	+6,5	+3,1	—2,0	—3,8	75
β Ursæ Min.	0	+1,5	+7,8	+8,8	—3,0	—5,2	74
α Persei S. P.	0	+0,5	+4,5	+4,3	—3,5	—7,0	73
α Cor. Bor.	0	+2,1	+3,6	+0,8	—6,4	—4,7	73
α Serpentis	0	+3,1	+4,2	+4,0	—0,2	—3,7	73
α Herculis	0	+1,8	+6,2	+4,9	—1,1	—2,4	71
γ Draconis	0	+4,2	+8,5	+8,0	—1,8	—7,2	71
α Lyræ	0	+2,7	+3,0	+2,8	—2,9	—4,1	70
α Aquilæ	0	+1,2	+5,5	+4,0	—1,1	—5,7	69
α Cygni	0	+1,0	+5,8	+3,7	—2,1	—5,7	68
♂	0	+0,1	+4,3	+3,1	—0,4	—5,9	68
α Persei	0	+1,1	+3,4	+5,1	—2,2	—4,4	64
Aldebaran	0	—2,0	+1,0	—3,6	—2,2	—6,2	64
Capella	0	0,0	+1,1	+3,3	—4,5	—6,9	64
β Tauri	0	—1,4	+0,8	—0,4	—5,3	—7,4	65
α Orionis	0	—1,0	+0,5	+2,0	—2,5	—5,5	65
Pollux	0	—0,7	+1,6	—1,1	—4,7	—7,1	69

Table III. (3) Greenwich Mural Circle.

September 6, 1813.

η Ursæ Maj.	0	—4,7	+0,5	—0,6	—6,2	—8,8	60°
Arcturus	0	—5,0	—1,2	—2,0	—6,8	—7,0	60
β Ursæ Min.	0	—7,2	—0,9	+1,8	—5,6	—8,0	60
α Herculis	0	—6,2	—3,5	—0,3	—6,3	—7,3	56
α Ophiuchi	0	—8,4	—4,4	—0,8	—5,4	—7,8	56
γ Draconis	0	—6,1	—1,4	—0,2	—7,6	—9,6	56
α Lyræ	0	—6,1	+1,3	—2,5	—8,1	—5,8	55
α Aquilæ	0	—5,8	—1 0	—2,0	—3,5	—7,8	55
α Cygni	0	—7,3	—4,1	—2,2	—6,2	—7,5	54
α Cephei	0	—6,8	—1,7	+1,0	—7,4	—8,7	54
β	0	—6,2	—3,0	—0 5	—6,0	—9,2	54
Castor	0	—7,7	—3,2	—1,2	—6,0	—8,0	55
Procyon	0	—6,2	—2,2	—1,2	—5,3	—8,1	55

Table III. (4) Greenwich Mural Circle.

November 30, 1813.

	A	B	C	D	E	E	Therm. In.
α Lyræ	0	—3,2	+10,8	+ 9,1	—12,5	—10,9	33°
α Aquilæ	0	—3,0	+10,6	+10,0	—11,0	—11,5	33
α Cygni	0	—3,4	+ 9,8	+ 9,1	—11,2	—12,2	32
α Cephei	0	—2,9	+10,8	+10,3	—11,2	—11,7	32
β Cephei	0	—1,8	+ 8,4	+ 8,8	—12,0	—13,0	32
α Ursæ Maj. S.P.	0	—3,2	+ 8,4	+10,1	— 9,0	—10,0	33
γ Ursæ Maj. S.P.	0	—2,3	+ 8,4	+10,6	— 8,3	— 9,8	31½
α Andromedæ	0	—4,2	+ 7,8	+ 7,2	—12,2	—12,4	31½
α Cassiopeæ	0	?	?	+ 6,0	—10,0	—13,5	31
Polaris.	0	—5,5	+ 8,5	+10,0	—10,0	—11,8	31
η Ursæ Maj. S.P.	0	—2,4	+ 9,0	+11,0	— 7,7	— 9,7	31
α Arietis	0	—5,0	+ 6,4	+ 6,8	—13,0	—12,2	31
β Ursæ Min. S. P.	0	—3,9	+ 9,0	+ 7,6	— 7,6	— 9,0	33
Polaris S. P.	0	—6,8	+ 6,2	+ 7,2	—11,7	—10,0	33
η Ursæ Maj.	0	—2,3	+ 7,9	+ 8,0	—10,7	—11,3	33
Arcturus	0	—3,0	+ 6,6	+ 7,2	—10,9	— 8,6	33
β Ursæ Min.	0	—3,5	+ 8,7	+ 9,7	— 8,0	— 9,2	33

TABLE IV. Dublin Circle.

