

GREENWICH  
SPECTROSCOPIC AND PHOTOGRAPHIC  
RESULTS.

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1890.

# RESULTS

OF THE

SPECTROSCOPIC AND PHOTOGRAPHIC OBSERVATIONS

MADE AT THE

ROYAL OBSERVATORY, GREENWICH,

IN THE YEAR

1890:

UNDER THE DIRECTION OF

W. H. M. CHRISTIE, M.A., F.R.S.,  
ASTRONOMER ROYAL.

(EXTRACTED FROM THE GREENWICH OBSERVATIONS, 1890.)

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1892.

# GREENWICH SPECTROSCOPIC AND PHOTOGRAPHIC RESULTS, 1890.

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## INTRODUCTION.

### § 1. *Spectroscopic Observations in the Year 1890.*

The spectroscope used for these observations was mounted on the South-east equatorial, the object-glass of which (made by Merz and Son of Munich) has a clear aperture of 12·8 inches, with a focal length of about 17<sup>ft.</sup> 10<sup>in.</sup>

This section contains :—Measures of Displacement of Lines in the Spectra of Stars, Sun, Moon, and Planets ; and Collected Results for Motions of Stars in the line of Sight.

The measures of displacement of lines in the spectra of stars were made with a micrometer in the viewing telescope of the "Half-prism" Spectroscope. The eye-piece used gives a magnifying power of 14. Estimations of the displacement, in terms of the apparent breadth of the bright comparison-line, were also made ; the breadth corresponding to any given width of slit being determined by a careful observation under similar conditions. 1<sup>rev.</sup> of the screw for opening the slit corresponds to 0·01 inch, or 10". It has not been thought necessary to give in detail all these particulars of the reductions. The values used in each case may be inferred from the observed motion, which is the algebraic sum of the concluded motion and of the Earth's motion. A displacement of one tenth-metre corresponds at D to a motion of 31·7 miles per second, at *b* to a motion of 36·1 miles, and at F to a motion of 38·4 miles. For comparison with the spectrum of hydrogen or other chemical element, an image of the vacuum tube or electrodes is formed on the slit, by means of a transparent plate of glass placed at an angle of 45° with the axis of the collimator, in connexion with a collimating lens, so that the cone of rays from the comparison-light fills the whole of the object-glass of the collimator. (a)

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Whenever the star-line was sufficiently distinct to allow of its being seen at the same time as the bright comparison-line, a direct comparison of the two was made; in other cases the bright line was compared with the pointer of the micrometer which had just previously been placed on the star-line, giving an indirect comparison.

The reading of the position-circle is given, as it is conceivable that the results might be affected by the position of the spectroscope. The slit lies north and south when the reading is  $6^{\circ}$ .

§ 2. *Measures of Positions and Areas of Sun Spots and Faculae on Photographs taken at the Royal Observatory, Greenwich, at Dehra Dûn in India, and at the Royal Alfred Observatory, Mauritius, in the year 1890; with the deduced Heliographic Longitudes and Latitudes.*

The photographs from which these measures were made were taken either at Greenwich; at Dehra Dûn, North-West Provinces, India; or at the Royal Alfred Observatory, Mauritius.

The photographs of the Greenwich series were taken with the Dallmeyer Photoheliograph returned from the Transit of Venus expedition to New Zealand, which, as now adapted, gives a solar image of 8 inches diameter on the photographic plate.

Bromo-iodized gelatine dry plates with alkaline development have been regularly used throughout the year.

The Indian photographs, which have been forwarded by the Solar Physics Committee to fill the gaps in the Greenwich series, were taken under the superintendence of the Deputy Surveyor General, Trigonometrical Survey of India, with a Dallmeyer photoheliograph giving an image of the Sun nearly 8 inches in diameter. In the process adopted at Dehra Dûn bromo-iodized collodion has been used in connexion with iron development.

The Mauritius photographs were taken under the superintendence of Dr. C. Meldrum, Director of the Royal Alfred Observatory, Mauritius, with a Dallmeyer photoheliograph, giving an image of the Sun about 8 inches in diameter. At the

Mauritius Observatory bromo-iodized gelatine dry plates have been used with alkaline development.

Photographs of the Sun were taken at Greenwich on 209 days, and Indian photographs on 130 days with Mauritius photographs on 22 days have been received from the Solar Physics Committee to complete the total of 361 days for which there are either Greenwich, Indian, or Mauritius photographs of the Sun available for measurement in 1890.

The *first* column on each page contains the Greenwich Civil Time at which each photograph was taken, expressed by the day of the year and decimals of a day, reckoning from Greenwich mean midnight January 1d. 0h., and also by the day of the month (civil reckoning), which latter is placed opposite the total area of Spots and Faculae for the day. The photographs taken in India are distinguished by the letter I, and those taken in Mauritius by the letter M.

The *second* column contains the initials of the two persons measuring the photograph; the initial on the left being that of the person who measured the photograph on the left of the centre of the measuring instrument, and that on the right being that of the person who measured on the right of the centre.

The following are the signatures of those persons who measured the photographs for the year 1890:—

E. W. Maunder	-	-	M	H. Appleyard	-	-	-	HA
S. J. Temple	-	-	ST					

The *third* column gives the No. of the group, and the letter for the spot. The groups are numbered in the order of their appearance.

The *next two* columns give the Distance from the Centre of the Sun in terms of the Sun's Radius, and the Position-Angle from the Sun's Axis, reckoned from the Sun's North Pole in the direction *n*, *f*, *s*, *p*, both results being corrected for the effects of astronomical refraction.

The measures of the photographs were made with a large position-micrometer specially constructed by Messrs. Troughton and Simms for the measurement of photographs of the Sun up to 12 inches in diameter. In this micrometer the

photograph is held with its film-side uppermost on three pillars fixed on a circular plate, which can be turned through a small angle, about a pivot in its circumference, by means of a screw and antagonistic spring acting at the opposite extremity of the diameter. The pivot of this plate is mounted on the circumference of another circular plate, which can be turned by screw-action about a pivot in its circumference,  $90^\circ$  distant from that of the upper plate, this pivot being mounted on a circular plate with position-circle which rotates about its centre. By this means small movements in two directions at right angles to each other can be readily given, and the photograph can be accurately centred with respect to the position-circle. When this has been done, a positive eye-piece, having at its focus a glass diaphragm ruled with cross-lines into squares, with sides of one-hundredth of an inch (for measurement of areas), is moved along a slide diametrically across the photograph, the diaphragm being nearly in contact with the photographic film, so that parallax is avoided. The distance of a spot or facula from the centre of the Sun is read off by means of a scale and vernier to 1-250th of an inch (corresponding to 0.001 of the Sun's radius for photographs having a solar diameter of 8 inches). The position-angle is read off on a large position-circle which rotates with the photographic plate. The photograph is illuminated by diffused light reflected from white paper placed at an angle of  $45^\circ$  between the photograph and the plate below.

The following is the process of measurement of a photograph:—By means of the screws attached to the plates carrying the pillars which hold the photograph, the image of the Sun is centred as accurately as possible by rotation. The position-circle is then set to the readings  $0^\circ$ ,  $90^\circ$ ,  $180^\circ$ , and  $270^\circ$  in succession, and the scale readings taken for the two limbs. The scale being so adjusted that its zero coincides with the centre of rotation of the position-circle, the mean of the eight readings for the limb gives the mean radius of the Sun directly.

At the principal focus of the photoheliograph are two cross-wires which serve to determine the zero of position-angles on the photograph.

One of the wires was found to be broken on July 18, and a fresh pair of wires was in consequence inserted on July 19.

The zero of position-angles for the Dallmeyer Photoheliograph, employed at Greenwich, has generally been determined throughout 1890 by the measurement of a plate which had been exposed to the Sun's rays twice, with an interval of about 100 seconds between the two exposures, the instrument being firmly clamped. Two images of the Sun, overlapping each other by a little more than the fifth part of the Sun's diameter, were

therefore produced upon the plate, and the exposures having been so given that the line joining the cusps passed through the centre of the plate, the inclination of the wires of the photoheliograph to this line was measured with the position-micrometer, and a small correction for the inclination of the Sun's path was then applied. The following table gives the correction for zero of position for the mean of the two wires as thus determined :—

Date, Greenwich Civil Time.		Correction for Zero.
1889 December	23. 12 <sup>h</sup>	+ 0. 39 <sup>o /</sup>
1890 January	29. 12	+ 0. 48
February	10. 12	+ 0. 48
April	1. 12	+ 0. 38
	29. 11	+ 0. 37
June	18. 10	+ 0. 33
	18. 11	+ 0. 34
July	21. 13	+ 1. 29
	22. 12	— 0. 4
August	13. 13	— 0. 14
	22. 11	— 0. 14
September	8. 11	+ 0. 1
October	10. 12	— 0. 3
November	26. 10	— 0. 12
1891 January	16. 10	— 0. 12
February	12. 12	— 0. 13

The zero of position has also been determined on several occasions by allowing the diurnal motion to carry a spot or the Sun's limb along the equatorial wire, a correction for the inclination of the Sun's path being applied to the reading of the position-circle so obtained, and also by running the image along the wire by the use of the R. A. slow motion, the mean of the two determinations, further corrected for the error of the perpendicularity of the wires, being then taken.

GREENWICH OBSERVATIONS, 1890.

(b)

The correction for error of perpendicularity of the wires in use up to 1890 July 18, was  $- 0^{\circ}. 25'$ ; for the new wires inserted 1890 July 19 it was  $- 0^{\circ}. 16'$ . The following table gives the correction for zero of position of the mean of the two wires as obtained by this method:—

Date, Greenwich Civil Time.		Corrected Zero of Position-Circle from Transit.	Zero of Position-Circle obtained when using R.A. Slow Motion.
1889	December 3. 11	+ 0. 43	+ 0. 41
1890	February 10. 12	+ 0. 42	+ 0. 39
	April 1. 11	+ 0. 43	+ 0. 40
	29. 11	+ 0. 40	+ 0. 42
	August 1. 13	- 0. 13	- 0. 12
	13. 13	- 0. 8	- 0. 9
	September 8. 11	- 0. 5	- 0. 9
1891	February 12. 12	- 0. 10	- 0. 12

In the use at Greenwich of the Dallmeyer Photoheliograph the position-circle has usually been set to some convenient reading near that for zero, so that the wires are respectively very nearly parallel and perpendicular to the circle of declination, and a correction for zero of position of the photoheliograph for the mean of the two wires has been applied to the zero of the position-circle of the micrometer. The setting of the position-circle was retained at  $353^{\circ}. 0$  up to 1890 July 22, when it was altered to  $354^{\circ}. 0$ . It has since been kept at the latter reading.

The correction for zero of position adopted from January 1 to April 29, was  $+ 0^{\circ}. 7$ ; from May 1 to July 15,  $+ 0^{\circ}. 6$ . The correction adopted from July 19 (when the new wires were inserted) to the end of the year, was  $- 0^{\circ}. 2$ . The zero of the position-circle of the micrometer has been determined from the readings of the position-circle for the four extremities of the two wires. The resulting combined correction is applied to all position-circle readings for spots and faculae, so as to give true position-angles.

In the use of the Photoheliographs at Dehra Dûn and in Mauritius the position-circle has always been set to the zero as determined by allowing the diurnal motion to carry a spot or the Sun's limb along the horizontal wire, and the accuracy of the adjustment has been tested at short intervals. No correction for zero of position of the wires has therefore been applied for the reduction of the photographs taken in India or in Mauritius.

The uncorrected distance from the Sun's centre for spots and faculæ is read off directly to 1-250th of an inch by means of a scale and vernier, the zero of the scale of the new micrometer being adjusted to coincide with the centre of the instrument.

Two sets of measures of the Sun's limb and of spots and faculæ on each photograph have been taken and the mean of the two sets adopted.

No correction has been applied to the photographs on account of distortion.

The correction for the effect of refraction has been thus found, the Sun's image being assumed to be sensibly an ellipse. The refraction being sensibly  $c \tan z$  where  $c = \sin 57''.5 = \frac{1}{3600}$  nearly, and  $z$  is the apparent zenith distance, we shall have—

$$\frac{\text{Vertical Diameter}}{\text{Horizontal Diameter}} = \frac{1 - c \sec^2 z}{1 - c} = 1 - c \tan^2 z ;$$

and thus the effect of refraction will be to diminish any vertical ordinate  $y$  by the quantity  $c \tan^2 z$ . Resolving this along and perpendicular to the radius vector  $r$ , and putting  $v$  for the position-angle of the vertex, we have for  $\delta r$  and  $\delta \theta$ , the corrections to radius vector and position-angle for the effect of refraction—

$$\delta r = + c . \tan^2 z \times r . \cos^2 (\theta - v) = + c . \tan^2 z \times r \times \frac{1 + \cos 2 (\theta - v)}{2},$$

$$\delta \theta = - c . \tan^2 z . \sin (\theta - v) . \cos (\theta - v) = - c . \tan^2 z \frac{\sin 2 (\theta - v)}{2}.$$

The quantity  $\delta r$  thus found is the correction, on the supposition that a horizontal diameter of the Sun is taken as the scale. But, as the mean of two diameters at right angles has been used, the scale itself requires the correction  $\delta R = + c . \tan^2 z \times R \times \frac{1}{2} \left\{ \frac{1 + \cos 2 (\theta_0 - v)}{2} + \frac{1 + \cos 2 (\theta_0 + 90^\circ - v)}{2} \right\} = + \frac{1}{2} c R . \tan^2 z$ , where  $R$  is the Sun's mean radius and  $\theta_0$ ,  $\theta_0 + 90^\circ$  the position-angles of the two diameters measured. Thus the final correction to  $r$  becomes—

$$\delta r = + c . \tan^2 z \times r \times \frac{\cos 2 (\theta - v)}{2}.$$

(b) 2

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The quantities  $c \tan^2 z$ ,  $-\frac{\sin 2(\theta - v)}{2}$ , and  $\frac{\cos 2(\theta - v)}{2}$  have been tabulated for use as follows,  $c \tan^2 z$  being expressed in circular measure and in arc for application to distances and position-angles respectively:—

$c \tan^2 z$ .

$z$ .	In Circular Measure.	In Arc.	$z$ .	In Circular Measure.	In Arc.	$z$ .	In Circular Measure.	In Arc.
0			0			0		
80	·0089	31	70	·0021	7	60	·0008	3
79	·0073	25	69	·0019	6½	58	·0007	2
78	·0061	21	68	·0017	6	56	·0006	2
77	·0052	18	67	·0015	5½	54	·0005	2
76	·0045	15	66	·0014	5	52	·0005	2
75	·0039	13	65	·0013	4½	50	·0004	1
74	·0034	11½	64	·0012	4	45	·0003	1
73	·0030	10	63	·0011	4	40	·0002	1
72	·0026	9	62	·0010	3	30	·0001	0
71	·0023	8	61	·0009	3			

Factors for Refraction.

$\theta - v$	$\theta - v$	$-\frac{\sin 2(\theta - v)}{2}$	$\frac{\cos 2(\theta - v)}{2}$	$\theta - v$	$\theta - v$	$-\frac{\sin 2(\theta - v)}{2}$	$\frac{\cos 2(\theta - v)}{2}$
0	0			0	0		
0	180	— ·00	+ ·50	95	275	+ ·09	— ·49
5	185	— ·09	+ ·49	100	280	+ ·17	— ·47
10	190	— ·17	+ ·47	105	285	+ ·25	— ·43
15	195	— ·25	+ ·43	110	290	+ ·32	— ·38
20	200	— ·32	+ ·38	115	295	+ ·38	— ·32
25	205	— ·38	+ ·32	120	300	+ ·43	— ·25
30	210	— ·43	+ ·25	125	305	+ ·47	— ·17
35	215	— ·47	+ ·17	130	310	+ ·49	— ·09
40	220	— ·49	+ ·09	135	315	+ ·50	·00
45	225	— ·50	·00	140	320	+ ·49	+ ·09
50	230	— ·49	— ·09	145	325	+ ·47	+ ·17
55	235	— ·47	— ·17	150	330	+ ·43	+ ·25
60	240	— ·43	— ·25	155	335	+ ·38	+ ·32
65	245	— ·38	— ·32	160	340	+ ·32	+ ·38
70	250	— ·32	— ·38	165	345	+ ·25	+ ·43
75	255	— ·25	— ·43	170	350	+ ·17	+ ·47
80	260	— ·17	— ·47	175	355	+ ·09	+ ·49
85	265	— ·09	— ·49	180	360	·00	+ ·50
90	270	·00	— ·50				

The position-angle of the Vertex  $v$  is readily taken from a globe.

The distance from centre in terms of the Sun's radius given in the *fourth* column is then readily found by dividing the measured distance  $r_0$ , as corrected for refraction, by the measured mean radius of the Sun,  $R$ ; and the Position-Angle from the Sun's Axis given in the *fifth* column is obtained by applying to the Position-Angle (from the N. point) corrected for refraction the Position-Angle of the Sun's Axis derived from the "Auxiliary Tables for determining the Angle of Position of the Sun's Axis, and the Latitude and Longitude of the Earth referred to the Sun's Equator," by Warren De La Rue, F.R.S.

The *sixth* and *seventh* columns give the heliographic longitude and latitude of the spot, which are thus computed.\* Let  $r$  be the measured distance of a spot from the centre of the Sun's apparent disc,  $R$  the measured radius of the Sun on the photograph, ( $R$ ) the tabular semidiameter of the Sun in arc, and  $\rho$ ,  $\rho'$  the angular distances of a spot from the centre of the apparent disk as viewed from the Sun's centre and from the Earth respectively. Then we have—

$$\rho' = \frac{r}{R}(R); \text{ and } \sin(\rho + \rho') = \frac{r}{R},$$

$$\text{whence } \rho = \sin^{-1} \frac{r}{R} - \rho'.$$

Log  $\sin \rho$  and log  $\cos \rho$  as computed from this formula are given in "Tables for the Reduction of Solar Observations No. 2," by Warren De La Rue, F.R.S. Then, if  $D$ ,  $\lambda$  are the heliographic latitudes of the Earth and the Spot respectively, referred to the Sun's Equator, and  $L$ ,  $l$  the heliographic longitudes reckoned from the ascending node of the Sun's Equator on the ecliptic, and  $\chi$  the position-angle from the Sun's axis, we have by the ordinary equations of spherical trigonometry—

$$\sin \lambda = \cos \rho \sin D + \sin \rho \cos D \cos \chi$$

$$\sin(L - l) = \sin \chi \sin \rho \sec \lambda.$$

The quantities  $L$  and  $D$  are derived from Warren De La Rue's Auxiliary Tables before referred to, in the computation of which the following formulæ have been used—

$$\tan L = \cos I \tan(\odot - N)$$

$$\sin D = \sin I \sin(\odot - N)$$

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\* Researches on Solar Physics: Heliographical Positions and Areas of Sun Spots observed with the Kew Photoheliograph during the years 1862 and 1863, by W. De La Rue, B. Stewart, and B. Loewy. Phil. Trans. 1869.

where  $I$  is the inclination of the Sun's Equator to the ecliptic,  $N$  the longitude of the ascending node, and  $\odot$  the longitude of the Sun.

The position-angle  $\chi$  is given by the formula—

$$\chi = P + G + H$$

where  $P$  is the position-angle from the north point of the Sun, and  $G$  and  $H$  two auxiliary angles given by the formulæ—

$$\begin{aligned}\tan G &= \tan \omega \cos \odot \\ \tan H &= \tan I \cos (\odot - N)\end{aligned}$$

where  $\omega$  is the obliquity of the ecliptic.

It will be seen that  $G$  is the inclination of two planes through the line joining the centres of the Earth and Sun passing through the poles of the Earth and of the ecliptic respectively, and that  $H$  is the inclination of two planes through the same line and the poles of the Sun and of the ecliptic. The values assumed for  $I$ ,  $N$ ,  $\omega$  in the computation of the Tables are  $7^\circ 15'$ ,  $74^\circ 18'$ , and  $23^\circ 27'.5$  respectively.

The Heliographic Longitude of the Spot is found from  $l$ , the Heliographic Longitude from Node, by subtracting the Reduction to the Prime Meridian, which is the Longitude of the Node at the epoch of the photograph, referred to the assumed Prime Meridian, the latter being the meridian which passed through the ascending node at mean noon, 1854, Jan. 1. The period of rotation assumed is 25.38 days.

The Heliographic Longitude and Latitude of the Centre of the Sun's Disk at the time of the exposure of each photograph are also given (in brackets) in the *sixth* and *seventh* columns respectively. The Longitude of the Centre of the Disk is found by subtracting the Reduction to the Prime Meridian from  $L$ , the Longitude of the Centre from the Node. The Latitude of the Centre is of course the same as  $D$ , the Heliographic Latitude of the Earth.

The measures of areas given in the *last three* columns were made with a glass diaphragm ruled into squares, with sides of one hundredth of an inch, and placed

nearly in contact with the photographic film. The integral number of squares and parts of a square contained in the area of a spot or facula was estimated by the observer, two independent sets of measures being made by two observers. The mean of the two sets of measures has been taken for each photograph. The factor for converting the areas, as measured in ten-thousandths of a square inch, into millionths of the Sun's visible hemisphere, allowing for the effect of foreshortening, has been inferred by means of a table of double entry, giving the equivalent of one square for different values of the Sun's radius, and for different distances of the spot or facula from the Sun's centre, as measured by means of the position-micrometer.

The individual spots in a group have in some cases not been measured separately, but combined into a cluster of two or three small spots close together, the position of the centre of gravity and the aggregate area of the cluster being given. The actual number of individual spots is usually stated in the Notes.

§ 3. *Ledgers of Areas and Positions of Groups of Sun Spots deduced from the measurement of the Solar photographs for each day in the year 1890.*

In these Ledgers the daily results for each group are collected together from the measures of the individual spots and given in a condensed form. The first column gives for each day, on which the group was observed, the Greenwich civil time at which each photograph was taken, expressed by the day of the month (civil reckoning) and the decimals of a day reckoning from Greenwich mean midnight. The second and third columns give the sums, for each day, of the projected areas of all the umbrae and whole spots comprised in the group, the projected area being the area as it is measured upon the photograph, uncorrected for foreshortening, and expressed in millionths of the Sun's apparent disk. The fourth and fifth columns give the sums for each day of the areas of all the umbrae and whole spots comprised in the group, corrected for foreshortening, and expressed in millionths of the Sun's visible hemisphere. The sixth and seventh columns give the mean longitude and latitude of the group, found by multiplying the longitude and latitude of each separately measured component of the group by its area, and dividing the sum of the products by the sum of the areas. The last column gives the mean longitude of the group from the central meridian, and is found by subtracting the longitude of the centre of the disk from the mean longitude of the group. At the foot of these daily results for each group are given the mean areas of umbrae and whole spots and the mean longitude and latitude for the period of observation.

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§ 4. *Total Projected Areas of Sun Spots and Faculæ, for each day, and Mean Areas and Mean Heliographic Latitude of Sun Spots and Faculæ, for each Rotation of the Sun, and for the Year 1890.*

This section requires no further explanation.

1892, February 25.

W. H. M. CHRISTIE.

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ROYAL OBSERVATORY, GREENWICH.

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SPECTROSCOPIC OBSERVATIONS

MADE AT THE

ROYAL OBSERVATORY, GREENWICH,

1890.

MEASURES OF DISPLACEMENT OF LINES in the SPECTRA of STARS, SUN, MOON, AND PLANETS as compared with those of TERRESTRIAL ELEMENTS, and CONCLUDED MOTIONS in the LINE of SIGHT, from OBSERVATIONS at the ROYAL OBSERVATORY, GREENWICH, in the Year 1890.

The day specified in the first column is the Civil Day, and the hours and minutes are those of Greenwich Civil Time, commencing at Greenwich Mean Midnight and counting from 0 to 24 hours.

Note.—The motion corresponding to the displacement actually observed may be inferred from the Concluded Motion by adding the Earth's Motion algebraically.

The "Half-prism" Spectroscope was used throughout. Each "Half-prism" is compound, and is composed of a flint "half-prism" (*i.e.*, the half of an isosceles prism, cut by a plane perpendicular to the base,) and a crown prism, cemented on the emergent face so as to form the half of a direct-vision prism. With one such half-prism a dispersion of about  $18\frac{1}{2}^\circ$  from A to H, equivalent to that produced by four flint prisms of  $60^\circ$ , is obtained; and with a train of two, a dispersion of about  $80^\circ$ , equivalent to that produced by sixteen flint prisms of  $60^\circ$ . One half-prism has been employed throughout. The dispersions have been inferred from measurements of the distance between  $b_1$  and  $b_2$  as compared with the wave-length measure.

$1^{\text{rev}}$  of the micrometer corresponds with one "half-prism" to  $10\cdot4$  tenth-metres or 375 miles per second for the  $b$  lines, and to  $7\cdot91$  tenth-metres or 304 miles per second for the F line.

$1^{\text{rev}}$  of the screw for opening the slit corresponds to  $0\cdot01$  inch, or about  $10^\circ$ .

The slit lies north and south when the reading of the Position Circle is  $6^\circ$ .

The velocity of light has been taken as 186,660 miles per second, and the distance of the Sun as 92,250,000 miles.

The estimations of displacements have been made by *indirect* comparison with the comparison-line, except where the contrary is expressly stated. The displacement is estimated in terms of the breadth of the comparison-line.

The sign + denotes a displacement towards the red or a motion of recession, — a displacement towards the blue or a motion of approach.

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
					Measured.	Estimated.		Measured.	Estimated.	
Jan. 4. 22. 0 22. 1	M	Aldebaran.....	F	$0\cdot198$	$+0\cdot329$	$+\frac{3}{4}$	+ 11'2	+ 88'7	+ 57'3	Spectrum very faint. Star-line seen with great difficulty. Position Circle $6^\circ$ .
	M	,,	F	$0\cdot198$	$+0\cdot165$	$+\frac{1}{3}$	+ 11'2	— 38'9	+ 19'3	
Feb. 7. 20. 23 20. 26	M	Aldebaran.....	F	$0\cdot198$	$+0\cdot169$	$+\frac{2}{3}$	+ 17'7	+ 33'6	+ 43'2	Spectrum faint. Definition bad. Star-line seen with great difficulty. Position Circle $6^\circ$ .
	M	,,	F	$0\cdot198$	$+0\cdot103$	$+\frac{1}{2}$	+ 17'7	+ 13'6	+ 28'0	
Feb. 18. 20. 10 20. 11 20. 16 20. 18 20. 28 20. 32 20. 34 20. 36 20. 46 20. 50 20. 51 20. 53 21. 25 21. 26 21. 27 21. 29 21. 44 21. 45 21. 51 22. 1 22. 9 22. 12	M	Rigel .....	F	$0\cdot170$	$+0\cdot119$	$+\frac{1}{4}$	+ 15'5	+ 20'6	+ 10'0	Spectrum rather faint but fairly steady. Definition fair.
	M	,,	F	$0\cdot170$	$+0\cdot175$	$+\frac{1}{2}$	+ 15'5	+ 37'6	+ 35'5	
	M	$\gamma$ Orionis .....	F	$0\cdot170$	$+0\cdot118$	$+\frac{1}{3}$	+ 17'0	+ 18'8	+ 17'0	Spectrum rather faint but fairly steady. Definition poor.
	M	,,	F	$0\cdot170$	$+0\cdot104$	$+\frac{1}{4}$	+ 17'0	+ 14'6	+ 8'5	
	M	$\beta$ Tauri .....	F	$0\cdot170$	$+0\cdot061$	$+\frac{1}{10}$	+ 17'5	+ 1'0	— 7'3	Spectrum faint but fairly steady. Star-line faint and very difficult to see. Measures rough and made with much difficulty.
	M	,,	F	$0\cdot170$	— 0'068	— $\frac{1}{10}$	+ 17'5	— 38'1	— 27'7	
	M	,,	F	$0\cdot170$	$+0\cdot089$	$+\frac{1}{4}$	+ 17'5	+ 9'5	+ 8'0	Spectrum bright but very unsteady. Direct comparison appeared to show a very small displacement towards the red.
	M	,,	F	$0\cdot170$	$+0\cdot040$	$+\frac{1}{10}$	+ 17'5	— 5'4	— 7'3	
	M	$\delta$ Orionis .....	F	$0\cdot170$	$+0\cdot168$	$+\frac{1}{3}$	+ 16'1	+ 34'9	+ 34'9	Spectrum bright and steady. Star-line seen well.
	M	,,	F	$0\cdot170$	— 0'096	— $\frac{1}{3}$	+ 16'1	— 45'2	— 50'1	
	M	,,	F	$0\cdot170$	$+0\cdot044$	$+\frac{1}{10}$	+ 16'1	— 3'3	— 5'9	Spectrum fairly bright and steady. Star-line faint and seen with difficulty.
	M	,,	F	$0\cdot170$	$+0\cdot080$	$+\frac{1}{5}$	+ 16'1	+ 8'2	+ 4'3	
	M	Sirius.....	F	$0\cdot170$	— 0'034	— $\frac{1}{10}$	+ 10'7	— 21'0	— 20'9	Spectrum fairly bright and steady. Star-line seen fairly well.
	M	,,	F	$0\cdot170$	$+0\cdot020$	$+\frac{1}{10}$	+ 10'7	— 4'6	— 0'5	
	M	,,	F	$0\cdot170$	$+0\cdot009$	0	+ 10'7	— 8'0	— 10'7	Spectrum bright and steady. Star-line seen well.
	M	,,	F	$0\cdot170$	$+0\cdot055$	$+\frac{1}{10}$	+ 10'7	+ 6'0	— 0'5	
M	Procyon.....	F	$0\cdot170$	$+0\cdot030$	$+\frac{1}{4}$	+ 10'6	— 1'5	+ 14'9	Spectrum bright and steady. Star-line seen well.	
M	,,	F	$0\cdot170$	$+0\cdot049$	$+\frac{1}{4}$	+ 10'6	+ 4'3	+ 14'9		
M	Pollux .....	F	$0\cdot170$	— 0'038	— $\frac{1}{10}$	+ 11'6	— 23'2	— 21'8	Spectrum bright and steady. Star-line faint and seen with difficulty.	
M	,,	F	$0\cdot170$	— 0'037	— $\frac{1}{10}$	+ 11'6	— 22'9	— 21'8		
M	Castor.....	F	$0\cdot170$	$+0\cdot176$	$+\frac{1}{3}$	+ 12'3	+ 41'2	+ 55'7	Spectrum fairly bright and steady. Star-line seen fairly well.	
M	,,	F	$0\cdot170$	$+0\cdot160$	$+\frac{1}{3}$	+ 12'3	+ 36'3	+ 55'7		

AT THE ROYAL OBSERVATORY, GREENWICH, IN THE YEAR 1890.

