ROYAL OBSERVATORY, GREENWICH.

APPENDIX I.

ON THE VALUE OF THE MOON'S SEMIDIAMETER

AS OBTAINED BY

THE INVESTIGATIONS OF HUGH BREEN, Esq.,

FROM

OCCULTATIONS

OBSERVED AT

CAMBRIDGE AND GREENWICH.

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In consequence of a suggestion by myself, arrangements were made by the Lords Commissioners of the Admiralty with Hugh Breen, Esq. (formerly Assistant of the Royal Observatory, Greenwich), for the discussion of occultations of stars, &c., by the Moon, observed at Cambridge and Greenwich (which had already been reduced to an advanced stage), with the view of deriving from them the amount of difference between the Moon's Semidiameter as observed in occultations and the Moon's Semidiameter as inferred from wire observations of the bright limbs made under appropriate circumstances. The papers containing the details of calculation were placed by their Lordships in my hands; some few being in the first instance omitted, which were afterwards in great measure supplied to me by Mr. Breen. A short Introduction was also prepared by Mr. Breen.

On examining these papers, I found that much labour was necessary for acquiring sufficient familiarity with the steps of the process in different parts of the work. I found also that, upon severe examination of the introductory calculations made at the Royal Observatory of Greenwich, (an examination for which I am indebted to E. J. Stone, Esq.) various anomalies were removed, which greatly altered the character of the conclusions. On balancing the different causes of uncertainty, I thought it desirable to suppress some series of observations. And, on consideration of the results as thus purified, it was evidently desirable to introduce a new classification of the numbers inferred from the individual observations. When these difficulties had been surmounted and these changes had been made, it appeared that better justice could be done to the subject generally and to Mr. Breen's labours on it, by preparing a new Introduction, than by modifying that which was already drawn up.

I have only to add here that it will appear, in the description of the process, that great judgment has been exercised by Mr. Breen in the adoption of methods of treating the observations. In regard to accuracy, I have not examined every part, but I have necessarily examined many parts, and in these I have scarcely found an error.

1. The observation of an occultation determines that, at a certain noted time, the Right Ascension and North Polar Distance of the star, &c., were the same as the apparent right ascension and north polar distance of one point on the Moon's apparent limb. By a process which is explained in the Introductions to the volumes of *Greenwich Observations*, from the Right Ascension and North Polar Distance of the star, the Geocentric Right Ascension and North Polar Distance of a fictitious star (being the same as the elements of the "corresponding point,") may be found, which fictitious star, to a geocentric observer, would touch the geocentric limb of the Moon at the same instant at which the real star, to the observer on the earth's surface, apparently touches the apparent limb of the Moon. The transference from the elements of the real star to the elements of the fictitious star assumes the knowledge of the Moon's parallax.

2. With the two elements for the fictitious star and the two elements for the Moon's center, the angular distance of the fictitious star from the Moon's center may be computed; but this distance will be affected by multiples of the possible errors of the two elements of the fictitious star, and therefore by multiples of the errors of Right Ascension and North Polar Distance of the real star and also by a multiple of the error of assumed Moon's parallax; it will likewise be affected by multiples of the errors of tabular Right Ascension and North Polar Distance of the Moon's center. In addition, it will be affected by a multiple of the error of the noted time (as influencing the computation of tabular elements of the Moon's center, and as influencing the position of the heavens on which the resolved effects of parallax depend); but this consideration will scarcely enter in the present investigation, in which no attempt is made to alter the times of observation as noted.

3. Every occultation which has been observed under my superintendence at the Observatory of Cambridge and the Royal Observatory of Greenwich has been treated in conformity with the principles just described. A value is thus obtained for the geocentric distance of the fictitious star from the Moon's geocentric center (which we may call the computed distance), together with terms showing each of the numerical factors multiplying each of the symbols which represent the errors above mentioned.

If the elements of the Moon and Star, including the Moon's tabular semidiameter, were perfectly correct, the computed distance would be the same as the tabular semidiameter. If the elements are incorrect but if their errors are known, then the computed distance, together with the additional terms mentioned, will be the true occultation semidiameter; putting then e, f, for the numbers of seconds of arc which ought to be added to the assumed R.A. and N.P.D. of the Star; x, y, the similar additions due to the tabular R.A. and N.P.D. of the Moon's center; and supposing that the assumed parallax ought to be multiplied by $(1+\frac{m}{1000})$; each occultation gives an equation of this form:—

True Occultation Semidiameter = computed distance + $Ae + Bf + Cx + Dy + Em$: and therefore,

True Occultation Semidiameter − Tabular Semidiameter =
−(Tabular Semidiameter − computed distance)
$+Ae+Bf+Cx+Dy+Em.$

The quantity within the bracket is that on the left side of the equations printed in the *Cambridge Observations* and *Greenwich Observations;* and the remaining quantity is the collection of terms on the right side of those equations; omitting that which depends on error of time (as not needed here), and that which depends on error of semidiameter (as included in the first side of our equations here).

4. The occultations selected by Mr. Breen for examination in reference to the value of inferred semidiameter were those observed at Cambridge from 1830 to 1835 (during my superintendence of the Cambridge Observatory) and those observed at Greenwich from 1836 to 1860; a selection of which I recognize the entire propriety.

5. First it was necessary to decide on the class of objects whose occultations ought to be included in the list for computation. The occultations of planets are treated by me, in the *Cambridge* and *Greenwich Observations*, in the same manner as those of stars; and great progress was made by Mr. Breen in their further reduction; but on consideration of the uncertainty (in some cases) of their daily places, the uncertainty of semidiameters, the difficulty of correction for phase, and the general rudeness of the observation, I have thought it best to reject the occultations of planets entirely.

6. In four instances occultations were rejected because no sufficient elements could be found for the star places; namely, 1848, June 6, 10 Sextantis; 1858, May 18, W.B. IX. 1296; 1859, May 8, Lalande $\frac{17237}{17238}$; and 1860, February 28, Rümker 963.

7. But the great cause for the rejection of observations is the want of adequate observations for correcting the tabular place of the Moon's center (or for giving the numerical values of x and y). Mr. Breen adopted the principle that no occultation was to be retained unless meridional observations (or, in late years, altazimuthal observations) of the Moon could be found on the same day at Greenwich, Madras, Cambridge, or Edinburgh. As giving a simple rule, this is an excellent practical principle. In one instance I have departed from it (1856, September 20, where I have taken the mean of meridional values of x and y for September 19 and September 21), and I think it possible that a similar departure might have been made with advantage in a few other cases; but on the whole I am perfectly satisfied with Mr. Breen's rule. The number of occultations lost from this cause is fifty-one.

8. After all rejections, the number of available occultations of every class is 321. Of these, twenty-five appear to be affected with some unexplained errors, leaving 296 fit for use.

9. For determining the corrections e and f to the assumed places of the stars, the following were the authorities adopted by Mr. Breen :—

The First Cambridge Catalogue, printed in the *Royal Astronomical Society's Memoirs*, vol. xi. The R.A.'s of this catalogue are all to be diminished by $0^{s}\cdot07$ to make them comparable with those of the other catalogues (see *Royal Astronomical Society's Memoirs*, vol. xvii. p. 5.)

The Greenwich Catalogue of 1439 Stars. This was first printed separately as Appendix to the *Greenwich Observations* 1842, but was subsequently reprinted as part of the *Greenwich Twelve-year Catalogue*, which was attached as Appendix to the *Greenwich Observations* 1847. In the tabular statement which follows this Introduction, the expression "Gr. 1439" is used for the 1439-Star Catalogue, as occupying the *first* column of elements (R.A. or N.P.D.) in the *Twelve-year Catalogue*.

The Greenwich Twelve-year Catalogue. The expression "Gr. 12-yr" is used to denote the *second* column of elements (R.A. or N.P.D.) in the *Twelve-year Catalogue*.

The Greenwich Six-year Catalogue. This is attached as Appendix to the *Greenwich Observations* 1854.

The annual Catalogues in the *Greenwich Observations* 1855 *to* 1860.

These catalogues have been combined as far as appeared necessary for each star, as is stated in the first Table which follows. The total number of observations employed is never less than five, and is generally much greater. The mean place of each catalogue is brought up to the commencement of the year of occultation by the precession of the *British Association Catalogue* and the proper motions given by Mr. Main in the *Royal Astronomical Society's Memoirs*, vols. xix and xxviii. Only for the N.P.D. of the First Cambridge Catalogue, the observations of which are nearly synchronous with the occultations in which they are used, no proper motions are applied. The results thus obtained from different catalogues are combined with weights proportionate to the number of observations on which they are founded.

The corrections to the place for the day of occultation are computed by the formulæ $Aa + Bb + Cc + Dd$, $Aa' + Bb' + Cc' + Dd'$, using the numbers which are given in the *Nautical Almanac* and the *British Association Catalogue*. These being applied to the mean places at beginning of the year, the true apparent elements for the day of occultation are found.

From the true apparent R.A. converted into arc, is subtracted the assumed R.A. of the star which is given in the section "Calculation of Occultations" in the *Cambridge Observations* and *Greenwich Observations*, and the remainder in seconds of arc is e. From the true apparent N.P.D. is subtracted the assumed N.P.D. of the star in the same section, and the remainder is f.

There is no variation in this process throughout the whole work.

10. The process for determining x and y is more varied. It is necessarily founded upon a comparison of the observed meridional places of the Moon with the tabular

meridional places of the Moon; the altazimuth results being also used from 1847, June; assuming that the errors thus determined at the time of Moon's transit or altazimuth observation will be sensibly accurate at the time of the occultation. The observed meridional or altazimuth places must be referred, as to equinox, to the same system of catalogues as the Star-places already mentioned. The tables used for computing the tabular meridional places in each year must be the same as the tables used in the same year for computing the assumed places of the Moon's center in the "Calculation of Occultations" in the printed *Cambridge* and *Greenwich Observations*: these tables are those of the *Berliner Jahrbuch* to 1833, and those of the *Nautical Almanac* from 1834 to 1860.

11. The meridional and altazimuth places of the Moon, as observed at Greenwich, are computed on a nearly uniform system in the *Reduction of the Greenwich Lunar Observations* 1750 *to* 1830, and the *Reduction of the Greenwich Lunar Observations* 1831 *to* 1851, the right ascensions being referred to the equinox of Bessel's *Tabulæ Regiomontanæ*, which is sensibly the same as that of the catalogues above mentioned. It is, however, to be remarked that the Right Ascension or North Polar Distance which is observed with the meridional or other instrument is that of a limb; and that a numerical semidiameter computed from the lunar tables must be applied to the R.A., and a computed parallax as well as semidiameter must be applied to the N.P.D., in order to obtain what is called the observed R.A. and N.P.D. of center, for comparison with the tabular place of center. As far as 1839, the parallax used was Plana's, and the semidiameter was computed by use of a factor (corresponding well with the mean of observed semidiameters), by which Plana's parallax was multiplied. But Mr. Breen thought it desirable, in order to obtain the best possible result, to reduce the parallax corrections and semidiameter corrections to what they would have been if Adams' parallax had been used, with the same factor for semidiameter. Accordingly the difference of parallaxes was computed by use of the formula given by Professor Adams in the *Monthly Notices of the Royal Astronomical Society*, vol. xiii., page 264. The right ascensions of the *Greenwich Lunar Reductions* are corrected with great regularity, as far as 1839, by the quantity $\frac{0\cdot273}{14} \times$ correction of Plana's parallax, with its appropriate sign, according as 1 L. or 2 L. was observed. The North Polar Distances are corrected for the direct effects of the change of parallax, but not for the change of semidiameter. I know not why the latter correction was omitted; it is, however, not important in any single instance, and is totally insensible in the mean of several observations.