Part I. Face Circle West.	Bott. Mic. —Left. H. W. L.	Bott. Mic. —Right H. W. R.	W. M.	Part 2. Face Circle East.	Bott. Mic. —Left H. E. L.	Bott. Mic. —Right H. E. R.	E. M.	WM + EM / 2
1821	"	"	"	1821	"	"	"	"
July 6	+4,3	+11,1	+7,7	July 6	—5,1	— 9,8	—7,4	+0,15
10	5,4	9,6	7,5	10	3,2	11,6	7,4	+0,05
11	6,0	9,8	7,9	11	4,1	11,1	7,6	+0,15
13	4,8	10,0	7,4	13	5,8	9,3	7,5	—0,05
18	6,2	8,8	7,5	18	2,9	12,2	7,5	0,00
20	4,2	11,6	7,9	20	4,7	10,8	7,7	+0,10
23	4,6	10,7	7,6	23	4,3	11,5	7,9	—0,15
27	5,3	11,1	8,2	27	5,5	11,2	8,3	—0,05
Aug. 1	6,2	8,6	7,4	Aug. 1	7,1	10,0	8,5	—0,55
2	4,8	10,1	7,5	2	5,5	11,4	8,4	—0,45
4	6,8	8,4	7,6	4	6,1	9,3	7,7	—0,05
14	6,0	9,8	7,9	14	4,9	11,7	8,3	—0,20
16	6,3	7,7	7,0	16	5,2	11,2	8,2	—0,60
23	7,5	8,1	7,8	23	6,1	10,2	8,2	—0,20
24	7,5	9,2	8,3	24	8,0	9,7	8,9	—0,30
Sept. 3	6,8	9,3	8,1	Sept. 3	7,4	9,8	8,6	—0,25
9	7,7	9,8	8,7	9	6,3	9,6	8,0	+0,35
12	7,0	12,9	9,9	12	6,8	8,2	7,5	+1,20
22	6,4	9,2	7,8	22	6,4	10,7	8,5	—0,35
26	5,0	9,7	7,3	26	5,8	8,6	7,2	+0,05
27	5,5	9,5	7,5	27	6,0	10,3	8,1	—0,30
28	5,3	9,8	7,5	28	4,7	9,2	7,0	+0,25
29	3,5	10,2	6,8	29	4,3	9,9	7,1	—0,15
Oct. 1	4,2	8,8	6,5	Oct. 1	5,1	10,5	7,8	—0,65
8	3,7	9,4	6,6	8	5.2	9,0	7,1	—0,25
14	4,5	10,2	7,3	14	5,0	9,5	7,2	+0,05
23	5,2	9,0	7,1	23	5,5	9,8	7,6	—0,25
29	5,5	9,3	7,4	29	4,2	8,9	6,5	+0,45
Nov. 27	4,5	10,0	7,2	Nov. 27	4,3	9,0	6,6	+0,30
28	5,0	8,8	6,9	28	4,7	9,0	6,8	+0,05
29	4,8	8,6	6,7	29	4,1	9,3	6,7	0,00
Dec. 3	5,0	9,2	7,1	Dec. 3	3,4	10,5	7,0	+0,05
5	4,6	10,1	7,3	5	4,3	8,8	6,5	+0,40
6	4,9	8,5	6,7	6	4,0	9,8	6,9	—0,10
11	5,3	7,7	6,5	11	4,1	8,6	6,3	+0,10
17	4,2	8,4	6,3	17	4,5	7,8	6,1	+0,10
21	5,5	7,4	6,5	21	4,8	8,2	6,5	0,00
24	2,9	8,4	5,6	24	3,5	8,1	5,8	—0,10
26	3,0	8,4	5,7	26	3,6	6,4	5,0	+0,35
30	4,6	10,5	7,5	30	3,5	7,7	5,6	+0,95
31	5,4	8,3	6,8	31	4,3	8,0	6,1	+0,35
1822				1822				
Jan. 1'	4,8	7,7	6,2	Jan. 1	4,0	8,1	6,0	+0,10
4	3,1	8,9	6,0	4	3,0	6,2	4,6	+0,70
5	0,2	9,6	4,9	5	1,9	8,6	5,2	—0,15
6	4,3	8,5	6,4	6	2,5	9,8	6,1	+0,15
16	5,9	7,4	6.6	16	3,5	8,9	6,2	+0,20
29	4,7	8,0	6,3	29	5,1	7,4	6,2	+0,05
30	5,4	8,0	6,7	30	4,7	8,7	6,7	0,00
Feb. 5	5,3	7,5	6,4	Feb. 5	4,0	8,3	6,1	+0,15
7	4,1	7,8	6,0	7	4,4	8,2	6,3	—0,15
11	3,3	10,9	7,1	11	2,4	9,3	5,8	+0,65
14	5,4	7,8	6,6	14	3,5	8,3	5,9	+0,35
15	2,3	9,8	6,0	15	2,7	7,4	5,0	+0,50