8

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
					Measured.	Estimated.		Measured.	Estimated.	
Feb. 18. 22. 20	M	$\gamma$ Geminorum..	F	0.170	+0.185	+ $\frac{1}{10}$	+ 14.8	(+ 41.4)	(+ 36.2)	Attempts to bisect the star-line were very unsatisfactory.
22. 22	M	"	F	0.170	-0.117	- $\frac{1}{10}$	+ 14.8	(- 50.3)	(- 48.8)	
22. 23	M	"	F	0.170	+0.128	+ $\frac{1}{10}$	+ 14.8	(+ 24.1)	(+ 19.2)	Spectrum very unsteady. Star-line faint.
22. 25	M	"	F	0.170	-0.137	- $\frac{1}{10}$	+ 14.8	(- 56.4)	(- 65.8)	
22. 44	M	Aldebaran.....	F	0.170	+0.142	+ $\frac{1}{10}$	+ 18.5	+ 24.6	+ 49.5	Spectrum steady and fairly bright. Star-line seen well.
22. 45	M	"	F	0.170	+0.103	+ $\frac{1}{10}$	+ 18.5	+ 12.8	+ 15.5	
22. 51	M	$\beta$ Aurigæ .....	F	0.170	+0.031	+ $\frac{1}{10}$	+ 15.4	- 6.0	- 5.2	Position Circle, 6°.
22. 52	M	"	F	0.170	-0.006	0	+ 15.4	- 17.2	- 15.4	
Mar. 3. 19. 55	M	Rigel .....	F	0.210	+0.162	+ $\frac{1}{10}$	+ 16.0	+ 33.2	+ 39.3	Spectrum faint and very unsteady.
19. 56	M	"	F	0.210	+0.232	+ $\frac{1}{10}$	+ 16.0	+ 54.5	+ 50.3	
19. 57	M	"	F	0.210	+0.117	+ $\frac{1}{10}$	+ 16.0	+ 19.5	+ 17.2	Spectrum faint and very unsteady. Star-line dark.
19. 59	M	"	F	0.210	+0.101	+ $\frac{1}{10}$	+ 16.0	+ 14.7	+ 11.6	
20. 9	M	$\gamma$ Orionis .....	F	0.210	+0.190	+ $\frac{1}{10}$	+ 17.8	+ 39.9	+ 9.8	Spectrum faint but fairly steady. Star-line dark.
20. 11	M	"	F	0.210	+0.014	+ $\frac{1}{10}$	+ 17.8	- 13.5	+ 19.1	
20. 18	M	$\beta$ Tauri .....	F	0.210	+0.086	+ $\frac{1}{10}$	+ 18.4	+ 7.7	+ 14.8	Spectrum exceedingly unsteady. Star-line unusually broad and diffused. Measures very rough.
20. 20	M	"	F	0.210	+0.117	+ $\frac{1}{10}$	+ 18.4	+ 17.1	+ 18.5	
20. 30	M	Sirius.....	F	0.210	+0.025	+ $\frac{1}{10}$	+ 12.6	- 5.0	- 1.5	Spectrum faint but fairly steady. Definition fair.
20. 32	M	"	F	0.210	+0.058	+ $\frac{1}{10}$	+ 12.6	+ 5.0	+ 9.5	
20. 34	M	"	F	0.210	-0.100	- $\frac{1}{10}$	+ 12.6	- 43.0	- 45.8	Spectrum fairly bright and steady. Star-line seen well.
20. 36	M	"	F	0.210	+0.081	+ $\frac{1}{10}$	+ 12.6	+ 12.0	- 1.5	
20. 38	M	"	F	0.210	+0.012	+ $\frac{1}{10}$	+ 12.6	- 9.0	- 1.5	Spectrum faint but fairly steady. Definition fair.
20. 39	M	"	F	0.210	+0.001	0	+ 12.6	- 12.3	- 12.6	
20. 57	M	$\gamma$ Geminorum..	F	0.210	+0.088	+ $\frac{1}{10}$	+ 16.9	+ 9.8	+ 10.7	Spectrum fairly bright and steady. Star-line seen well.
20. 59	M	"	F	0.210	+0.075	+ $\frac{1}{10}$	+ 16.9	+ 5.9	+ 16.3	
21. 9	M	Procyon.....	F	0.210	+0.031	+ $\frac{1}{10}$	+ 13.6	- 4.2	+ 8.5	Spectrum faint but steady. Star-line very faint and seen with great difficulty.
21. 11	M	"	F	0.210	+0.062	+ $\frac{1}{10}$	+ 13.6	+ 5.2	+ 14.0	
21. 25	M	Pollux .....	F	0.210	-0.029	- $\frac{1}{10}$	+ 14.6	- 23.4	- 25.7	Spectrum fairly bright and steady. Star-line seen well.
21. 29	M	"	F	0.210	-0.031	- $\frac{1}{10}$	+ 14.6	- 24.0	- 25.7	
21. 37	M	Castor .....	F	0.210	+0.105	+ $\frac{1}{10}$	+ 15.0	+ 16.9	+ 21.9	The coincidence of the two spectra appeared perfect.
21. 38	M	"	F	0.210	+0.150	+ $\frac{1}{10}$	+ 15.0	+ 30.6	+ 40.3	
21. 49	M	Moon.....	F	0.210	+0.033			+ 10.0		Star-line very broad, diffused, and ill-defined.
21. 50	M	"	F	0.210	-0.025			- 7.6		
21. 52	M	"	F	0.210	-0.087			- 26.4		Spectrum bright but very unsteady. Star-line seen fairly well.
21. 53	M	"	F	0.210	+0.032			+ 9.7		
21. 54	M	"	F	0.210	+0.009			+ 2.7		Spectrum faint and very unsteady. Measures made with great difficulty.
22. 11	M	$\beta$ Aurigæ .....	F	0.210	+0.032	+ $\frac{1}{10}$	+ 16.8	- 7.1	- 5.7	
22. 14	M	"	F	0.210	-0.099	- $\frac{1}{10}$	+ 16.8	- 46.9	- 53.7	Position Circle, 6°.
22. 22	M	Capella .....	F	0.210	+0.106	+ $\frac{1}{10}$	+ 17.1	+ 15.1	+ 27.1	
22. 23	M	"	F	0.210	+0.076	+ $\frac{1}{10}$	+ 17.1	+ 6.0	+ 19.8	Spectrum faint and very unsteady. Measures made with great difficulty.
22. 41	M	$\beta$ Persei.....	F	0.210	-0.099	- $\frac{1}{10}$	+ 16.4	- 46.5	- 53.3	
22. 42	M	"	F	0.210	-0.142	- $\frac{1}{10}$	+ 16.4	- 59.5	- 60.6	
Mar. 7. 21. 46	M	Sirius.....	F	0.210	+0.008	+ $\frac{1}{10}$	+ 13.0	- 10.6	- 7.5	Spectrum exceedingly unsteady. Much cloud, definition bad.
21. 48	M	"	F	0.210	-0.118	- $\frac{1}{10}$	+ 13.0	- 48.8	- 49.9	
21. 49	M	"	F	0.210	-0.147	- $\frac{1}{10}$	+ 13.0	- 57.7	- 57.2	Position Circle, 6°.
21. 50	M	"	F	0.210	-0.013	- $\frac{1}{10}$	+ 13.0	- 17.0	- 24.1	
Mar. 12. 19. 51	M	Sirius.....	F	0.225	+0.108	+ $\frac{1}{10}$	+ 13.4	+ 19.4	+ 12.5	Spectrum bright but most unsteady. Definition very bad. Star line observed with great difficulty.
19. 52	M	"	F	0.225	+0.047	+ $\frac{1}{10}$	+ 13.4	+ 0.9	- 3.0	
20. 2	M	"	F	0.225	+0.093	+ $\frac{1}{10}$	+ 13.4	+ 14.9	+ 12.5	Spectrum exceedingly unsteady. Definition bad. Star-line seen with great difficulty.
20. 5	M	"	F	0.225	-0.157	- $\frac{1}{10}$	+ 13.4	- 61.1	- 47.9	
20. 6	M	"	F	0.225	-0.113	- $\frac{1}{10}$	+ 13.4	- 47.7	- 47.9	
20. 8	M	"	F	0.225	-0.062	- $\frac{1}{10}$	+ 13.4	- 32.2	- 39.3	
20. 24	M	Rigel .....	F	0.225	+0.121	+ $\frac{1}{10}$	+ 15.8	+ 20.9	+ 25.6	Spectrum faint and very unsteady. Measures made with great difficulty.
20. 25	M	"	F	0.225	+0.080	+ $\frac{1}{10}$	+ 15.8	+ 8.5	+ 18.7	

MOTIONS OF STARS IN THE LINE OF SIGHT, INFERRED FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
					Measured.	Estimated.		Measured.	Estimated.	
Mar. 12. 20. 32	M	δ Orionis .....	F	0'225	-0'061	-	+ 17'0	- 35'5	- 42'9	Spectrum faint and very unsteady. for first two observations, but better for last two.
20. 33	M	,,	F	0'225	+0'090	+ 3/3	+ 17'0	+ 10'3	+ 17'5	
20. 35	M	,,	F	0'225	+0'114	+ 3/3	+ 17'0	+ 17'6	+ 17'5	
20. 37	M	,,	F	0'225	-0'007	0	+ 17'0	- 19'1	- 17'0	Spectrum faint and very unsteady. The work of bisecting the line was most difficult and trying, the star-line being very faint.
20. 49	M	ε Orionis .....	F	0'225	+0'105	+ 2/2	+ 16'9	+ 15'0	+ 24'5	
20. 51	M	,,	F	0'225	+0'088	+ 4/4	+ 16'9	+ 9'8	+ 9'0	
20. 53	M	,,	F	0'225	+0'099	+ 3/3	+ 16'9	+ 13'2	+ 17'6	
20. 55	M	,,	F	0'225	+0'049	+ 2/2	+ 16'9	- 2'0	+ 3'8	
21. 3	M	ζ Orionis .....	F	0'225	+0'022	+ 1/10	+ 16'8	- 10'1	- 6'4	Spectrum very unsteady. Star-line faint, but seen well by glimpses.
21. 5	M	,,	F	0'225	-0'024	+ 1/10	+ 16'8	- 24'1	- 27'2	
21. 7	M	,,	F	0'225	+0'010	+ 1/10	+ 16'8	- 13'8	- 11'6	
21. 8	M	,,	F	0'225	-0'008	0	+ 16'8	- 19'2	- 16'8	Spectrum unsteady, but star-line seen fairly well.
21. 16	M	γ Orionis .....	F	0'225	-0'015	0	+ 17'8	- 22'4	- 17'8	
21. 18	M	,,	F	0'225	-0'004	0	+ 17'8	- 19'0	- 17'8	
21. 26	M	β Tauri .....	F	0'225	+0'094	+ 1/3	+ 18'5	+ 10'1	+ 16'0	
21. 28	M	,,	F	0'225	+0'078	+ 1/3	+ 18'5	+ 5'2	+ 7'4	
21. 37	M	Aldebaran .....	F	0'225	+0'173	+ 3/3	+ 18'0	+ 34'5	+ 33'8	Spectrum very unsteady. Star-line seen with much difficulty. Measures rough.
21. 39	M	,,	F	0'225	+0'056	+ 3/3	+ 18'0	- 1'0	+ 7'9	
21. 49	M	β Aurigæ .....	F	0'225	-0'113	- 2/2	+ 17'2	- 51'5	- 58'6	Spectrum fairly bright but unsteady.
21. 53	M	,,	F	0'225	-0'125	- 3/3	+ 17'2	- 55'2	- 51'7	
22. 5	M	Capella .....	F	0'225	+0'051	+ 3/3	+ 17'1	- 1'6	+ 17'4	Spectrum unsteady. Star-line faint and seen with great difficulty.
22. 7	M	,,	F	0'225	+0'159	+ 3/3	+ 17'1	+ 31'2	+ 34'7	
22. 14	M	β Persei .....	F	0'225	-0'111	- 3/3	+ 15'2	- 48'9	- 49'7	Spectrum fairly bright but unsteady. Star-line seen fairly well.
22. 16	M	,,	F	0'225	-0'116	- 3/3	+ 15'2	- 50'5	- 49'7	
22. 17	M	,,	F	0'225	-0'211	- 3/3	+ 15'2	- 79'3	- 67'0	Spectrum fairly bright and steady. Star-line seen fairly well.
22. 19	M	,,	F	0'225	-0'135	- 3/3	+ 15'2	- 56'2	- 49'7	
22. 26	M	α Persei .....	F	0'225	-0'064	- 3/3	+ 14'9	- 34'3	- 35'6	
22. 29	M	,,	F	0'225	-0'130	- 3/3	+ 14'9	- 54'4	- 49'4	
22. 37	M	γ Geminorum..	F	0'225	-0'090	- 3/3	+ 17'8	- 45'1	- 52'3	
22. 39	M	,,	F	0'225	-0'053	- 3/3	+ 17'8	- 33'9	- 43'7	Spectrum fairly bright and steady. Star-line seen fairly well.
22. 45	M	Castor .....	F	0'225	+0'152	+ 3/3	+ 16'4	+ 29'8	+ 25'0	
22. 47	M	,,	F	0'225	+0'109	+ 3/3	+ 16'4	+ 16'7	+ 18'1	Spectrum bright and fairly steady.
22. 48	M	,,	F	0'225	+0'101	+ 3/3	+ 16'4	+ 14'3	+ 18'1	
22. 50	M	,,	F	0'225	-0'019	0	+ 16'4	- 22'2	- 16'4	Spectrum bright and fairly steady. Star-line faint, but seen fairly well.
22. 59	M	Pollux .....	F	0'225	-0'121	- 3/3	+ 16'1	- 52'3	- 78'2	
23. 1	M	,,	F	0'225	-0'120	- 3/3	+ 16'1	- 52'5	- 57'5	
23. 13	M	Procyon .....	F	0'225	-0'009	0	+ 15'2	- 17'9	- 15'2	Spectrum bright but very unsteady.
23. 15	M	,,	F	0'225	-0'026	- 1/10	+ 15'2	- 23'1	- 20'4	
23. 16	M	,,	F	0'225	-0'074	- 2/10	+ 15'2	- 37'7	- 41'1	
23. 18	M	,,	F	0'225	-0'073	- 2/10	+ 15'2	- 37'4	- 35'9	
Position Circle, 6°.										
Mar. 14. 11. 50	M	Sky.....	F	0'225	-0'014			- 4'3		The coincidence of the two spectra appeared perfect.
11. 55	M	,,	F	0'225	-0'022			- 6'7		
12. 0	M	,,	F	0'225	+0'008			+ 2'4		
12. 5	M	,,	F	0'225	-0'005			- 1'5		
12. 10	M	,,	F	0'225	-0'015			- 4'6		Position Circle, 6°.
Position Circle, 6°.										
Mar. 17. 20. 34	M	Nebula in Orion..	N <sub>1</sub>	0'095	+0'086		+ 16'2	+ 13'0		Compared with Nitrogen. The measures of the nebular line were made with great difficulty but may give a fair result for the position of the line. Assuming the wave-length of the Nitrogen line as 5005.2 tenth-metres that of the chief line in the Orion nebula, would be 5005.0, when corrected for the motion of the earth in its orbit. But the measures of the nebular line are not only too rough to give any trustworthy determination of the motion of the nebula in the line of sight, but must also be corrected for the difference in wave-length, as yet not precisely determined, between the nebular line and the line of Nitrogen.
20. 41	M	,,	N <sub>1</sub>	0'095	+0'118		+ 16'2	+ 23'9		
20. 48	M	,,	N <sub>1</sub>	0'095	-0'032		+ 16'2	- 27'1		
20. 53	M	,,	N <sub>1</sub>	0'095	+0'121		+ 16'2	+ 24'9		
20. 57	M	,,	N <sub>1</sub>	0'095	-0'074		+ 16'2	- 41'3		
21. 5	M	,,	N <sub>1</sub>	0'095	-0'047		+ 16'2	- 32'2		
21. 15	M	,,	N <sub>1</sub>	0'095	+0'009		+ 16'2	- 13'1		

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.	
					Measured.	Estimated.		Measured.	Estimated.		
Mar. 17. 22. 1	M	$\alpha$ Orionis .....	$b_1$	0.095	+0.031	+ $\frac{1}{10}$	+ 17.8	- 6.2	- 3.9	Spectrum exceedingly unsteady. Star-lines seen with great difficulty.	
22. 3	M	,,	$b_1$	0.095	+0.100	+ $\frac{1}{10}$	+ 17.8	+ 19.7	+ 28.6		
22. 4	M	,,	$b_4$	0.095	+0.145	+ $\frac{1}{10}$	+ 17.8	+ 36.6	+ 27.0		
22. 7	M	,,	$b_4$	0.095	+0.093	+ $\frac{1}{10}$	+ 17.8	+ 17.1	+ 38.2		
22. 11	M	,,	$b_1$	0.095	+0.062	+ $\frac{1}{10}$	+ 17.8	+ 5.5	+ 37.9		
22. 12	M	,,	$b_1$	0.095	+0.049	+ $\frac{1}{10}$	+ 17.8	+ 0.6	+ 17.0		
22. 14	M	,,	$b_4$	0.095	+0.074	+ $\frac{1}{10}$	+ 17.8	+ 10.0	+ 19.5		
22. 15	M	,,	$b_4$	0.095	+0.081	+ $\frac{1}{10}$	+ 17.8	+ 12.6	+ 27.0		
22. 27	M	Aldebaran.....	$b_1$	0.095	+0.065	+ $\frac{1}{10}$	+ 17.4	+ 7.0	+ 24.4		Spectrum exceedingly unsteady. Star-lines seen with great difficulty.
22. 29	M	,,	$b_1$	0.095	+0.053	+ $\frac{1}{10}$	+ 17.4	+ 2.5	+ 24.4		
22. 37	M	Capella .....	$b_1$	0.095	+0.098	+ $\frac{1}{10}$	+ 16.9	+ 19.9	+ 52.7		Spectrum exceedingly unsteady. Star-line seen well from time to time.
22. 39	M	,,	$b_1$	0.095	+0.051	+ $\frac{1}{10}$	+ 16.9	+ 2.2	+ 17.9		
22. 40	M	,,	$b_1$	0.095	+0.089	+ $\frac{1}{10}$	+ 16.9	+ 16.5	+ 29.5		Spectrum faint and exceedingly unsteady. Star-line seen with great difficulty.
22. 41	M	,,	$b_1$	0.095	+0.051	+ $\frac{1}{10}$	+ 16.9	+ 2.2	+ 29.5		
22. 49	M	Pollux .....	$b_1$	0.095	+0.052	- $\frac{1}{10}$	+ 16.7	- 36.2	- 51.5		
22. 51	M	,,	$b_1$	0.095	-0.006	0	+ 16.7	- 18.9	- 16.7		
23. 33	M	Arcturus .....	$b_1$	0.095	-0.155	- $\frac{1}{10}$	- 6.8	- 51.4	- 62.8		
23. 34	M	,,	$b_1$	0.095	-0.073	- $\frac{1}{10}$	- 6.8	- 20.6	- 28.0		
23. 35	M	,,	$b_1$	0.095	-0.077	- $\frac{1}{10}$	- 6.8	- 22.1	- 28.0		
23. 36	M	,,	$b_1$	0.095	-0.072	- $\frac{1}{10}$	- 6.8	- 20.2	- 28.0		
										Position Circle, 6°.	
Mar. 18. 12. 2	M	Sky.....	$b_1$	0.095	+0.008			+ 3.0		The coincidence of the two spectra appeared perfect.	
12. 4	M	,,	$b_1$	0.095	+0.003			+ 1.1			
12. 6	M	,,	$b_1$	0.095	+0.018			+ 6.8			
12. 8	M	,,	$b_1$	0.095	-0.018			- 6.8			
12. 10	M	,,	$b_1$	0.095	+0.002			+ 0.8			
										Position Circle 6°.	
Mar. 21. 23. 0	M	Procyon.....	F	0.208	-0.038	- $\frac{1}{10}$	+ 16.4	- 28.0	- 27.7	Spectrum bright and steady. Star-line seen well.	
23. 15	M	,,	F	0.208	-0.056	- $\frac{1}{10}$	+ 16.4	- 33.4	- 38.9		
23. 30	M	Castor .....	F	0.208	+0.114	+ $\frac{1}{10}$	+ 17.4	+ 17.2	+ 20.2	Spectrum bright and steady. Star-line seen well.	
23. 40	M	,,	F	0.208	+0.025	+ $\frac{1}{10}$	+ 17.4	- 9.8	- 6.1		
23. 55	M	Pollux .....	F	0.208	-0.172	- $\frac{1}{10}$	+ 17.2	- 69.5	- 73.6	Spectrum bright and steady. Star-line seen well.	
22. 0. 5	M	,,	F	0.208	-0.165	- $\frac{1}{10}$	+ 17.2	- 67.3	- 73.6		
0. 30	M	Regulus.....	F	0.208	+0.031	+ $\frac{1}{10}$	+ 10.1	- 0.7	+ 1.2	Passing cloud interrupted the observations and rendered them difficult and rough.	
0. 40	M	,,	F	0.208	-0.036	- $\frac{1}{10}$	+ 10.1	- 21.0	- 21.4		
										Position Circle, 6°.	
Mar. 28. 22. 33	M	Moon .....	F	0.208	-0.014			- 4.3		The coincidence of the two spectra appeared perfect. Both spectra were seen well.	
22. 36	M	,,	F	0.208	+0.002			+ 0.6			
22. 39	M	,,	F	0.208	-0.011			- 3.3		Spectrum bright but somewhat unsteady. Star-line seen well.	
22. 42	M	,,	F	0.208	-0.026			- 7.9			
22. 45	M	,,	F	0.208	+0.010			+ 3.0			
22. 50	M	$\gamma$ Geminorum..	F	0.208	-0.169	- $\frac{1}{10}$	+ 18.3	- 69.6	- 74.7		
23. 0	M	,,	F	0.208	-0.164	- $\frac{1}{10}$	+ 18.3	- 68.1	- 74.7		
23. 10	M	,,	F	0.208	-0.208	- $\frac{1}{10}$	+ 18.3	- 81.5	- 85.9		
23. 20	M	,,	F	0.208	-0.194	- $\frac{1}{10}$	+ 18.3	- 77.2	- 85.9		
23. 30	M	Castor .....	F	0.208	+0.044	+ $\frac{1}{10}$	+ 17.8	- 4.4	- 6.5		
23. 40	M	,,	F	0.208	+0.012	+ $\frac{1}{10}$	+ 17.8	- 14.2	- 6.5		
23. 55	M	Pollux .....	F	0.208	-0.064	- $\frac{1}{10}$	+ 17.8	- 37.2	- 40.3		
29. 0. 5	M	,,	F	0.208	-0.172	- $\frac{1}{10}$	+ 17.8	- 70.1	- 74.2		
0. 15	M	Procyon.....	F	0.208	-0.060	- $\frac{1}{10}$	+ 17.0	- 35.2	- 39.5	Spectrum bright but very unsteady. Star-line seen fairly well.	
0. 25	M	,,	F	0.208	-0.011	0	+ 17.0	- 20.3	- 17.0		
0. 35	M	,,	F	0.208	-0.008	0	+ 17.0	- 19.4	- 17.0	Spectrum bright but unsteady. Star-line seen well.	
0. 45	M	,,	F	0.208	-0.052	- $\frac{1}{10}$	+ 17.0	- 32.8	- 39.5		
0. 55	M	Regulus.....	F	0.208	+0.077	+ $\frac{1}{10}$	+ 11.8	+ 11.6	+ 16.4	Spectrum bright and fairly steady, but star-line faint and difficult to see.	
1. 0	M	,,	F	0.208	+0.113	+ $\frac{1}{10}$	+ 11.8	+ 22.5	+ 25.8		
1. 15	M	$\gamma$ Leonis .....	F	0.208	-0.055	- $\frac{1}{10}$	+ 11.8	- 28.5	- 23.1	Spectrum bright and steady. Star-line seen fairly well, but very broad and diffused.	
1. 25	M	,,	F	0.208	+0.028	0	+ 11.8	- 3.3	- 11.8		
1. 35	M	$\beta$ Leonis .....	F	0.208	+0.142	+ $\frac{2}{10}$	+ 5.6	+ 37.5	+ 39.5	Position Circle, 6°.	
1. 45	M	,,	F	0.208	+0.031	+ $\frac{1}{10}$	+ 5.6	+ 3.8	+ 5.7		

MOTIONS OF STARS IN THE LINE OF SIGHT, INFERRED FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.		
					Measured.	Estimated.		Measured.	Estimated.			
Apr. 3. 20. 9	M	Rigel .....	F	r	0'192	-0'010	0	+ 13'7	- 16'7	- 13'7	Spectrum bright but very unsteady. Star-line faint and very difficult to see.	
	M	"	F		0'192	+0'156	+ 2'2	+ 13'7	+ 33'7	+ 26'3		
	M	γ Orionis .....	F		0'192	+0'012	+ 1'0	+ 15'9	- 12'3	- 10'9		Spectrum unsteady. Star-line faint and difficult to see.
	M	"	F		0'192	-0'054	- 1'0	+ 15'9	- 32'3	- 25'9		
	M	β Tauri .....	F		0'192	-0'048	- 1'0	+ 16'8	- 31'4	- 36'8		Spectrum fairly bright and steady. Star-line seen fairly well.
	M	"	F		0'192	-0'057	- 1'0	+ 16'8	- 34'1	- 41'8		
	M	Sirius .....	F		0'192	+0'046	+ 1'0	+ 14'1	- 0'2	+ 10'9		Spectrum very unsteady indeed.
M	"	F		0'192	-0'057	- 1'0	+ 14'1	- 31'4	- 47'4			
Position Circle, 6°.												
Apr. 22. 20. 37	M	Procyon .....	F		0'192	-0'080	- 1/4	+ 17'2	- 41'5	- 40'2	Spectrum fairly bright and steady. Star-line seen well.	
	M	"	F		0'192	-0'102	0	+ 17'2	- 20'8	- 17'2		
	M	"	F		0'192	-0'054	- 1/10	+ 17'2	- 33'6	- 35'6	Spectrum bright and steady. Star-line seen well.	
	M	"	F		0'192	-0'069	- 1/10	+ 17'2	- 38'2	- 26'4		
	M	Castor .....	F		0'192	+0'141	+ 1'0	+ 17'3	+ 25'5	+ 44'1	Spectrum bright and steady. Star-line seen well.	
	M	"	F		0'192	+0'102	+ 1'0	+ 17'3	+ 13'7	+ 13'4		
	M	Pollux .....	F		0'192	-0'150	- 1'0	+ 17'7	- 63'3	- 54'5	Spectrum bright and steady. Star-line seen fairly well.	
	M	"	F		0'192	-0'057	- 1'0	+ 17'7	- 35'0	- 40'7		
	M	Regulus .....	F		0'192	+0'099	+ 1'0	+ 16'3	+ 13'8	+ 29'7	Spectrum bright and steady. Star-line seen well.	
	M	"	F		0'192	+0'013	+ 1'0	+ 16'3	- 12'3	- 16'3		
	M	"	F		0'192	+0'052	+ 1/10	+ 16'3	- 0'5	+ 14'4	Spectrum bright and fairly steady, but star-line faint and seen with difficulty.	
	M	"	F		0'192	+0'044	+ 1'0	+ 16'3	- 2'9	+ 2'1		
	M	γ Leonis .....	F		0'192	-0'067	- 1'0	+ 16'2	- 36'6	- 34'6	Spectrum bright and steady. Star-line seen fairly well.	
	M	"	F		0'192	-0'011	0	+ 16'2	- 19'5	- 16'2		
	M	β Leonis .....	F		0'192	+0'085	+ 3/10	+ 12'0	+ 13'8	+ 15'6	Spectrum bright but unsteady. Star-line seen fairly well.	
	M	"	F		0'192	+0'083	+ 3/10	+ 12'0	+ 13'2	+ 34'0		
	M	Spica .....	F		0'192	+0'049	+ 1/10	+ 3'3	+ 11'6	+ 19'7	Spectrum bright and steady. Star-line seen fairly well.	
	M	"	F		0'192	+0'103	+ 1'0	+ 3'3	+ 28'0	+ 27'4		
	M	Arcturus .....	F		0'192	-0'070	- 1'0	+ 2'7	- 24'0	- 25'7	Spectrum bright and steady. Star-line seen fairly well.	
	M	"	F		0'192	-0'087	- 1'0	+ 2'7	- 29'1	- 33'4		
	M	α Coronæ Bor.	F		0'192	+0'042	+ 1'0	- 1'8	+ 14'6	+ 11'0	Spectrum bright and steady. Star-line seen fairly well.	
	M	"	F		0'192	+0'109	+ 1'0	- 1'8	+ 34'9	+ 47'8		
M	"	F		0'192	+0'123	+ 1'0	- 1'8	+ 39'2	+ 47'8	Spectrum rather faint and unsteady, but star-line seen fairly well.		
M	"	F		0'192	+0'118	+ 1'0	- 1'8	+ 37'6	+ 38'6			
M	β Libræ .....	F		0'192	-0'089	- 1'0	- 4'7	- 22'3	- 22'9	Position Circle, 6°.		
M	"	F		0'192	-0'051	- 1/4	- 4'7	- 10'8	- 18'3			
Apr. 30. 21. 6	M	Procyon .....	F		0'192	+0'036	+ 1/10	+ 16'7	- 5'8	+ 1'7	Spectrum faint and very unsteady. Star-line seen fairly well.	
	M	"	F		0'192	-0'005	0	+ 16'7	- 18'2	- 16'7		
	M	Castor .....	F		0'192	+0'029	+ 1/4	+ 16'6	- 7'8	+ 6'4	Spectrum faint. Star-line seen fairly well.	
	M	"	F		0'192	+0'013	+ 1'0	+ 16'6	- 12'6	- 16'6		
	M	Pollux .....	F		0'192	-0'096	- 1'0	+ 17'0	- 46'1	- 44'6	Spectrum faint but fairly steady. Measures made with difficulty.	
	M	"	F		0'192	-0'198	- 1'0	+ 17'0	- 77'1	- 63'0		
	M	Regulus .....	F		0'192	-0'140	- 1'0	+ 17'2	- 59'7	- 54'0	Spectrum rather faint and very unsteady. Star-line faint and very diffused.	
	M	"	F		0'192	-0'113	- 1'0	+ 17'2	- 51'5	- 44'8		
	M	γ Leonis .....	F		0'192	-0'107	- 1'0	+ 17'1	- 49'6	- 47'8	Spectrum faint and unsteady. Star-line very faint.	
	M	"	F		0'192	-0'075	- 1'0	+ 17'1	- 39'9	- 40'1		
	M	β Leonis .....	F		0'192	-0'032	- 1'0	+ 13'6	- 23'3	- 25'1	Spectrum fairly steady. Star-line seen fairly well.	
	M	"	F		0'192	-0'010	0	+ 13'6	- 16'6	- 13'6		
	M	Moon .....	F		0'192	+0'017	0		+ 5'1		The coincidence of the two spectra appeared perfect.	
	M	"	F		0'192	+0'007	0		+ 2'1			
	M	"	F		0'192	+0'001	0		+ 0'3		Spectrum bright and fairly steady. Star-line seen fairly well.	
	M	"	F		0'192	+0'013	0		+ 4'0			
	M	"	F		0'192	-0'020	0		- 6'1		Spectrum bright and fairly steady. Star-line seen fairly well.	
	M	Spica .....	F		0'192	-0'067	- 1'0	+ 5'6	- 26'0	- 28'6		
	M	"	F		0'192	-0'081	- 1'0	+ 5'6	- 30'2	- 28'6	Spectrum bright and fairly steady. Star-line seen fairly well.	
	M	Arcturus .....	F		0'192	-0'188	- 1'0	+ 4'8	- 61'9	- 60'0		
	M	"	F		0'192	-0'098	- 1'0	+ 4'8	- 34'6	- 41'6	Spectrum bright and fairly steady. Star-line seen fairly well.	
	M	"	F		0'192	-0'081	- 1'0	+ 4'8	- 29'4	- 35'5		
M	"	F		0'192	-0'060	- 1'0	+ 4'8	- 23'0	- 27'8	Spectrum fairly bright and steady. Star-line seen well.		
M	β Libræ .....	F		0'192	+0'020	+ 1'0	- 2'3	+ 8'4	+ 6'9			
M	"	F		0'192	+0'009	+ 1'0	- 2'3	+ 5'0	+ 6'9			