12. From 1840 to 1851, Professor Adams' parallaxes and the derived semidiameters are used in the *Greenwich Lunar Reductions*; and the observed places of that work, both meridional and altazimuthal, are used without alteration.

13. From 1852 to 1855, the places computed in the *Greenwich Observations* 1856, Introduction, pages xcii to cviii, are tacitly employed (the errors of tables therein

mentioned being used). From 1856 to 1860 the places given in the printed *Observations* are used without alteration. The fundamental catalogues of stars used for these reductions are the same as those above-mentioned by which e and f are determined.

14. None of the tabular places of the *Greenwich Lunar Reductions* (which were computed from Plana's theory) have been used. As far as 1833 the tabular places are interpolated with fourth differences from the *Berliner Jahrbuch*, and for 1834 and 1835 they are similarly interpolated from the *Nautical Almanac*. From 1836 to 1860 the tabular places are already given in the *Greenwich Observations*, as derived from the *Nautical Almanac*.

15. The adoption of numbers corresponding to the observations at Cambridge and Edinburgh (when no observations were made at Greenwich) has been guided by the same principles. The elements are taken from the printed *Cambridge Observations* and *Edinburgh Observations*.

16. For the supplementary observations at Madras, the numbers are taken without alteration from Mr. Breen's Reduction of the Madras Observations in the *Memoirs of the Royal Astronomical Society*, vol. xxxi., page 253, &c. The author had the Greenwich Catalogues in view in making those reductions.

17. It will appear from this statement that the observed R.A.'s of the Moon have been referred to the same equinox as the places of the stars occulted; and that the same lunar tables have been used in computing tabular places for comparison with the meridional and altazimuthal observations on the one hand, and for computing the assumed place of Moon's center in the occultation calculations on the other hand. The excesses of the observed R.A. and N.P.D. above the tabular R.A. and N.P.D. are therefore the proper quantities to be used for x and y; and they are so used in the following tables.

18. When there are satisfactory observations both with the meridional instrument and with the altazimuth at Greenwich, the means of the resulting values of x and of y are used. When observations are obtained with only one, its result is used alone.

19. It is now necessary to allude to the numerical value of m. Its symbolical value is $\frac{1000 \times (\text{True Parallax}—\text{Assumed Parallax})}{\text{Assumed Parallax.}}$. Understanding that Adams' Parallax is the true parallax, and remarking that the parallax used in the "Calculation of Occultations" is that of the *Berliner Jahrbuch* from 1830 to 1833, and that of the *Nautical Almanac* from 1834 to 1860, and that Burckhardt's formulæ were used in the *Berliner Jahrbuch* and in the *Nautical Almanac* to the end of 1853, (reduced, however, to Adams' Parallax in the *Greenwich Observations* for 1853,) this formula becomes $\frac{1000 \times \text{Excess of Adams' Parallax above Burckhardt's Parallax}}{\text{Burckhardt's Parallax.}}$, to be used to the end of 1852. In the *Monthly Notices of the Royal Astronomical Society*, vol. xiii., page 263, Professor Adams has given the formula for the "Excess of Adams' Parallax above Burckhardt's Parallax;" and Mr. Breen has used it to compute the

numerical value of the "Excess" for every day from 1831 to 1839, in a Table forming the Appendix to the Nautical Almanac 1867. I have not received all the papers necessary for verifying these calculations, but I do not doubt their accuracy. For the years subsequent to 1839 the numerical value of the "Excess" is given in the *Nautical Almanac* 1856, Supplement. From these numbers the value of m is computed by the formula above to the end of 1852. In 1853 Adams' Parallax is used in the *Greenwich Observations*, and after 1853 in the *Nautical Almanac*, and the value of m is therefore 0.

20. The numerical values of the five quantities e, f, x, y, m, are now obtained for every occultation, and it only remains to substitute them in the expression $A \times e + B \times f + C \times x + D \times y + E \times m$, for which the numerical values of A, B, C, D, E, are given in the "Calculation of Occultations" in the *Cambridge* and *Greenwich Observations*. The whole of the papers containing this operation are placed in my hands, and the work appears to be very accurate. This substitution gives immediately, for each occultation, the numerical value of "Inferred Semidiameter —Tabular Semidiameter." These numbers are given in the second table which follows this Introduction, in the column headed "Correction to assumed Semidiameter."

21. It is now necessary to refer this correction to *one* finally-assumed semidiameter. At my request, Mr. Stone has with great care examined the various alterations that have been made, either in the *Nautical Almanac*, or in the addition of numbers in the daily reductions at Greenwich to the values of the *Nautical Almanac*. The result for the mean assumed semidiameters is as follows:—

From 1830 to 1852, it is	15′. 32″·09.
In 1853	15′. 34″·68.
In 1854 and 1855	15′. 35″·40.
In 1856	15′. 34″·61.
From 1857 to 1860	15′. 34″·68.

The last of these, being regarded as a very certain determination of the Moon's semidiameter as viewed with the Greenwich instruments, is taken as the "finally-assumed" or "finally-adopted telescopic" semidiameter. To find the relation of the "inferred semidiameter" or "occultation semidiameter" to this "finally-adopted telescopic semidiameter" we must apply the following numbers to the "Correction to assumed Semidiameter:"—

From 1830 to 1852	− 2″·59.
In 1853	0″·00.
In 1854 and 1855	+ 0″·72.
In 1856	− 0″·07.
From 1857 to 1861	0″·00.

Thus the "Correction to adopted Semidiameter" in the second table is formed. The numbers in that column from beginning to end are strictly comparable.

22. A very slight consideration of the circumstances of observation, as well as an examination of the results, showed that it was necessary to divide them under the

heads of "Disappearances of Stars at the Dark Limb," "Disappearances of Stars at the Bright Limb," "Reappearances of Stars at the Dark Limb," "Reappearances of Stars at the Bright Limb," as entitled to different degrees of credit. And it soon appeared necessary to separate some, as affected by large errors, either in part explained by remarks in the Observations, or of which no account can be given. All results, however, good or bad, are placed before the reader.

23. The means of results are as follows :—

Disappearance of Stars at the Dark Limb.

Mean correction to "finally adopted Telescopic Semidiameter," from 132 Observations . . . . . — 2″·00

No Observations are separated.

Disappearance of Stars at the Bright Limb.

Mean correction to "finally adopted Telescopic Semidiameter," from 51 Observations . . . . . — 0·60

Four Observations are separated.

Reappearance of Stars at the Dark Limb.

Mean correction to "finally adopted Telescopic Semidiameter," from 64 Observations . . . . . — 2·40

Ten Observations are separated.

Reappearance of Stars at the Bright Limb.

Mean correction to "finally adopted Telescopic Semidiameter," from 49 Observations . . . . . + 1·51

Eleven Observations are separated.

24. Of these means, the first and third are (from the nature of the observation) very far superior to the second and fourth, and the first is greatly preferable to the third. We cannot be sensibly in error in saying that the Moon's Occultation Semidiameter is less than the Moon's Telescopic Semidiameter by 2″·0. The second and fourth classes (as might *a priori* be expected) give an Occultation Semidiameter larger than that of the first and third classes.

25. The origin of this difference of 2″·0 is to be sought, as it appears to me, in one of two causes. Either it is due to irradiation of the Telescopic Semidiameter, and I do not doubt that a part at least of the 2″·0 is to be ascribed to that cause; or it may be due to refraction by the Moon's atmosphere. If the whole 2″·0 were caused by atmospheric refraction, this would imply a horizontal refraction of 1″·0, which is only about $\frac{1}{2000}$th part of the earth's horizontal refraction. It is possible that an atmosphere competent to produce this refraction would not make itself visible in any other way.

26. The only other investigations with which I am acquainted, which bear in any way upon the determination of the diameter of the unilluminated Moon, are those

founded upon measures of differences of R.A. of various parts, and differences of N.P.D. of various parts, in large eclipses of the Sun. Measures of this kind were made by me at Cambridge with the 4-inch equatoreal in the eclipse of 1833, (discussed in the *Memoirs of the Astronomical Society*, vol. viii.); these give, as correction to Burckhardt's Semidiameter, $-4''\cdot21$, or to Adams' Semidiameter, $-6''\cdot80$. Measures of the same kind were made at Greenwich in the eclipses of 1836; 1845, and 1846 (imperfectly); and 1860. In those of 1836 the discordances of comparable measures and other circumstances show that the results are not worthy of the slightest confidence; but those of 1860 were made with a very sharply-defining telescope of 12 inches aperture, very firmly mounted, and with the order of personal co-operation carefully arranged. The correction deduced from this eclipse is $-2''\cdot97$. It will be remembered that in these investigations the observations have been so planned and the equations so formed that the corrections to Semidiameters of Sun and Moon are exhibited as separate quantities; and there is no doubt that the correction found for the Moon's Semidiameter belongs only to the Moon's Semidiameter under the circumstances of observation. Remarking that, in these observations, where the Moon is dark, the effect of irradiation and telescope-fault is to make the Moon's diameter too small, and more so for the less perfect telescope, these results, especially the last, may be considered as distinctly harmonizing with that deduced from the occultations.

Mr. De La Rue, from his photographs taken during the eclipse of 1860, obtained the following corrections to the Telescopic Semidiameter:—

By the differences between observed and tabular distances of centers, deduced from the measurements of the distances of peripheries and of the measures of cusps of *all* the photographs	$-2''\cdot1$
By the times of first and last contact deduced from the measurements of the distances of the peripheries in the photographs taken near these epochs	$-2''\cdot2$
By the times of first and last contact deduced from the measurements of the distances of the peripheries *and of the cusps* in the photographs taken near these epochs	$-1''\cdot0$

In these, however, it is assumed that the discordance from tabular values is to be divided proportionally; the lunar semidiameter being derived from a value assigned to the micrometer-scale in accordance with the tabular value of the Sun's semidiameter. The ratio between solar and lunar semidiameters in the photographs agreed with the calculated ratio. If the Sun's tabular semidiameter were assumed to be free from error, the correction attributable to the Moon's would (as I understand) be increased. Though this consideration throws some doubt on the conclusion, yet there can be no doubt that the general result agrees in sign, and perhaps nearly in quantity, with that obtained from the occultations.

G. B. AIRY.

The errors in the preliminary reductions of occultations, discovered in the course of these investigations, are given in the Errata printed in this volume of *Observations*, 1864.