Table V. Dublin Circle, 1821.	Z. D. 14° 45′	Error from Mean.	Z. D. 14° 45′	Error from Mean.
	″	″	″	″
July 6	56,57	+0,15	55,58	−0,83
10	56,50	+0,08	55,51	−0,90
11	57,10	+0,68	56,09	−0,32
13	57,27	+0,85	56,29	−0,12
18	58,73	+2,31	57,76	+1,35
20	56,34	−0,18	55,38	−1,03
23	56,14	−0,28	55,30	−1,11
25	58,73	+2,31	57,80	+1,39
27	56,39	−0,03	55,48	−0,93
Aug. 1	56,69	+0,27	55,81	−0,60
2	56,46	+0,04	55,68	−0,73
4	55,97	−0,45	55,10	−1,31
14	55,75	−0,67	55,08	−1,33
16	56,89	+0,47	56,16	−0,25
23	55,11	−1,31	54,46	−1,95
24	57,81	+1,39	57,17	+0,76
Sept. 3	55,97	−0,45	55,46	−0,95
9	55,85	−0,57	55,44	−0,97
12	56,34	−0,08	55,98	−0,43
22	57,31	+0,89	57,12	+0,71
26	57,33	+0,91	57,20	+0,81
27	56,15	−0,27	56,04	−0,37
28	55,84	−0,58	55,75	−0,66
29	56,33	−0,09	56,26	−0,15
Oct. 1	57,21	−0,79	57,16	+0,75
8	56,97	−0,55	57,04	+0,63
14	56,29	−0,13	56,44	+0,03
23	57,24	−0,82	57,57	+1,16
29	55,89	−0,53	56,30	−0,11
Nov. 27	55,31	−1,11	56,11	−0,30
28	56,76	+0,34	57,58	+1,17
29	56,26	−0,16	57,08	+0,67
Dec. 3	56,25	−0,17	57,12	+0,71
5	56,75	+0,33	57,64	+1,23
6	57,56	+1,14	58,45	+2,04
11	56,21	−0,21	57,15	+0,74
17	56,51	+0,09	57,46	+1,05
21	57,00	+0,58	57,99	+1,58
24	56,51	+0,09	57,50	+1,09
26	56,13	−0,29	57,12	+0,71
30	55,91	−0,51	56,91	+0,50
31	56,42	0,00	57,42	+1,01
1822 Jan. 1	57,63	+1,21	58,63	+2,22
4	56,51	+0,09	57,50	+1,09
5	56,45	+0,03	57,45	+1,04
6	56,89	+0,47	57,89	+1,48
16	56,93	+0,51	57,89	+1,48
29	55,64	−0,78	56,52	+0,11
30	55,85	−0,57	56,72	+0,31
Feb. 5	56,88	+0,46	57,68	+1,57
7	57,33	+0,91	58,11	+1,70
11	57,12	+0,70	57,88	+1,77
14	56,14	−0,28	56,85	+0,44
15	55,94	−0,48	56,63	+0,22