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
					Measured.	Estimated.		Measured.	Estimated.	
Apr. 30. <sup>d h m</sup> 23. 43	M	$\alpha$ Ophiuchi ...	F	0'192	-0'019	0	- 9'5	+ 3'7	+ 9'5	Spectrum fairly bright and steady. Star-line very broad and difficult to bisect.
23. 44	M	"	F	0'192	-0'093	- $\frac{1}{10}$	- 9'5	- 18'8	- 18'1	
23. 46	M	"	F	0'192	-0'114	- $\frac{1}{10}$	- 9'5	- 25'1	- 13'5	
23. 50	M	"	F	0'192	-0'128	- $\frac{1}{10}$	- 9'5	- 29'4	- 21'2	
May 1. 0. 1	M	Vega .....	F	0'192	-0'159	- $\frac{1}{10}$	- 7'7	- 40'6	- 29'1	Spectrum bright and steady. Star-line seen well, but observing position very awkward. Position Circle, 6°.
0. 3	M	"	F	0'192	-0'094	- $\frac{1}{10}$	- 7'7	- 20'9	- 23'0	
May 5. 21. 31	M	Arcturus .....	F	0'192	-0'044	- $\frac{1}{10}$	+ 5'9	- 19'3	- 28'9	Spectrum steady but faint. Star-line very faint. Measures made with difficulty.  Position Circle, 6°.
21. 33	M	"	F	0'192	-0'137	- $\frac{1}{10}$	+ 5'9	- 47'5	- 42'7	
21. 41	M	Moon .....	F	0'192	-0'012	0		- 3'6		
21. 42	M	"	F	0'192	-0'008	0		- 2'4		
21. 43	M	"	F	0'192	+0'012	0		+ 3'6		
21. 44	M	"	F	0'192	+0'007	0		+ 2'1		
21. 45	M	"	F	0'192	+0'036	0		+ 10'9		
May 7. 21. 22	M	Arcturus .....	F	0'192	-0'048	- $\frac{1}{10}$	+ 6'4	- 21'0	- 24'8	
21. 25	M	"	F	0'192	-0'118	- $\frac{1}{10}$	+ 6'4	- 42'2	- 37'1	
21. 40	M	$\gamma$ Ursæ Majoris	F	0'192	-0'067	- $\frac{1}{10}$	+ 8'2	- 28'6	- 35'8	
21. 45	M	"	F	0'192	+0'006	0	+ 8'2	- 6'4	- 8'2	
21. 57	M	$\zeta$ Ursæ Majoris	F	0'192	-0'127	- $\frac{1}{10}$	+ 8'9	- 47'5	- 54'9	
22. 2	M	"	F	0'192	-0'110	- $\frac{1}{10}$	+ 8'9	- 42'3	- 54'9	
22. 17	M	$\epsilon$ Ursæ Majoris	F	0'192	-0'180	- $\frac{1}{10}$	+ 9'9	- 64'6	- 65'1	
22. 24	M	"	F	0'192	-0'123	- $\frac{1}{10}$	+ 9'9	- 47'3	- 36'7	
22. 47	M	$\delta$ Ursæ Majoris	F	0'192	+0'077	+	+ 10'9	+ 12'5	+ 35'1	
22. 50	M	"	F	0'192	+0'034	+	+ 10'9	- 0'6	- 1'7	
23. 5	M	$\gamma$ Ursæ Majoris	F	0'192	-0'029	+	+ 12'0	- 20'8	- 30'4	
23. 9	M	"	F	0'192	-0'128	-	+ 12'0	- 50'9	- 42'7	
23. 21	M	$\beta$ Ursæ Majoris	F	0'192	-0'151	-	+ 12'7	- 58'5	- 49'5	
23. 24	M	"	F	0'192	-0'236	-	+ 12'7	- 84'4	- 67'0	
23. 42	M	$\alpha$ Ursæ Majoris	F	0'192	-0'197	-	+ 11'6	- 71'4	- 57'6	
23. 45	M	"	F	0'192	-0'031	- $\frac{1}{4}$	+ 11'6	- 21'0	- 34'6	
May 12. 22. 10	M	Spica .....	F	0'192	-0'147	- $\frac{1}{2}$	+ 8'9	- 53'6	- 54'9	Spectrum very faint and unsteady. Observation interrupted by cloud. Position Circle, 6°.
May 15. 21. 45	M	Spica .....	F	0'192	-0'046	- $\frac{1}{10}$	+ 9'7	- 23'7	- 37'1	Spectrum bright and fairly steady. Star-line seen fairly well, but appeared rather broader, fainter, and more diffused than usual. Spectrum bright and fairly steady. Star-line faint and seen with difficulty. Spectrum fairly bright and steady. Star-line seen well. Spectrum bright and steady. Star-line seen well. Spectrum bright and steady. Star-line broad, diffused, and difficult to bisect.
21. 47	M	"	F	0'192	-0'159	- $\frac{1}{10}$	+ 9'7	- 58'0	- 55'4	
21. 49	M	"	F	0'192	-0'276	- $\frac{1}{10}$	+ 9'7	- 93'5	- 64'5	
21. 52	M	"	F	0'192	-0'170	- $\frac{1}{10}$	+ 9'7	- 61'3	- 55'4	
22. 4	M	Arcturus .....	F	0'192	-0'152	- $\frac{1}{10}$	+ 8'2	- 54'4	- 53'9	
22. 5	M	"	F	0'192	-0'060	- $\frac{1}{10}$	+ 8'2	- 26'4	- 31'0	
22. 17	M	$\beta$ Libræ .....	F	0'192	-0'160	- $\frac{1}{10}$	+ 2'2	- 50'8	- 63'1	
22. 19	M	"	F	0'192	-0'144	- $\frac{1}{10}$	+ 2'2	- 45'9	- 32'7	
22. 21	M	"	F	0'192	-0'064	- $\frac{1}{10}$	+ 2'2	- 21'6	- 32'7	
22. 22	M	"	F	0'192	-0'103	- $\frac{1}{10}$	+ 2'2	- 33'5	- 32'7	
22. 44	M	$\alpha$ Coronæ Bor.	F	0'192	+0'102	+	+ 3'2	+ 27'8	+ 33'4	
22. 47	M	"	F	0'192	+0'150	+	+ 3'2	+ 42'4	+ 42'5	
23. 0	M	$\alpha$ Ophiuchi ...	F	0'192	-0'019	- $\frac{1}{10}$	- 6'4	+ 0'6	- 2'7	
23. 2	M	"	F	0'192	-0'048	0	- 6'4	- 8'2	+ 6'4	
23. 3	M	"	F	0'192	-0'079	- $\frac{1}{4}$	- 6'4	- 17'6	- 16'4	
23. 4	M	"	F	0'192	-0'068	- $\frac{1}{4}$	- 6'4	- 14'3	- 16'4	

## MOTIONS OF STARS IN THE LINE OF SIGHT, INFERRED FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.	
					Measured.	Estimated.		Measured.	Estimated.		
May 15. 23. 19 23. 21 23. 31 23. 33 23. 47 23. 49 16. 0. 2 0. 4	M	Vega .....	F	0'192	-0'022	- $\frac{1}{10}$	- 6'4	- 0'3	- 2'7	Spectrum bright and steady. Star-line very broad, diffused, and difficult to bisect.	
	M	,,	F	0'192	-0'044	- $\frac{1}{10}$	- 6'4	- 7'0	- 2'7		
	M	$\alpha$ Cygni .....	F	0'192	-0'239	- $\frac{1}{10}$	- 8'9	- 63'6	- 46'0	Spectrum bright and steady. Star-line rather faint but seen fairly well.	
	M	,,	F	0'192	-0'157	- $\frac{1}{10}$	- 8'9	- 38'8	- 36'8		
	M	$\alpha$ Cephei .....	F	0'192	-0'126	- $\frac{1}{10}$	- 4'5	- 33'8	- 26'0	Spectrum bright and steady. Star-line seen well.	
	M	,,	F	0'192	-0'154	- $\frac{1}{10}$	- 4'5	- 42'3	- 32'1		
	M	Altair .....	F	0'192	-0'040	- $\frac{1}{10}$	- 14'2	+ 2'1	+ 5'1	Spectrum bright and steady. Star-line seen well. Position Circle, 6°.	
	M	,,	F	0'192	-0'088	- $\frac{1}{10}$	- 14'2	- 12'5	- 8'6		
	May 16. 11. 30	M	Sun .....	F	0'192	-0'002			- 0'6		Both spectra seen well. The coincidence of the two spectra appeared perfect.  Position Circle, 6°.
		M	,,	F	0'192	+0'009			+ 2'7		
M		,,	F	0'192	+0'008			+ 2'4			
M		,,	F	0'192	+0'003			+ 0'9			
M		,,	F	0'192	0'000			0'0			
May 17. 21. 41	M	Regulus .....	F	0'192	+0'091	+ $\frac{3}{8}$	+ 17'9	+ 9'7	+ 18'7	Spectrum bright and steady. Star-line seen well, but observations interrupted by cloud. Position Circle, 6°.	
May 21. 21. 30 21. 40 21. 55 22. 5 22. 15 22. 25 22. 40 22. 55 23. 20 23. 30 23. 45 23. 58 22. 0. 8 0. 15 0. 30 0. 40	M	Regulus .....	F	0'174	-0'176	- $\frac{1}{10}$	+ 17'9	- 71'4	- 75'0	Spectrum very unsteady. Observations made with difficulty.	
	M	,,	F	0'174	-0'141	- $\frac{1}{10}$	+ 17'9	- 60'7	- 60'8		
	M	$\gamma$ Leonis .....	F	0'174	-0'053	- $\frac{1}{10}$	+ 17'7	- 33'8	- 34'8	Spectrum unsteady. Star-line faint and difficult to see.	
	M	,,	F	0'174	-0'009	0	+ 17'7	- 20'4	- 17'7		
	M	$\beta$ Leonis .....	F	0'174	+0'046	+ $\frac{1}{10}$	+ 16'5	- 2'5	- 7'9	Spectrum unsteady. Star-line seen with difficulty.	
	M	,,	F	0'174	+0'035	+ $\frac{1}{10}$	+ 16'5	- 5'9	- 7'9		
	M	Spica .....	F	0'174	+0'136	+ $\frac{1}{10}$	+ 11'1	+ 30'2	+ 31'8	Spectrum exceedingly unsteady. Measures made with great difficulty.	
	M	,,	F	0'174	+0'112	+ $\frac{1}{10}$	+ 11'1	+ 22'9	+ 17'5		
	M	Arcturus .....	F	0'174	-0'120	- $\frac{1}{10}$	+ 9'5	- 45'9	- 43'8	Spectrum bright but unsteady. Star-line seen well.	
	M	,,	F	0'174	-0'117	- $\frac{1}{10}$	+ 9'5	- 45'0	- 43'8		
	M	$\alpha$ Coronæ Bor. ..	F	0'174	+0'027	+ $\frac{1}{10}$	+ 4'4	+ 3'8	+ 4'2	Spectrum bright but unsteady. Star-line seen well.	
	M	,,	F	0'174	+0'125	+ $\frac{1}{10}$	+ 4'4	+ 33'6	+ 29'9		
	M	$\alpha$ Ophiuchi ...	F	0'174	-0'016	- $\frac{1}{10}$	- 5'0	+ 0'1	- 3'6	Spectrum fairly bright and steady. Star-line seen fairly well.	
	M	,,	F	0'174	-0'057	- $\frac{1}{10}$	- 5'0	- 12'1	- 12'1		
	M	Vega .....	F	0'174	-0'189	- $\frac{1}{10}$	- 5'8	- 51'6	- 51'3	Spectrum bright and fairly steady. Star-line seen well. Position Circle, 6°.	
M	,,	F	0'174	-0'199	- $\frac{1}{10}$	- 5'8	- 54'6	- 51'3			
May 23. 21. 31 21. 33 21. 43 21. 44 21. 59 22. 0 22. 1 22. 2 22. 3 22. 13 22. 15 22. 27 22. 29 22. 37 22. 39 22. 58 23. 0	M	Castor .....	F	0'193	+0'274	+ $\frac{1}{10}$	+ 12'7	+ 70'5	+ 55'2	Spectrum faint. Star-line extremely broad and diffused.	
	M	,,	F	0'193	+0'261	+ $\frac{1}{10}$	+ 12'7	+ 66'6	+ 55'2		
	M	Pollux .....	F	0'193	-0'176	- $\frac{1}{10}$	+ 13'4	- 66'9	- 54'1	Spectrum faint and unsteady but star-line seen well.	
	M	,,	F	0'193	-0'140	- $\frac{1}{10}$	+ 13'4	- 55'9	- 64'3		
	M	Moon .....	F	0'193	+0'006			+ 1'8		Both spectra seen well. The coincidence of the two spectra appeared perfect.	
	M	,,	F	0'193	-0'010			+ 3'0			
	M	,,	F	0'193	+0'007			+ 2'1		Spectrum bright but unsteady. Star-line seen well.	
	M	,,	F	0'193	-0'019			- 5'8			
	M	,,	F	0'193	-0'005			- 1'5		Spectrum bright but unsteady. Star-line seen well.	
	M	Regulus .....	F	0'193	+0'032	+ $\frac{1}{10}$	+ 17'8	- 8'1	- 7'6		
	M	,,	F	0'193	+0'006	+ $\frac{1}{10}$	+ 17'8	- 16'0	- 17'8	Spectrum faint and unsteady. Star-line very faint. Measures rough.	
	M	$\gamma$ Leonis .....	F	0'193	+0'028	+ $\frac{1}{8}$	+ 17'6	- 9'1	+ 2'8		
	M	,,	F	0'193	-0'033	0	+ 17'6	- 27'6	- 17'6	Spectrum unsteady. Star-line very broad and very difficult to bisect.	
	M	$\beta$ Leonis .....	F	0'193	+0'219	+ $\frac{1}{10}$	+ 16'7	+ 49'8	+ 51'2		
	M	,,	F	0'193	+0'014	+ $\frac{1}{10}$	+ 16'7	- 12'4	+ 8'8	Spectrum bright but very unsteady. Star-line seen well.	
	M	Spica .....	F	0'193	-0'161	- $\frac{1}{10}$	+ 11'6	- 60'5	- 62'5		
	M	,,	F	0'193	-0'200	- $\frac{1}{10}$	+ 11'6	- 72'3	- 72'7		

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second		REMARKS.	
					Measured.	Estimated		Measured.	Estimated.		
May 23. 23. 11	M	Arcturus .....	F	r 0'193	r -0'158	- $\frac{1}{2}$	+ 9'9	- 57'9	- 60'8	Spectrum bright and steady. Star-line seen fairly well. Spectrum fairly bright and steady. Star-line seen well but broad and diffused. Spectrum bright and steady. Star-line seen well but very diffused. Spectrum bright and steady. Star-line broad and diffused. Spectrum bright and steady. Star-line seen well. Spectrum bright but unsteady. Star-line seen well.	
23. 13	M	,,	F	0'193	-0'155	- $\frac{1}{2}$	+ 9'9	- 57'0	- 60'8		
23. 32	M	$\beta$ Libræ.....	F	0'193	-0'034	- $\frac{1}{10}$	+ 4'5	- 14'8	- 14'7		
23. 33	M	,,	F	0'193	-0'087	- $\frac{1}{4}$	+ 4'5	- 30'9	- 30'0		
23. 41	M	$\alpha$ Coronæ Bor..	F	0'193	+0'086	+ $\frac{3}{10}$	+ 4'8	+ 21'3	+ 25'7		
23. 43	M	,,	F	0'193	+0'112	+ $\frac{3}{5}$	+ 4'8	+ 29'2	+ 35'9		
23. 54	M	$\alpha$ Ophiuchi .....	F	0'193	-0'002	0	- 4'5	+ 3'9	+ 4'5		
23. 56	M	,,	F	0'193	-0'115	- $\frac{1}{3}$	- 4'5	- 30'4	- 29'4		
24. 0. 5	M	Vega .....	F	0'193	-0'047	- $\frac{1}{10}$	- 5'6	- 8'7	- 4'6		
0. 7	M	,,	F	0'193	-0'056	- $\frac{1}{4}$	- 5'6	- 11'4	- 19'9		
0. 17	M	Altair .....	F	0'193	-0'102	- $\frac{1}{10}$	- 13'2	- 17'8	- 17'3		
0. 19	M	,,	F	0'193	-0'121	- $\frac{1}{3}$	- 13'2	- 23'5	- 20'7		
May 31. 22. 29	M	Spica .....	F	0'187	-0'241	- $\frac{3}{5}$	+ 13'3	- 86'5	- 62'0		Spectrum tremulous and rather faint, but star-line seen well. Spectrum bright and steady. Star-line seen fairly well. Both spectra seen well. The coincidence of the two spectra appeared perfect. Spectrum bright and steady. Star-line seen fairly well. Spectrum rather faint and unsteady. Star-line seen fairly well. Spectrum bright and steady. Line in planet's spectrum seen fairly well. Calculated motion -0'8 miles per second. Spectrum faint but steady. Star-line seen fairly well. Spectrum very bright and steady. Star-line seen well. Spectrum bright and steady. Star-line seen well. Position Circle, 6°.
22. 32	M	,,	F	0'187	-0'104	- $\frac{3}{10}$	+ 13'3	- 44'9	- 37'6		
22. 34	M	,,	F	0'187	-0'146	- $\frac{2}{5}$	+ 13'3	- 57'7	- 45'7		
22. 36	M	,,	F	0'187	-0'170	- $\frac{3}{5}$	+ 13'3	- 64'9	- 53'9		
22. 45	M	Arcturus .....	F	0'187	-0'050	- $\frac{3}{10}$	+ 11'3	- 26'5	- 35'6		
22. 47	M	,,	F	0'187	-0'142	- $\frac{3}{3}$	+ 11'3	- 54'4	- 38'3		
22. 54	M	Moon .....	F	0'187	+0'023			+ 7'0			
22. 55	M	,,	F	0'187	+0'005			+ 1'5			
22. 56	M	,,	F	0'187	+0'009			+ 2'7			
22. 57	M	,,	F	0'187	-0'015			- 4'6			
22. 58	M	,,	F	0'187	+0'006			+ 1'8			
23. 9	M	$\alpha$ Coronæ Bor..	F	0'187	+0'033	+ $\frac{1}{10}$	+ 6'3	+ 3'7	+ 1'8		
23. 11	M	,,	F	0'187	+0'065	+ $\frac{3}{5}$	+ 6'3	+ 13'4	+ 9'9		
23. 20	M	$\beta$ Libræ.....	F	0'187	-0'162	- $\frac{3}{5}$	+ 6'8	- 56'0	- 47'4		
23. 22	M	,,	F	0'187	-0'145	- $\frac{1}{2}$	+ 6'8	- 50'8	- 47'4		
23. 29	M	Mars .....	F	0'187	-0'027	0		- 8'2	0'0		
23. 30	M	,,	F	0'187	+0'014	0		+ 4'3	0'0		
23. 52	M	$\alpha$ Ophiuchi .....	F	0'187	-0'093	- $\frac{1}{4}$	- 2'6	- 25'7	- 17'7		
23. 53	M	,,	F	0'187	-0'050	- $\frac{1}{4}$	- 2'6	- 12'6	- 17'7		
June 1. 0. 1	M	Vega .....	F	0'187	-0'080	- $\frac{1}{2}$	- 4'7	- 19'6	- 15'6		
0. 3	M	,,	F	0'187	-0'119	- $\frac{2}{5}$	- 4'7	- 31'4	- 27'7		
0. 13	M	Altair .....	F	0'187	-0'111	- $\frac{1}{4}$	- 11'9	- 21'8	- 8'4		
0. 15	M	,,	F	0'187	-0'033	- $\frac{1}{4}$	- 11'9	+ 1'9	- 8'4		
June 2. 22. 16	M	Regulus.....	F	0'187	+0'047	+ $\frac{1}{4}$	+ 17'4	- 3'1	+ 2'9	Spectrum bright but exceedingly unsteady. Observations interrupted by cloud. Position Circle, 6°.	
22. 19	M	,,	F	0'187	-0'039	- $\frac{1}{5}$	+ 17'4	- 29'2	- 33'6		
June 6. 23. 6	M	Spica .....	F	0'164	+0'145	+ $\frac{3}{5}$	+ 14'4	(+ 29'6)	(+ 40'1)	Spectrum bright but very unsteady. Spectroscope found to be out of adjustment. Spectrum unsteady and rather faint. Star-line faint. Spectrum bright and fairly steady. Line in the planet's spectrum seen fairly well. Calculated motion +0'3. Spectrum steady and fairly bright. Star-line seen fairly well. Position Circle, 6°.	
23. 8	M	,,	F	0'164	+0'040	+ $\frac{1}{4}$	+ 14'4	(- 2'3)	(+ 8'3)		
23. 23	M	$\beta$ Libræ.....	F	0'164	-0'188	- $\frac{3}{5}$	+ 8'3	- 65'4	- 62'8		
23. 26	M	,,	F	0'164	-0'070	- $\frac{3}{5}$	+ 8'3	- 29'6	- 81'0		
23. 36	M	Mars .....	F	0'164	-0'026	0		- 7'9	0'0		
23. 38	M	,,	F	0'164	-0'014	0		- 4'3	0'0		
23. 50	M	$\alpha$ Ophiuchi.....	F	0'164	-0'016	0	- 1'2	- 3'7	+ 1'2		
23. 52	M	,,	F	0'164	-0'063	- $\frac{1}{4}$	- 1'2	- 17'9	- 21'5		
June 27. 22. 34	M	Arcturus .....	F	0'164	-0'083	- $\frac{1}{4}$	+ 14'6	- 39'8	- 33'2		Spectrum bright but unsteady. Star-line seen well for a moment now and then. Both spectra seen well. The coincidence of the two spectra appeared perfect.
22. 36	M	,,	F	0'164	-0'069	- $\frac{1}{4}$	+ 14'6	- 35'6	- 28'6		
22. 51	M	Moon .....	F	0'164	+0'030			+ 9'1			
22. 53	M	,,	F	0'164	+0'025			+ 7'6			
22. 55	M	,,	F	0'164	+0'008			+ 2'4			
22. 56	M	,,	F	0'164	-0'033			- 10'0			
22. 57	M	,,	F	0'164	-0'011			- 3'3			

## MOTIONS OF STARS IN THE LINE OF SIGHT, INFERRED FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.	
					Measured.	Estimated.		Measured.	Estimated.		
June 27. 23. 15 <sup>d h m</sup>	M	$\alpha$ Coronæ Bor..	F	0.164	-0.043	-1/10	+ 10.5	- 23.6	- 16.1	Spectrum bright and fairly steady. Star-line seen fairly well.	
23. 18	M	"	F	0.164	+0.041	+	+ 10.5	+ 1.9	+ 3.5		
23. 27	M	$\alpha$ Ophiuchi ...	F	0.164	-0.105	-	+ 3.8	- 35.7	- 26.1		Spectrum fairly bright and steady. Star-line seen well.
23. 30	M	"	F	0.164	-0.041	-	+ 3.8	- 16.2	- 15.0		
23. 41	M	Altair .....	F	0.164	-0.210	-	- 6.3	- 57.5	- 27.2		Spectrum bright and steady. Star-line seen well. Position Circle, 6°.
23. 43	M	"	F	0.164	-0.141	-	- 6.3	- 36.5	- 27.2		
July 3. 22. 4	M	Arcturus .....	F	0.164	-0.065	-	+ 15.0	- 34.7	- 33.6	Spectrum very unsteady. Star-line seen with difficulty.	
22. 6	M	"	F	0.164	-0.075	-	+ 15.0	- 37.8	- 37.3		
22. 13	M	$\alpha$ Coronæ Bor..	F	0.164	+0.019	+	+ 11.1	- 5.3	- 5.5	Spectrum fairly bright. Star-line seen fairly well.	
22. 15	M	"	F	0.164	-0.055	-	+ 11.1	- 27.8	- 22.3		
22. 30	M	$\alpha$ Ophiuchi ...	F	0.164	-0.120	-	+ 5.2	- 41.6	- 38.7	Spectrum steady but rather faint. Star-line unusually broad and diffused.	
22. 32	M	"	F	0.164	-0.102	-	+ 5.2	- 36.2	- 33.2		
22. 45	M	Vega .....	F	0.164	-0.208	-	- 0.3	- 62.9	- 36.9	Spectrum bright but unsteady. Star-line seen well.	
22. 48	M	"	F	0.164	-0.209	-1	- 0.3	- 63.2	- 55.5		
22. 56	M	Moon .....	F	0.164	+0.024			+ 7.3		The coincidence of the two spectra appeared perfect. But the Moon being very low down in the sky its spectrum was not seen well.	
22. 57	M	"	F	0.164	+0.015			+ 4.6			
22. 58	M	"	F	0.164	+0.015			+ 4.6			
22. 59	M	"	F	0.164	-0.003			- 0.9			
23. 0	M	"	F	0.164	-0.008			- 2.4			
23. 11	M	Altair .....	F	0.164	-0.198	-	- 4.9	- 55.2	- 32.3	Spectrum bright and steady. Star-line seen fairly well.	
23. 13	M	"	F	0.164	-0.212	-1	- 4.9	- 59.5	- 51.0		
23. 27	M	$\alpha$ Cygni .....	F	0.164	-0.163	-1	- 7.0	- 42.4	- 48.8	Observations interrupted by cloud. Position Circle, 6°.	
Aug. 1. 22. 4	M	$\alpha$ Ophiuchi ...	F	0.162	-0.160	-1/10	+ 10.9	- 62.2	- 43.5	Spectrum faint but fairly steady. Definition poor.	
22. 5	M	"	F	0.162	-0.064	-1/10	+ 10.9	- 30.3	- 20.7		
22. 16	M	Altair .....	F	0.162	-0.157	-	+ 2.5	- 50.2	- 51.4	Spectrum bright and steady. Star-line seen well.	
22. 19	M	"	F	0.162	-0.124	-	+ 2.5	- 40.2	- 41.6		
22. 29	M	$\zeta$ Aquilæ .....	F	0.162	+0.039	+	+ 5.2	+ 6.6	+ 4.6	Spectrum faint but steady. Star-line broad and diffused, but seen fairly well.	
22. 32	M	"	F	0.162	-0.055	+	+ 5.2	- 21.9	- 15.0		
22. 43	M	$\gamma$ Lyrae .....	F	0.162	+0.041	+	+ 3.4	+ 9.0	+ 16.1	Spectrum faint but fairly steady. Star-line seen fairly well.	
22. 45	M	"	F	0.162	+0.031	+	+ 3.4	+ 6.0	+ 6.4		
22. 56	M	Vega .....	F	0.162	-0.009	0	+ 3.7	- 6.4	- 3.7	Spectrum bright and steady. Star-line seen well.	
22. 57	M	"	F	0.162	-0.019	-1/10	+ 3.7	- 9.5	- 13.5		
23. 20	M	$\alpha$ Cephei .....	F	0.162	-0.376	-1	- 5.6	- 108.6	- 92.2	Spectrum bright and steady. Star-line seen with the utmost difficulty.	
23. 24	M	"	F	0.162	-0.239	-1	- 5.6	- 67.0	- 92.2		
23. 36	M	$\alpha$ Andromedæ..	F	0.162	-0.051	-	- 14.3	- 1.2	- 10.2	Spectrum bright and steady. Star-line seen fairly well.	
23. 39	M	"	F	0.162	-0.114	-	- 14.3	- 20.3	- 18.3		
23. 50	M	$\alpha$ Pegasi .....	F	0.162	-0.155	-	- 11.3	- 35.8	- 27.8	Spectrum faint but fairly steady. Star-line seen fairly well.	
23. 51	M	"	F	0.162	-0.114	-	- 11.3	- 23.3	- 27.8		
23. 59	M	Moon .....	F	0.162	+0.017			+ 5.1		Position Circle, 6°.	
2. 0. 1	M	"	F	0.162	-0.005			- 1.5			
0. 2	M	"	F	0.162	+0.010			+ 3.0			
0. 3	M	"	F	0.162	+0.028			+ 8.5			
0. 3	M	"	F	0.162	-0.013			- 3.9			
Aug. 4. 21. 42	M	Altair .....	F	0.162	-0.150	-	+ 3.3	- 48.9	- 35.9	Spectrum faint and unsteady, but star-line seen fairly well.	
21. 44	M	"	F	0.162	-0.119	-	+ 3.3	- 39.4	- 42.4		
21. 56	M	$\alpha$ Cygni .....	F	0.162	-0.245	-	- 3.3	- 71.1	- 61.9	Spectrum faint but fairly steady. Star-line seen fairly well. Position Circle, 6°.	
22. 0	M	"	F	0.162	-0.203	-	- 3.3	- 58.4	- 70.0		
Aug. 6. 22. 2	M	Arcturus .....	F	0.162	-0.101	-	+ 14.3	- 45.0	- 52.4	Spectrum most unsteady. Star-line seen with great difficulty.	
22. 4	M	"	F	0.162	-0.167	-	+ 14.3	- 65.0	- 62.0		
22. 16	M	$\alpha$ Coronæ Bor..	F	0.162	-0.187	-	+ 12.8	- 69.6	- 50.9	Spectrum faint and very unsteady. Star-line exceedingly ill-defined.	
22. 22	M	"	F	0.162	-0.245	-	+ 12.8	- 87.2	- 76.4		