TABLE I.—FORMATION OF ELEMENTS TO BE SUBSTITUTED IN THE EQUATIONS

Year and Day.	Name of Star occulted.	Phenomenon.	Authority for Place of Star.	Value of e	Value of f
1830.					
January 5	75 Tauri	D D	First Camb., Gr. 12-yr.	− 0·45	+ 1·90
	A.S.C. 516 (Brad. 619)	D D, R B	First Camb., Gr. 12-yr.	+ 1·20	+ 4·74
	Aldebaran	D D	First Camb.	− 2·70	+ 4·64
March 3	u Geminorum (26)	D D	First Camb., Gr. 1439, Gr. 12-yr.	+ 1·65	+ 2·10
April 5	τ Leonis	D D	First Camb., Gr. 1439	+ 3·90	+ 4·19
1831.					
January 26	f Geminorum	D D	First Camb., Gr. 1439, Gr. 12-yr.	− 0·90	+ 3·72
October 21	ξ^2 Ceti	D B, R D	First Camb., Gr. 12-yr.	− 6·90	− 0·53
October 23	θ^1 Tauri	D B	First Camb., Gr. 1439, Gr. 6-yr.	+ 7·05	+ 5·61
	θ^2 Tauri	D B, R D	First Camb., Gr. 6-yr.	+ 0·45	+ 8·05
	75 Tauri	D B, R D	First Camb., Gr. 1439, Gr. 12-yr.	− 0·45	+ 1·93
	Aldebaran	D B, R D	First Camb.	− 3·15	+ 4·77
December 22	Regulus	D B	First Camb.	− 4·05	+ 3·64
1832.					
January 25	γ Libræ	D B, R D	First Camb., Gr. 1439	− 4·50	+ 7·72
February 10	Aldebaran	D D, R B	First Camb.	− 2·55	+ 4·63
March 8	Aldebaran	D D	First Camb.	− 2·55	+ 4·62
1833.					
September 6	i Tauri	D B, R D	First Camb., Gr. 1439, Gr. 12-yr.	+ 6·75	+ 4·99
November 25	A. S. C. 350 (Piazzi III. 4)	D D, R B	First Camb.	+ 0·60	+ 0·81
December 21	A. S. C. 214 (Piazzi I. 225)	D D	First Camb.	+ 5·25	+ 1·88
December 31	ν Virginis	D B, R D	First Camb., Gr. 1439	+ 2·10	+ 1·64
1834.					
January 22	O^2 Tauri (141)	D D	First Camb., Gr. 12-yr.	+ 5·40	+ 3·56
February 24	ν Virginis	R D	First Camb., Gr. 1439	+ 1·95	+ 2·13
March 16	i Tauri	D D	First Camb., Gr. 1439, Gr. 12-yr.	+ 3·75	+ 1·83
April 20	ν Virginis	D D, R B	First Camb., Gr. 1439	+ 1·80	+ 2·18
April 24	ζ^2 Libræ	R D	First Camb., Gr. 1439, Gr. 12-yr.	+ 0·15	+ 3·49
July 15	ζ^1 Libræ	D D	First Camb., Gr. 12-yr.	− 4·05	+ 6·54
July 21	ϕ Capricorni	D B, R D	First Camb.	+ 2·55	+ 1·44
September 14	ε Capricorni	D D, R B	First Camb., Gr. 1439	− 1·50	+ 2·76
December 8	τ Piscium (30)	D D	First Camb., Gr. 1439, Gr. 12-yr.	+ 0·30	+ 1·67
1835.					
February 4	ξ^1 Arietis	D D	First Camb., Gr. 12-yr., Gr. 6-yr.	+ 3·90	+ 0·83
February 19	ω^2 Scorpii	R D	First Camb., G. 1439, G. 12-yr., G. 6-yr.	+ 0·15	+ 3·59
April 6	κ Geminorum	D D, R B	First Camb., Gr. 1439	+ 1·05	+ 2·26
December 4	τ Tauri	D B	First Camb., Gr. 1439, Gr. 12-yr.	+ 0·75	+ 2·13
December 10	η Leonis	D B, R D	First Camb., Gr. 1439, Gr. 12-yr.	+ 0·30	+ 1·50

GIVEN BY THE OCCULTATIONS OBSERVED AT CAMBRIDGE.

Authority for Observed Meridian Place of Moon.	Authority for Tabular Meridian Place of Moon.	Value of x	Value of y	Value of m
Greenwich Lunar Reductions corrected for parallax and semidiameter	Berliner Jahrbuch	− 7·95	− 0·27	+ 0·315
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
,,	,,	− 6·30	+ 2·31	+ 0·792
,,	,,	+ 3·60	+ 7·25	+ 0·760
Gr. Lu. Red. corr. for paral. and semid.	Berliner Jahrbuch	− 9·60	+ 2·08	+ 0·410
,,	,,	− 7·80	+ 2·88	+ 0·328
,,	,,	− 10·65	+ 3·46	− 0·238
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
,,	,,	− 4·65	+ 4·77	− 0·147
Gr. Lu. Red. corr. for paral. and semid.	Berliner Jahrbuch	− 6·30	− 5·23	+ 0·397
Madras Red. in R.A.S. Mem.	Berl. Jahrb. in Mad. Red.	− 2·10	+ 6·28	− 0·034
Gr. Lu. Red. corr. for paral. and semid.	Berliner Jahrbuch	+ 4·80	− 0·41	+ 0·698
Camb. Obs. corr. for paral. and semid.	Berl. Jahrb. in Camb. Obs.	− 8·10	+ 4·61	+ 0·787
Gr. Lu. Red. corr. for paral. and semid.	Berliner Jahrbuch	− 3·15	+ 3·56	− 0·074
,,	,,	− 7·05	+ 2·91	− 0·203
,,	,,	− 15·60	− 3·53	+ 0·791
Gr. Lu. Red. corr. for paral. and semid.	Nautical Almanac	− 8·70	+ 8·73	+ 0·165
Madras Red. in R.A.S. Mem.	Naut. Alm. in Mad. Red.	− 15·00	− 2·43	+ 1·697
Camb. Obs. corr. for paral. and semid.	Naut. Alm. in Camb. Obs.	+ 1·20	− 3·03	− 0·010
Gr. Lu. Red. corr. for paral. and semid.	Nautical Almanac	− 9·45	+ 5·92	− 0·035
,,	,,	− 5·25	+ 5·50	+ 0·861
,,	,,	− 7·35	+ 0·86	+ 0·707
,,	,,	− 9·00	− 4·73	+ 0·508
,,	,,	− 7·20	− 1·58	+ 0·379
,,	,,	− 4·95	+ 3·91	− 0·052
Gr. Lu. Red. corr. for paral. and semid.	Nautical Almanac	− 2·70	+ 1·90	+ 0·523
Camb. Obs. corr. for paral. and semid.	Naut. Alm. in Camb. Obs.	− 7·05	− 11·02	+ 0·728
Gr. Lu. Red. corr. for paral. and semid.	Nautical Almanac	− 0·75	+ 8·67	+ 0·089
,,	,,	− 4·80	+ 0·77	+ 1·036
,,	,,	+ 2·55	− 1·80	+ 0·497

TABLE I. (*continued.*)—FORMATION OF ELEMENTS TO BE SUBSTITUTED IN THE

Year and Day.	Name of Star occulted.	Phenomenon.	Authority for Place of Star.	Value of *e*	Value of *f*
1836.					
January 12	α^1 Libræ	D B : R D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 1·05	+ 2·75
	α^2 Libræ	D B	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 2·70	+ 3·09
March 6	λ Virginis	D B : R D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 5·10	+ 2·72
April 25	η Leonis	D D : R B	Gr. 1439, Gr. 12-yr.	− 2·05	+ 2·06
May 26	θ Virginis	D D	Gr. 1439	− 3·75	+ 2·10
May 29	δ Scorpii	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 1·50	+ 3·76
June 29	ω Sagittarii	R D	Gr. 1439	− 0·90	+ 1·51
	a Sagittarii	D B	Gr. 1439	− 3·45	+ 3·08
July 23	δ Scorpii	D D : R B	Gr. 1439	− 1·35	+ 3·75
September 1	A^1 Tauri	D B	Gr. 1439	− 0·15	+ 2·36
1837.					
March 26	σ Scorpii	D B : R D	Gr. 1439	− 2·40	+ 4·79
August 18	10 Ceti	R D	Gr. 1439, Gr. 12-yr.	+ 1·95	+ 4·29
August 21	δ Arietis	D B	Gr. 1439	− 0·30	+ 1·36
September 14	27 Piscium	D B : R D	Gr. 1439	− 2·40	+ 1·42
November 7	ψ^1 Aquarii	D D : R B	First Camb., Gr. 1439	− 0·15	+ 1·35
1838.					
February 4	136 Tauri	D D	Gr. 1439	− 0·45	+ 1·88
March 6	λ Cancri	D D	Gr. 1439	+ 4·35	+ 1·25
April 1	47 Geminorum	D D	Gr. 1439	+ 3·45	+ 0·58
April 12	χ Libræ	R D	Gr. 1439, Gr. 12-yr.	− 1·20	+ 3·58
October 29	25 Piscium	D D	Gr. 1439	+ 5·10	+ 6·15
December 27	9 Tauri	D D	Gr. 1439	− 1·35	+ 3·78
	23 Tauri	D D	Gr. 1439	+ 0·75	+ 1·00
	η Tauri	D D : R B	Gr. 1439	0·00	+ 1·44
	28 Tauri	D D	Gr. 1439	+ 10·20	+ 0·22
	27 Tauri	R B	Gr. 1439	− 0·15	+ 0·82
1839.					
February 23	47 Geminorum	D D : R B	Gr. 1439	+ 3·45	+ 0·77
May 21	τ Leonis	D D : R B	Gr. 1439, Gr. 12-yr.	− 2·55	+ 1·87
May 27	π Scorpii	R B	Gr. 1439	− 2·85	+ 4·90
August 25	96 Aquarii	R D	Gr. 1439, Gr. 12-yr.	− 2·10	+ 1·03
September 23	δ Piscium	D B	Gr. 1439	− 1·65	+ 2·75
September 26	16 Tauri	D B : R D	Gr. 1439	+ 0·30	+ 1·03
	19 Tauri	D B : R D	Gr. 1439	− 1·20	+ 2·30
	20 Tauri	D B : R D	Gr. 1439	− 0·45	+ 0·47
October 19	96 Aquarii	D D	Gr. 1439, Gr. 12-yr.	− 1·95	+ 0·97
1840.					
January 11	δ Piscium	R B	Gr. 1439, Gr. 12-yr.	− 1·65	− 2·78
January 16	135 Tauri	D D	Gr. 1439	− 0·45	+ 1·98
April 11	ν Leonis	D B : R B	Gr. 1439, Gr. 12-yr.	− 2·55	+ 2·38
June 3	η Cancri	D D	Gr. 1439	− 0·90	+ 2·50
October 13	19 Tauri	D B : R D	Gr. 1439	− 1·20	+ 2·39
	20 Tauri	D B : R D	Gr. 1439	− 0·45	+ 0·53
	16 Tauri	R D	Gr. 1439	+ 0·45	+ 1·20
1841.					
August 29	θ Capricorni	D D : R B	Gr. 1439	− 2·55	+ 1·88
December 18	ρ Aquarii	D D	Gr. 12-yr.	+ 0·30	+ 2·00
1842.					
January 23	125 Tauri	D D	Gr. 12-yr, Gr. 6-yr.	+ 1·95	+ 2·52
March 22	c^3 Cancri	D D	Gr. 1439, Gr. 12-yr.	+ 9·60	− 2·33
	c^1 Cancri	D D	Gr. 12-yr.	+ 7·20	− 0·84
October 23	132 Tauri	D B	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 1·80	+ 2·56
November 12	9 Piscium	D D	Gr. 12-yr.	+ 3·45	+ 6·66
	ϵ Piscium	D D	Gr. 1439, Gr. 12-yr.	− 1·35	+ 1·92
November 22	d^2 Cancri	R D	Gr. 12-yr.	+ 5·40	+ 3·43
December 14	47 Arietis	D D	Gr. 12-yr.	+24·30	+ 7·76

EQUATIONS GIVEN BY THE OCCULTATIONS OBSERVED AT GREENWICH.