Table VI. Dublin Circle.	Ann. Var. 1815.	No. of Observations.	Jan. 1.	Mean N. P. D.	Reduction to 1819.	Mean N. P. D. Jan. 1, 1819.	
Polaris.	″ −19,474	62 above, 74 below	1811	*1 ° ′ ″ 1 42 0,80	′ ″ −2 35,79	° ′ ″ 1 39 25,01	from Ob. 1809-1813
				- - - -	- - - -	*3 1 39 25,05	from Ob. 1818-1821
Arcturus	+18,990	77	1811	*1 69 49 40,95	+2 31,92	69 52 12,87	from Ob. 1809-1813
		40	1814	*2 69 50 38,57	+1 34,93	13,40	from Ob. 1814
		259	- - -	- - - - - - -	- - - -	*3 13,66	from Ob. 1818-1821
α Lyræ	− 2,984	126	1811	*1 51 23 6,65	− 23,87	51 22 42,78	from Ob. 1809-1813
		40	1814	*2 51 22 57,93	− 14,92	43,01	from Ob. 1814
		227	- - -	- - - - -	- - - -	*3 42 84	from Ob. 1818-1821
α Aquilæ	− 9,033	76	1811	*1 81 37 17,30	−1 12,26	81 36 5,04	from Ob. 1809-1813
		45	1814	*2 81 36 50,34	45,19	5,15	from Ob. 1814
		320	- - -	- - - - - - -	- - - -	*3 5,11	from Ob. 1818-1821
α Cygni	−12,580	47	1812	*1 45 23 10,77	−1 28,06	45 21 42,71	from Ob. 1810-1813
		22	1814	*2 45 22 45,44	1 2,91	42,53	from Ob. 1814
		142	- - -	- - - - - -	- - - -	*3 42,30	from Ob. 1818-1821

*1 Trans. R. I. Acad. Vol. XII. p. 48-64.

*2 ——————— p. 119-125.

*3 Phil. Trans. 1821.

Explanations of, and Remarks relative to, the preceding Tables.

Table I. contains the difference of polar distances of γ Draconis and α Lyræ, reduced to January 1, 1815, from observations with the Greenwich mural circle, of *both* stars on *each* of 337 days from 1812 to 1816 inclusive. In the years 1812 and 1813 six microscopes were used, afterwards only two.

The greatest arc is that of September 16, 1816, and the least, that of July 21, 1812.

The former - - -	= 12° 53′ 52″,67.
The latter - - -	= 12 53 45 ,95.
The mean of 337 Observations	= 12 53 49 ,30.

Table II. contains the differences from the Greenwich observations of the polar distances of α Lyræ and Polaris, reduced to January 1, 1815, for three winters, together with the difference by the standard catalogue.

These arcs are discordant among themselves, and the last of them singularly differs from the standard catalogue.

The latter part of this Table exhibits the arcs when both stars were observed on the same day, in the winter 1815-1816. It is conceived there is no reason to expect that the arc, exceeding 150°, between the direct and reflected images of α Lyræ, can be more exactly measured than the arc, about 50°, between Polaris and α Lyræ.

Table III. The great irregularities that take place in the readings of the microscopes of the Greenwich circle, when there appears to be no cause for such, are very remarkable.

Part (1) of Table III. exhibits the difference between the microscope A and each of the other microscopes, on every other day, when α Lyræ was observed from July, 1813, to February, 1814.

The numbers in the *same* vertical column ought to have been equal had no derangements taken place. The index equation = — 0″,45, is stated to have been constant between July and November 1. Between November 1, and February 25, it increased gradually to —3″,60. But the discordances in each of the vertical columns seem not to have relation to the changes of the index equation; on the contrary the alterations, that appear to have taken place, when the index equation is supposed to have remained the same, are as great as when it was changed.