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
					Measured.	Estimated.		Measured.	Estimated.	
Aug. 6. 22. 35 <sup>d h m</sup>	M	$\alpha$ Ophiuchi ...	F	0'162	-0'120	- $\frac{1}{3}$	+ 11'6	- 48'0	- 43'4	Spectrum faint and unsteady. Star-line ill-defined.
22. 36	M	,,	F	0'162	-0'116	- $\frac{1}{3}$	+ 11'6	- 46'9	- 43'4	
22. 45	M	Vega .....	F	0'162	+0'014	+ $\frac{1}{10}$	+ 4'3	0'0	+ 5'2	Spectrum very bright but very unsteady. Star-line seen fairly well.
22. 46	M	,,	F	0'162	-0'054	- $\frac{1}{8}$	+ 4'3	- 20'7	- 23'4	
23. 2	M	$\gamma$ Lyræ .....	F	0'162	-0'061	- $\frac{1}{10}$	+ 4'2	- 22'7	- 13'7	Spectrum very faint but fairly steady. Star-line seen fairly well.
23. 5	M	,,	F	0'162	-0'018	- $\frac{1}{10}$	+ 4'2	- 9'7	- 13'7	
23. 14	M	$\zeta$ Aquilæ .....	F	0'162	-0'010	0	+ 6'3	- 9'3	- 6'3	Spectrum faint. Star-line seen with difficulty.
23. 16	M	,,	F	0'162	-0'039	- $\frac{1}{10}$	+ 6'3	- 18'1	- 15'8	
23. 27	M	Altair.....	F	0'162	-0'187	- $\frac{1}{3}$	+ 3'8	- 60'6	- 61'0	Spectrum bright and fairly steady. Star-line seen fairly well.
23. 29	M	,,	F	0'162	-0'268	- $\frac{1}{3}$	+ 3'8	- 85'2	- 80'1	
23. 41	M	$\delta$ Cygni .....	F	0'162	-0'263	- $\frac{1}{3}$	0'0	- 79'9	- 57'2	Spectrum faint. Star-line faint and ill-defined.
23. 46	M	,,	F	0'162	-0'202	- $\frac{1}{3}$	0'0	- 61'4	- 47'7	
7. 0. 1	M	$\alpha$ Pegasi.....	F	0'162	-0'082	- $\frac{1}{3}$	- 10'0	- 14'9	- 13'8	Spectrum rather faint but steady. Star-line seen fairly well.
0. 3	M	,,	F	0'162	-0'168	- $\frac{1}{3}$	- 10'0	- 41'0	- 37'7	
0. 15	M	$\alpha$ Andromedæ..	F	0'162	-0'377	- $\frac{1}{3}$	- 13'7	- 100'8	- 81'7	Spectrum faint and somewhat unsteady. Star-line faint.
0. 17	M	,,	F	0'162	-0'101	- $\frac{1}{3}$	- 13'7	- 17'0	- 18'1	
0. 28	M	Moon .....	F	0'162	-0'006	- $\frac{1}{3}$	-	- 1'8	-	The coincidence of the two spectra appeared perfect.
0. 29	M	,,	F	0'162	-0'008	- $\frac{1}{3}$	-	- 2'4	-	
0. 30	M	,,	F	0'162	-0'015	- $\frac{1}{3}$	-	- 4'6	-	
0. 31	M	,,	F	0'162	-0'008	- $\frac{1}{3}$	-	- 2'4	-	
0. 32	M	,,	F	0'162	+0'001	- $\frac{1}{3}$	-	+ 0'3	-	
0. 45	M	$\beta$ Cassiopeiæ...	F	0'162	-0'116	- $\frac{1}{3}$	- 11'0	- 24'3	- 36'7	Spectrum faint but steady. Star-line faint and seen with difficulty.
0. 48	M	,,	F	0'162	-0'132	- $\frac{1}{3}$	- 11'0	- 29'1	- 36'7	
1. 0	M	$\gamma$ Cassiopeiæ...	F	0'162	-0'098	- $\frac{1}{3}$	- 11'8	- 18'0	- 20'0	Spectrum bright and steady. Star-line very little brighter than the continuous spectrum, and observed with great difficulty.
1. 3	M	,,	F	0'162	-0'027	- $\frac{1}{10}$	- 11'8	+ 3'6	+ 2'3	
Position Circle, 6°.										
Sept. 8. 21. 20	M	$\alpha$ Coronæ Bor..	F	0'198	-0'093	- $\frac{1}{3}$	+ 10'6	- 38'9	- 36'3	Spectrum bright and steady. Star-line seen well.
21. 23	M	,,	F	0'198	-0'014	0	+ 10'6	- 14'9	- 10'6	
21. 41	M	$\alpha$ Ophiuchi ...	F	0'198	-0'052	- $\frac{1}{3}$	+ 14'7	- 30'5	- 30'7	Spectrum very bright and steady. Star-line very ill-defined and difficult to observe.
21. 45	M	,,	F	0'198	-0'082	- $\frac{1}{3}$	+ 14'7	- 39'6	- 46'8	
22. 1	M	Vega .....	F	0'198	-0'016	0	+ 7'6	- 12'5	- 7'6	Spectrum bright but rather unsteady.
22. 3	M	,,	F	0'198	-0'105	- $\frac{1}{10}$	+ 7'6	- 39'5	- 29'0	
22. 13	M	Altair.....	F	0'198	-0'041	- $\frac{1}{3}$	+ 11'4	- 23'8	- 27'4	Spectrum bright and steady. Star-line seen well.
22. 15	M	,,	F	0'198	-0'097	- $\frac{1}{3}$	+ 11'4	- 40'9	- 32'8	
22. 28	M	$\alpha$ Cygni .....	F	0'198	-0'141	- $\frac{1}{3}$	+ 1'9	- 44'7	- 34'0	Spectrum bright and steady.
22. 36	M	,,	F	0'198	-0'161	- $\frac{1}{3}$	+ 1'9	- 50'8	- 50'0	
22. 52	M	$\alpha$ Pegasi.....	F	0'198	-0'053	- $\frac{1}{3}$	- 1'7	- 14'4	- 19'7	Spectrum bright and steady. Star-line faint, diffused, and observed with difficulty.
22. 55	M	,,	F	0'198	-0'102	- $\frac{1}{3}$	- 1'7	- 29'3	- 19'7	
23. 49	M	$\alpha$ Andromedæ..	F	0'198	-0'064	- $\frac{1}{3}$	- 7'3	- 12'1	- 8'7	Spectrum bright and steady. Star-line seen fairly well.
23. 50	M	,,	F	0'198	-0'037	- $\frac{1}{3}$	- 7'3	- 4'0	- 5'5	
23. 56	M	$\gamma$ Pegasi.....	F	0'198	+0'112	+ $\frac{1}{4}$	- 6'5	+ 40'5	+ 38'6	Spectrum fairly bright and steady. Star-line seen fairly well.
23. 58	M	,,	F	0'198	+0'069	+ $\frac{1}{4}$	- 6'5	+ 27'5	+ 22'5	
Position Circle, 6°.										
Sept. 10. 12. 20	M	Sky .....	F	0'198	+0'023	-	-	+ 7'0	-	The coincidence of the two spectra appeared perfect.
12. 21	M	,,	F	0'198	+0'003	-	-	+ 0'9	-	
12. 22	M	,,	F	0'198	+0'008	-	-	+ 2'4	-	
12. 23	M	,,	F	0'198	-0'006	-	-	- 1'8	-	
12. 24	M	,,	F	0'198	-0'012	-	-	- 3'6	-	
Position Circle, 6°.										
Sept. 11. 22. 37	M	$\alpha$ Pegasi.....	F	0'162	-0'172	- $\frac{1}{3}$	- 0'9	- 51'4	- 51'9	Spectrum rather faint but steady. Star-line seen well.
22. 38	M	,,	F	0'162	-0'122	- $\frac{1}{3}$	- 0'9	- 36'2	- 43'1	
22. 49	M	$\gamma$ Pegasi.....	F	0'162	-0'246	- $\frac{1}{3}$	- 5'7	- 69'0	- 53'0	Spectrum faint but fairly steady. Star-line ill-defined.
22. 51	M	,,	F	0'162	-0'147	- $\frac{1}{3}$	- 5'7	- 39'0	- 23'7	
Position Circle, 6°.										

## MOTIONS OF STARS IN THE LINE OF SIGHT, INFERRED FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
					Measured.	Estimated.		Measured.	Estimated.	
Sept. 13. 20. 49	M	Vega .....	F	0'188	-0'042	- $\frac{1}{10}$	+ 7.9	- 20.6	- 18.1	Spectrum bright and steady. Star-line seen well.
20. 51	M	,,	F	0'188	-0'068	- $\frac{1}{10}$	+ 7.9	- 28.6	- 33.4	
21. 1	M	$\gamma$ Lyrae .....	F	0'188	+0'034	+ $\frac{1}{10}$	+ 9.1	+ 1.2	+ 11.3	Spectrum steady, but extremely faint.
21. 3	M	,,	F	0'188	-0'170	- $\frac{1}{10}$	+ 9.1	- 60.7	- 43.1	
21. 14	M	$\zeta$ Aquilae .....	F	0'188	+0'081	+ $\frac{1}{10}$	+ 13.0	+ 11.6	+ 7.4	Spectrum steady, but extremely faint.
21. 15	M	,,	F	0'188	+0'073	+ $\frac{1}{10}$	+ 13.0	+ 9.2	+ 12.5	
21. 28	M	$\delta$ Cygni .....	F	0'188	+0'029	+ $\frac{1}{10}$	+ 4.6	+ 4.2	+ 15.8	Spectrum fairly bright and steady. Star-line seen fairly well.
21. 31	M	,,	F	0'188	+0'058	+ $\frac{1}{10}$	+ 4.6	+ 13.0	+ 29.4	
21. 39	M	Altair .....	F	0'188	-0'061	- $\frac{1}{10}$	+ 12.3	- 30.8	- 37.8	Spectrum bright and steady. Star-line seen fairly well.
21. 41	M	,,	F	0'188	-0'061	- $\frac{1}{10}$	+ 12.3	- 30.8	- 42.9	
21. 56	M	$\alpha$ Cygni .....	F	0'188	-0'144	- $\frac{1}{10}$	+ 2.7	- 46.4	- 53.7	Spectrum steady and fairly bright.
21. 59	M	,,	F	0'188	-0'026	- $\frac{1}{10}$	+ 2.7	- 10.6	- 28.2	
22. 13	M	$\alpha$ Pegasi .....	F	0'188	+0'132	+ $\frac{1}{10}$	- 0.3	+ 40.4	+ 34.3	Spectrum steady and fairly bright. Star-line seen fairly well.
22. 14	M	,,	F	0'188	+0'037	+ $\frac{1}{10}$	- 0.3	+ 11.6	+ 10.5	
22. 15	M	,,	F	0'188	+0'080	+ $\frac{1}{10}$	- 0.3	+ 24.6	+ 25.8	Spectrum faint but steady. Star-line ill-defined and observed with difficulty.
22. 16	M	,,	F	0'188	+0'037	+ $\frac{1}{10}$	- 0.3	+ 11.6	+ 10.5	
22. 23	M	$\gamma$ Pegasi .....	F	0'188	-0'120	- $\frac{1}{10}$	- 5.1	- 31.3	- 28.9	Spectrum steady but not bright. Star-line seen fairly well.
22. 25	M	,,	F	0'188	-0'211	- $\frac{1}{10}$	- 5.1	- 59.0	- 62.9	
22. 33	M	$\alpha$ Andromedæ ..	F	0'188	-0'096	- $\frac{1}{10}$	- 6.0	- 23.1	- 24.6	Spectrum fairly bright and steady. Star-line faint and very diffused.
22. 35	M	,,	F	0'188	-0'026	- $\frac{1}{10}$	- 6.0	- 1.9	- 4.2	
22. 47	M	$\beta$ Cassiopeïæ ...	F	0'188	-0'047	- $\frac{1}{10}$	- 7.6	- 6.7	- 17.9	Spectrum bright and steady. Star-line feebly bright, but observed with difficulty.
22. 50	M	,,	F	0'188	-0'053	- $\frac{1}{10}$	- 7.6	- 8.5	- 2.6	
23. 0	M	$\gamma$ Cassiopeïæ ...	F	0'188	-0'013	0	- 9.3	+ 5.3	+ 9.3	Spectrum bright and steady. Star-line feebly bright, but observed with difficulty.
23. 2	M	,,	F	0'188	+0'006	0	- 9.3	+ 11.1	+ 9.3	
23. 13	M	$\delta$ Cassiopeïæ ...	F	0'188	-0'025	- $\frac{1}{10}$	- 1.0	- 6.6	- 9.2	Spectrum steady and fairly bright. Star-line seen fairly well.
23. 16	M	,,	F	0'188	-0'070	- $\frac{1}{10}$	- 1.0	- 20.3	- 19.4	
23. 26	M	$\beta$ Persei .....	F	0'188	-0'060	- $\frac{1}{10}$	- 15.0	- 3.2	- 10.5	Spectrum fairly bright and steady. Star-line seen fairly well.
23. 28	M	,,	F	0'188	-0'026	- $\frac{1}{10}$	- 15.0	+ 7.1	+ 4.8	
23. 36	M	$\alpha$ Persei .....	F	0'188	-0'064	- $\frac{1}{10}$	- 14.7	- 4.7	- 10.8	Spectrum fairly bright and steady. Star-line seen fairly well.
23. 38	M	,,	F	0'188	-0'029	- $\frac{1}{10}$	- 14.7	+ 5.9	+ 4.5	
23. 47	M	Capella .....	F	0'188	+0'117	+ $\frac{1}{10}$	- 16.7	+ 52.2	+ 50.7	Spectrum bright but very unsteady. Star-line faint.
23. 49	M	,,	F	0'188	+0'098	+ $\frac{1}{10}$	- 16.7	+ 46.5	+ 57.5	
Sept. 15. 11. 26	M	Sky .....	F	0'188	+0'028			+ 8.5		The coincidence of the two spectra appeared perfect.
11. 27	M	,,	F	0'188	-0'014			- 4.3		
11. 28	M	,,	F	0'188	+0'014			+ 4.3		
11. 29	M	,,	F	0'188	+0'016			+ 4.9		
11. 30	M	,,	F	0'188	+0'013			+ 4.0		
										Position Circle, 6°.
Sept. 15. 20. 30	M	Arcturus .....	$b_1$	0'120	-0'149	- $\frac{1}{10}$	+ 7.8	(- 63.8)	(- 66.9)	Spectrum rather faint and very unsteady.
20. 32	M	,,	$b_1$	0'120	-0'092	- $\frac{1}{10}$	+ 7.8	(- 42.3)	(- 47.2)	
20. 34	M	,,	$b_1$	0'120	-0'155	- $\frac{1}{10}$	+ 7.8	(- 66.0)	(- 66.9)	Spectrum fairly bright and steady. Star-line exceedingly faint and seen with great difficulty.
20. 36	M	,,	$b_1$	0'120	-0'209	- $\frac{1}{10}$	+ 7.8	(- 86.3)	(- 66.9)	
21. 28	M	$\beta$ Ursæ Minoris	$b_1$	0'120	-0'182	- $\frac{1}{10}$	- 3.5	(- 64.8)	(- 55.6)	Spectrum very unsteady and not very bright. Star-line exceedingly faint and seen with difficulty.
21. 30	M	,,	$b_1$	0'120	-0'072	- $\frac{1}{10}$	- 3.5	(- 23.5)	(- 26.1)	
21. 51	M	$\alpha$ Ursæ Majoris	$b_1$	0'120	+0'138	+ $\frac{1}{10}$	- 7.5	(+ 59.3)	(+ 66.6)	Spectrum bright and fairly steady. Star-line exceedingly faint and seen with difficulty.
21. 53	M	,,	$b_1$	0'120	+0'091	+ $\frac{1}{10}$	- 7.5	(+ 41.7)	(+ 46.9)	
22. 23	M	$\alpha$ Cassiopeïæ ...	$b_1$	0'120	+0'073	+ $\frac{1}{10}$	- 8.6	(+ 36.0)	(+ 32.2)	Spectrum bright and fairly steady. Star-line exceedingly faint and seen with difficulty.
22. 27	M	,,	$b_1$	0'120	+0'074	+ $\frac{1}{10}$	- 8.6	(+ 36.4)	(+ 38.2)	
22. 40	M	Capella .....	$b_1$	0'120	+0'079	+ $\frac{1}{10}$	- 16.7	(+ 46.4)	(+ 56.1)	Spectrum bright and fairly steady. Star-line exceedingly faint.
22. 42	M	,,	$b_1$	0'120	+0'139	+ $\frac{1}{10}$	- 16.7	(+ 68.9)	(+ 75.8)	
22. 58	M	$\gamma$ Andromedæ ..	$b_1$	0'120	-0'095	- $\frac{1}{10}$	- 12.3	(- 23.4)	(- 27.1)	Spectrum fairly bright and steady. Star-line very faint.
23. 2	M	,,	$b_1$	0'120	-0'039	- $\frac{1}{10}$	- 12.3	(- 2.4)	(- 11.3)	
										Position Circle, 6°.

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.
					Measured.	Estimated.		Measured.	Estimated.	
Sept. 17. 11. 32 <sup>d h m</sup>	M	Sky.....	<i>b</i> <sub>1</sub>	0'120	-0'027			- 10'1		The sky spectrum was found to be displaced towards the blue by a very small but unmistakable amount, and the measures made on the night of Sept. 15-16 have therefore been rejected. Position Circle, 6°.
11. 33	M	,,	<i>b</i> <sub>1</sub>	0'120	-0'034			- 12'8		
11. 34	M	,,	<i>b</i> <sub>1</sub>	0'120	-0'024			- 9'0		
11. 35	M	,,	<i>b</i> <sub>1</sub>	0'120	-0'011			- 4'1		
11. 36	M	,,	<i>b</i> <sub>1</sub>	0'120	-0'018			- 6'8		
Sept. 24. 20. 36	M	Vega .....	F	0'120	-0'061	- 1/3	+ 8'5	- 27'0	- 36'1	Cloud passing.
20. 39	M	,,	F	0'120	-0'124	- 1/3	+ 8'5	- 46'2	- 36'1	
20. 42	M	,,	F	0'120	-0'064	- 1/4	+ 8'5	- 27'9	- 29'2	
20. 44	M	,,	F	0'120	-0'098	- 1/3	+ 8'5	- 38'2	- 36'1	Position Circle, 6°.
Oct. i. 21. 12	M	Vega .....	F	0'168	-0'005	0	+ 8'7	- 10'2	- 8'7	Spectrum bright but unsteady. Definition bad. Wind high.
21. 13	M	,,	F	0'168	-0'033	0	+ 8'7	- 18'7	- 8'7	
21. 26	M	Altair.....	F	0'168	-0'049	- 1/10	+ 14'9	- 29'8	- 23'2	Spectrum bright but unsteady. Definition bad. Wind high.
21. 27	M	,,	F	0'168	-0'085	- 1/10	+ 14'9	- 40'7	- 39'8	
21. 36	M	<i>a</i> Cygni .....	F	0'168	-0'022	- 1/10	+ 5'3	- 12'0	- 13'6	Spectrum bright but unsteady. Definition bad.
21. 39	M	,,	F	0'168	+0'026	+ 1/10	+ 5'3	+ 2'6	+ 3'0	
21. 55	M	<i>a</i> Pegasi .....	F	0'168	-0'095	- 1/3	+ 5'0	- 33'8	- 32'6	Spectrum bright but unsteady. Definition poor.
21. 56	M	,,	F	0'168	-0'034	- 1/10	+ 5'0	- 15'3	- 13'3	
22. 8	M	<i>γ</i> Pegasi.....	F	0'168	-0'018	- 1/10	+ 0'3	- 5'8	- 8'6	Spectrum faint. Cloud passing. Definition bad.
22. 10	M	,,	F	0'168	-0'072	- 1/4	+ 0'3	- 22'2	- 21'0	
22. 15	M	<i>a</i> Andromedæ..	F	0'168	-0'042	- 1/10	- 1'2	- 11'5	- 7'1	Spectrum faint and unsteady. Observations interrupted by cloud. Definition bad. Position Circle 6°.
Oct. 3. 20. 59	M	Vega .....	F	0'158	+0'010	0	+ 8'7	- 5'7	- 8'7	Spectrum bright and fairly steady. Definition fair.
21. 2	M	,,	F	0'158	-0'091	- 1/10	+ 8'7	- 36'3	- 38'3	
21. 15	M	Altair.....	F	0'158	-0'151	- 1/5	+ 15'1	- 60'9	- 54'6	Spectrum bright and fairly steady. Definition fair.
21. 17	M	,,	F	0'158	-0'121	- 1/5	+ 15'1	- 51'8	- 48'0	
21. 42	M	<i>a</i> Cygni .....	F	0'158	-0'119	- 1/3	+ 5'5	- 41'6	- 38'4	Spectrum bright and steady. Star-line rather faint. Definition fair.
21. 44	M	,,	F	0'158	-0'086	- 1/5	+ 5'5	- 31'6	- 25'2	Position Circle, 6°.
Oct. 9. 20. 23	M	Vega .....	F	0'159	-0'075	- 1/3	+ 8'7	- 31'5	- 38'8	Spectrum bright and steady. Star-line seen fairly well.
20. 27	M	,,	F	0'159	-0'164	- 1/3	+ 8'7	- 58'5	- 44'8	
20. 39	M	Altair.....	F	0'159	-0'147	- 1/4	+ 15'6	- 60'3	- 38'1	Spectrum bright and steady. Star-line seen fairly well.
20. 41	M	,,	F	0'159	-0'040	- 1/4	+ 15'6	- 27'7	- 38'1	
20. 51	M	<i>a</i> Cygni .....	F	0'159	-0'137	- 1/3	+ 6'3	- 47'9	- 51'4	Spectrum bright and steady. Star-line seen fairly well.
20. 55	M	,,	F	0'159	-0'100	- 1/3	+ 6'3	- 36'7	- 36'4	
21. 25	M	<i>a</i> Pegasi .....	F	0'159	-0'021	- 1/10	+ 7'2	- 13'6	- 16'2	Spectrum bright and steady. Star-line seen fairly well.
21. 26	M	,,	F	0'159	-0'060	- 1/3	+ 7'2	- 25'4	- 37'3	
21. 35	M	<i>γ</i> Pegasi.....	F	0'159	+0'039	+ 1/10	+ 2'8	+ 9'0	+ 6'2	Spectrum bright but unsteady. Definition poor.
21. 39	M	,,	F	0'159	+0'003	0	+ 2'8	- 1'9	- 2'8	
21. 54	M	<i>a</i> Andromedæ..	F	0'159	+0'005	0	+ 1'1	+ 0'4	- 1'1	Spectrum bright but unsteady. Definition bad.
21. 59	M	,,	F	0'159	+0'009	0	+ 1'1	+ 1'6	- 1'1	
22. 13	M	<i>β</i> Arietis .....	F	0'159	-0'040	- 1/10	- 4'9	- 7'2	- 4'1	Spectrum bright and steady. Star-line seen fairly well.
22. 18	M	,,	F	0'159	-0'046	- 1/10	- 4'9	- 9'1	- 13'1	
22. 31	M	<i>β</i> Persei.....	F	0'159	-0'217	- 1/3	- 10'5	- 55'4	- 43'6	Spectrum bright and steady. Star-line seen fairly well.
22. 34	M	,,	F	0'159	-0'199	- 1/3	- 10'5	- 49'9	- 49'6	
22. 45	M	<i>a</i> Persei.....	F	0'159	+0'029	+ 1/10	+ 11'1	+ 19'9	+ 20'1	Spectrum bright and steady. Star-line seen fairly well.
22. 48	M	,,	F	0'159	-0'021	- 1/10	- 11'1	+ 4'7	+ 2'1	Position Circle, 6°.
Oct. 11. 19. 32	M	<i>β</i> Cassiopeiæ...	F	0'172	-0'027	- 1/4	- 3'0	- 5'2	- 11'3	Spectrum bright and steady. Star-line seen well.
19. 35	M	,,	F	0'172	-0'082	- 1/4	- 3'0	- 21'9	- 14'9	

MOTIONS OF STARS IN THE LINE OF SIGHT, INFERRED FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		REMARKS.	
					Measured.	Estimated.		Measured.	Estimated.		
Oct. 11. 19. 52 19. 56	M	γ Cassiopeie ...	F	0'172	+0'081	+ $\frac{1}{10}$	- 4'9	+ 29'5	+ 28'7	Star-line very little brighter than the continuous spectrum, and observed with great difficulty.	
	M	,,	F	0'172	+0'018	+ $\frac{1}{10}$	- 4'9	+ 10'4	+ 12'0		
20. 13	M	δ Cassiopeie ...	F	0'172	+0'247	+	- 6'0	+ 81'0	+ 53'6	Spectrum bright but very unsteady.	
20. 15	M	,,	F	0'172	+0'203	+	- 6'0	+ 67'7	+ 53'6	Definition bad.	
20. 55	M	Vega .....	F	0'172	-0'119	-	+ 8'7	- 44'8	- 37'3	Spectrum bright but very unsteady.	
20. 56	M	,,	F	0'172	-0'097	-	+ 8'7	- 38'2	- 32'5	Definition bad.	
21. 3	M	Altair .....	F	0'172	-0'204	-	+ 15'8	- 77'8	- 51'5	Spectrum bright but very unsteady.	
21. 5	M	,,	F	0'172	-0'196	-	+ 15'8	- 75'3	- 58'6	Definition bad.	
21. 17	M	γ Cygni .....	F	0'172	-0'193	-	+ 8'2	- 66'8	- 51'0	Spectrum faint and unsteady. Definition bad.	
21. 18	M	,,	F	0'172	-0'090	-	+ 8'2	- 35'5	- 32'0		
21. 25	M	α Cygni .....	F	0'172	-0'165	-	+ 6'5	- 56'6	- 30'3	Spectrum bright but unsteady. Definition poor.	
21. 28	M	,,	F	0'172	-0'015	0	+ 6'5	- 11'1	- 6'5		
21. 39	M	α Cephei .....	F	0'172	-0'140	-	+ 0'8	- 43'3	- 24'6	Spectrum bright, but definition exceedingly bad.	
21. 45	M	,,	F	0'172	-0'030	-	+ 0'8	- 9'9	- 15'1		
22. 7	M	α Pegasi .....	F	0'172	-0'035	-	+ 7'8	- 18'4	- 14'9	Spectrum bright and fairly steady. Definition poor.	
22. 10	M	,,	F	0'172	-0'094	-	+ 7'8	- 36'4	- 31'6		
22. 21	M	γ Pegasi .....	F	0'172	+0'063	+	+ 3'4	+ 15'7	+ 14'5	Spectrum bright but unsteady. Definition poor.	
22. 23	M	,,	F	0'172	-0'008	0	+ 3'4	- 5'8	- 3'4		
22. 27	M	α Andromedæ.	F	0'172	-0'019	-	+ 1'7	- 7'5	- 8'8	Spectrum bright but unsteady. Definition poor.	
22. 29	M	,,	F	0'172	-0'048	-	+ 1'7	- 16'3	- 19'6	Position Circle, 6°.	
Oct. 16. 19. 9	M	Vega .....	F	0'198	-0'105	-	+ 8'6	- 40'5	- 30'6	Spectrum very faint, unsteady, and definition poor. Wind high.	
	19. 11	M	,,	F	0'198	-0'161	-	+ 8'6	- 57'5		- 38'0
	19. 13	M	,,	F	0'198	-0'060	-	+ 8'6	- 26'8	- 30'6	
	19. 15	M	,,	F	0'198	-0'055	-	+ 8'6	- 25'3	- 27'0	
	19. 28	M	Altair .....	F	0'198	-0'058	-	+ 16'1	- 33'7	- 34'5	Spectrum unsteady. Definition bad.
	19. 38	M	,,	F	0'198	-0'132	-	+ 16'1	- 56'2	- 40'6	Observations interrupted by cloud.
	19. 48	M	α Cephei .....	F	0'198	-0'044	-	+ 1'4	- 14'8	- 8'7	Spectrum unsteady. Definition bad.
	19. 50	M	,,	F	0'198	-0'058	-	+ 1'4	- 19'0	- 23'4	Position for observing very awkward.
											Position Circle, 6°.