Authority for Observed Meridian Place of Moon.	Authority for Tabular Meridian Place of Moon.	Value of *x*	Value of *y*	Value of *m*
Greenwich Lunar Reductions corrected for parallax and semidiameter	Nautical Almanac in Greenwich Observations	− 3·90	− 2·01	+ 0·034
,,	,,	,,	,,	,,
,,	,,	− 9·45	− 1·65	+ 0·945
Edinb. Obs. corr. for paral. and semid.	Naut. Alm. in Edinb. Obs.	− 2·70	+ 0·20	− 0·360
Gr. Lu. Red. corr. for paral. and semid.	Naut. Alm. in Gr. Obs.	− 7·95	− 4·94	+ 0·342
Camb. Obs. corr. for paral. and semid.	Naut. Alm. in Camb. Obs.	− 9·75	− 8·16	+ 0·749
Gr. Lu. Red. corr. for paral. and semid.	Naut. Alm. in Gr. Obs.	,,	,,	,,
,,	,,	− 11·25	− 1·87	+ 0·782
,,	,,	− 0·60	+ 2·31	+ 0·276
Gr. Lu. Red. corr. for paral. and semid.	Naut. Alm. in Gr. Obs.	− 5·25	− 8·85	+ 1·060
,,	,,	− 12·60	+ 4·56	+ 0·028
Madras Red. in R. A. S. Mem.	Naut. Alm. in Madras Red.	− 5·40	+ 0·50	+ 0·439
Camb. Obs. corr. for paral. and semid.	Naut. Alm. in Camb. Obs.	− 7·65	+ 7·91	+ 0·912
Gr. Lu. Red. corr. for paral. and semid.	Naut. Alm. in Gr. Obs.	− 4·20	− 0·08	+ 1·166
Madras Red. in R. A. S. Mem.	Naut. Alm. in Madras Red.	− 8·25	+ 0·27	+ 0·010
Madras Red. in R. A. S. Mem.	Naut. Alm. in Madras Red.	− 8·55	− 4·42	− 0·144
Edinb. Obs. corr. for paral. and semid.	Naut. Alm. in Edinb. Obs.	− 4·65	+ 0·70	+ 0·773
Gr. Lu. Red. corr. for paral. and semid.	Naut. Alm. in Gr. Obs.	+ 0·45	− 3·20	+ 1·360
,,	,,	+ 0·30	+ 0·16	+ 1·158
Edinb. Obs. corr. for paral. and semid.	Naut. Alm. in Edinb. Obs.	− 2·70	+ 4·80	+ 0·378
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
Madras Red. in R. A. S. Mem.	Naut. Alm. in Madras Red.	− 10·05	− 0·96	+ 0·418
Edinb. Obs. corr. for paral. and semid.	Naut. Alm. in Edinb. Obs.	− 2·85	+ 4·90	+ 0·974
Edinb. Obs. corr. for paral. and semid.	Naut. Alm. in Edinb. Obs.	+ 5·70	+ 0·85	+ 0·964
Gr. Lu. Red. corr. for paral. and semid.	Naut. Alm. in Gr. Obs.	− 15·60	+ 3·53	− 0·518
Madras Red. in R. A. S. Mem.	Naut. Alm. in Madras Red.	− 1·20	+ 8·88	− 0·200
Gr. Lu. Red. corr. for paral. and semid.	Naut. Alm. in Gr. Obs.	− 15·75	+ 0·79	− 0·563
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
,,	,,	+ 1·20	+ 3·66	+ 0·933
Greenwich Lunar Reductions	Naut. Alm. in Gr. Obs.	− 0·60	+ 0·14	+ 0·741
,,	,,	− 9·60	− 1·32	+ 0·645
,,	,,	− 9·15	− 4·64	+ 0·268
,,	,,	− 13·20	− 5·40	+ 1·070
,,	,,	− 10·64	+ 4·72	− 0·277
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
Greenwich Lunar Reductions	Naut. Alm. in Gr. Obs.	+ 3·90	+ 0·78	+ 0·810
,,	,,	+ 3·45	− 1·24	+ 0·990
Greenwich Lunar Reductions	Naut. Alm. in Gr. Obs.	− 15·90	− 1·71	− 0·327
,,	,,	− 15·00	− 5·74	− 0·937
,,	,,	,,	,,	,,
,,	,,	− 7·20	− 1·10	− 0·132
,,	,,	− 4·20	− 0·27	− 0·087
,,	,,	,,	,,	,,
,,	,,	− 7·85	− 5·01	+ 0·070
,,	,,	− 2·25	− 1·86	− 0·109

TABLE I. (*continued.*)—FORMATION OF ELEMENTS TO BE SUBSTITUTED IN THE

Year and Day.	Name of Star occulted.	Phenomenon.	Authority for Place of Star.	Value of *e*	Value of *f*
1843.					
August 12	9 Piscium	R D	Gr. 12-yr.	+ 3·45	+ 6·81
October 1	*f* Sagittarii	D D	Gr. 12-yr., Gr. 6-yr.	− 2·70	+ 4·48
November 11	ζ Geminorum	D B	Gr. 1439, Gr. 12-yr.	− 1·80	+ 1·25
1844.					
January 2	τ Tauri	D D : R B	Gr. 1439, Gr. 12-yr.	+ 0·60	+ 1·29
March 28	5 Cancri	D D	Gr. 12-yr., Gr. 6-yr.	+ 8·40	+ 4·88
April 1	*c* Leonis	D D : R B	Gr. 1439, Gr. 12-yr.	− 1·50	+ 2·69
August 1	16 Piscium	R D	Gr. 12-yr.	− 1·80	+ 6·33
September 29	ρ^3 Arietis	R D	Gr. 1439, Gr. 12-yr.	+ 4·05	+ 4·76
October 22	9 Piscium	D D	Gr. 12-yr.	+ 3·45	+ 6·80
	κ Piscium	D D	Gr. 1439, Gr. 12-yr.	− 1·20	+ 2·04
1845.					
February 21	14 Sextantis	D D	Gr. 12-yr.	+ 5·70	+ 5·55
March 19	60 Cancri	D D	Gr. 12-yr.	+ 1·50	+ 1·98
August 20	δ Piscium	R D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 0·60	+ 3·15
October 20	E^2 Orionis	R D	Gr. 12-yr.	+ 3·90	+10·21
December 6	λ Piscium	D D	Gr. 1439, Gr. 12-yr.	− 5·70	+ 4·34
1846.					
April 5	A^3 Cancri	D D	Gr. 12-yr.	+ 7·80	+ 7·87
May 11	β^1 Scorpii	D B : R D	Gr. 1439, Gr. 12-yr.	− 0·15	− 0·44
July 5	ν Scorpii	D D	Gr. 1439, Gr. 12-yr.	+ 1·05	+ 3·21
September 1	ρ^1 Sagittarii	D D : R B	Gr. 1439, Gr. 12-yr.	− 3·15	+ 3·15
October 3	21 Piscium	D D	Gr. Obs. 1855, 1856, 1857, 1859	− 0·45	− 0·21
November 9	A^2 Cancri	R D	Gr. 12-yr.	+ 7·50	+ 7·86
December 30	119 Tauri	D D	Gr. 1439	+ 7·20	+ 2·81
	120 Tauri	D D	Gr. 1439	+ 5·70	+ 5·88
1847.					
January 25	B.A.C. 1272 (Piazzi III. 249)	D D	Gr. 1439.	+ 5·25	+ 1·46
March 24	λ Geminorum	D D : R B	Gr. 12-yr.	+ 0·60	+ 3·72
March 26	κ Cancri	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 1·05	+ 2·70
April 22	A^3 Cancri	D D	Gr. 1439	+ 7·50	+ 8·02
May 23	ν Leonis	D D	Gr. 1439, Gr. 12-yr.	− 2·10	+ 2·13
June 1	ρ^1 Sagittarii	D B : R D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 3·15	+ 3·04
1848.					
January 16	Aldebaran	R B	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 0·75	+ 0·43
May 7	68 Geminorum	D D : R B	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 0·30	+ 0·33
May 11	*d* Leonis	R B	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 0·45	− 0·01
June 13	α^2 Libræ	D D	Gr. 6-yr.	− 0·15	+14·63
July 11	θ Libræ	D D : R B	Gr. 12-yr., Gr. 6-yr.	− 0·30	+ 0·15
August 21	γ Tauri	D B : R D	Gr. 12-yr., Gr. 6-yr.	+ 0·15	+ 0·19
August 22	111 Tauri	D B : R D	Gr. 6-yr.	+16·95	+ 1·96
September 15	ξ^1 Ceti	D B : R D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 1·80	− 0·77
November 9	ξ^1 Ceti	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 1·65	− 0·74
1849.					
January 5	θ^1 Tauri	D D : R B	Gr. 1439, Gr. 6-yr.	+ 1·20	− 0·29
	θ^2 Tauri	D D : R B	Gr. 1439, Gr. 6-yr.	0·00	− 0·90
	B. A. C. 1391 (Bradley 619)	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 0·30	− 1·18
	B.A.C. 1394 (Piazzi IV. 102)	D D	Gr. 6-yr.	− 1·65	+13·27
February 27	B. A. C. 830 (Bradley 381)	D D	Gr. 6-yr., Gr. Obs. 1854	+ 1·05	− 3·62
March 29	111 Tauri	D D : R B	Gr. 6-yr.	+ 0·90	+ 3·63
	117 Tauri	D D	Gr. 6-yr.	− 0·45	+ 1·49
July 12	*f* Piscium	R D	Gr. 6-yr.	− 0·45	− 0·27
September 5	ν Piscium	D B : R D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 0·90	− 1·49
September 8	θ^2 Tauri	D B	Gr. 1439, Gr. 6-yr.	0·00	− 0·92
November 29	γ Tauri	D B	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 1·05	− 0·33

EQUATIONS GIVEN BY THE OCCULTATIONS OBSERVED AT GREENWICH.