It may be said, if the relative positions of the microscopes remained the same for the day, no inconvenience could arise from their changing from one day to another. But what are the causes of these changes? How can the accuracy of an instrument be relied on, or be estimated, that admits of such changes? Besides, if we examine, the relative positions do not appear to remain the same for even a day, (2) (3) (4) exhibit the state of the differences for three several days: one in summer, one in autumn, and one in winter. Such discordances, it is true, are not found here as in (1) but they are much greater than could have been expected or ought to be. It may perhaps be supposed that *these* arise from errors of division, but it is not likely that errors of division have any great influence. Indeed it is probable that this instrument is more accurately divided than any one that has ever been constructed.

Table IV. This Table is constructed from observations of α Lyræ made with the Dublin circle. It exhibits the state of the side microscopes compared with the bottom microscope for about eight months (one season of the observations of α Lyræ.)

The readings from which these are deduced are given in my paper on solar nutation, printed for the XIVth Volume of the Transactions of the Royal Irish Academy, and of which paper copies have been for some time in the hands of several persons.

In part (1), the second column marked WL (meaning face of the circle west and left hand microscope) contains the differences between the bottom microscope and the left hand microscope for each day. The column marked WR contains the difference between the bottom and right hand microscope. The fourth column, WM, contains the mean of these differences for each day. These second and third columns show a great steadiness during such a length of time. There are no sudden changes, such as we meet with in the Greenwich circle. Nothing, I conceive, can be more remarkable than the contrast in this respect between the two instruments. In the Dublin circle, when a change appears to take place, it comes on gradually.

From the construction and manner in which the Dublin circle is supported, it is to be expected that changes may take place of the relative positions of the two microscopes to the bottom microscope, while the *mean* of the two microscopes will still preserve the same relation to the bottom microscopes. This is shown most satisfactorily in column 4, marked WM.

Part (2) contains the comparison of the microscopes when the face of the circle was east. The same consistency appear here as when the face was west. No stronger proof of the excellence of the Dublin instrument can be required than is exhibited by the columns WM and EM.

Considering the manner in which the microscopes are placed on the two instruments, theory must be in favour of the superior steadiness of those of the Greenwich instrument, but experience teaches us quite otherwise.

The last column of part (2) of this Table will, I conceive, appear highly worthy of attention. It is half the sum of the columns WM and EM, and therefore is the difference for *each* day between the zenith distances determined by the bottom microscope, and by the mean of the side microscopes.

It shows that the different temperatures of winter and summer do not operate a change in the figure of the circle, at least in an arc of 14°, and so in this respect can have no reference to the parallax of *α* Lyræ.

The same column also shows the great exactness of the readings, the very few instances of discordances in the column may be either attributed to slight temporary derangements in the microscopes, as is evidently shown, September 12, in column WR, or to the small errors of reading lying so as to appear with an accumulated effect.

If B, L, R represent the readings of the bottom, left, and right hand microscopes, when the face of the circle is west, and B′ L′ R′ the same when the face is east; the quantity in the last column of this Table, part (2) =

$$\frac{1}{2}\left(B - \frac{L+R}{2} + B' - \frac{L'+R'}{2}\right) = \frac{B+B'}{2} - \frac{1}{2}\left(\frac{L+L'}{2} + \frac{R+R'}{2}\right) =$$

the mean of the differences between the zenith distance by the bottom and each of the side microscopes respectively.

It will seldom happen for other stars that the number in the last column will be so very small. But the equality of the numbers is the circumstance to be reckoned on here, not their magnitude.

Table V, column 1, contains the mean Z. distance of α Lyræ, reduced to January 1, 1819, from each days observation with the Dublin circle, between July, 1821, and February, 1822, in which, besides the usual equations, the equation for parallax (const. 1″,1) is used, and also the constant of aberration is taken = 20″,35, conformably to the results in my paper on solar nutation, above referred to.

Column 2 contains the difference between this and the mean zenith distance 14° 45′ 56″,42.

Column 3 contains the mean zenith distance uncorrected for parallax, and taking the aberration = 20″.25.

Column 4 contains the difference between the 3rd column and the mean 14° 45′ 56″,41.

Table VI. contains the mean places of several stars obtained at different periods. These stars having been very frequently observed in consequence of the investigations about parallax, show the consistency of the instrument at these different periods.