COLLECTED RESULTS for MOTIONS of STARS in the line of Sight, from SPECTROSCOPIC OBSERVATIONS made at the ROYAL OBSERVATORY, GREENWICH, in the Year 1890.

(F for the Star or Moon is compared with  $H\beta$  of Hydrogen; and  $b_1, b_2, b_3$ , with  $Mg_1, Mg_2, Mg_3$ , of Magnesium.)

(+ denotes Recession; - Approach.)

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
$\alpha$ ANDROMEDÆ.										
F line broad and nebulous.										
August	1	M	2	1	6	0.162	F	- 14.3	- 10.8	- 14.3
	7	M	2	1	6	0.162	F	- 13.7	- 58.9	- 49.9
September	8	M	2	1	6	0.198	F	- 7.3	- 8.1	- 7.1
	13	M	2	1	6	0.188	F	- 6.0	- 12.5	- 14.4
October	1	M	1	1	6	0.168	F	- 1.2	- 11.5	- 7.1
	9	M	2	1	6	0.159	F	+ 1.1	+ 1.0	- 1.1
	11	M	2	1	6	0.172	F	+ 1.7	- 11.9	- 14.2
$\beta$ CASSIOPEÆ.										
F line broad, faint, and diffused at the edges.										
August	7	M	2	1	6	0.162	F	- 11.0	- 26.7	- 36.7
September	13	M	2	1	6	0.188	F	- 7.6	- 7.6	- 10.3
October	11	M	2	1	6	0.172	F	- 3.0	- 13.6	- 13.1
$\gamma$ PEGASÆ.										
F line broad and diffused at the edges.										
September	8	M	2	1	6	0.198	F	- 6.5	+ 34.0	+ 30.6
	11	M	2	1	6	0.162	F	- 5.7	- 54.0	- 38.4
	13	M	2	1	6	0.188	F	- 5.1	- 45.2	- 45.9
October	1	M	2	1	6	0.168	F	+ 0.3	- 14.0	- 14.8
	9	M	2	1	6	0.159	F	+ 2.8	+ 3.6	+ 1.7
	11	M	2	1	6	0.172	F	+ 3.4	+ 5.0	+ 5.6
$\alpha$ CASSIOPEÆ.										
$b$ lines fairly distinct.										
September	15	M	2	1	6	0.120	$b_1$	- 8.6	(+ 36.2)	(+ 35.2)

16 COLLECTED RESULTS FOR MOTIONS OF STARS IN THE LINE OF SIGHT, FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.	
								Measured.	Estimated.
<p><math>\gamma</math> CASSIOPELE.</p> <p>F line narrow and feebly bright.</p>									
August 7	M	2	1	6	0.162	F	- 11.8	- 7.2	- 8.9
September 13	M	2	1	6	0.188	F	- 9.3	+ 8.2	+ 9.3
October 11	M	2	1	6	0.172	F	- 4.9	+ 20.0	+ 20.4
<p><math>\delta</math> CASSIOPELE.</p> <p>F line broad, dark, and diffused.</p>									
September 13	M	2	1	6	0.188	F	- 1.0	- 13.5	- 14.3
October 11	M	2	1	6	0.172	F	- 6.0	+ 74.4	+ 53.6
<p><math>\beta</math> ARIETIS.</p> <p>F line broad, dark, and diffused.</p>									
October 9	M	2	1	6	0.159	F	- 4.9	- 8.2	- 8.6
<p><math>\gamma</math> ANDROMEDÆ.</p> <p>The two components of this double star have been observed together as one star. <i>b</i> lines narrow and sharp, but faint.</p>									
September 15	M	2	1	6	0.120	<i>b</i> <sub>1</sub>	- 12.3	(- 12.9)	(- 19.2)
<p><math>\beta</math> PERSEI (<i>Algol</i>).</p> <p>F line broad, dark, and diffused.</p>									
March 3	M	2	1	6	0.210	F	+ 16.4	- 53.0	- 57.0
12	M	4	1	6	0.225	F	+ 15.2	- 58.7	- 54.0
September 13	M	2	1	6	0.188	F	- 15.0	+ 2.0	- 2.9
October 9	M	2	1	6	0.159	F	- 10.5	- 52.7	- 46.6

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
<p><math>\alpha</math> PERSEI.</p> <p>F line rather broad and diffused, but not very dark.</p>										
March	12	M	2	1	6	0.225	F	+ 14.9	- 44.4	- 42.5
September	13	M	2	1	6	0.188	F	- 14.7	+ 0.6	- 3.2
October	9	M	2	1	6	0.159	F	- 11.1	+ 12.3	+ 11.1
<p><math>\alpha</math> TAURI (<i>Aldebaran</i>).</p> <p>F line narrow and sharp. <i>b</i> lines narrow, sharp, and distinct.</p>										
January	4	M	2	1	6	0.198	F	+ 11.2	+ 63.8	+ 38.3
February	7	M	2	1	6	0.198	F	+ 17.7	+ 23.6	+ 35.6
	18	M	2	1	6	0.170	F	+ 18.5	+ 18.7	+ 32.5
March	12	M	2	1	6	0.225	F	+ 18.0	+ 16.8	+ 20.9
	17	M	2	1	6	0.095	<i>b</i> <sub>1</sub>	+ 17.4	+ 4.8	+ 24.4
<p><math>\alpha</math> AURIGÆ (<i>Capella</i>).</p> <p>F line narrow and sharp, but not very dark. <i>b</i> lines narrow and sharp.</p>										
March	3	M	2	1	6	0.210	F	+ 17.1	+ 10.6	+ 23.5
	12	M	2	1	6	0.225	F	+ 17.1	+ 14.7	+ 26.1
	17	M	4	1	6	0.095	<i>b</i> <sub>1</sub>	+ 16.9	+ 10.2	+ 32.4
September	13	M	2	1	6	0.188	F	- 16.7	+ 49.4	+ 54.1
	15	M	2	1	6	0.188	<i>b</i> <sub>1</sub>	- 16.7	(+ 57.7)	(+ 66.0)
<p><math>\beta</math> ORIONIS (<i>Rigel</i>).</p> <p>F line narrow and sharp, but occasionally faint.</p>										
February	18	M	2	1	6	0.170	F	+ 15.5	+ 29.1	+ 22.8
March	3	M	4	1	6	0.210	F	+ 16.0	+ 30.5	+ 29.6
	12	M	2	1	6	0.225	F	+ 15.8	+ 14.7	+ 22.2
April	3	M	2	1	6	0.192	F	+ 13.7	+ 8.5	+ 6.3

18 COLLECTED RESULTS FOR MOTIONS OF STARS IN THE LINE OF SIGHT, FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890,	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
<p><math>\gamma</math> ORIONIS.</p> <p>F line somewhat diffused at the edges, but not very broad.</p>										
February	18	M	2	1	6	0'170	F	+ 17'0	+ 16'7	+ 12'8
March	3	M	2	1	6	0'210	F	+ 17'8	+ 13'2	+ 14'5
	12	M	2	1	6	0'225	F	+ 17'8	- 20'7	- 17'8
April	3	M	2	1	6	0'192	F	+ 15'9	- 22'3	- 18'4
<p><math>\beta</math> TAURI.</p> <p>F line broad and fairly dark.</p>										
February	18	M	4	1	6	0'170	F	+ 17'5	- 8'3	- 8'6
March	3	M	2	1	6	0'210	F	+ 18'4	+ 12'4	+ 16'7
	12	M	2	1	6	0'225	F	+ 18'5	+ 7'7	+ 11'7
April	3	M	2	1	6	0'192	F	+ 16'8	- 32'8	- 39'3
<p><math>\delta</math> ORIONIS.</p> <p>F line faint and ill-defined.</p>										
February	18	M	4	1	6	0'170	F	+ 16'1	- 1'4	- 4'2
March	12	M	4	1	6	0'225	F	+ 17'0	- 6'7	- 6'2
<p><math>\epsilon</math> ORIONIS.</p> <p>F line narrow and fairly dark.</p>										
March	12	M	4	1	6	0'225	F	+ 16'9	+ 9'0	+ 13'7
<p><math>\zeta</math> ORIONIS.</p> <p>F line narrow but faint.</p>										
March	12	M	4	1	6	0'225	F	+ 16'8	- 16'8	- 15'5

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
<p><math>\alpha</math> ORIONIS.</p> <p>Third type spectrum. The <i>b</i> lines stand out on the back ground of a shaded band from which it is often difficult to separate them.</p>										
March	17	M	4	1	6	0.095	<i>b</i> <sub>1</sub>	+ 17.8	+ 4.9	+ 19.9
	17	M	4	1	6	0.095	<i>b</i> <sub>4</sub>	+ 17.8	+ 19.1	+ 27.9
<p><math>\beta</math> AURIGÆ.</p> <p>F line broad and diffused.</p>										
February	18	M	2	1	6	0.170	F	+ 15.4	- 11.6	- 10.3
March	3	M	2	1	6	0.210	F	+ 16.8	- 27.0	- 29.7
	12	M	2	1	6	0.225	F	+ 17.2	- 53.4	- 55.2
<p><math>\gamma</math> GEMINORUM.</p> <p>F line dark, broad, and diffused at the edges.</p>										
February	18	M	4	1	6	0.170	F	+ 14.8	(- 10.3)	(- 14.8)
March	3	M	2	1	6	0.210	F	+ 16.9	+ 7.9	+ 13.5
	12	M	2	1	6	0.225	F	+ 17.8	- 39.5	- 48.0
	28	M	4	1	6	0.208	F	+ 18.3	- 74.1	- 80.3
<p><math>\alpha</math> CANIS MAJORIS (<i>Sirius</i>).</p> <p>F line dark, but very broad and diffused at the edges.</p>										
February	18	M	4	1	6	0.170	F	+ 10.7	- 6.9	- 8.2
March	3	M	6	1	6	0.210	F	+ 12.6	- 8.7	- 8.9
	7	M	4	1	6	0.210	F	+ 13.0	- 33.5	- 34.7
	12	M	6	1	6	0.225	F	+ 13.4	- 17.6	- 18.9
April	3	M	2	1	6	0.192	F	+ 14.1	- 15.8	- 18.3

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
<i>α</i> GEMINORUM ( <i>Castor</i> ).										
The two components of this double star have been observed together as one star. F line very broad and diffused.										
February	18	M	2	1	6	0·170	F	+ 12·3	+ 38·8	+ 55·7
March	3	M	2	1	6	0·210	F	+ 15·0	+ 23·8	+ 31·1
	12	M	4	1	6	0·225	F	+ 16·4	+ 19·7	+ 11·2
	21	M	2	1	6	0·208	F	+ 17·4	+ 3·7	+ 7·1
	28	M	2	1	6	0·208	F	+ 17·8	- 9·3	- 6·5
April	22	M	2	1	6	0·192	F	+ 17·3	+ 19·6	+ 28·8
	30	M	2	1	6	0·192	F	+ 16·6	- 10·2	- 5·1
May	23	M	2	1	6	0·193	F	+ 12·7	+ 68·6	+ 55·2
<i>α</i> CANIS MINORIS ( <i>Procyon</i> ).										
F line narrow but rather faint, and on a background of a faint diffused shading.										
February	18	M	2	1	6	0·170	F	+ 10·6	+ 1·4	+ 14·9
March	3	M	2	1	6	0·210	F	+ 13·6	+ 0·5	+ 11·3
	12	M	4	1	6	0·225	F	+ 15·2	- 29·0	- 28·2
	21	M	2	1	6	0·208	F	+ 16·4	- 30·7	- 33·3
	29	M	4	1	6	0·208	F	+ 17·0	- 26·9	- 28·3
April	22	M	4	1	6	0·192	F	+ 17·2	- 33·5	- 29·8
	30	M	2	1	6	0·192	F	+ 16·7	- 12·0	- 7·5
<i>β</i> GEMINORUM ( <i>Pollux</i> ).										
F line narrow but faint. <i>b</i> lines narrow and sharp but faint.										
February	18	M	2	1	6	0·170	F	+ 11·6	- 23·1	- 21·8
March	3	M	2	1	6	0·210	F	+ 14·6	- 23·7	- 25·7
	12	M	2	1	6	0·225	F	+ 16·1	- 52·7	- 67·9
	17	M	2	1	6	0·095	<i>b</i> <sub>1</sub>	+ 16·7	- 27·6	- 34·1
	21	M	2	1	6	0·208	F	+ 17·2	- 68·4	- 73·6
	28	M	2	1	6	0·208	F	+ 17·8	- 53·7	- 57·3
April	22	M	2	1	6	0·192	F	+ 17·7	- 49·2	- 47·6
	30	M	2	1	6	0·192	F	+ 17·0	- 61·6	- 53·8
May	23	M	2	1	6	0·193	F	+ 13·4	- 61·4	- 59·2

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
<p><math>\alpha</math> LEONIS (<i>Regulus</i>).</p> <p>F line faint and diffused at the edges.</p>										
March	21	M	2	1	6	0.208	F	+ 10.1	- 10.9	- 10.1
	29	M	2	1	6	0.208	F	+ 11.8	+ 17.1	+ 21.1
April	22	M	4	1	6	0.192	F	+ 16.3	- 0.5	+ 7.5
	30	M	2	1	6	0.192	F	+ 17.2	- 55.6	- 49.4
May	17	M	1	1	6	0.192	F	+ 17.9	+ 9.7	+ 18.7
	21	M	2	1	6	0.174	F	+ 17.9	- 66.1	- 67.9
	23	M	2	1	6	0.193	F	+ 17.8	- 12.1	- 12.7
June	2	M	2	1	6	0.187	F	+ 17.4	- 16.2	- 15.4
<p><math>\gamma</math> LEONIS.</p> <p>The two components of this double star have been observed together as one star.</p> <p>F line narrow, but faint.</p>										
March	29	M	2	1	6	0.208	F	+ 11.8	- 15.9	- 17.5
April	22	M	2	1	6	0.192	F	+ 16.2	- 28.1	- 25.4
	30	M	2	1	6	0.192	F	+ 17.1	- 44.8	- 44.0
May	21	M	2	1	6	0.174	F	+ 17.7	- 27.1	- 26.3
	23	M	2	1	6	0.193	F	+ 17.6	- 18.4	- 7.4
<p><math>\beta</math> URSÆ MAJORIS.</p> <p>F line broad and diffused at the edges.</p>										
May	7	M	2	1	6	0.192	F	+ 12.7	- 71.5	- 58.7
<p><math>\alpha</math> URSÆ MAJORIS.</p> <p>F line narrow and faint. <i>b</i> lines narrow and faint.</p>										
May	7	M	2	1	6	0.192	F	+ 11.6	- 46.2	- 46.1
September	15	M	2	1	6	0.120	<i>b</i> <sub>1</sub>	- 7.5	(+ 50.5)	(+ 56.8)

22 COLLECTED RESULTS FOR MOTIONS OF STARS IN THE LINE OF SIGHT, FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
$\beta$ LEONIS.										
F line dark and very broad, and diffused.										
March	29	M	2	1	6	0.208	F	+ 5.6	+ 20.7	+ 22.6
April	22	M	2	1	6	0.192	F	+ 12.0	+ 13.5	+ 24.8
	30	M	2	1	6	0.192	F	+ 13.6	- 20.0	- 19.4
May	21	M	2	1	6	0.174	F	+ 16.5	- 4.2	- 7.9
	23	M	2	1	6	0.193	F	+ 16.7	+ 18.7	+ 30.0
$\gamma$ URSÆ MAJORIS.										
F line broad, very diffused, and ill-defined.										
May	7	M	2	1	6	0.192	F	+ 12.0	- 35.9	- 36.6
$\delta$ URSÆ MAJORIS.										
F line rather faint and ill-defined.										
May	7	M	2	1	6	0.192	F	+ 10.9	+ 6.0	+ 16.7
$\epsilon$ URSÆ MAJORIS.										
F line broad and ill-defined.										
May	7	M	2	1	6	0.192	F	+ 9.9	- 56.0	- 50.9
$\alpha$ VIRGINIS ( <i>Spica</i> ).										
F line faint and rather narrow.										
April	22	M	2	1	6	0.192	F	+ 3.3	+ 19.8	+ 23.6
	30	M	2	1	6	0.192	F	+ 5.6	- 28.1	- 28.6
May	12	M	1	1	6	0.192	F	+ 8.9	- 53.6	- 54.9
	15	M	4	1	6	0.192	F	+ 9.7	- 59.1	- 53.1
	21	M	2	1	6	0.174	F	+ 11.1	+ 26.6	+ 24.7
	23	M	2	1	6	0.193	F	+ 11.6	- 66.4	- 67.6
	31	M	4	1	6	0.187	F	+ 13.3	- 63.5	- 49.8
June	6	M	2	1	6	0.164	F	+ 14.4	(+ 13.7)	(+ 24.2)

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
<p>ζ URSAE MAJORIS. F line broad and ill-defined.</p>										
May	7	M	2	1	6	0.192	F	+ 8.9	- 44.9	- 54.9
<p>η URSAE MAJORIS. F line faint and ill-defined.</p>										
May	7	M	2	1	6	0.192	F	+ 8.2	- 17.5	- 22.0
<p>α BOÖTIS (<i>Arcturus</i>). F line narrow and sharp. <i>b</i> lines narrow, sharp, and dark.</p>										
March	17	M	4	1	6	0.095	<i>b</i> <sub>1</sub>	- 6.8	- 28.6	- 36.7
April	22	M	2	1	6	0.192	F	+ 2.7	- 26.6	- 29.6
	30	M	4	1	6	0.192	F	+ 4.8	- 37.2	- 41.2
May	5	M	2	1	6	0.192	F	+ 5.9	- 33.4	- 34.8
	7	M	2	1	6	0.192	F	+ 6.4	- 31.6	- 31.0
	15	M	2	1	6	0.192	F	+ 8.2	- 40.4	- 42.5
	21	M	2	1	6	0.174	F	+ 9.5	- 45.5	- 43.8
	23	M	2	1	6	0.193	F	+ 9.9	- 57.5	- 60.8
31	M	2	1	6	0.187	F	+ 11.3	- 40.5	- 37.0	
June	27	M	2	1	6	0.164	F	+ 14.6	- 37.7	- 30.9
July	3	M	2	1	6	0.164	F	+ 15.0	- 36.3	- 35.5
August	6	M	2	1	6	0.162	F	+ 14.3	- 55.0	- 57.2
September	15	M	4	1	6	0.120	<i>b</i> <sub>1</sub>	+ 7.8	(- 64.7)	(- 62.0)
<p>β URSAE MINORIS. <i>b</i> lines exceedingly faint.</p>										
September	15	M	2	1	6	0.120	<i>b</i> <sub>1</sub>	- 3.5	(- 44.2)	(- 40.9)

24 COLLECTED RESULTS FOR MOTIONS OF STARS IN THE LINE OF SIGHT, FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
<i>β</i> LIBRÆ.										
F line broad and diffused at the edges.										
April	22	M	2	1	6	0.192	F	- 4.7	- 16.6	- 20.6
	30	M	2	1	6	0.192	F	- 2.3	+ 6.7	+ 6.9
May	15	M	4	1	6	0.192	F	+ 2.2	- 38.0	- 40.3
	23	M	2	1	6	0.193	F	+ 4.5	- 22.9	- 22.4
	31	M	2	1	6	0.187	F	+ 6.8	- 53.4	- 47.4
June	6	M	2	1	6	0.164	F	+ 8.3	- 47.5	- 71.9
<i>α</i> CORONÆ BOREALIS.										
F line broad and diffused at the edges.										
April	22	M	4	1	6	0.192	F	- 1.8	+ 31.6	+ 36.3
May	15	M	2	1	6	0.192	F	+ 3.2	+ 35.1	+ 38.0
	22	M	2	1	6	0.174	F	+ 4.4	+ 18.7	+ 17.1
	23	M	2	1	6	0.193	F	+ 4.8	+ 25.3	+ 30.8
	31	M	2	1	6	0.187	F	+ 6.3	+ 8.6	+ 5.9
June	27	M	2	1	6	0.164	F	+ 10.5	- 10.9	- 6.3
July	3	M	2	1	6	0.164	F	+ 11.1	- 16.6	- 13.9
August	6	M	2	1	6	0.162	F	+ 12.8	- 78.4	- 63.7
September	8	M	2	1	6	0.198	F	+ 10.6	- 26.9	- 23.5
<i>α</i> OPHIUCHI.										
F line very ill-defined and nebulous.										
April	30	M	4	1	6	0.192	F	- 9.5	- 17.4	- 10.8
May	15	M	4	1	6	0.192	F	- 6.4	- 9.9	- 7.3
	22	M	2	1	6	0.174	F	- 5.0	- 6.1	- 7.9
	23	M	2	1	6	0.193	F	- 4.5	- 13.3	- 12.5
	31	M	2	1	6	0.187	F	- 2.6	- 19.2	- 17.7
June	6	M	2	1	6	0.164	F	- 1.2	- 10.8	- 10.2
	27	M	2	1	6	0.164	F	+ 3.8	- 26.0	- 20.6
July	3	M	2	1	6	0.164	F	+ 5.2	- 38.9	- 36.0
August	1	M	2	1	6	0.162	F	+ 10.9	- 46.3	- 32.1
	6	M	2	1	6	0.162	F	+ 11.6	- 47.5	- 43.4
September	8	M	2	1	6	0.198	F	+ 14.7	- 35.1	- 38.8

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
<p><math>\alpha</math> LYRÆ (<i>Vega</i>).</p> <p>F line broad and diffused.</p>										
May	1	M	2	1	6	0.192	F	- 7.7	- 30.8	- 26.1
	15	M	2	1	6	0.192	F	- 6.4	- 3.7	- 2.7
	22	M	2	1	6	0.174	F	- 5.8	- 53.1	- 51.3
	24	M	2	1	6	0.193	F	- 5.6	- 10.1	- 12.3
June	1	M	2	1	6	0.187	F	- 4.7	- 25.5	- 21.7
July	3	M	2	1	6	0.164	F	- 0.3	- 63.1	- 46.3
August	1	M	2	1	6	0.162	F	+ 3.7	- 8.0	- 8.6
	6	M	2	1	6	0.162	F	+ 4.3	- 10.4	- 9.1
September	8	M	2	1	6	0.198	F	+ 7.6	- 26.0	- 18.3
	13	M	2	1	6	0.188	F	+ 7.9	- 24.6	- 25.8
	24	M	4	1	6	0.120	F	+ 8.5	- 34.8	- 34.4
October	1	M	2	1	6	0.168	F	+ 8.7	- 14.5	- 8.7
	3	M	2	1	6	0.158	F	+ 8.7	- 21.0	- 23.5
	9	M	2	1	6	0.159	F	+ 8.7	- 45.0	- 41.8
	11	M	2	1	6	0.172	F	+ 8.7	- 41.5	- 34.9
	16	M	4	1	6	0.198	F	+ 8.6	- 37.5	- 31.6
<p><math>\gamma</math> LYRÆ.</p> <p>F line broad and diffused.</p>										
August	1	M	2	1	6	0.162	F	+ 3.4	+ 7.5	+ 11.3
	6	M	2	1	6	0.162	F	+ 4.2	- 16.2	- 13.7
September	13	M	2	1	6	0.188	F	+ 9.1	- 29.8	- 15.9
<p><math>\zeta</math> AQUILÆ.</p> <p>F line broad, nebulous, and faint.</p>										
August	1	M	2	1	6	0.162	F	+ 5.2	- 7.7	- 5.2
	6	M	2	1	6	0.162	F	+ 6.3	- 13.7	- 11.1
September	13	M	2	1	6	0.188	F	+ 13.0	+ 10.4	+ 10.0
<p><math>\delta</math> CYGNI.</p> <p>F line broad, diffused, and faint.</p>										
August	6	-M	2	1	6	0.162	F	0.0	- 70.7	- 52.5
September	13	-M	2	1	6	0.188	F	+ 4.6	+ 8.6	+ 22.6

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
<p><math>\alpha</math> AQUILE (<i>Altair</i>).</p> <p>F line very broad and nebulous.</p>										
May	16	M	2	1	6	0.192	F	- 14.2	- 5.2	- 1.8
	24	M	2	1	6	0.193	F	- 13.2	- 20.7	- 19.0
June	1	M	2	1	6	0.187	F	- 11.9	- 10.0	- 8.4
	27	M	2	1	6	0.164	F	- 6.3	- 47.0	- 27.2
July	3	M	2	1	6	0.164	F	- 4.9	- 57.4	- 41.7
August	1	M	2	1	6	0.162	F	+ 2.5	- 45.2	- 46.5
	4	M	2	1	6	0.162	F	+ 3.3	- 44.2	- 39.2
	6	M	2	1	6	0.162	F	+ 3.8	- 72.9	- 70.6
September	8	M	2	1	6	0.198	F	+ 11.4	- 32.4	- 30.1
	13	M	2	1	6	0.188	F	+ 12.3	- 30.8	- 40.4
October	1	M	2	1	6	0.168	F	+ 14.9	- 35.3	- 31.5
	3	M	2	1	6	0.158	F	+ 15.1	- 56.4	- 51.3
	9	M	2	1	6	0.159	F	+ 15.6	- 44.0	- 38.1
	11	M	2	1	6	0.172	F	+ 15.8	- 76.6	- 55.1
	16	M	2	1	6	0.198	F	+ 16.1	- 45.0	- 37.6
<p><math>\gamma</math> CYGNI.</p> <p>F line narrow but faint.</p>										
October	11	M	2	1	6	0.172	F	+ 8.2	- 51.2	- 41.5
<p><math>\alpha</math> CYGNI.</p> <p>F line narrow and fairly dark.</p>										
May	15	M	2	1	6	0.192	F	- 8.9	- 51.2	- 41.4
July	3	M	1	1	6	0.164	F	- 7.0	- 42.4	- 48.8
August	4	M	2	1	6	0.162	F	- 3.3	- 64.8	- 66.0
September	8	M	2	1	6	0.198	F	+ 1.9	- 47.8	- 42.0
	13	M	2	1	6	0.188	F	+ 2.7	- 28.5	- 41.0
October	1	M	2	1	6	0.168	F	+ 5.3	- 4.7	- 5.3
	3	M	2	1	6	0.158	F	+ 5.5	- 36.6	- 31.8
	9	M	2	1	6	0.159	F	+ 6.3	- 42.3	- 43.9
	11	M	2	1	6	0.172	F	+ 6.5	- 33.9	- 18.4

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
<p><math>\alpha</math> CEPHEI.</p> <p>F line broad, dark, and diffused at the edges.</p>										
May	15	M	2	1	6	0.192	F	- 4.5	- 38.1	- 29.1
August	1	M	2	1	6	0.162	F	- 5.6	- 87.8	- 92.2
October	11	M	2	1	6	0.172	F	+ 0.8	- 26.6	- 19.9
	16	M	2	1	6	0.198	F	+ 1.4	- 16.9	- 16.1
<p><math>\alpha</math> PEGASI.</p> <p>F line broad and diffused at the edges.</p>										
August	1	M	2	1	6	0.162	F	- 11.3	- 29.6	- 27.8
	7	M	2	1	6	0.162	F	- 10.0	- 28.0	- 25.8
September	8	M	2	1	6	0.198	F	- 1.7	- 21.9	- 19.7
	11	M	2	1	6	0.162	F	- 0.9	- 43.8	- 47.5
	13	M	4	1	6	0.188	F	- 0.3	+ 22.1	+ 20.3
October	1	M	2	1	6	0.168	F	+ 5.0	- 24.6	- 23.0
	9	M	2	1	6	0.159	F	+ 7.2	- 19.5	- 26.8
	11	M	2	1	6	0.172	F	+ 7.8	- 27.4	- 23.3
<p>GREAT NEBULA IN ORION.</p>										
March	17	M	7	1	6	0.095	N	+ 16.2	- 7.4	...
<p>Compared with Nitrogen. The motion given for the Nebula is corrected for the orbital motion of the earth, but requires a further correction for the difference in wavelength between the Nebular line and the line of Nitrogen.</p>										
<p>MARS.</p>										
May	31	M	2	1	6	0.187	F	...	- 2.0	0.0
June	6	M	2	1	6	0.164	F	...	- 6.1	0.0
<p>Calculated relative motion of Mars, May 31, - 0.8 miles per second; June 6, + 0.3.</p>										

28 COLLECTED RESULTS FOR MOTIONS OF STARS IN THE LINE OF SIGHT, FROM SPECTROSCOPIC OBSERVATIONS

Date, 1890.	Observer.	Number of Measures.	Number of Prisms.	Position Circle.	Width of Slit.	Line.	Earth's Motion in Miles per Second.	Concluded Motion of Star in Miles per Second.		
								Measured.	Estimated.	
MOON.										
March	3	M	5	1	6	0'210	F	...	- 2'3	...
	28	M	5	1	6	0'208	F	...	- 2'4	...
April	30	M	5	1	6	0'192	F	...	+ 1'1	...
May	5	M	5	1	6	0'192	F	...	+ 2'2	...
	23	M	5	1	6	0'193	F	...	- 1'3	...
	31	M	5	1	6	0'187	F	...	+ 1'7	...
June	27	M	5	1	6	0'164	F	...	+ 1'2	..
July	3	M	5	1	6	0'164	F	...	+ 2'6	...
August	2	M	5	1	6	0'162	F	...	+ 2'2	...
	7	M	5	1	6	0'162	F	...	- 2'2	...
SUN.										
May	16	M	5	1	6	0'192	F	...	+ 1'1	...
SKY.										
March	14	M	5	1	6	0'225	F	...	- 2'9	...
	18	M	5	1	6	0'095	b <sub>1</sub>	...	+ 1'0	...
Sept.	10	M	5	1	6	0'198	F	...	+ 1'0	...
	15	M	5	1	6	0'188	F	...	+ 3'5	...
	17	M	5	1	6	0'120	b <sub>1</sub>	...	(- 8'6)	...