Authority for Observed Meridian Place of Moon.	Authority for Tabular Meridian Place of Moon.	Value of *x*	Value of *y*	Value of *m*
Greenwich Lunar Reductions.	Naut. Alm. in Gr. Obs.	− 5·10	+ 1·77	+ 0·290
,,	,,	− 0·60	+ 4·18	+ 0·279
,,	,,	− 3·15	− 1·88	+ 0·795
Greenwich Lunar Reductions.	Naut. Alm. in Gr. Obs.	− 7·35	− 5·61	+ 0·678
,,	,,	0·00	− 5·51	+ 0·305
,,	,,	+ 0·15	− 1·23	+ 0·613
,,	,,	− 10·65	+ 7·90	+ 0·276
,,	,,	− 5·10	+ 1·07	+ 1·060
,,	,,	− 0·90	+ 0·29	+ 0·961
,,	,,	,,	,,	,,
Greenwich Lunar Reductions.	Naut. Alm. in Gr. Obs.	+ 1·35	+ 1·85	+ 1·024
,,	,,	− 0·30	+ 0·55	+ 0·251
,,	,,	− 12·90	+ 9·94	+ 0·480
,,	,,	+ 4·20	+ 1·62	+ 0·206
,,	,,	− 10·05	+ 2·69	+ 0·764
Greenwich Lunar Reductions.	Naut Alm. inGr. Obs.	− 4·50	+ 2·28	− 0·062
,,	,,	− 9·45	+ 0·97	+ 1·413
,,	,,	− 10·05	+ 8·25	+ 0·731
,,	,,	− 13·50	+ 3·83	+ 1·852
,,	,,	− 9·45	− 1·81	+ 1·464
,,	,,	− 4·05	+ 3·39	− 0·132
,,	,,	− 0·75	− 3·44	+ 0·199
,,	,,	,,	,,	,,
Authority for Observed Place of Moon.	Authority for Tabular Place of Moon.			
Madras Red. in R. A. S. Memoirs	Naut. Alm. in Madras Red.	− 7·95	− 1·81	+ 0·035
Gr. Lu. Red. Merid.	Naut. Alm. in Gr. Obs.	− 5·25	+ 0·43	+ 0·594
,,	,,	− 8·25	+ 2·87	+ 0·389
,,	,,	− 8·40	+ 4·36	+ 0·736
,,	,,	− 20·25	+ 2·44	+ 0·723
Gr. Lu. Red. Merid. and Altaz.	,,	− 8·10	− 0·19	+ 1·006
Gr. Lu. Red. Merid. and Altaz.	Naut. Alm. in Gr. Obs.	− 10·05	+ 0·10	+ 0·122
,,	,,	− 2·10	− 1·82	+ 1·509
,,	,,	− 9·45	+ 4·49	+ 1·097
,,	,,	− 6·60	+ 2·13	+ 0·581
,,	,,	− 4·20	+ 1·47	+ 0·246
,,	,,	− 10·05	+ 6·26	+ 0·677
Gr. Lu. Red. Merid.	,,	− 13·65	+ 0·34	+ 0·991
Gr. Lu. Red. Merid. and Altaz.	,,	− 11·25	+ 3·28	+ 0·586
,,	,,	− 8·70	− 1·24	+ 1·123
Gr. Lu. Red. Merid. and Altaz.	Naut. Alm. in Gr. Obs.	− 10·20	+ 3·66	+ 0·828
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
,,	,,	− 6·00	− 0·59	+ 1·525
,,	,,	− 3·45	+ 1·05	+ 1·804
,,	,,	,,	,,	,,
,,	,,	− 14·70	0·00	+ 1·014
,,	,,	− 5·10	+ 0·68	+ 0·014
,,	,,	− 9·15	+ 1·63	+ 0·661
,,	,,	− 12·15	+ 5·12	+ 0·840

TABLE I. (*continued.*)—FORMATION OF ELEMENTS TO BE SUBSTITUTED IN THE

Year and Day.	Name of Star occulted.	Phenomenon.	Authority for Place of Star.	Value of e	Value of f
1850.					
January 23	θ^1 Tauri	D D : R B	Greenwich 1439, Greenwich 6-yr.	+ 0·20	+ 0·01
	θ^2 Tauri	D D : R B	Gr. 1439, Gr. 6-yr.	+ 0·15	− 0·78
	B. A. C. 1391 (Bradley 619)	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 0·15	− 1·73
	Aldebaran	D D : R B	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 0·60	+ 0·43
March 23	o^1 Canceri	D D	Gr. 12-yr.	− 1·20	+ 1·78
June 1	42 Aquarii	R D	Gr. 6-yr.	+ 0·15	+ 4·22
August 14	γ Libræ	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 0·15	− 0·67
October 21	B. A. C. 845 (μ Ceti)	R D	Gr. 12-yr., Gr. 6-yr.	+ 0·15	+ 1·28
December 17	75 Tauri	D D	Gr. 1439, Gr. 12-yr.	+ 1·50	+ 0·44
1851.					
January 15	χ^3 Orionis	D D	Gr. Obs. 1859, 1860.	− 2·25	− 1·76
	68 Orionis	D D	Gr. 12-yr.	− 2·40	− 4·71
January 17	θ Canceri	R D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	0·00	+ 0·11
March 13	d^1 Canceri	D D	Gr. 1439, Gr. 6-yr.	− 1·05	+ 2·87
	θ Canceri	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	0·00	+ 0·11
April 6	m Tauri	D D	Gr. 6-yr.	− 3·00	+ 0·47
September 14	μ Ceti	R D	Gr. 12-yr., Gr. 6-yr.	+ 0·60	+ 1·37
1852.					
February 3	63 Geminorum	D D	Gr. 1439, Gr. 12-yr.	0·00	− 0·88
February 11	ζ^2 Libræ	R D	Gr. 6-yr.	− 0·90	− 1·23
September 24	29 Aquarii (mean)	D D	Gr. 6-yr.	0·00	+ 4·21
October 24	30 Piscium	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 1·05	+ 0·09
	33 Piscium	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 0·75	− 0·28
1853.					
March 26	95 Virginis	R D	Gr. 6-yr.	− 0·30	+ 2·07
	κ Virginis	R D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 0·75	− 1·79
March 28	β^1 Scorpii	D B : R D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 0·60	− 0·53
May 20	95 Virginis	D D	Gr. 6-yr.	− 0·30	+ 2·03
	κ Virginis	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 0·75	− 1·76
May 22	β^1 Scorpii	D D : R B	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 0·60	− 0·53
July 17	B. A. C. 5831 (Bradley 2182)	D D	Gr. 1439.	− 1·35	+ 0·99
August 29	48 Geminorum	R D	Gr. Obs. 1855, 1856, 1857, 1860	− 1·35	+ 2·62
September 20	38 Arietis	R D	First Cambridge, Gr. 1439	+ 0·15	+ 0·35
October 14	33 Piscium	D D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 0·60	+ 0·29
1854.					
February 7	121 Tauri	D D	Gr. Obs. 1857	− 0·15	+ 1·48
April 4	ϵ Geminorum	D D : R B	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	− 0·90	− 0·26
May 6	i Leonis	D D	Gr. Obs. 1854, 1855, 1857	− 1·50	− 3·73
September 19	i Leonis	R D	Gr. Obs. 1854, 1855, 1857	− 1·50	− 3·69
September 30	ω Sagittarii	D D : R B	Gr. 1439.	− 1·35	+ 0·25
	A Sagittarii	D D : R B	Gr. 1439, Gr. 12-yr.	− 1·50	+ 0·62
October 11	139 Tauri	R D	Gr. 1439, Gr. 12-yr., Gr. 6-yr.	+ 0·75	+ 0·43
December 10	B. A. C. 3579 (Piazzi X. 83)	R D	Gr. 6-yr.	− 2·25	− 2·95
	i Leonis	R D	Gr. Obs. 1854, 1855, 1857.	− 1·50	− 3·69
1855.					
March 5	7 Virginis S. star	D B	Gr. 6-yr.	− 3·75	+ 1·11
	7 Virginis N. star	D B	Gr. 6-yr.	− 0·90	− 1·81
April 7	3 Sagittarii	R D	Gr. 1439, Gr. 12-yr.	− 2·40	+ 0·46
April 23	λ Canceri	D D	Gr. 1439, Gr. 6-yr.	+ 0·15	− 0·27
August 30	o Piscium	D B : R D	Gr. 1439, Gr. 12-yr.	− 0·75	− 0·03
October 24	o Piscium	D D	Gr. 1439, Gr. 12-yr.	− 0·75	+ 0·02
1856.					
January 12	27 Piscium	D D : R B	Gr. 1439, Gr. 6-yr.	− 0·60	− 0·47
	29 Piscium	D D : R B	Gr. 1439, Gr. 12-yr.	− 0·90	+ 0·40
March 13	136 Tauri	D D : R B	Gr. 1439, Gr. 6-yr.	− 0·90	− 0·11

EQUATIONS GIVEN BY THE OCCULTATIONS OBSERVED AT GREENWICH.

Authority for Observed Place of Moon.	Authority for Tabular Place of Moon.	Value of x	Value of y	Value of m
{Greenwich Lunar Reductions. Meridian and Altazimuth.}	{Nautical Almanac in Greenwich Observations}	− 4·80	+ 2·71	+ 0·134
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
,,	,,	,,	,,	,,
,,	,,	−15·15	+ 1·84	− 0·922
,,	,,	− 3·75	−10·08	+ 0·721
,,	,,	−14·10	− 0·38	− 0·069
G. L. R. Altazimuth	,,	−10·50	+ 3·37	− 0·134
G. L. R. Merid. and Altaz.	,,	−12·75	− 1·04	+ 0·107
G. L. R. Merid and Altaz.	Naut. Alm. in Gr. Obs.	−21·00	+ 7·11	− 0·042
,,	,,	,,	,,	,,
,,	,,	−30·60	− 2·54	+ 0·376
,,	,,	−15·45	+ 3·19	− 0·960
,,	,,	,,	,,	,,
,,	,,	− 1·80	− 1·34	+ 0·283
,,	,,	− 7·05	+ 5·13	+ 0·019
{Greenwich Obs. 1856. Introduction. Merid. and Altaz.}	Naut. Alm. in Gr. Obs.	−13·95	+ 5·41	+ 0·298
,,	,,	− 8·25	− 6·28	+ 1·357
,,	,,	− 7·35	+ 0·92	+ 0·467
,,	,,	− 6·30	+ 3·36	+ 0·141
,,	,,	,,	,,	,,
Gr. Obs. 1856. Introd. Merid. and Altaz.	Naut. Alm. in Gr. Obs.	− 8·70	− 1·77	
,,	,,	,,	,,	
,,	,,	− 7·65	− 7·26	
,,	,,	− 8·25	− 1·27	
,,	,,	,,	,,	
,,	,,	−14·40	− 6·27	
,,	,,	− 3·00	− 8·66	
,,	,,	− 2·55	+ 9·66	
,,	,,	−15·15	+ 4·34	
,,	,,	−13·95	+ 5·33	
Gr. Obs. 1856. Introd. Merid. and Altaz.	Naut. Alm. in Gr. Obs.	− 7·05	+ 9·36	
,,	,,	− 8·25	+ 5·14	
,,	,,	− 5·40	+ 4·20	
,,	,,	−20·25	+ 3·76	
,,	,,	−11·25	+ 1·99	
,,	,,	,,	,,	
,,	,,	− 1·95	+ 5·64	
,,	,,	+ 1·95	+ 0·50	
,,	,,	,,	,,	
Gr. Obs. 1856. Introd. Merid. and Altaz.	Naut. Alm. in Gr. Obs.	− 2·85	− 2·89	
,,	,,	,,	,,	
,,	,,	−11·85	− 5·13	
,,	,,	− 9·15	+ 0·73	
,,	,,	−12·00	+11·62	
,,	,,	,,	,,	
Gr. Obs. Merid. and Altaz.	Naut. Alm. in Gr. Obs.	− 8·40	+ 7·74	
,,	,,	,,	,,	
,,	,,	− 5·10	+ 4·70	

TABLE I. (*concluded.*)—FORMATION OF ELEMENTS TO BE SUBSTITUTED IN THE

Year and Day.	Name of Star occulted.	Phenomenon.	Authority for Place of Star.	Value of *e*	Value of *f*
1856.					
March 26	Antares	D B : R D	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	− 0·60	− 0·16
March 27	43 Ophiuchi	R D	Gr. Obs. 1855, 1856, 1857	− 1·80	+ 3·61
June 5	*c* Geminorum	R B	Gr. 1839	− 4·20	+ 0·40
June 16	Antares	R B	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	− 0·60	− 0·16
September 20	136 Tauri	D B : R D	Gr. 1839, Gr. 6-yr.	− 0·90	− 0·03
1857.					
January 16	B. A. C. 4394 (B. F. 1825.).	R D	Gr. Obs. 1857, 1858	+ 0·15	− 2·54
March 8	37 Leonis	R B	Gr. 6-yr.	− 1·35	− 0·71
April 2	λ Cancri	D D	Gr. 1839, Gr. 6-yr.	+ 0·15	− 0·36
May 6	Spica	D D : R B	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	+ 0·75	− 0·07
May 27	γ Cancri	D D	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	− 0·75	+ 1·10
June 2	58 Virginis	D D	Gr. Obs. 1857, 1858, 1859	− 1·65	− 4·34
July 7	ω Sagittarii	R D	Gr. 1839	− 1·65	+ 0·07
	A^1 Sagittarii	R D	Gr. 1839, Gr. 12-yr.	− 1·50	+ 0·39
August 9	B. A. C. 221 (Piazzi O. 189)	R D	Gr. 1839, Gr. 6-yr.	+ 1·65	− 1·19
October 6	27 Tauri	D B : R D	Gr. 1839, Gr. 12-yr.	− 1·05	+ 1·35
October 26	χ Capricorni	D D	Gr. 1839, Gr. 12-yr.	− 1·35	+ 0·79
October 28	70 Aquarii	D D	Gr. Obs. 1855, 1857	− 0·60	+ 0·83
November 27	ε Piscium	D D	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	+ 0·30	+ 0·41
December 4	γ Cancri	D B	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	− 0·75	+ 1·05
1858.					
February 19	ε Arietis	R B	Gr. 6-yr.	− 0·45	+ 0·24
February 20	20 Tauri	D D : R B	Gr. 1839	− 1·05	+ 0·26
	16 Tauri	R B	Gr. 1839	− 1·05	+ 0·31
	19 Tauri	R B	Gr. 1839	− 1·50	+ 0·89
February 25	83 Cancri	D D	Gr. 1839, Gr. 6-yr.	+ 0·90	+ 0·01
February 27	*c* Leonis	R D	Gr. 1839, Gr. 12-yr.	− 1·80	+ 0·17
April 25	28 Virginis	D D	Gr. Obs. 1855, 1859	− 1·80	+ 3·98
May 18	83 Cancri	D D : R B	Gr. 1839, Gr. 6-yr.	+ 0·90	+ 0·01
May 19	Regulus	D D : R B	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	+ 0·30	− 0·01
August 29	μ Arietis	R D	Gr. 1839, Gr. 12-yr.	− 1·50	+ 0·60
August 30	19 Tauri	D B : R D	Gr. 1839	− 1·50	+ 0·80
	20 Tauri	D B : R D	Gr. 1839	− 1·05	+ 0·32
	16 Tauri	R D	Gr. 1839	− 1·05	+ 0·26
November 22	136 Tauri	D B : R D	Gr. 1839, Gr. 6-yr.	− 1·05	− 0·06
1859.					
April 13	37 Sextantis	D D	Gr. 12-yr.	− 1·05	+ 0·06
September 21	μ^2 Cancri	D B : R D	Gr. Obs. 1857	− 0·15	+ 5·88
October 14	19 Tauri	D B	Gr. 1839	− 1·65	+ 0·80
	20 Tauri	D B	Gr. 1839	− 1·05	+ 0·14
November 8	101 Piscium	D B	Gr. Obs. 1855, 1858	− 0·60	+ 2·22
November 15	δ Cancri	D B	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	− 1·20	− 0·22
December 8	23 Tauri	D D : R B	Gr. 1839	− 0·90	+ 0·40
	16 Tauri	R B	Gr. 1839	− 1·20	+ 0·25
	17 Tauri	R B	Gr. 6-yr.	− 2·10	+ 2·61
	η Tauri	D D : R B	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	+ 0·30	+ 0·09
	28 Tauri	D D : R B	Gr. 1839, Gr. 6-yr., Gr. Obs. 1860	− 0·30	+ 0·79
	27 Tauri	D D : R B	Gr. 1839, Gr. 12-yr.	− 1·20	+ 0·28
1860.					
January 4	17 Tauri	D D	Gr. 6-yr.	− 2·25	+ 2·67
	19 Tauri	D D	Gr. 1839	− 1·80	+ 0·83
	20 Tauri	D D	Gr. 1839	− 1·20	+ 0·19
February 28	19 Tauri	D D : R B	Gr. 1839	− 1·80	+ 0·85
	16 Tauri	D D : R B	Gr. 1839	− 1·20	+ 0·19
	20 Tauri	D D : R B	Gr. 1839	− 1·20	+ 0·11
March 4	δ Cancri	D D : R B	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	− 1·20	− 0·33
March 5	18 Leonis	D D : R B	Gr. 12-yr.	− 0·75	+ 0·23
	B. A. C. 3345 (Brad. 1373).	D D	Gr. Obs. 1857, 1858, 1859, 1860	− 2·85	− 1·16
May 2	γ Virginis	R B	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	− 1·95	+ 0·49
September 6	27 Tauri	D B : R D	Gr. 1839, Gr. 12-yr.	− 1·35	+ 0·24
	28 Tauri	D B : R D	Gr. 1839, Gr. Obs. 1860	− 0·45	+ 0·78
	η Tauri	R D	Gr. 1839, Gr. 12-yr., Gr. 6-yr.	+ 0·30	+ 0·06

EQUATIONS GIVEN BY THE OCCULTATIONS OBSERVED AT GREENWICH.

Authority for Observed Place of Moon.	Authority for Tabular Place of Moon.	Value of *x*	Value of *y*
Greenwich Observations, Meridian and Altazimuth ..	{ Nautical Almanac in Greenwich Observations }	− 1·95	− 7·33
,,	,,	− 1·50	− 1·02
,,	,,	− 4·95	+ 5·02
,,	,,	− 6·45	− 4·17
Mean of Meridian, September 19 and 21	,,	−19·88	+ 4·35
Gr. Obs. Merid. and Altaz.	Naut. Alm. in Gr. Obs.	− 4·20	− 3·43
,,	,,	− 3·45	− 4·53
,,	,,	− 7·20	+ 0·31
,,	,,	− 2·10	− 7·08
,,	,,	−10·05	+ 2·46
,,	,,	− 4·25	− 7·05
,,	,,	− 7·80	+ 2·20
,,	,,	,,	,,
,,	,,	− 9·30	+ 8·58
,,	,,		+10·42
,,	,,	−16·50	+ 7·39
,,	,,	− 3·15	+ 6·65
,,	,,	− 3·15	+ 9·91
,,	,,	−14·10	− 1·68
		− 9·00	
Gr. Obs. Merid. and Altaz.	Naut. Alm. in Gr. Obs.	− 6·75	+ 1·05
,,	,,	− 7·80	+ 7·62
,,	,,	,,	,,
,,	,,	,,	,,
,,	,,	−16·65	− 7·93
,,	,,	−11·70	− 6·63
,,	,,	− 7·20	− 4·40
,,	,,	− 7·05	− 0·47
,,	,,	− 6·75	− 3·19
,,	,,	−10·35	+ 9·84
,,	,,	−13·35	+ 8·78
,,	,,	,,	,,
,,	,,	,,	,,
,,	,,	−17·55	+ 2·54
Gr. Obs. Merid. and Altaz.	Naut. Alm. in Gr. Obs.	−14·70	−14·64
,,	,,	−13·05	− 5·08
,,	,,	−13·05	+ 6·99
,,	,,	,,	,,
,,	,,	− 7·80	+ 7·55
,,	,,	−18·60	− 6·20
,,	,,	−12·90	+ 8·53
,,	,,	,,	,,
,,	,,	,,	,,
,,	,,	,,	,,
,,	,,	,,	,,
Gr. Obs. Merid. and Altaz.	Naut. Alm. in Gr. Obs.	−10·20	+ 6·03
,,	,,	,,	,,
,,	,,	,,	,,
,,	,,	− 2·40	+ 4·16
,,	,,	,,	,,
,,	,,	,,	,,
,,	,,	−21·90	− 9·58
,,	,,	−20·85	− 9·23
,,	,,	,,	,,
,,	,,	−12·90	−12·01
,,	,,	− 8·70	+ 2·86
,,	,,	,,	,,
,,	,,	,,	,,

TABLE II., PART I.—CORRECTIONS TO THE MOON'S TABULAR SEMIDIAMETER GIVEN BY DISAPPEARANCES OF STARS AT THE DARK LIMB.