ROYAL OBSERVATORY, GREENWICH.

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MEASURES OF POSITIONS AND AREAS

OF

SUN SPOTS AND FACULÆ

ON

PHOTOGRAPHS

TAKEN WITH THE

PHOTOHELIOGRAPHS

AT GREENWICH, IN INDIA, AND IN MAURITIUS,

WITH THE DEDUCED

HELIOGRAPHIC LONGITUDES AND LATITUDES.

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1890.

MEASURES OF POSITIONS and AREAS of SUN SPOTS and FACULÆ on PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DŪN in INDIA, and at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the Year 1890.

NOTE.—The Greenwich Civil Time at which the photograph was taken is expressed by the Day of the Year and decimals of a day, reckoning from Midnight, January 1<sup>st</sup>. 0<sup>h</sup>.

For convenience of reference the Month and Day of the Month (Civil Reckoning) are added.

The letter I. signifies that the photograph was taken in India; the letter M. that the photograph was taken in Mauritius; the time given is Greenwich Civil Time.

The position-angles are reckoned from the North Pole of the Sun's Axis in the direction N. E. S. W. N.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).	
1890. 0 <sup>h</sup> 45 <sup>m</sup> 4 Jan. 1	ST,M	2111 Centre	0 <sup>o</sup> 241	116 <sup>o</sup> 1	344 <sup>o</sup> 0 (356 <sup>o</sup> 6)	-9 <sup>o</sup> 3 (-3 <sup>o</sup> 3)	10 (10)	57 (57)	(0)	1890. 8 <sup>h</sup> 50 <sup>m</sup> 9	ST,M	2113 Centre	0 <sup>o</sup> 669	230 <sup>o</sup> 3	286 <sup>o</sup> 3 (250 <sup>o</sup> 5)	-28 <sup>o</sup> 7 (-4 <sup>o</sup> 2)	0 (0)	7 (19)	5 (0)	(0)
1 <sup>h</sup> 29 <sup>m</sup> 8 I. Jan. 2	ST,M	2111 Centre	0 <sup>o</sup> 107	166 <sup>o</sup> 4	344 <sup>o</sup> 0 (345 <sup>o</sup> 5)	-9 <sup>o</sup> 3 (-3 <sup>o</sup> 4)	16 (16)	67 (67)	(0)	Jan. 9										
2 <sup>h</sup> 28 <sup>m</sup> 0 I. Jan. 3	ST,M	2111 Centre	0 <sup>o</sup> 230	242 <sup>o</sup> 5	344 <sup>o</sup> 4 (332 <sup>o</sup> 5)	-9 <sup>o</sup> 5 (-3 <sup>o</sup> 5)	12 (12)	48 (48)	(0)	10 <sup>h</sup> 20 <sup>m</sup> 4 I. Jan. 11	ST,M		0 <sup>o</sup> 855	239 <sup>o</sup> 5	284 <sup>o</sup> 7 (228 <sup>o</sup> 2)	-28 <sup>o</sup> 2 (-4 <sup>o</sup> 4)	0 (0)	96 (227)	227 (452)	
3 <sup>h</sup> 21 <sup>m</sup> 3 I. Jan. 4	ST,M	2111 Centre	0 <sup>o</sup> 419	255 <sup>o</sup> 1	344 <sup>o</sup> 4 (320 <sup>o</sup> 3)	-9 <sup>o</sup> 5 (-3 <sup>o</sup> 6)	9 (9)	41 (41)	(0)	11 <sup>h</sup> 54 <sup>m</sup> 6 I. Jan. 12	ST,M		0 <sup>o</sup> 880	57 <sup>o</sup> 7	155 <sup>o</sup> 5 (210 <sup>o</sup> 8)	+25 <sup>o</sup> 5 (-4 <sup>o</sup> 5)	0 (0)	215 (215)		
4 <sup>h</sup> 20 <sup>m</sup> 3 I. Jan. 5	ST,M	2111 Centre	0 <sup>o</sup> 947	260 <sup>o</sup> 0	18 <sup>o</sup> 6 344 <sup>o</sup> 4 (307 <sup>o</sup> 2)	-10 <sup>o</sup> 7 -9 <sup>o</sup> 6 (-3 <sup>o</sup> 7)	9 (9)	29 (29)	26 70 73 (169)	12 <sup>h</sup> 32 <sup>m</sup> 3 I. Jan. 13	ST,M		0 <sup>o</sup> 824	55 <sup>o</sup> 4	152 <sup>o</sup> 0 (200 <sup>o</sup> 2)	+24 <sup>o</sup> 8 (-4 <sup>o</sup> 6)	0 (0)	122 (122)		
5 <sup>h</sup> 21 <sup>m</sup> 2 I. Jan. 6	ST,M	2111 Centre	0 <sup>o</sup> 731	263 <sup>o</sup> 3	340 <sup>o</sup> 8 345 <sup>o</sup> 0 (293 <sup>o</sup> 9)	-7 <sup>o</sup> 6 -9 <sup>o</sup> 6 (-3 <sup>o</sup> 9)	7 (7)	26 17 6 (49)	109 157 <sup>c</sup> 186 <sup>c</sup> (452)	13 <sup>h</sup> 30 <sup>m</sup> 0 I. Jan. 14										
6 <sup>h</sup> 42 <sup>m</sup> 9 I. Jan. 7	ST,M	2111 Centre	0 <sup>o</sup> 920	261 <sup>o</sup> 1	344 <sup>o</sup> 9 (277 <sup>o</sup> 9)	-9 <sup>o</sup> 8 (-4 <sup>o</sup> 0)	0 (0)	17 (17)	187 <sup>n</sup> (187)	14 <sup>h</sup> 19 <sup>m</sup> 2 M. Jan. 15										
7 <sup>h</sup> 23 <sup>m</sup> 7 I. Jan. 8	ST,M		0 <sup>o</sup> 976	259 <sup>o</sup> 6	345 <sup>o</sup> 1 341 <sup>o</sup> 6 (267 <sup>o</sup> 3)	-11 <sup>o</sup> 1 -6 <sup>o</sup> 6 (-4 <sup>o</sup> 1)	0 (0)	17 (17)	138 144 249 (531)	15 <sup>h</sup> 32 <sup>m</sup> 5 I. Jan. 16	ST,M		0 <sup>o</sup> 951	278 <sup>o</sup> 4	231 <sup>o</sup> 7 (160 <sup>o</sup> 7)	+6 <sup>o</sup> 4 -30 <sup>o</sup> 1 -26 <sup>o</sup> 4 (-4 <sup>o</sup> 9)	0 (0)	41 207 262 (510)		

The Groups of Spots are numbered in the order of their appearance. When there is no number in the third column it is to be understood that there is a Facula unaccompanied by a Spot. The positions of Faculae relative to the Spots with which they are associated are indicated by the letters n, s, p, f, c, denoting respectively north, south, preceding, following, concentric. The longitude and latitude of the centre of the disk are given in brackets. The Areas of Spots and Faculae are expressed in millionths of the Sun's visible Hemisphere.

Group 2111, 1889, Dec. 27-1890, Jan. 7. A regular spot.  
Group 2112, 1890, Jan. 6. Two small spots.  
Group 2113, Jan. 9. Three very small spots.

Measures of Positions and Areas of Sun Spots and Faculae on Photographs—continued.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).
1890. 16 <sup>h</sup> 18 <sup>m</sup> M.	ST, M	2114 2114	0'491 0'493 0'861	344'6 353'9 119'7	157'6 152'8 91'8	+23'2 +24'2 -28'0	0 0 (0)	4 9 (13)	294 (294)	1890. 26 <sup>h</sup> 47 <sup>m</sup> I.	ST, M	Centre	0'958 0'946	246'9 240'0	91'1 85'0 (13'9)	-23'8 -30'2 (-5'8)	(0)	(0)	76 203 (279)
Jan. 17	Centre				(149'5)	(-5'0)				Jan. 27	Centre								
17 <sup>h</sup> 42 <sup>m</sup> Jan. 18	ST, M	2114 Centre	0'572	324'3	154'2 (133'1)	+22'8 (-5'1)	0 (0)	16 (16)	(0)	Jan. 28	Centre				(2'4)	(-5'9)	(0)	(0)	(0)
18 <sup>h</sup> 44 <sup>m</sup> Jan. 19	ST, M	2114a 2114 Centre	0'731 0'696	308'6 310'2	158'0 (119'8)	+23'0 (-5'2)	8 9 (17)	44 30 (74)	1500 (150)	28 <sup>h</sup> 42 <sup>m</sup> Jan. 29	ST, M	Centre	0'897	57'9	291'4 (348'3)	+25'2 (-6'0)	(0)	(0)	45 (45)
19 <sup>h</sup> 43 <sup>m</sup> Jan. 20	ST, M	2114a 2114 2114 2114 Centre	0'848 0'834 0'818 0'806	300'8 303'4 301'2 303'5	158'6 156'1 155'3 (106'7)	+22'5 +23'9 +21'6 (-5'3)	29 0 8 (48)	194 5 28 (293)	4730 (473)	29'216 I. Jan. 30	ST, M	2115a 2115b Centre	0'794 0'810	51'8 53'2	294'5 292'4 (337'8)	+25'0 +24'7 (-6'1)	1 0 (1)	3 2 (5)	390 (39)
20 <sup>h</sup> 42 <sup>m</sup> Jan. 21	ST, M	2114a 2114 2114 Centre	0'942 0'906 0'900	296'9 298'7 300'6	159'4 153'2 151'7 (93'6)	+23'1 +23'1 +24'5 (-5'4)	23 22 2 (47)	231 83 16 (330)	4900 (490)	30'341 I. Jan. 31	ST, M	2115a 2115b Centre	0'653 0'682	40'5 42'9	295'5 292'5 (323'1)	+24'3 +24'7 (-6'1)	11 0 (11)	22 15 (37)	(0)
21 <sup>h</sup> 42 <sup>m</sup> Jan. 22	ST, M	2114a 2114 Centre	0'991 0'970	293'9 295'3	159'5 (80'5)	+22'7 +22'9 (-5'4)	21 5 (26)	171 44 (215)	8760 (876)	31'292 I. Feb. 1	ST, M	2115a 2115b	0'555 0'592	24'7 29'1	295'8 292'0	+24'2 +25'2	2 0	7 11	95 35 (130)
22 <sup>h</sup> 44 <sup>m</sup> Jan. 23	Centre				(67'0)	(-5'5)	(0)	(0)	(0)	32'239 I. Feb. 2	Centre				(295'5)	(-6'3)	(0)	(0)	(0)
23 <sup>h</sup> 20 <sup>m</sup> I. Jan. 24	ST, M	Centre	0'638	225'4	88'9 (56'9)	-31'3 (-5'6)	(0)	(0)	276 (276)	33'285 I. Feb. 3	ST, M	Centre	0'886 0'894	255'7 301'5	347'1 340'9 (284'3)	-15'6 +24'4 (-6'3)	(0)	(0)	54 45 (99)
24 <sup>h</sup> 24 <sup>m</sup> I. Jan. 25	ST, M	Centre	0'768 0'775 0'944	242'8 234'0 61'0	91'7 90'1 337'9 (43'3)	-24'3 -31'0 +25'0 (-5'7)	(0)	(0)	83 139 83 (305)	34'317 I. Feb. 4	Centre				(270'7)	(-6'4)	(0)	(0)	(0)
25 <sup>h</sup> 44 <sup>m</sup> Jan. 26	ST, M	Centre	0'892 0'895	245'2 238'9	90'3 89'8 (27'5)	-24'7 -30'3 (-5'8)	(0)	(0)	69 114 (183)	35'480 Feb. 5	ST, M	Centre	0'866	302'5	308'2 (255'4)	+23'9 (-6'4)	(0)	(0)	98 (98)
										36'260 I. Feb. 6	ST, M	Centre	0'843	305'2	294'3 (245'0)	+24'9 (-6'5)	(0)	(0)	87 (87)

The Groups of Spots are numbered in the order of their appearance. When there is no number in the third column it is to be understood that there is a Facula unaccompanied by a Spot. The positions of Faculae relative to the Spots with which they are associated are indicated by the letters *n, s, p, f, c*, denoting respectively north, south, preceding, following, concentric. The longitude and latitude of the centre of the disk are given in brackets. The Areas of Spots and Faculae are expressed in millionths of the Sun's visible Hemisphere.

Group 2114, Jan. 17-22. Three small spots on Jan. 17, the two following of which are measured together. One small spot on Jan. 18. The group has greatly enlarged by Jan. 19, and yet further by Jan. 20, on which date it consists of a large spot *a*, followed by a stream of smaller spots. *a* has changed its shape between Jan. 19 and Jan. 20.  
Group 2115, Jan. 30-Feb. 1. Two very small spots *a* and *b*.

MEASURES OF POSITIONS AND AREAS OF SUN SPOTS AND FACULÆ ON PHOTOGRAPHS

Measures of Positions and Areas of Sun Spots and Faculæ on Photographs—continued.

Greenwich Civil Time.	Measures.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measures.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.				
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).				
1890. 37 <sup>h</sup> 33 <sup>m</sup> I. Feb. 7	ST,M	Centre	0 <sup>o</sup> 927 0 <sup>o</sup> 977	301 <sup>o</sup> 2 63 <sup>o</sup> 0	292 <sup>o</sup> 3 158 <sup>o</sup> 0 (230 <sup>o</sup> 9)	+25 <sup>o</sup> 6 +24 <sup>o</sup> 5 (-6 <sup>o</sup> 6)	(o)	(o)	118 149 (267)	1890. 49 <sup>h</sup> 17 <sup>m</sup> I. Feb. 19		Centre			0	0	0	(75 <sup>o</sup> 1)	(-7 <sup>o</sup> 1)	(o)	(o)	(o)	
38 <sup>h</sup> 41 <sup>m</sup> Feb. 8	ST,M	Centre	0 <sup>o</sup> 932	59 <sup>o</sup> 3	154 <sup>o</sup> 4 (216 <sup>o</sup> 8)	+25 <sup>o</sup> 5 (-6 <sup>o</sup> 6)	(o)	(o)	312 (312)	50 <sup>h</sup> 19 <sup>m</sup> M. Feb. 20		Centre						(61 <sup>o</sup> 5)	(-7 <sup>o</sup> 1)	(o)	(o)	(o)	
39 <sup>h</sup> 43 <sup>m</sup> Feb. 9		Centre			(203 <sup>o</sup> 4)	(-6 <sup>o</sup> 7)	(o)	(o)	(o)	51 <sup>h</sup> 17 <sup>m</sup> I. Feb. 21		Centre						(48 <sup>o</sup> 7)	(-7 <sup>o</sup> 1)	(o)	(o)	(o)	
40 <sup>h</sup> 43 <sup>m</sup> Feb. 10		Centre			(190 <sup>o</sup> 2)	(-6 <sup>o</sup> 7)	(o)	(o)	(o)	52 <sup>h</sup> 21 <sup>m</sup> I. Feb. 22		Centre						(35 <sup>o</sup> 0)	(-7 <sup>o</sup> 1)	(o)	(o)	(o)	
41 <sup>h</sup> 45 <sup>m</sup> Feb. 11		Centre			(176 <sup>o</sup> 7)	(-6 <sup>o</sup> 8)	(o)	(o)	(o)	53 <sup>h</sup> 17 <sup>m</sup> M. Feb. 23		Centre						(22 <sup>o</sup> 3)	(-7 <sup>o</sup> 2)	(o)	(o)	(o)	
42 <sup>h</sup> 41 <sup>m</sup> Feb. 12		Centre			(164 <sup>o</sup> 1)	(-6 <sup>o</sup> 8)	(o)	(o)	(o)	54 <sup>h</sup> 53 <sup>m</sup> Feb. 24		Centre						(4 <sup>o</sup> 5)	(-7 <sup>o</sup> 2)	(o)	(o)	(o)	
43 <sup>h</sup> 40 <sup>m</sup> Feb. 13	ST,M	Centre	0 <sup>o</sup> 893	113 <sup>o</sup> 7	87 <sup>o</sup> 6 (151 <sup>o</sup> 1)	-24 <sup>o</sup> 3 (-6 <sup>o</sup> 9)	(o)	(o)	31 (31)	55 <sup>h</sup> 40 <sup>m</sup> Feb. 25		Centre						(353 <sup>o</sup> 0)	(-7 <sup>o</sup> 2)	(o)	(o)	(o)	
44 <sup>h</sup> 19 <sup>m</sup> I. Feb. 14		Centre			(140 <sup>o</sup> 6)	(-6 <sup>o</sup> 9)	(o)	(o)	(o)	56 <sup>h</sup> 16 <sup>m</sup> I. Feb. 26		Centre						(342 <sup>o</sup> 9)	(-7 <sup>o</sup> 2)	(o)	(o)	(o)	
45 <sup>h</sup> 30 <sup>m</sup> I. Feb. 15	ST,M	Centre	0 <sup>o</sup> 931	239 <sup>o</sup> 4	194 <sup>o</sup> 7 (125 <sup>o</sup> 9)	-30 <sup>o</sup> 9 (-6 <sup>o</sup> 9)	(o)	(o)	102 (102)	57 <sup>h</sup> 44 <sup>m</sup> Feb. 27	ST,M	Centre	0 <sup>o</sup> 897	272 <sup>o</sup> 6	29 <sup>o</sup> 6 (326 <sup>o</sup> 1)	-0 <sup>o</sup> 9 (-7 <sup>o</sup> 2)	(o)	(o)					47 (47)
46 <sup>h</sup> 44 <sup>m</sup> Feb. 16	ST,M	Centre	0 <sup>o</sup> 990 0 <sup>o</sup> 953 0 <sup>o</sup> 823	239 <sup>o</sup> 9 286 <sup>o</sup> 2 305 <sup>o</sup> 3	195 <sup>o</sup> 5 180 <sup>o</sup> 8 158 <sup>o</sup> 0 (111 <sup>o</sup> 0)	-30 <sup>o</sup> 7 +13 <sup>o</sup> 1 +23 <sup>o</sup> 7 (-7 <sup>o</sup> 0)	(o)	(o)	177 27 41 (245)	58 <sup>h</sup> 40 <sup>m</sup> Feb. 28	ST,M	Centre	0 <sup>o</sup> 974 0 <sup>o</sup> 946 0 <sup>o</sup> 933	270 <sup>o</sup> 9 240 <sup>o</sup> 5 239 <sup>o</sup> 6	30 <sup>o</sup> 1 25 <sup>o</sup> 5 23 <sup>o</sup> 0 (313 <sup>o</sup> 5)	-0 <sup>o</sup> 8 -30 <sup>o</sup> 2 -30 <sup>o</sup> 9 (-7 <sup>o</sup> 2)	(o)	11 10 (21)					37 77 <sup>c</sup> (114)
47 <sup>h</sup> 19 <sup>m</sup> I. Feb. 17	ST,M	Centre	0 <sup>o</sup> 901 0 <sup>o</sup> 879	301 <sup>o</sup> 7 307 <sup>o</sup> 4	158 <sup>o</sup> 4 153 <sup>o</sup> 2 (101 <sup>o</sup> 1)	+24 <sup>o</sup> 6 +28 <sup>o</sup> 1 (-7 <sup>o</sup> 0)	(o)	(o)	143 161 (304)	59 <sup>h</sup> 27 <sup>m</sup> I. Mar. 1		Centre						(302 <sup>o</sup> 1)	(-7 <sup>o</sup> 2)	(o)	(o)	(o)	
48 <sup>h</sup> 40 <sup>m</sup> Feb. 18	ST,M	Centre	0 <sup>o</sup> 945	299 <sup>o</sup> 4	150 <sup>o</sup> 2 (85 <sup>o</sup> 2)	+24 <sup>o</sup> 8 (-7 <sup>o</sup> 0)	(o)	(o)	180 (180)	60 <sup>h</sup> 43 <sup>m</sup> Mar. 2		Centre						(286 <sup>o</sup> 8)	(-7 <sup>o</sup> 3)	(o)	(o)	(o)	

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Group 2116, Feb. 28. Two small spots.

Measures of Positions and Areas of Sun Spots and Faculae on Photographs—continued.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULAE.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULAE.
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).
1890. 61 <sup>h</sup> 41 <sup>m</sup> Mar. 3	ST, M	Centre	0.982	210.5	355.7 (273.8)	-59.8 (-7.3)	(0)	(0)	114 (114)	1890. 70 <sup>h</sup> 40 <sup>m</sup> Mar. 12	ST, M	2117d 2117e 21118 Centre	0.773 0.785 0.950	322.3 325.1 66.3	188.9 188.0 87.9 (155.3)	+31.7 +34.0 +19.8 (-7.2)	6 18 0 (24)	19 82 10 (111)	270c 82 10 (596)
62.505 Mar. 4	ST, M	Centre	0.963 0.933	53.0 121.1	193.4 190.0 (259.4)	+32.7 -31.6 (-7.3)	36 (36)	322 (322)	786c 121 (907)	71.366 I. Mar. 13	ST, M	2117d 2117e Centre	0.854 0.856 0.914	314.3 316.7 62.4	188.3 187.2 82.2 (142.6)	+31.6 +33.5 +21.6 (-7.2)	0 0 (0)	5 27 (32)	347c 27 (666)
63.417 Mar. 5	ST, M	Centre	0.891 0.909 0.924 0.872	194.3 48.9 49.4 122.7	280.0 193.3 190.8 (247.5)	-65.9 +32.5 +33.1 (-7.3)	45 0 (45)	259 58 (317)	33 682c (792)	72.401 Mar. 14	ST, M	2117d 2117e Centre	0.954 0.883 0.933 0.929 0.818	201.6 236.4 308.4 311.0 56.3	190.7 190.0 188.4 186.6 82.0 (129.1)	-66.5 -32.9 +31.9 +33.9 +22.1 (-7.2)	0 0 3 0 (0)	3 7 (10)	50 47 437c 298 (832)
64.166 I. Mar. 6	ST, M	Centre	0.857 0.876 0.829	44.4 45.4 126.4	192.3 189.6 184.3 (237.6)	+32.7 +33.1 -33.9 (-7.3)	52 0 (52)	279 42 (321)	673c 35 (708)	73.501 Mar. 15	ST, M	2117a 2117b Centre	0.982 0.927	305.2 236.9	186.8 182.8 (114.9)	+32.5 -33.2 (-7.1)	(0)	(0)	278 91 (369)
65.335 I. Mar. 7	ST, M	Centre	0.760 0.783 0.948	34.7 36.4 63.7	191.5 188.7 155.9 (222.2)	+32.4 +33.0 +22.1 (-7.2)	67 0 (67)	259 11 (270)	646c 84 (730)	74.554 Mar. 16	Centre			(100.7)	(-7.1)	(0)	(0)	(0)	
66.328 I. Mar. 8	ST, M	Centre	0.688 0.876	22.7 57.8	190.8 155.2 (209.1)	+32.5 +23.7 (-7.2)	50 (50)	246 (246)	142c 107 (249)	75.412 Mar. 17	ST, M	Centre	0.929	301.1	150.9 (89.3)	+25.4 (-7.1)	(0)	(0)	78 (78)
67.509 Mar. 9	ST, M	Centre	0.650 0.640 0.662	2.5 5.1 5.4	191.6 189.7 189.2 (193.5)	+33.1 +32.2 +33.9 (-7.2)	0 28 13 (41)	42 103 46 (191)	(0)	77.190 M. Mar. 19	Centre			(75.6)	(-7.0)	(0)	(0)	(0)	
68.162 I. Mar. 10	ST, M	Centre	0.657 0.643 0.663 0.653	352.0 353.9 354.8 357.6	191.1 189.5 189.0 (184.9)	+33.2 +32.4 +34.0 (-7.2)	2 13 14 (29)	34 106 55 (199)	(0)	79.519 Mar. 21	ST, M	Centre	0.842	302.0	85.6 (35.3)	+22.2 (-6.9)	(0)	(0)	133 (133)
69.443 Mar. 11	ST, M	Centre	0.698 0.716	333.7 335.7	189.4 188.8 (168.1)	+32.0 +33.9 (-7.2)	6 17 (23)	25 99 (124)	197c (197)	80.522 Mar. 22	ST, M	2119a 2119b Centre	0.919 0.877 0.581 0.581	296.3 305.3 341.6 345.3	83.6 74.9 33.8 31.5 (22.0)	+20.8 +26.4 +26.6 +27.3 (-6.9)	0 0 0 (0)	3 3 (6)	99 60 (159)

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Group 2117, March 4-14. A large spot *a*, with two well-defined nuclei. It is followed by a smaller spot *b* on March 5, 6, and 7. *b* has disappeared by March 8, and *a* has broken up into three parts, *c, d* and *e* by March 9, of which *c* has disappeared by March 11.  
 Group 2118, March 12. A very small spot.  
 Group 2119, March 22-23. Two very small spots *a* and *b* on March 22. *b* has disappeared by March 23, and *a* has divided into two parts, which are, however, still measured together.

Measures of Positions and Areas of Sun Spots and Faculæ on Photographs—continued.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).
1890. 81 <sup>d</sup> .130	ST,M		0.980 0.916	293.5 300.9	92.5 73.5	+21.4 +24.7			113 70	1890. 93 <sup>d</sup> .544									
I.		2119a	0.632	330.7	34.1	+26.9		0		Apr. 4	Centre				(210.2)	(-6.2)	(0)	(0)	(0)
Mar. 23		Centre			(13.9)	(-6.9)	(0)	(6)	(183)	94 <sup>d</sup> .431	Centre				(198.5)	(-6.2)	(0)	(0)	(0)
82.393					(357.3)	(-6.8)	(0)	(0)	(0)	95 <sup>d</sup> .196									
I.		Centre								I.	Centre				(188.4)	(-6.1)	(0)	(0)	(0)
Mar. 24		Centre								Apr. 6	Centre								
83.587	ST,M		0.870 0.938	306.0 165.8	33.4 297.8	+26.6 -70.6			61 40	96 <sup>d</sup> .188									
Mar. 25		Centre			(341.6)	(-6.8)	(0)	(0)	(101)	I.	Centre				(175.3)	(-6.0)	(0)	(0)	(0)
84.485										Apr. 7	Centre								
Mar. 26		Centre								97 <sup>d</sup> .446	Centre				(158.7)	(-6.0)	(0)	(0)	(0)
85.233										Apr. 8	Centre								
I.		Centre								98 <sup>d</sup> .500	Centre				(144.8)	(-5.9)	(0)	(0)	(0)
Mar. 27		Centre								Apr. 9	Centre								
86.521										99 <sup>d</sup> .309		2120	0.482	340.0	144.2	+21.1	1	6	
Mar. 28		Centre								I.	Centre				(134.1)	(-5.8)	(1)	(6)	(0)
87.388										Apr. 10	Centre								
Mar. 29		Centre								100 <sup>d</sup> .402	ST,M	2121	0.397	151.6	107.6	-26.1	0	7	
88.182										Apr. 11	Centre	2121	0.400	148.1	106.2	-25.4	0	4	
I.		Centre										Centre			(119.7)	(-5.8)	(0)	(11)	(0)
Mar. 30		Centre								101 <sup>d</sup> .398	ST,M	2122	0.691	318.7	137.0	+26.3	8	39	
89.409										Apr. 12	Centre	2122	0.679	320.4	135.3	+26.5	0	11	
Mar. 31		Centre										2122	0.655	319.6	134.3	+24.9	0	2	
90.440												2122	0.666	322.2	133.6	+26.6	0	3	
Apr. 1		Centre										2121	0.346	184.2	108.1	-25.8	2	8	
												2121	0.343	172.9	103.8	-25.5	2	20	
91.396										Apr. 12	Centre				(106.5)	(-5.7)	(12)	(83)	(0)
Apr. 2		Centre								102 <sup>d</sup> .389	ST,M	2122	0.794	308.4	136.9	+25.4	0	11	192 c
										Apr. 13	Centre	2121	0.382	204.2	103.5	-25.8	0	11	
92.401	ST,M		0.875 0.911	46.0 49.8	176.6 169.9	+33.3 +32.5			31 29	103 <sup>d</sup> .431	ST,M		0.886	303.8	134.8	+26.4			179
Apr. 3		Centre			(225.3)	(-6.3)	(0)	(0)	(60)	Apr. 14	Centre				(79.7)	(-5.5)	(0)	(0)	(179)

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Group 2120, April 10. A small spot.  
 Group 2121, April 11-17. Two very small spots on April 11 and 12. The preceding spot has disappeared by April 13, and the following by April 14. The group has re-appeared by April 15, as two very small faint spots, one of which has disappeared by April 16.  
 Group 2122, April 12-13. A small but dark spot with several small companions following it on April 12. The group has entirely changed its appearance by April 13, and consists only of a close pair of very small faint spots.

Measures of Positions and Areas of Sun Spots and Faculae on Photographs—continued.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).
1890. 104 <sup>h</sup> 407	ST, M		0'952	300'2	133'5	+26'6			207	1890. 116 <sup>h</sup> 207									
		2121	0'670	235'2	104'7	-26'7	0	8		M.									
		2121	0'643	233'2	102'0	-27'1	0	9		Apr. 27	Centre				(270'8)	(-4'3)	(0)	(0)	(0)
Apr. 15		Centre			(66'8)	(-5'4)	(0)	(17)	(207)										
105 <sup>h</sup> 513	ST, M	2121	0'786	239'6	101'5	-27'0	0	14	163 p	117 <sup>h</sup> 468	M, ST	2123 a	0'586	31'8	234'2	+25'7	2	7	
Apr. 16		Centre			(52'2)	(-5'4)	(0)	(14)	(163)	Apr. 28	Centre				(254'2)	(-4'3)	(2)	(7)	(0)
106 <sup>h</sup> 323	M, ST	2121	0'875	242'6	101'4	-26'4	1	2	176 p	118 <sup>h</sup> 400	M, ST	2123 b	0'504	10'5	236'1	+25'4	5	19	
Apr. 17		Centre			(41'5)	(-5'3)	(1)	(2)	(176)	Apr. 29	Centre	2123 a	0'511	13'6	234'3	+25'5	0	10	
												2123 c	0'538	16'6	232'0	+26'8	0	21	
107 <sup>h</sup> 278	M, ST		0'959	243'7	102'9	-26'7			214	119 <sup>h</sup> 228	M, ST		0'918	300'3	292'4	+25'7			49
Apr. 18		Centre	0'903	300'7	87'5	+24'8	(0)	(0)	58	I.		2123 b	0'497	349'5	236'7	+25'2	0	20	26
					(28'9)	(-5'2)	(0)	(0)	(272)	Apr. 30	Centre	2123 c	0'514	359'4	231'3	+26'8	0	36	
108 <sup>h</sup> 154	M, ST		0'955	185'6	40'6	-76'4			68						(231'0)	(-4'0)	(0)	(56)	(75)
Apr. 19		Centre	0'955	177'1	4'5	-77'4	(0)	(0)	42	120 <sup>h</sup> 393	M, ST		0'957	300'6	283'9	+27'7			133
					(17'3)	(-5'1)	(0)	(0)	(110)			2123 b	0'596	326'2	237'1	+25'9	0	18	
109 <sup>h</sup> 189										May 1	Centre	2123 c	0'568	236'6	230'3	+27'5	0	14	
Apr. 20		Centre			(3'7)	(-5'0)	(0)	(0)	(0)						(215'6)	(-3'9)	(0)	(32)	(133)
110 <sup>h</sup> 400										121 <sup>h</sup> 394									
Apr. 21		Centre			(347'6)	(-4'9)	(0)	(0)	(0)	May 2	Centre				(202'4)	(-3'8)	(0)	(0)	(0)
111 <sup>h</sup> 503										122 <sup>h</sup> 393	ST, M		0'784	308'1	232'5	+26'2			182
Apr. 22		Centre			(333'1)	(-4'8)	(0)	(0)	(0)	May 3	Centre				(189'2)	(-3'7)	(0)	(0)	(182)
112 <sup>h</sup> 395										123 <sup>h</sup> 184	M, ST		0'871	303'6	232'7	+26'7			255
Apr. 23		Centre			(321'3)	(-4'8)	(0)	(0)	(0)	I.	Centre				(178'6)	(-3'6)	(0)	(0)	(255)
113 <sup>h</sup> 253										May 4									
Apr. 24		Centre			(309'9)	(-4'6)	(0)	(0)	(0)	124 <sup>h</sup> 538	ST, M		0'960	299'3	230'3	+26'8	(0)	(0)	183
										May 5	Centre				(160'8)	(-3'5)	(0)	(0)	(183)
114 <sup>h</sup> 218	M, ST		0'951	59'6	230'4	+27'0			77	125 <sup>h</sup> 590									
Apr. 25		Centre			(297'2)	(-4'5)	(0)	(0)	(77)	May 6	Centre				(146'9)	(-3'4)	(0)	(0)	(0)
115 <sup>h</sup> 426	ST, M		0'849	54'3	230'8	+26'9			170	126 <sup>h</sup> 186									
Apr. 26		Centre			(281'3)	(-4'4)	(0)	(0)	(170)	I.	Centre				(139'0)	(-3'3)	(0)	(0)	(0)
										May 7									

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Group 2123, April 28-May 1. A very small spot *a* on April 28. Two small spots *b* and *c* are seen near it on April 29. *a* has disappeared by April 30.



Measures of Positions and Areas of Sun Spots and Faculae on Photographs—*continued*.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).	
1890. 142 <sup>d</sup> .392 May 23	ST,M	2126 Centre	0.963 0.389	259.0 345.0	358.7 290.7 (284.6)	-11.0 +20.5 (-1.5)	0 (0)	4 (4)	70 (70)	1890. 154 <sup>d</sup> .222 I. June 4	ST,M	Centre	0.939 0.956	277.4 120.2	58.6 57.9 (128.1)	+7.0 -28.7 (-0.0)	0 (0)	0 (0)	58 65 (123)	
143.400 May 24	ST,M	2126 Centre	0.491	320.6	290.7 (271.3)	+20.9 (-1.4)	0 (0)	3 (3)	(0)	155.478	M,ST	2130 2130 2130	0.493 0.501 0.469	211.8 208.8 206.5	128.0 127.0 124.8	-24.5 -25.8 -24.6	0 0 0	6 3 5	60 53 (113)	
144.414 May 25		Centre			(257.9)	(-1.2)	(0)	(0)	(0)	June 5	Centre				(111.5)	(+0.1)	(0)	(14)	(113)	
145.215 I. May 26		Centre			(247.3)	(-1.1)	(0)	(0)	(0)	156.237 I. June 6	ST,M	2130 2130	0.605 0.565	224.8 221.0	129.5 125.5	-25.2 -25.0	0 0	14 15	55 (55)	
146.458 May 27	M,ST	Centre	0.896 0.918	295.4 113.1	291.4 165.9 (230.8)	+22.0 -21.5 (-1.0)	(0)	(0)	280 84 (364)	157.450	M,ST	2130 2130	0.759 0.713	235.8 233.5	129.1 124.4	-25.0 -24.8	26 6	74 31	403 c (436)	
147.520 May 28	M,ST	Centre	0.970 0.933 0.854 0.816	292.8 301.6 306.0 117.5	291.0 281.7 269.2 165.3 (216.8)	+21.8 +28.8 +29.6 -22.7 (-0.9)	(0)	(0)	202 89 50 90 (431)	158.248 I. June 8	ST,M	2130 2130 2130	0.853 0.827 0.821	240.2 240.7 238.9	129.2 126.5 125.3	-24.7 -23.5 -24.7	20 0 0	89 3 2	297 c (429)	
148.455 May 29		Centre			(204.4)	(-0.8)	(0)	(0)	(0)	159.400	M,ST	2130 2130	0.949 0.924	243.3 243.2	128.7 124.2 (59.6)	-25.0 -24.3 (+0.6)	0 0 (0)	13 8 (21)	234 c (234)	
150.406 May 31	M,ST	Centre	0.955	296.3	249.0 (178.6)	+24.9 (-0.5)	(0)	(0)	42 (42)	160.422	M,ST	2131 2131	0.988 0.732	245.3 126.1	125.5 5.4 3.4 (46.0)	-24.2 -25.0 -26.4 (+0.7)	0 0 2 (2)	5 10 (15)	326 41 c (367)	
151.480 June 1	M,ST	Centre	0.932	295.8	230.6 (164.4)	+23.7 (-0.4)	(0)	(0)	89 (89)	June 10	Centre				(33.0)	(+0.8)	(0)	(0)	(0)	
152.601 June 2		Centre			(149.6)	(-0.3)	(0)	(0)	(0)	161.408 June 11	Centre									(0)
153.622 June 3	M,ST	Centre	0.886	277.6	198.0 (136.1)	+6.6 (-0.2)	(0)	(0)	42 (42)	162.197 I. June 12	Centre				(22.5)	(+0.9)	(0)	(0)	(0)	

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Group 2129, May 30. A very small spot.  
 Group 2130, June 5-9. A number of very small faint spots on June 5. These have collected into two clusters by June 6, and have coalesced to form two spots by June 7. A third spot is seen near the following spot on June 8, but has disappeared by June 9.  
 Group 2131, June 10. Two small faint spots.

Measures of Positions and Areas of Sun Spots and Faculæ on Photographs—*continued*.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).							Area for each Group (and for Day).	Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).		Area of WHOLE for each Spot (and for Day).
1890. 163 <sup>d</sup> .194 I.				°	°	°				1890. 175 <sup>d</sup> .492 June 25				°	°	°				
June 13		Centre			(9'3)	(+1'1)	(o)	(o)	(o)			Centre			(206'6)	(+2'5)	(o)	(o)	(o)	
164 <sup>d</sup> .287 I.										176 <sup>d</sup> .268 I.	ST,M		0'949	119'6	128'7	-27'0			96	
June 14		Centre			(354'9)	(+1'2)	(o)	(o)	(o)	June 26		Centre			(196'3)	(+2'6)	(o)	(o)	(96)	
165 <sup>d</sup> .454 June 15		Centre			(339'4)	(+1'3)	(o)	(o)	(o)	177 <sup>d</sup> .489 June 27	M,ST		0'860	123'4	126'9	-26'6			137	
June 16		Centre			(326'9)	(+1'4)	(o)	(o)	(o)			Centre			(180'1)	(+2'8)	(o)	(o)	(137)	
167 <sup>d</sup> .279 I.										178 <sup>d</sup> .493 June 28	M,ST		0'769	131'7	126'2	-28'6			95	
June 17		Centre			(315'3)	(+1'5)	(o)	(o)	(o)			Centre			(166'9)	(+2'8)	(o)	(o)	(95)	
168 <sup>d</sup> .406 June 18		Centre			(300'3)	(+1'7)	(o)	(o)	(o)	179 <sup>d</sup> .266 I.	ST,M		0'839	123'9	106'0	-26'0			48	
June 19		Centre			(287'0)	(+1'8)	(o)	(o)	(o)	June 29		Centre		0'968	114'2	83'9	-22'5			168
169 <sup>d</sup> .414 I.										180 <sup>d</sup> .617 June 30	M,ST		0'853	118'1	84'8	-21'9			88	
June 20		Centre			(273'8)	(+1'9)	(o)	(o)	(o)	181 <sup>d</sup> .469 July 1		Centre			(138'8)	(+3'0)	(o)	(o)	(88)	
171 <sup>d</sup> .214 I.										182 <sup>d</sup> .198 I.					(127'4)	(+3'1)	(o)	(o)	(o)	
June 21		Centre			(263'2)	(+2'0)	(o)	(o)	(o)	July 2		Centre			(117'8)	(+3'2)	(o)	(o)	(o)	
172 <sup>d</sup> .382 I.	ST,M		0'825 0'938	209'6 70'9	282'2 180'0	-43'9 +17'1			163 100	183 <sup>d</sup> .394 July 3		Centre			(102'0)	(+3'3)	(o)	(o)	(o)	
June 22		Centre			(247'8)	(+2'1)	(o)	(o)	(263)	184 <sup>d</sup> .390 July 4	M,ST	2132a	0'995	113'8	6'8	-23'3	o	111	257 <sup>s</sup>	
173 <sup>d</sup> .490 I.										185 <sup>d</sup> .430 I.	ST,M		0'850	302'6	127'0	-25'0			73	
June 23		Centre			(233'1)	(+2'2)	(o)	(o)	(o)			Centre		2132	0'929	121'2	11'9	-27'2	5	33
174 <sup>d</sup> .506 June 24		Centre			(219'6)	(+2'3)	(o)	(o)	(o)	July 5		Centre		2132a	0'945	118'1	8'3	-25'0	27	135
														2132	0'970	118'2	2'9	-26'2	o	105
														2132b	0'970	115'3	2'3	-23'4	21	87
															(75'0)	(+3'6)	(53)	(360)	(827)	

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Group 2132. July 4-11. A large regular spot *a* on July 4. A second *b* is seen on July 5, together with a number of smaller spots. The group consists, on July 5 and the three succeeding days, of two clusters, each formed by a regular spot, *a* or *b*, with a stream of smaller spots stretching *s p*. These clusters have broken up by July 10, and only a few small spots remain.

Measures of Positions and Areas of Sun Spots and Faculae on Photographs—continued.

Greenwich Civil Time.	Measures.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measures.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).							Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).		
1890. 186 <sup>a</sup> .261	ST,M		0°924	299°8	126°6	+25°6			82	1890. 191 <sup>d</sup> .634	M,ST	2133a	0°649	228°9	24°5	-21°6	22	98		
			0°917	235°5	119°8	-37°9			101			2133	0°598	224°5	19°5	-21°4	0	8		
I.		2132	0°862	122°5	10°6	-25°4	4	33	} 918c			2132	0°509	198°8	3°2	-24°6	0	5		
		2132a	0°876	119°4	7°9	-23°4	39	138					2132	0°524	195°3	1°7	-26°1	0	3	
		2132	0°918	120°7	2°6	-26°2	21	67					2132	0°476	197°1	1°6	-22°8	0	2	
		2132	0°917	119°0	2°3	-24°7	0	20					2132	0°477	193°1	359°6	-23°4	0	15	
		2132b	0°921	117°4	1°2	-23°4	16	72					Centre		(352°9)	(+4°2)	(22)	(131)	(0)	
July 6		Centre			(64°0)	(+3°7)	(80)	(330)	(1101)	July 11										
										192°456	ST,M	2133a	0°760	237°1	24°9	-20°6	15	55		
187°464	M,ST	2133	0°584	130°2	20°1	-18°7	0	4	} 1066c	I.		2133	0°711	233°0	19°7	-21°9	0	3		
		2133	0°604	133°2	20°1	-21°0	0	12			July 12	Centre		0°930	92°1	274°0	-0°4			
		2132	0°711	128°7	11°1	-23°3	0	8							(342°1)	(+4°3)	(15)	(58)	(91)	
		2132	0°726	130°7	10°8	-25°2	3	34			193°523	M,ST		0°749	231°4	6°7	-24°4			
		2132a	0°742	126°4	7°8	-23°2	17	109					2133a	0°881	243°1	25°1	-21°1	19	87	} 283c
		2132	0°804	126°4	2°3	-25°8	4	36				2133	0°839	241°0	19°7	-21°3	0	9		
July 7		Centre	0°805	122°9	0°9	-23°3	16	120	(1066)	July 13	Centre		0°967	66°9	252°3	+23°5	(19)	(96)	(913)	
					(48°1)	(+3°8)	(40)	(323)		194°430	M,ST		0°859	238°3	9°0	-24°2				
188°523	M,ST	2133a	0°465	155°1	22°0	-21°1	4	17	} 166 sf			2133a	0°952	246°5	24°7	-20°8	10	104		
		2133	0°499	151°3	19°2	-22°1	0	3					2133	0°916	244°4	18°1	-21°2	0	11	
		2132	0°612	141°8	9°5	-25°1	0	19			July 14	Centre		0°908	67°0	251°2	+22°7	(10)	(115)	(828)
		2132a	0°609	137°5	7°6	-23°1	12	77							(315°9)	(+4°5)				
		2132	0°677	134°9	2°2	-25°2	6	23			195°413	M,ST		0°916	240°7	4°1	-24°5			
July 8		Centre	0°677	131°7	0°8	-23°4	24	162	(0)				0°823	64°8	249°0	+23°2	(0)	(0)	(667)	
					(34°1)	(+3°9)	(46)	(301)		July 15	Centre				(302°9)	(+4°6)				
189°184	ST,M		0°899	240°8	105°4	-37°3			44	196°287	ST,M		0°963	243°5	1°7	-24°0				
I.		2133a	0°429	175°2	23°2	-21°2	8	17	} 591	July 16	Centre				(291°3)	(+4°6)	(0)	(0)	(591)	
		2132a	0°533	148°5	7°8	-23°2	16	65												
		2132	0°606	144°2	2°3	-25°7	1	6			197°335	I.								
		2132	0°588	142°1	2°2	-23°9	0	34			July 17	Centre				(277°5)	(+4°7)	(0)	(0)	(0)
		2132b	0°594	139°3	0°6	-23°0	25	104												
July 9		Centre	0°613	141°4	0°6	-24°9	0	10	(44)	198°435	Centre				(263°0)	(+4°8)	(0)	(0)	(0)	
					(25°4)	(+4°0)	(50)	(236)		July 18	Centre				(248°8)	(+4°9)	(0)	(0)	(41)	
190°468	M,ST	2133a	0°501	209°2	23°5	-21°9	18	108	} 41	199°499	M,ST		0°935	233°8	310°5	-31°2				
		2133	0°473	203°6	20°0	-21°6	0	12												
		2132	0°532	183°9	10°6	-27°8	0	2			200°561	Centre				(234°8)	(+5°0)	(0)	(0)	(0)
		2132	0°494	167°1	1°4	-24°6	0	18												
		2132	0°475	163°3	359°8	-22°9	8	24			July 20	Centre								
July 10		Centre	0°459	177°6	356°3	-23°1	3	21	(0)											
					(8°3)	(+4°1)	(29)	(185)												

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Group 2133, July 7-14. Two very small faint spots on July 7. On July 8 a small regular spot, *a*, with a very small companion. *a* has greatly increased in size by July 10. The penumbra on the south side of *a* appears contracted on July 12, causing an apparent shift in latitude of the centre of the spot.

Measures of Positions and Areas of Sun Spots and Faculæ on Photographs—continued.

Greenwich Civil Time.	Measures.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measures.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).	
1890. 201 <sup>d</sup> .566 July 21		Centre		°	°	°				1890. 208 <sup>d</sup> .408	H,ST	2135a 2135 2136a	0'210 0'227 0'984 0'909 0'943 0'967	171'6 154'7 72'2 119'6 114'8 102'5	129'2 125'4 50'3 71'4 64'6 57'5	-6'3 -6'1 +18'5 -23'8 -21'1 -10'5	15 1 30	110 15 149		
202'591 July 22	M,ST	2134 2135a 2135	0'970 0'985 0'997	127'9 97'8 98'1	139'4 128'9 123'5	-34'8 -6'7 -7'7	0 30 0	6 177 46	111c 121c (232)	July 28	Centre				(131'0)	(+5'7)	(46)	(274)	298c 73 258 43 (672)	
303'476 July 23	M,ST	2134 2134 2135a 2135	0'851 0'920 0'944 0'925 0'957	298'5 130'9 129'9 99'5 99'4	253'0 139'1 134'5 129'7 124'3	+26'9 -34'2 -34'8 -6'7 -7'4		7 3 147 71	64 137c 384c (585)	July 29	Centre	2135a 2135 2135 2137 2137 2137 2137 2137 2136a	0'286 0'254 0'239 0'835 0'847 0'864 0'864 0'921	224'3 218'8 210'2 119'8 119'7 120'1 119'0 72'3	129'4 127'1 124'8 67'2 65'9 64'1 63'8 50'5	-6'2 -5'8 -6'3 -20'9 -21'4 -22'4 -21'5 +18'5	22 1 0 2 2 33	98 12 18 5 13 11 3 163	98c 12 18 5 13 11 3 609c	92c (701)
204'487 July 24	M,ST	2135a 2135	0'915 0'818 0'877 0'873	295'7 102'2 101'6 134'7	248'7 129'4 123'1 134'3	+25'6 -6'9 -7'5 -34'4	23 11	157 50	62 274c 96 (432)	July 31	Centre	2135a 2136a	0'609 0'704	252'8 69'8	129'8 50'3	-5'5 +18'3	4 27	17 162		
205'394 July 25	M,ST	2135a 2135	0'683 0'756 0'802	105'7 104'6 141'8	129'6 123'6 133'9	-6'6 -7'3 -34'7	24 3	154 22	109 (109)	212'426	ST,M	2135a 2137 2137 2136a 2136	0'908 0'805 0'484 0'504 0'485 0'533 0'967	226'4 258'2 173'6 166'7 62'3 62'9 115'3	131'4 130'1 74'6 70'7 51'1 47'9 6'9	-35'3 -5'8 -22'6 -23'3 +18'4 +19'3 -22'6	0 0 0 0 29 0	4 17 8 131 3	97f 203 (335)	
206'457 July 26	ST,HA	2135a 2135 2135 2135	0'500 0'524 0'545 0'579	113'1 112'7 111'1 109'7	129'4 127'9 126'2 123'8	-6'5 -6'9 -6'6 -6'7	24 3 1 0	128 21 7 17	(0)	213'183	ST,M	2137 2137 2136a	0'868 0'480 0'474 0'348	257'9 195'9 187'2 51'6	126'4 75'9 71'5 12'2	-7'4 -21'4 -22'0 +18'2	2 0 25	14 10 137	264	
207'362 July 27	ST,HA	2135a 2135 2135 2135	0'337 0'352 0'386 0'411	127'4 121'4 121'9 119'7	129'2 127'3 125'6 123'8	-6'4 -5'2 -6'5 -6'5	19 1 2 0	122 6 23 9	97 68 (165)	Aug. 2	Centre	2136a 2136a	0'946 0'207	259'6 356'0	120'6 51'9	-7'8 +18'0	22	123	197	
		Centre	0'955 0'990	114'9 112'1	76'1 66'0	-21'8 -20'9				Aug. 3	Centre	2136a	0'849 0'882	128'1 123'5	2'2 356'5	-27'6 -25'6 +6'1		79 214 (490)		

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Group 2134, July 22-23. A very small faint spot on July 22. A second is seen near it on July 23.  
 Group 2135, July 22-Aug. 1. A regular spot *a*, followed by a stream of small spots.  
 Group 2136, July 28-Aug. 6. A large irregular spot *a*, with a small companion on Aug. 1. *a* has become elongated in a direction parallel to the equator by Aug. 2, diminishes in size on the following days, and has broken up into several small spots by Aug. 5.  
 Group 2137, July 29-Aug. 2. Four very small spots on July 29. The group is not seen on July 31. But on Aug. 1 and 2 a number of very small spots arranged in two clusters are seen nearly in the same place.

Measures of Positions and Areas of Sun Spots and Faculae on Photographs—continued.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).							Area for each Group (and for Day).	Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).		Area of WHOLE for each Spot (and for Day).
1890. 215 <sup>d</sup> .581	ST,M	2136a	0.332 0.808	307.2 132.9	52.1 353.8	+17.5 -28.8	16	70	81	1890. 224 <sup>d</sup> .401 Aug. 13				0	0	0				
Aug. 4		Centre			(36.1)	(+6.2)	(16)	(70)	(81)		Centre				(279.5)	(+6.7)	(0)	(0)	(0)	
216.459	ST,M	2136	0.488	291.2	52.6	+15.6	0	2		225.500 Aug. 14					(265.0)	(+6.7)	(0)	(0)	(0)	
		2136	0.492	294.8	52.3	+17.4	7	34			Centre									
		2136	0.478	297.1	51.0	+18.1	0	4		226.463 Aug. 15					(251.3)	(+6.8)	(0)	(0)	(0)	
		2138a	0.531	149.2	7.6	-21.1	0	14			Centre									
		2138b	0.551	145.7	5.1	-21.2	0	9		227.481 Aug. 16					(238.9)	(+6.8)	(0)	(0)	(0)	
Aug. 5		Centre			(24.5)	(+6.2)	(7)	(63)	(0)		Centre									
217.400	ST,M		0.911	242.4	72.4	-21.9			110											
		2136	0.657	289.5	52.4	+17.5	4	14		228.467 Aug. 17					(225.8)	(+6.8)	(0)	(0)	(0)	
		2136	0.633	290.0	50.5	+17.4	0	2			Centre									
		2138a	0.461	171.6	8.0	-20.8	4	19												
		2138b	0.468	165.8	5.1	-20.6	6	25		229.400 Aug. 18					(214.5)	(+6.9)	(0)	(0)	(0)	
Aug. 6		Centre			(12.1)	(+6.3)	(14)	(60)	(110)		Centre									
218.592	ST,M	2138a	0.491	204.5	8.8	-20.3	0	9		230.197 M. Aug. 19					(202.9)	(+6.9)	(0)	(0)	(0)	
		2138b	0.464	196.9	4.5	-20.0	0	24			Centre									
Aug. 7		Centre			(35.6.3)	(+6.3)	(0)	(33)	(0)		Centre									
219.372 I.	ST,M		0.867	290.1	46.2	+20.6			345											
Aug. 8		Centre			(34.6.0)	(+6.4)	(0)	(0)	(345)											
220.506 I.	ST,M		0.950	291.0	43.7	+22.0			292	231.448 Aug. 20	ST,M	0.908	100.9	122.7	-6.9	(186.4)	(+7.0)	(0)	(0)	91
		Centre	0.730	231.9	9.0	-21.6			144		Centre								(91)	
Aug. 9		Centre			(33.1.0)	(+6.5)	(0)	(0)	(436)											
221.568	ST,M		0.852	238.4	8.6	-22.5			297	232.198 I. Aug. 21	ST,M	0.883	299.9	236.7	+28.3	(176.5)	(+7.0)	(0)	(0)	43
		Centre	0.803	229.3	359.9	-26.8			157		Centre	0.838	103.3	121.5	-7.1	(176.5)	(+7.0)	(0)	(0)	55
Aug. 10		Centre			(317.0)	(+6.5)	(0)	(0)	(454)										(98)	
222.501	ST,M		0.930	242.5	7.7	-22.5			212	233.408 Aug. 22					(160.5)	(+7.0)	(0)	(0)	(0)	
		Centre	0.878	237.3	358.8	-24.5			140											
		2139	0.676	302.4	344.1	+26.4	0	5		234.535 Aug. 23					(145.6)	(+7.1)	(0)	(0)	(0)	
		2139	0.665	304.6	342.6	+27.4	1	5			Centre									
Aug. 11		Centre			(304.7)	(+6.6)	(1)	(10)	(352)											
223.238 M.										235.479 Aug. 24	ST,M	2140	0.555	212.4	151.7	-21.1			4	16
Aug. 12		Centre			(294.9)	(+6.6)	(0)	(0)	(0)			2140	0.536	210.5	150.0	-20.6		0	6	
													0.974	70.1	54.7	+21.0				
															(133.2)	(+7.1)	(4)	(22)	162	

The Groups of Spots are numbered in the order of their appearance. When there is no number in the third column it is to be understood that there is a Facula unaccompanied by a Spot. The positions of Faculae relative to the Spots with which they are associated are indicated by the letters *n, s, p, f, c*, denoting respectively north, south, preceding, following, concentric. The longitude and latitude of the centre of the disk are given in brackets. The Areas of Spots and Faculae are expressed in millionths of the Sun's visible Hemisphere.

Group 2138, Aug. 5-7. Two small spots, *a* and *b*. Two very small companions are seen close to *b* on Aug. 6, and are measured with it.  
 Group 2139, Aug. 11. Two very small spots.  
 Group 2140, Aug. 24-28. Two very small faint spots. The group is not seen on Aug. 26. On Aug. 27 only one spot is seen; on Aug. 28 there are two.