Year and Day.	Name of Star.	Correction to assumed Semi-diameter.	Correction to adopted Semidiameter.	
1830.		"	"	"
January 5	75 Tauri	+ 3·18	+ 0·59	
	A. S. C. 516	+ 2·23		− 0·36
	(Bradley 619)			
	Aldebaran	+ 2·65	+ 0·06	
March 3	μ Geminorum(26)	+ 2·92	+ 0·33	
April 5	τ Leonis	− 2·31		− 4·90
1831.				
January 26	f Geminorum	+ 2·59	0·00	
1832.				
February 10	Aldebaran	+ 1·29		− 1·30
March 8	Aldebaran	− 4·35		− 6·94
1833.				
November 25	A. S. C. 350 (Piazzi III. 4)	− 3·97		− 6·56
December 21	A. S. C. 214 (Piazzi I. 225)	+ 7·45	+ 4·86	
1834.				
January 22	Q^2 Tauri (141)	+ 5·81	+ 3·22	
March 16	ε Tauri	− 4·78		− 7·37
April 20	ν Virginis	+ 3·92	+ 1·33	
July 15	ζ^1 Librae	+ 5·73	+ 3·14	
September 14	ϵ Capricorni	+ 3·12	+ 0·53	
December 8	τ Piscium (30)	+ 1·92		− 0·67
1835.				
February 4	ξ^1 Arietis	+ 1·62		− 0·97
April 6	κ Geminorum	− 0·37		− 2·96
1836.				
April 25	η Leonis	+ 0·24		− 2·35
May 26	θ Virginis	− 4·42		− 7·01
May 29	β Scorpii	+ 1·32		− 1·27
July 23	β Scorpii	+ 5·14	+ 2·55	
1837.				
November 7	ψ^1 Aquarii	+ 1·10		− 1·49
1838.				
February 4	136 Tauri	+ 3·91	+ 1·32	
March 6	λ Cancri	+ 4·34	+ 1·75	
April 1	47 Geminorum	− 1·37		− 3·96
October 29	20 Piscium	+ 0·67		− 1·92
December 27	9 Tauri	− 4·28		− 6·87
	23 Tauri	− 2·42		− 5·01
	η Tauri	− 0·77		− 3·36
	28 Tauri	− 0·59		− 3·18
1839.				
February 23	47 Geminorum	− 0·16		− 2·75
May 21	τ Leonis	− 3·28		− 5·87
October 19	96 Aquarii	+ 1·37		− 1·22
1840.				
January 16	136 Tauri	+ 0·03		− 2·56
June 3	η Caneri	− 1·36		− 3·95
1841.				
August 29	θ Capricorni	+ 1·74		− 0·85
December 18	ρ Aquarii	+ 2·42		− 0·17
1842.				
January 23	125 Tauri	+ 2·63	+ 0·04	
March 22	o^2 Cancri	+ 0·73		− 1·86
	o^1 Cancri	− 1·61		− 4·20
November 12	9 Piscium	+ 1·52		− 1·07
	κ Piscium	− 0·15		− 2·74
December 14	47 Arietis	+ 1·50		− 1·09
1843.				
October 1	f Sagittarii	− 1·78		− 4·37
1844.				
January 2	τ Tauri	+ 1·68		− 0·91
March 28	5 Cancri	+ 0·38		− 2·21
April 1	ϵ Leonis	+ 0·29		− 2·30
October 22	9 Piscium	− 1·84		− 4·43
	κ Piscium	− 1·62		− 4·11
1845.				
February 21	14 Sextantis	+ 3·71	+ 1·12	
March 19	60 Cancri	+ 3·70	+ 1·11	
December 6	λ Piscium	+ 1·61		− 0·98
1846.				
April 5	A^3 Caneri	− 2·71		− 5·30
July 5	ν Scorpii	+ 0·67		− 1·92
September 1	β^1 Sagittarii	+ 1·33		− 1·26
October 3	21 Piscium	+ 2·06		− 0·53
December 30	119 Tauri	+ 1·23		− 1·36
	120 Tauri	+ 1·08		− 1·51
1847.				
January 25	B. A. C. 1272 (Piaz.III.249)	+ 2·59	0·00	
March 24	λ Geminorum	− 1·40		− 3·99
March 26	κ Cancri	+ 1·71		− 0·88
April 22	A^2 Cancri	+ 1·35		− 1·24
May 23	ν Leonis	+ 6·11	+ 3·52	
1848.				
May 7	68 Geminorum	+ 1·88		− 0·71
June 13	σ^2 Librae	+ 0·95		− 1·64
July 11	θ Librae	+ 1·37		− 1·22
November 9	ξ^1 Ceti	+ 3·27	+ 0·68	
1849.				
January 5	θ^1 Tauri	− 0·40		− 2·99
	θ^2 Tauri	− 0·36		− 2·95
	B. A. C. 1391 (Bradley 619)	− 2·04		− 4·63
	B. A. C. 1394 (Piaz. IV. 102)	− 0·35		− 2·94
	B. A. C. 830 (Bradley 381)	+ 1·46		− 1·13
February 27				
March 29	111 Tauri	+ 2·25		− 0·34
	117 Tauri	+ 2·99	+ 0·40	
1850.				
January 23	θ^1 Tauri	− 4·25		− 6·84
	θ^2 Tauri	− 0·78		− 3·37
	B. A. C. 1391 (Bradley 619)	− 1·83		− 4·42
	Aldebaran	− 1·03		− 3·62
March 23	ϵ^1 Caneri	+ 0·57		− 2·02
August 14	γ Librae	+ 3·03	+ 0·44	
December 17	75 Tauri	− 0·14		− 2·73

TABLE II., PART I.—CORRECTIONS TO THE MOON'S TABULAR SEMIDIAMETER GIVEN BY DISAPPEARANCES OF STARS AT THE DARK LIMB—*concluded.*

Year and Day.	Name of Star.	Correction to assumed Semi-diameter.	Correction to adopted Semidiameter.	
1851.		"	"	"
January 15	χ^3 Orionis	+ 5·29	+ 2·70	
	68 Orionis	+ 4·62	+ 2·03	
March 13	d^1 Caneri	− 0·67		− 3·26
	θ Caneri	− 0·16		− 2·75
April 6	m Tauri	+ 0·72		− 1·87
1852.				
February 3	63 Geminorum	+ 2·21		− 0·38
September 24	29 Aquarii	− 2·48		− 5·07
October 24	30 Piscium	+ 0·37		− 2·22
	33 Piscium	− 0·14		− 2·73
1853.				
May 20	95 Virginis		+ 0·41	
	κ Virginis			− 1·80
May 22	β^1 Scorpii		+ 6·06	
July 17	B. A. C. 5831. (Brad. 2182)			− 3·02
October 14	33 Piscium		+ 0·55	
1854.				
February 7	121 Tauri	− 2·53		− 1·81
April 4	ϵ Geminorum	− 0·92		− 0·20
May 6	i Leonis	− 2·80		− 2·08
September 30	α Sagittarii	− 1·98		− 1·26
	A Sagittarii	− 3·68		− 2·96
1855.				
April 23	λ Caneri	− 4·37		− 3·65
October 24	o Piscium	+ 1·29	+ 2·01	
1856.				
January 12	27 Piscium	− 1·22		− 1·29
	29 Piscium	− 1·44		− 1·51
March 13	136 Tauri	− 4·33		− 4·40
1857.				
April 2	λ Cancri			− 5·19
May 6	Spica			− 0·49
May 27	γ Caneri		+ 0·84	
June 2	58 Virginis			− 3·89
October 26	χ Capricorni			− 2·83
October 28	70 Aquarii			− 1·93
November 27	ϵ Piscium		+ 2·52	
1858.				
February 20	20 Tauri			− 7·13
February 25	83 Caneri			− 1·78
April 25	28 Virginis			− 0·71
May 18	85 Caneri			− 1·06
May 19	Regulus			− 2·22
1859.				
April 13	37 Sextantis		+ 0·85	
December 8	23 Tauri			− 4·90
	η Tauri			− 7·55
	28 Tauri			− 5·22
	27 Tauri			− 5·37
1860.				
January 4	17 Tauri			− 5·86
	19 Tauri			− 4·71
	20 Tauri			− 4·61
February 28	19 Tauri			− 0·46
	16 Tauri			− 5·81
	20 Tauri			− 5·47
March 4	δ Caneri			− 2·96
March 5	18 Leonis			− 1·34
	B. A. C. 3345. (Brad. 1373)			− 4·10

TABLE II., PART II.—CORRECTIONS TO THE MOON'S TABULAR SEMIDIAMETER GIVEN BY DISAPPEARANCES OF STARS AT THE BRIGHT LIMB.

1831.		"	"	"
October 21	ξ^2 Ceti			
October 23	θ^1 Tauri	+ 4·49	+ 1·90	
	θ^2 Tauri	+ 1·99		− 0·60
	75 Tauri	+ 3·61	+ 1·02	
	Aldebaran	+ 1·03		− 1·56
December 22	Regulus	+ 1·89		− 0·70
1832.				
January 25	γ Librae	+ 2·96	+ 0·37	
1833.				
September 6	i Tauri			
December 31	ν Virginis	− 0·28		− 2·87
1834.				
July 21	ρ Capricorni	+ 3·93	+ 1·34	
1835.				
December 4	τ Tauri	+ 3·15	+ 0·56	
December 10	η Leonis	+ 8·35	+ 5·76	
1836.				
January 12	α^1 Librae	+ 5·33	+ 2·74	
	α^2 Librae	+ 3·34	+ 0·75	
March 6	λ Virginis	− 4·38		− 6·97
June 29	α Sagittarii	− 1·98		− 4·57
September 1	A^1 Tauri	+ 2·86	+ 0·27	
1837.				
March 26	σ Scorpii	+ 4·50	+ 1·91	
August 21	β Arietis	− 0·36		− 2·95
September 14	27 Piscium			

TABLE II., PART II.—CORRECTIONS TO THE MOON'S TABULAR SEMIDIAMETER GIVEN BY DISAPPEARANCES OF STARS AT THE BRIGHT LIMB—*concluded.*

Year and Day.	Name of Star.	Correction to assumed Semi-diameter.	Correction to adopted Semidiameter.
1839.		"	" "
September 23	δ Piscium	+ 6·40	+ 3·81
September 26	16 Tauri	+ 5·86	+ 3·27
	19 Tauri	+ 4·15	+ 1·36
	20 Tauri	+ 3·14	+ 0·55
1840.			
April 11	ν Leonis	− 0·85	− 3·44
October 13	19 Tauri	+ 2·20	− 0·39
	20 Tauri	+ 2·67	+ 0·08
1842.			
October 23	132 Tauri	− 2·94	− 5·53
1843.			
November 11	ζ Geminorum ...		
1846.			
May 11	β^1 Scorpii	+ 7·06	+ 4·47
1847.			
June 1	ρ^1 Sagittarii	+ 3·01	+ 0·42
1848.			
August 21	γ Tauri	+ 5·42	+ 2·83
August 22	111 Tauri	+ 4·53	+ 1·94
September 15	ξ^1 Ceti	− 2·53	− 5·12
1849.			
September 5	ν Piscium.....	+ 5·69	+ 3·10
September 8	θ^2 Tauri.....	+ 3·80	+ 1·21
November 29	γ Tauri	− 0·85	− 3·44
1853.			
March 28	β^1 Scorpii		− 2·71
1855.			
March 5	γ Virginis S. S...	− 7·81	− 7·09
	γ Virginis N. S. .	− 0·29	+ 0·43 − 0·20
August 30	ϵ Piscium	− 0·92	
1856.			
March 26	Antares	− 7·23	− 6·51
September 20	136 Tauri	+ 3·75	+ 4·47
1857.			
October 6	27 Tauri		+ 0·10
December 4	γ Caneri		− 0·33
1858.			
August 30	19 Tauri		− 0·04
	20 Tauri		− 2·87
November 22	136 Tauri		+ 0·10
1859.			
September 21	μ^2 Caneri.....		+ 2·31
October 14	19 Tauri		− 2·03
	20 Tauri		− 5·23
November 8	101 Piscium		− 4·14
November 15	δ Caneri.....		− 3·47
1860.			
September 6	27 Tauri		− 4·38
	28 Tauri.		− 1·02

1831.				
October 21	ξ^2 Ceti	No cause of error can be found.....	+ 16·67	+ 14·08
1833.				
September 6	i Tauri.....	The factor of t is 0·451 : it seems probable that in this observation, as well as in that of reappearance, there is an error of 1^m, but none can be found	+ 27·89	+ 25·30
1837.				
September 14	27 Piscium	The error of Moon's place at Madras, used here, does not agree well with that at Cambridge.....	+ 10·23	+ 7·64
1843.				
November 11	ζ Geminorum ...	No cause of error can be found.....	+ 14·14	+ 11·55

TABLE II., PART III.—CORRECTIONS TO THE MOON'S TABULAR SEMIDIAMETER GIVEN BY REAPPEARANCES OF STARS AT THE DARK LIMB.

1831.		"	"
October 21	ξ^2 Ceti		
October 23	θ^2 Tauri.....	− 1·44	− 4·03
	75 Tauri	− 0·46	− 3·05
	Aldebaran	− 2·36	− 4·95
1832.			
January 25	γ Libræ	− 1·01	− 3·60
1833.			
September 6	i Tauri		
December 31	ν Virginis	− 3·72	− 6·31
1834.			
February 24	ν Virginis	− 1·03	− 3·62
April 24	ζ^1 Libræ.....	+ 8·94	+ 6·35
July 21	φ Capricorni	− 2·02	− 4·61

TABLE II., PART III.—CORRECTIONS TO THE MOON'S TABULAR SEMIDIAMETER GIVEN BY REAPPEARANCES OF STARS AT THE DARK LIMB—*continued.*

Year and Day.	Name of Star.	Correction to assumed Semi-diameter.	Correction to adopted Semidiameter.
1835.		"	" "
February 19	ω^2 Scorpii		
December 10	η Leonis.....		
1836.			
January 12	α^1 Libræ	− 1·27	− 3·86
March 6	λ Virginis		
June 29	ω Sagittarii	+ 0·78	− 1·81
1837.			
March 26	σ Scorpii	+ 2·22	− 0·37
August 18	10 Ceti	− 0·15	− 2·74
September 14	27 Piscium		
1838.			
April 12	χ Libræ	+ 1·78	− 0·81
1839.			
August 25	96 Aquarii		
September 26	16 Tauri	− 2·84	− 5·43
	19 Tauri	− 2·82	− 5·41
	20 Tauri	− 3·21	− 5·80
1840.			
October 13	19 Tauri	− 0·59	− 3·58
	20 Tauri	− 2·37	− 4·96
	16 Tauri	− 3·08	− 5·67
1842.			
November 22	d^2 Caneri.....	− 1·64	− 4·23
1843.			
August 12	9 Piscium	− 0·50	− 3·09
1844.			
August 1	16 Piscium	− 3·06	− 5·65
September 29	β^3 Arietis	+ 0·68	− 1·91
1845.			
August 20	δ Piscium.....	+ 2·21	− 0·38
October 20	E^2 Orionis.....	− 1·05	− 3·64
1846.			
May 11	β^1 Scorpii	− 0·35	− 2·94
November 9	A^2 Caneri	− 0·34	− 2·93
1847.			
June 1	ρ^1 Sagittarii	+ 0·52	− 2·07
1848.			
August 21	γ Tauri	+ 7·55	+ 4·96
August 22	111 Tauri	− 3·42	− 6·01
September 15	ξ^1 Ceti	− 5·75	− 8·34
1849.			
July 12	f Piscium.....	+ 0·24	− 2·35
September 5	ν Piscium	+ 0·89	− 1·70
1850.			
June 1	42 Aquarii	+ 0·94	− 1·65
October 21	{B. A. C. 845 (μ Ceti)}	+ 2·33	− 0·26
1851.			
January 17	θ Caneri.....		
September 14	μ Ceti	− 0·32	− 2·91
1852.			
February 11	α^2 Libræ.....	+ 0·72	− 1·87
1853.			
March 26	95 Virginis		− ·021
	κ Virginis		− 1·42
March 28	β^1 Scorpii		+ 1·01
August 29	48 Geminorum ..		− 0·93
September 20	38 Arietis		− 4·90
1854.			
September 19	i Leonis	− 1·80	− 1·08
October 11	139 Tauri	− 4·49	− 3·77
December 10	{B. A. C. 3579 (Piazzi X. 83)}	− 1·45	− 0·73
	i Leonis	+ 0·99	+ 1·71
1855.			
April 7	3 Sagittarii	+ 4·30	+ 5·02
August 30	ϵ Piscium.....	− 5·19	− 4·47
1856.			
March 26	Antares	− 2·17	− 2·24
March 27	43 Ophiuchi	+ 4·42	+ 4·35
September 20	136 Tauri	− 0·59	− 0·66
1857.			
January 16	{B. A. C. 4394 (B. F. 1805)}		− 3·67
July 7	ω Sagittarii		
	A^1 Sagittarii....		+ 2·86
August 9	{B. A. C. 221 (Piazzi O. 189)}		− 3·27
October 6	27 Tauri		− 1·00
1858.			
February 27	c Leonis		
August 29	μ Arietis		− 1·86
August 30	19 Tauri		− 1·21
	20 Tauri		− 4·27
August 30	16 Tauri		− 5·53
November 22	136 Tauri		− 3·93
1859.			
September 21	μ^2 Caneri.....		− 2·81
1860.			
September 6	27 Tauri		− 2·30
	28 Tauri		− 3·95
	η Tauri		− 1·15

TABLE II., PART III.—CORRECTIONS TO THE MOON'S TABULAR SEMIDIAMETER GIVEN BY REAPPEARANCES OF STARS AT THE DARK LIMB—*concluded.*

Year and Day.	Name of Star.		Correction to assumed Semi-diameter.	Correction to adopted Semidiameter.
1831.			"	" "
October 21	ξ^2 Ceti		+ 8·38	+ 5·79
1833.				
September 6	*i* Tauri	The factor of *t* is ·424. It seems probable that here, as well as at the disappearance, there is an error of 1^m, but none has been found	−23·39	−25·98
1835.				
February 19	ω^2 Scorpii		+10·18	+ 7·59
December 10	η Leonis		−13·80	−16·39
1836.				
March 6	λ Virginis		+13·43	+10·84
1837.				
September 14	27 Piscium	The error of Moon's place used here, derived from Madras, does not agree with that derived from Cambridge	+11·29	+ 8·70
1839.				
August 25	96 Aquarii	The Moon's meridian-error is suspicious	− 9·07	−11·66
1851.				
January 17	θ Cancri	The elements of the Moon are derived from altazimuth observation by an inexperienced observer	−10·90	−13·49
1857.				
July 7	ω Sagittarii	"Perhaps a little late"		+ 8·35
1858.				
February 27	*c* Leonis	"Probably a few seconds late," but this would make the error +. The time had been altered 3^m; it appears that the observation was confused, or that possibly another star was observed		−10·98

TABLE II., PART IV.—CORRECTIONS TO THE MOON'S TABULAR SEMIDIAMETER GIVEN BY REAPPEARANCES OF STARS AT THE BRIGHT LIMB.

Year and Day.	Name of Star.	Correction to assumed Semi-diameter.	Correction to adopted Semidiameter.	Year and Day.	Name of Star.	Correction to assumed Semi-diameter.	Correction to adopted Semidiameter.
1830.		"	" "	1838.		"	" "
January 5	A. S. C. 516 (Bradley 619)	+ 4·52	+ 1·93	December 27	η Tauri	+ 6·43	+ 3·84
					27 Tauri	+ 4·83	+ 2·24
1832.				1839.			
February 10	Aldebaran	− 0·15	− 2·74	February 23	47 Geminorum	+ 4·04	+ 1·45
1833.				May 21	τ Leonis	+ 9·68	+ 7·09
November 25	A. S. C. 350 (Piazzi III. 4)	+ 8·49	+ 5·90	May 27	π Scorpii		
1834.				1840.			
April 20	ρ Virginis	+ 4·48	+ 1·89	January 11	β Piscium	+ 6·35	+ 3·76
September 14	ϵ Capricorni	+ 5·25	+ 2·66	April 11	ν Leonis	+ 1·88	− 0·71
1835.				1841.			
April 6	κ Geminorum			August 29	θ Capricorni		
1836.				1844.			
April 25	η Leonis	+ 3·25	+ 0·66	January 2	τ Tauri	− 0·56	− 3·15
July 23	β Scorpii	+ 4·68	+ 2·09	April 1	*c* Leonis	+ 6·24	+ 3·65
1837.				1846.			
November 7	ψ^1 Aquarii	+ 2·23	− 0·36	September 1	ρ^1 Sagittarii		

TABLE II., PART IV.—CORRECTIONS TO THE MOON'S TABULAR SEMIDIAMETER GIVEN BY REAPPEARANCES OF STARS AT THE BRIGHT LIMB—*concluded.*

Year and Day.	Name of Star.	Correction to assumed Semi-diameter.	Correction to adopted Semidiameter.	Year and Day.	Name of Star.	Correction to assumed Semi-diameter.	Correction to adopted Semidiameter.
1847.		"	" "	1856.		"	" "
March 24	λ Geminorum	− 0·96	− 3·55	March 13	136 Tauri	+ 7·15	+ 7·08
1848.				June 5	*c* Geminorum		
January 16	Aldebaran	− 0·70	− 3·29	June 16	Antares	− 6·37	− 6·44
May 7	68 Geminorum			1857.			
May 11	*d* Leonis	+ 3·62	+ 1·03	March 8	37 Leonis		
July 11	θ Libræ	+ 3·56	+ 0·97	May 6	Spica		+ 0·13
1849.				1858.			
January 5	δ^1 Tauri	+ 9·88	+ 7·29	February 19	ϵ Arietis		+ 5·44
	δ^2 Tauri	+ 5·67	+ 3·08	February 20	20 Tauri		+ 0·05
March 29	111 Tauri	+ 4·83	+ 2·24		16 Tauri		− 1·03
1850.					19 Tauri		+ 0·12
January 23	δ^1 Tauri	+ 4·12	+ 1·53	May 18	83 Cancri		+ 2·14
	δ^2 Tauri	+ 3·53	+ 0·94	May 19	Regulus		− 5·66
	Aldebaran	+ 1·37	− 1·22	1859.			
1853.				December 8	23 Tauri		+ 2·27
May 22	β^1 Scorpii		+ 0·31		16 Tauri		
1854.					17 Tauri		+ 4·06
April 4	ϵ Geminorum	− 0·10	+ 0·62		η Tauri		+ 5·92
September 30	ω Sagittarii				28 Tauri		+ 6·63
	A Sagittarii	+ 0·44	+ 1·16		27 Tauri		+ 1·55
1856.				1860.			
January 12	27 Piscium			February 28	19 Tauri		+ 3·77
	29 Piscium	+ 6·68	+ 6·61		16 Tauri		− 2·10
					20 Tauri		− 0·85
				March 4	3 Cancri		+ 0·31
				March 5	18 Leonis		+ 3·56
				May 2	q Virginis		

1835.			"	" "	
April 6	κ Geminorum	A little distance from the Moon	+ 10·39	+ 7·80	
1839.					
May 27	π Scorpii	Doubtful; clouds	+ 12·52	+ 9·93	
1841.					
August 29	θ Capricorni		+ 11·23	+ 8·64	
1846.					
September 1	ρ^1 Sagittarii		+ 13·93	+ 11·34	
1848.					
May 7	68 Geminorum	Doubtful	+ 19·39	+ 16·80	
1854.					
September 30	ω Sagittarii		− 10·21		− 9·49
1856.					
January 12	27 Piscium		+ 14·90	+ 14·83	
June 5	*c* Geminorum	Separated from the Limb	+ 12·42	+ 12·35	
1857.					
March 8	37 Leonis	Separated from the Limb		+ 8·21	
1859.					
December 8	16 Tauri	Separated from the Limb		+ 13·08	
1860.					
May 2	q Virginis	Separated from the Limb		+ 7·72	