MEASURES OF POSITIONS AND AREAS OF SUN SPOTS AND FACULÆ ON PHOTOGRAPHS

Measures of Positions and Areas of Sun Spots and Faculæ on Photographs—continued.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.		
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).							Area for each Group (and for Day).	Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).		Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).
1890. 236 <sup>h</sup> 40 <sup>m</sup> 2	ST, M	2140	0.677	227.9	153.4	-21.0	0	11		1890. 241 <sup>h</sup> 40 <sup>m</sup> 2	ST, M	2141	0.930	259.5	121.8	-7.0					
		2140	0.651	225.3	150.6	-21.1	0	14				2141	0.208	6.7	53.4	+19.1	0	6		39	
		2141	0.970	70.6	43.7	+20.5	21	56	} 151 f			2141	0.198	21.1	50.6	+17.8	0	2			
		2141	0.981	70.7	40.5	+20.3	0	10				2141	0.238	23.3	49.2	+19.8	0	1			
			0.791	68.1	69.1	+21.6				27		2141	0.276	31.3	46.1	+20.8	14	57			
			0.920	68.9	53.3	+22.2				145		2141	0.265	37.5	45.1	+19.2	0	2			
Aug. 25	Centre			(121.0)	(+7.1)	(21)	(91)	(323)				2141a	0.308	39.4	42.9	+20.8	51	335			
237 <sup>h</sup> 41 <sup>m</sup> 1	ST, M	2141	0.888	70.8	44.6	+20.3	16	42	} 371 c			2141	0.905	70.6	42.2	+20.6	10	73			
		2141	0.942	71.5	36.3	+19.8	0	2				2141	0.946	69.5	35.5	+21.7	9	54			
		2141	0.946	69.5	35.5	+21.7	9	54				2141b	0.429	51.3	33.8	+22.2	66	459			
		2141	0.838	67.6	50.9	+22.6				113		2141b	0.429	51.3	33.8	+22.2	66	459			
Aug. 26	Centre			(107.7)	(+7.1)	(35)	(171)	(484)		242 <sup>h</sup> 35 <sup>m</sup> 9	ST, M	2141	0.277	321.9	52.7	+19.6	0	5			
238 <sup>h</sup> 59 <sup>m</sup> 1	ST, M	2140	0.897	242.6	150.2	-20.7	0	13	220 p			2141	0.244	326.3	50.5	+18.9	0	4			
		2141	0.735	67.8	45.4	+21.1	11	49	} 774 c			2141	0.240	342.5	46.7	+20.4	9	49			
		2141	0.756	69.3	43.3	+20.3	9	54				2141a	0.237	351.8	44.4	+20.8	37	274			
		2141	0.795	68.6	39.6	+21.3	15	133				2141	0.217	0.5	42.2	+19.7	0	45			
		2141	0.837	68.1	35.2	+22.2	47	299				2141	0.263	12.6	38.8	+22.0	2	24			
Aug. 27	Centre			(92.0)	(+7.2)	(82)	(548)	(994)			Aug. 31	Centre			(42.3)	(+7.2)	(126)	(901)	(0)		
239 <sup>h</sup> 40 <sup>m</sup> 0	ST, M	2140	0.977	247.2	155.0	-20.4	0	29	} 193 s f	243 <sup>h</sup> 42 <sup>m</sup> 2	ST, M	2141a	0.370	309.1	46.0	+20.4	72	362			
		2140	0.965	246.5	151.8	-20.4	0	5				2141	0.324	310.5	43.2	+19.1	0	10			
		2141	0.603	64.7	45.8	+20.8	6	25				2141	0.306	320.1	40.2	+20.6	10	73			
		2141	0.621	65.9	44.2	+20.4	9	38				2141	0.287	327.9	37.6	+21.1	0	6			
		2141	0.637	66.4	42.9	+20.4	0	12				2141	0.277	332.2	36.1	+21.2	10	36			
		2141a	0.662	66.2	41.0	+21.0	22	232				2141b	0.276	341.0	33.7	+22.3	63	394			
		2141	0.682	65.7	39.5	+21.7	1	21				2142a	0.556	141.9	7.0	-19.2	0	14			
		2141	0.721	68.8	35.7	+20.2	3	68				2142b	0.576	139.1	4.8	-19.1	0	14			
		2141b	0.739	66.4	34.5	+22.2	66	328			Sept. 1	Centre			(28.2)	(+7.2)	(155)	(909)	(0)		
Aug. 28	Centre			(81.3)	(+7.2)	(107)	(758)	(193)			244 <sup>h</sup> 42 <sup>m</sup> 8	ST, M	0.869	292.8	75.4	+23.3					39
240 <sup>h</sup> 42 <sup>m</sup> 8	ST, M	2141	0.351	53.0	50.5	+19.0	0	6			2141a	0.550	296.6	46.4	+20.4	77	446				
		2141	0.426	55.8	45.7	+20.6	6	47			2141	0.501	300.0	42.5	+20.9	0	7				
		2141	0.444	59.2	43.9	+19.7	0	8			2141	0.478	300.6	40.8	+20.5	0	14				
		2141a	0.476	58.7	42.0	+20.8	48	275			2141	0.452	301.8	39.0	+20.3	0	9				
		2141	0.539	61.5	37.3	+21.1	0	12			2141	0.424	307.3	36.1	+21.6	5	22				
		2141b	0.579	61.9	34.5	+21.9	69	470			2141	0.385	306.8	34.0	+20.1	0	6				
		2141	0.614	60.0	32.3	+23.8	0	18			2141b	0.400	311.9	33.6	+22.3	37	333				
		2141	0.630	62.3	30.6	+22.8	0	9			2142a	0.455	167.3	8.8	-19.1	10	56				
Aug. 29	Centre			120.4	10.5	-23.2			80	Sept. 2	Centre			(14.9)	(+7.2)	(129)	(905)	(39)			
				(67.7)	(+7.2)	(123)	(845)	(80)				2142b	0.480	159.5	4.7	-19.5	0	12			

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Group 2141. Aug. 25-Sept. 6. Two spots of no great size on Aug. 25. The group rapidly increases in size on the succeeding days, and has become a large beautiful and complicated group by Aug. 27, and 28; two of the spots *a* and *b* being much larger than the rest. *a* moves forward in longitude coalescing with the spots it overtakes, so that by Sept. 1 it leads the group. *b* is usually the last spot in the group, and increases in size up to Aug. 31, the smaller spots in the following portion of the group coalescing with it. The small spots in the centre of the group gradually die out and *a* and *b* alone remain by Sept. 6.

Group 2142. Sept. 1-9. Two small spots *a* and *b*. A few very small spots are seen between *a* and *b*, on Sept. 4 and 5, and are measured with *a* on Sept. 5. They have coalesced with *a* by Sept. 6. The group has greatly increased in size by Sept. 7.

Measures of Positions and Areas of Sun Spots and Faculae on Photographs—continued.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		Faculae.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		Faculae.		
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).		
1890 245 <sup>d</sup> .501	ST,M		0.946	291.7	73.0	+22.8			123	1890. 250 <sup>d</sup> .394	ST,M		0.899	242.9	354.5	-20.4			219		
		2141a	0.814	291.1	55.2	+21.3			74			2142	0.969	248.3	8.0	-18.9	0	45	} 627 c		
		2141	0.728	291.2	46.9	+20.3	68	402				2142b	0.947	246.2	2.9	-19.8	29	193			
		2141	0.663	293.0	41.3	+20.5	0	14				2145	0.590	60.2	262.4	+23.2	0	3	} 49 f		
		2141b	0.642	293.2	39.6	+20.3	0	5				2146	0.812	127.2	251.1	-24.3	5	20			
		2142a	0.578	299.3	33.7	+22.5	29	217					0.902	126.5	240.7	-28.4			116		
		2142b	0.464	197.1	9.1	-19.1	6	22					0.932	71.5	226.3	+19.9			76		
Sept. 3	Centre		0.454	188.0	4.6	-19.4	0	14	(103)	(674)	(197)	Centre			(296.1)	(+7.3)	(34)	(261)	(1087)		
246.178	ST,M	2141a	0.820	289.8	47.0	+20.4	79	372	} 845 c	251.477	ST,M	2142b	0.996	249.9	3.5	-19.1	0	116	} 452 c		
		2141	0.767	290.6	41.6	+20.4	0	5					2142	0.984	249.0	358.1	-19.1	0		39	
	I.	2141b	0.683	295.2	33.6	+22.4	26	138				2142	0.979	247.2	356.1	-20.5	0	22			
		2142a	0.532	213.3	9.8	-19.3	3	14				2145a	0.400	47.4	263.3	+22.7	7	28			
		2142	0.494	207.2	5.5	-18.9	0	10				2145	0.421	48.9	261.8	+22.8	0	3			
Sept. 4	Centre		0.491	204.6	4.2	-19.3	0	6	(351.8)	(+7.3)	(108)	(545)	(1434)	2145	0.440	49.2	260.6	+23.5	0	7	
247.448	ST,M		0.912	241.7	34.8	-22.0			65			2145	0.460	47.9	259.8	+24.7	2	7			
		2141a	0.942	289.0	46.5	+20.3	49	347	} 1548 c			2145	0.485	47.3	258.6	+25.9	0	9			
		2141	0.869	292.3	35.6	+22.9	0	4					2145b	0.495	50.1	257.1	+25.2	0	4		
		2141b	0.846	292.0	32.9	+22.5	12	66				2146	0.689	137.4	251.2	-24.2	2	9			
		2142a	0.671	231.0	8.3	-18.9	0	19				2147	0.786	133.9	243.3	-27.4	0	2			
		2142b	0.636	226.7	4.3	-19.5	3	16				2147	0.844	132.5	236.2	-29.7	0	2			
Sept. 5	Centre		0.636	226.7	4.3	-19.5	3	16	(335.0)	(+7.3)	(64)	(452)	(1613)	Centre		0.833	70.3	225.2	+20.4		
																(281.8)	(+7.3)	(11)	(248)	(649)	
248.137	ST,M	2141a	0.982	289.1	46.6	+20.1	69	359	} 1318 p	252.451	ST,M	2145a	0.285	17.6	262.9	+22.8	5	19	} 136 n p		
		2141b	0.917	291.4	33.2	+22.5	7	58					2145	0.334	23.0	260.0	+25.0	0		7	
	I.	2143	0.961	243.6	34.7	-22.8	0	12				2145b	0.347	27.9	257.9	+24.9	3	30			
		2142a	0.766	237.2	8.7	-19.2	6	27				Centre			(268.2)	(+7.2)	(8)	(56)	(0)		
		2142b	0.725	233.3	3.9	-19.9	4	34													
		2144	0.660	228.7	35.5	-19.6	1	7				253.422	ST,M	2145a	0.303	334.0	264.4	+22.9	2	4	
		2144	0.626	224.7	35.3	-20.0	2	9				2145b	0.315	355.3	257.7	+25.4	5	37			
		2145	0.901	66.8	261.1	+24.0	0	5	38 f			2148	0.886	120.6	200.5	-22.8	0	8			
Sept. 6	Centre		0.901	66.8	261.1	+24.0	0	5	(325.9)	(+7.3)	(89)	(511)	(1492)	Centre			(256.1)	(+7.2)	(7)	(49)	(49)
249.486	ST,M	2142a	0.915	245.0	9.4	-19.3	0	30	} 613 c	254.369	ST,M	2145a	0.433	310.2	264.6	+22.9	0	3	} 164 n f		
		2142	0.895	245.1	6.7	-18.4	0	63					2145	0.385	317.8	259.9	+23.5	0		7	
		2142b	0.878	242.7	3.9	-19.8	56	261				2145b	0.386	325.3	257.6	+25.5	0	20			
		2145	0.711	64.3	264.1	+23.3	0	11				2148	0.779	126.4	201.1	-22.2	0	14			
		2145	0.786	63.7	257.2	+25.1	0	12				Centre			(243.6)	(+7.2)	(0)	(44)	(164)		
			0.902	73.1	242.9	+18.4			119												
			0.935	121.7	245.9	-26.2			225			255.429	ST,M	2145b	0.556	307.3	257.6	+25.3	0	12	
Sept. 7	Centre		0.935	121.7	245.9	-26.2			(308.1)	(+7.3)	(56)	(377)	(957)	Centre			(229.6)	(+7.2)	(0)	(12)	(0)

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Group 2143, Sept. 6. A small spot preceding Group 2142, on the same parallel.  
 Group 2144, Sept. 6. Two small spots following Group 2142, on the same parallel.  
 Group 2145, Sept. 6-14. One or two very small spots on Sept. 6, 7, and 8. By Sept. 9 the group has become a long straggling stream of spots; but by Sept. 11 only *a* and *b*, the first and last spots, remain. A small spot is seen between *a* and *b* on Sept. 12; only *b* remains by Sept. 13.  
 Group 2146, Sept. 8-9. A small spot.  
 Group 2148, Sept. 11-12. A small spot.  
 Group 2147, Sept. 9. Two very small spots.

MEASURES OF POSITIONS AND AREAS OF SUN SPOTS AND FACULÆ ON PHOTOGRAPHS

Measures of Positions and Areas of Sun Spots and Faculæ on Photographs—continued.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.		
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).		
1890. 256 <sup>a</sup> .205 I. Sept. 14	ST,M	2145 <sup>b</sup> Centre	0.655 0.936	301.6 118.3	257.5 155.8	+25.7 -23.3	0 (+7.2)	6 (6)	398 <sup>p</sup> 99 (497)	1890. 265 <sup>a</sup> .411	ST,M	0.873 0.827 0.775 0.894	236.5 230.3 66.8 68.9	151.0 143.3 47.7 34.1	-24.7 -27.0 +22.3 +22.0					71 290 274 431 (1066)	
257.597 Sept. 15	HA,M	2149 Centre	0.858 0.995 0.851	295.6 111.0 115.2	259.9 119.8 147.5	+25.6 -20.0 -17.1	0 (+7.2)	128 (128)	299 195 (494)	266.391	ST,M	0.949 0.910 0.731 2151 2151	241.0 235.8 67.8 66.9 113.9 61.5	150.7 142.5 38.7 34.3 14.3 10.5	-24.7 -27.2 +20.8 +22.3 -20.9 +29.2			0 14 18	51 167 303 <sup>p</sup> 242 148 (911)		
258.370 Sept. 16	ST,M	2149 Centre	0.928 0.920 0.958	294.2 238.9 113.3	259.7 250.9 121.6	+25.1 -24.9 -19.9	11 (11)	92 (92)	183 26 341 <sup>f</sup> (550)	267.412	ST,M	0.974 0.829 0.551 2151 2151 2151	239.9 237.0 62.0 60.8 61.9 60.7 116.4	142.5 120.1 40.3 37.1 33.8 10.8 8.9	-27.1 -22.3 +20.9 +22.7 +23.0 +28.9 -21.2			2 10 24	19 46 162	103 209 (587)	
259.434 Sept. 17	ST,M	2150 <sup>a</sup> 2150 <sup>b</sup> 2149 Centre	0.678 0.714 0.885	142.9 140.4 117.5	149.7 146.1 120.2	-26.4 -27.2 -20.3	7 8 14 (176.8)	43 56 129 (228)	119 <sup>c</sup> 367 <sup>c</sup> (486)	270.180	ST,M	2151 2151 2151 2151 <sup>b</sup>	0.264 0.266 0.320 0.341	13.8 25.5 30.4 29.3	39.5 36.4 33.3 32.9	+21.5 +20.6 +22.7 +23.9			10 4 3 7	64 21 24 34	
260.479 Sept. 18	ST,M	2150 <sup>a</sup> 2150 <sup>b</sup> 2149 Centre	0.585 0.625 0.771	160.8 153.6 123.3	150.6 144.9 119.9	-26.5 -27.2 -19.9	10 20 11 (163.0)	64 97 83 (244)	413 <sup>c</sup> (413)	271.339	ST,M	2151 <sup>a</sup> 2151 2151 <sup>b</sup>	0.267 0.287 0.827	342.8 5.7 126.2	39.7 33.1 347.8	+21.5 +23.3 -24.7			17 3 20	72 22 (94)	272 (272)
261.412 Sept. 19	ST,M	2150 <sup>a</sup> 2150 2150 <sup>b</sup> 2149 Centre	0.560 0.549 0.574 0.650	180.9 175.7 169.2 132.7	150.7 148.1 143.8 120.3	-26.8 -26.0 -27.1 -20.0	7 0 9 0 (150.7)	24 11 55 36 (126)		277.540	ST,M	2151 <sup>a</sup> 2151 2151 2151 <sup>b</sup>	0.267 0.287 0.827	342.8 5.7 126.2	39.7 33.1 347.8	+21.5 +23.3 -24.7			17 3 20	72 22 (94)	272 (272)
262.405 Sept. 20	ST,M	2150 <sup>a</sup> 2150 2150 <sup>b</sup> Centre	0.908 0.591 0.566 0.572	239.5 199.2 191.8 187.8	196.1 150.0 144.9 142.5	-23.8 -26.9 -26.5 -27.3	4 0 5 (137.5)	18 4 25 (47)	121 (121)	271.339	ST,M	2151 <sup>a</sup> 2151 2151 <sup>b</sup>	0.423 0.382 0.364	309.3 309.3 321.8	40.2 37.9 33.7	+21.8 +20.3 +23.1			4 0 0	21 1 18	
263.458 Sept. 21	ST,M	Centre	0.963	249.0	194.4 (123.6)	-18.0 (+7.0)	0 (0)	0 (0)	356 (356)	I.	2151 <sup>a</sup> 2151 2151 2152 <sup>a</sup> 2152 <sup>b</sup>	0.269 0.280 0.944	329.6 336.4 68.2	27.9 26.5 308.0	+20.0 +21.5 +22.8			0 0 0	7 4 4		
264.394 Sept. 22	ST,M	Centre	0.922	68.9	43.3 (111.3)	+22.2 (+7.0)	0 (0)	0 (0)	576 (576)	Sept. 29	Centre									152 (152)	

The Groups of Spots are numbered in the order of their appearance. When there is no number in the third column it is to be understood that there is a Facula unaccompanied by a Spot. The positions of Faculae relative to the Spots with which they are associated are indicated by the letters *n, s, p, f, c*, denoting respectively north, south, preceding, following, concentric. The longitude and latitude of the centre of the disk are given in brackets. The Areas of Spots and Faculae are expressed in millionths of the Sun's visible Hemisphere.

Group 2149, Sept. 15-19. One spot on Sept. 15 and 16. A second is seen closely following it on Sept. 17, and is measured with it. The group diminishes in size, and consists of three small spots closely following each other, and measured as one, on Sept. 18 and 19.  
 Group, 2150, Sept. 17-20. Two clusters of small spots, *a* and *b*, on Sept. 17. Both *a* and *b* have coalesced to form irregular spots by Sept. 18. Small spots are seen between them on Sept. 19 and 20.  
 Group 2151, Sept. 24-Oct. 1. Two small spots on Sept. 24. The group has greatly increased in size by Sept. 25, and forms a very irregular straggling stream. By Sept. 28 it consists of two fairly compact clusters, *a* and *b*. A few very small spots are seen near these on Sept. 29 and 30. Only *a* remains by Oct. 1.  
 Group 2152, Sept. 29-Oct. 2. Two very small spots, *a* and *b*. They have greatly increased in size by Sept. 30.

Measures of Positions and Areas of Sun Spots and Faculae on Photographs—continued.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).
1890.				0	0	0				1890.				0	0	0			
272 <sup>d</sup> .436	ST, M	2151a	0'605	297'2	40'3	+21'5	10	44		279 <sup>d</sup> .365	HA, M		0'970	242'6	344'9	-24'6			137
		2151	0'604	299'6	39'7	+22'8	0	6				2154a	0'701	223'5	305'9	-25'2	3	11	208 <sup>c</sup>
		2151b	0'533	304'4	33'6	+23'4	0	18				2154	0'683	221'1	303'5	-25'5	1	5	
		2151	0'506	311'2	29'9	+25'5	0	5				2154	0'688	218'4	302'4	-27'0	0	6	345
		2152a	0'461	300'8	29'9	+19'7	7	45		Oct. 7	Centre			(273'8)	(+6'3)	(+)	(22)	(345)	
		2152b	0'429	307'7	26'4	+21'4	0	57											
Sept. 30		Centre			(5'1)	(+6'7)	(17)	(175)	(0)	280'390	ST, M	2154a	0'814	232'4	305'6	-25'4	0	3	1328 <sup>f</sup>
																			91
273'212	ST, M		0'843	291'2	52'2	+21'4			505	Oct. 8	Centre	2154a	0'846	122'7	(260'2)	(+6'2)	(0)	(3)	(223)
		2151a	0'726	294'0	40'3	+21'8	1	12											
		2152a	0'603	293'4	30'6	+19'2	11	34		281'396	ST, M		0'924	290'9	314'9	+21'6			37
		2152b	0'552	300'9	25'5	+22'2	5	28					0'890	235'7	302'2	-26'7			66
		2153	0'435	205'7	6'2	-16'5	0	1		Oct. 9	Centre			(247'0)	(+6'1)	(0)	(0)	(103)	
Oct. 1		Centre			(354'9)	(+6'6)	(17)	(75)	(505)										
274'556	ST, M	2152a	0'811	288'7	31'4	+19'0	4	23		282'455	ST, M		0'969	243'4	304'1	-23'8			42
		2152b	0'753	294'6	25'0	+22'7	3	11	1197 <sup>p</sup>				0'959	238'2	300'3	-28'1			78
		Centre	0'969	63'4	260'4	+27'3			162	Oct. 10	Centre			(233'0)	(+6'1)	(0)	(0)	(120)	
					(337'3)	(+6'6)	(7)	(34)	(1359)										
Oct. 2										283'433	ST, M		0'953	72'4	147'0	+18'6			159
										Oct. 11	Centre			(220'1)	(+6'0)	(0)	(0)	(159)	
275'400	ST, M		0'912	293'1	27'8	-18'0			1347	284'410	ST, M		0'870	72'5	146'7	+18'1			180
			0'822	237'1	14'1	-22'2			182	Oct. 12	Centre			(207'2)	(+5'9)	(0)	(0)	(180)	
			0'912	63'0	260'3	+27'3			71										
					(326'1)	(+6'5)	(0)	(0)	(1600)										
Oct. 3										285'444	ST, M		0'873	126'6	141'3	-27'8			76
276'431	ST, M		0'962	292'0	27'8	+22'9			587	Oct. 13	Centre			(193'5)	(+5'9)	(0)	(0)	(76)	
			0'914	242'8	13'3	-21'6			82										
			0'975	100'8	236'9	-8'9			146										
					(312'5)	(+6'5)	(0)	(0)	(815)										
Oct. 4										286'185	HA, M		0'799	251'2	233'9	-11'1			262
277'557	ST, M		0'839	236'6	347'3	-23'4			71	Oct. 14	Centre		0'915	120'9	123'7	-25'2			102
		2154a	0'545	191'1	304'3	-25'8	0	6											
		2154b	0'552	186'8	301'9	-26'8	0	6											
		Centre	0'908	105'2	231'9	+16'5	(0)	(12)	(539)										
					(297'7)	(+6'4)	(0)	(12)	(539)	287'161	HA, M		0'913	255'0	234'6	-11'1			318
Oct. 5										Oct. 15	Centre			(170'8)	(+5'8)	(0)	(0)	(318)	
278'403	ST, M		0'916	240'2	346'9	-24'1			190										
		2154a	0'596	209'1	305'1	-25'4	3	14	485 <sup>c</sup>	288'390	Centre			(154'8)	(+5'6)	(0)	(0)	(0)	
		2154b	0'589	202'3	301'0	-26'8	0	3		Oct. 16									
		2155	0'830	107'3	233'0	-10'6	0	5											
		2155	0'847	108'4	231'5	-11'9	0	3		289'289	HA, M		0'927	93'3	75'2	-29'6			50
		Centre	0'979	114'5	212'2	-22'4			78	Oct. 17	Centre			(142'9)	(+5'6)	(0)	(0)	(50)	
Oct. 6					(286'5)	(+6'3)	(3)	(25)	(753)										

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Group 2153, Oct. 1. A very small faint spot. Group 2154, Oct. 5-8. Two very small spots, *a* and *b*, on Oct. 5. Group 2155, Oct. 6. Two very small spots.

Measures of Positions and Areas of Sun Spots and Faculæ on Photographs.—*continued.*

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).	
1890. 290 <sup>d</sup> .400	ST,M		0.772 0.933	95.2 66.9	77.6 59.1	+ 7.5 + 23.5			300 262	1890. 296 <sup>d</sup> .177	HA,M	0.945 2156 0.525	120.0 150.4	346.5 35.9	-26.2 -22.4				153	
Oct. 18		Centre			(128.2)	(+5.5)	(0)	(0)	(562)	I.	2156 0.544	151.0 146.3	35.4 34.4	-23.6 -20.6	0	5	4	11		
291.272	HA,M	2156	0.999	112.7	31.7	-22.3	44	250	509			2156 0.555	149.4	34.2	-23.8	1	5			
I.			0.960	65.1	42.4	+25.4			54			2156 0.550	147.4	33.4	-22.9	5	36			
Oct. 19		Centre	0.982	92.0	38.0	- 0.9	(44)	(250)	(563)			2156 0.515	143.9	33.3	-19.9	10	142			
292.433	HA,M	2156	0.963	115.5	31.1	-22.8	30	629	541 <sup>c</sup>			2156 0.548	145.1	32.4	-22.0	0	27			
I.			0.846	62.5	45.0	+26.0			355			2156 0.575	144.9	31.1	-23.4	1	22			
Oct. 20		Centre	0.960	66.6	27.2	+23.9	(30)	(629)	(1288)			2156 0.567	141.4	29.8	-21.7	3	34			
293.503	HA,M		0.877	287.6	148.5	+17.9			71	Oct. 24	Centre	2157 0.459	113.2	27.1	- 5.9	4	29			244 <sup>c</sup>
			2156 0.853	120.1	34.6	-22.2	13	106		297.292	HA,M	2156 0.448	176.8	35.8	-21.7	5	24			
			2156 0.876	120.5	32.1	-23.5	11	251		I.	2156 0.473	175.2	34.8	-23.2	0	8				
			2156 0.869	117.6	32.0	-20.8	33	370			2156 0.437	170.8	33.0	-20.7	11	154				
			2156 0.901	119.4	28.6	-23.6	105	408			2156 0.453	164.1	29.7	-20.9	0	22				
			2157 0.890	98.6	25.4	- 5.2	1	18	243 <sup>f</sup>		2156 0.491	164.8	29.3	-23.4	1	55				
Oct. 21		Centre	0.886	64.4	25.7	+25.0	(87.3)	(+5.2)	(163)	(1153)	(1527)	2156 <sup>a</sup> 0.518	160.3	26.3	-24.3	90	372			
294.390	HA,M		0.719	124.8	36.7	-20.2	0	5		Oct. 25	Centre	2157 0.264	135.2	26.6	- 6.0	0	13			
			2156 0.773	125.7	32.7	-23.0	20	325		298.548	ST,HA	2156 0.502	212.3	37.4	-20.4	8	43			
			2156 0.772	122.3	31.4	-20.7	38	286				2156 0.461	209.5	35.6	-28.2	1	8			
			2156 0.819	128.0	29.4	-26.8	83	457			2156 0.468	204.5	33.7	-29.8	0	62				
			2156 0.806	122.6	28.5	-22.2	3	13			2156 0.465	199.4	31.1	-30.6	0	22				
			2157 0.768	104.1	27.0	- 7.4	0	5	64 <sup>c</sup>		2156 0.471	193.7	27.7	-22.4	0	25				
			2157 0.779	101.0	25.5	- 5.3	3	15	328 <sup>p</sup>		2156 <sup>a</sup> 0.491	189.8	26.0	-24.0	77	400				
Oct. 22		Centre	0.809	62.2	23.3	+25.4	(75.5)	(+5.1)	(147)	(1196)	(1550)	2156 0.471	174.1	17.5	-32.6	0	9			
295.188	HA,M		0.647	134.0	35.0	-22.3	7	68		Oct. 26	Centre	2157 0.292	128.3	24.0	- 5.8	0	5			
			2156 0.637	129.3	33.7	-19.5	5	43		299.405	ST,M	2156 0.607	228.7	38.3	-19.5	0	9			
			2156 0.684	132.7	32.0	-23.4	19	289				2156 0.604	225.7	36.9	-20.8	3	12			
			2156 0.664	128.9	31.8	-20.4	34	154			2156 0.565	221.2	32.9	-20.8	0	17				
			2156 0.714	133.5	30.3	-25.3	2	30		Oct. 27	Centre	2156 <sup>a</sup> 0.544	208.1	25.7	-24.0	80	335			
			2156 0.699	129.1	29.4	-22.0	0	12				2156 0.491	189.8	26.0	-24.0	77	400			
			2156 <sup>a</sup> 0.735	130.5	27.3	-24.5	112	392		300.181	HA,M	2156 0.788	296.3	49.3	+23.4					
			2157 0.653	104.4	25.8	- 5.4	0	15	119 <sup>p</sup>			2156 0.752	307.1	43.0	+30.3					
Oct. 23		Centre	0.697	59.7	23.9	+24.3	(65.1)	(+5.0)	(179)	(1003)	(1554)	2156 0.569	212.1	18.5	-24.4	0	14			
									378	Oct. 28	Centre			(359.2)	(+4.6)	(79)	(297)	(741)		

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Group 2156, Oct. 19–Nov. 1. A very large spot of irregular shape. It is measured in several divisions, though but a single spot on Oct. 21 and 22. It has broken up by Oct. 23 into a number of spots, the last of which, *a*, is the largest, and is a well-defined regular spot. The preceding spots die out on the succeeding days, and *a* alone remains by October 31.

Group 2157, Oct. 21–25. One or two very small faint spots.

Measures of Positions and Areas of Sun Spots and Faculae on Photographs—continued.

Greenwich Civil Time.	Measures.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULAE.	Greenwich Civil Time.	Measures.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULAE.	
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).	
1890. 301 <sup>d</sup> .288	HA,M		0.867	295.0	43.6	+23.8			31	1890. 310 <sup>d</sup> .253	HA,M	2158a	0.983	115.7	149.9	-24.5	0	80		
			0.773	297.4	33.0	+23.8			47	M.	2158	0.995	116.4	144.7	-25.8	0	45	206c		
			0.766	297.0	32.5	+23.4			76	Nov. 7	Centre			(226.4)	(+3.5)	(0)	(125)	(206)		
		I.	2156	0.850	242.4	37.9	-20.5	0	4											
			2156	0.839	242.4	36.8	-20.1	29	40											
			2156	0.834	241.0	35.8	-21.0	0	7	811c	311.434	ST,M	2158a	0.913	118.5	149.5	-24.2	34	174	
			2156	0.813	241.3	33.8	-20.0	2	8				2158	0.938	118.3	145.5	-25.0	0	17	391c
			2156	0.773	230.5	26.1	-26.1	0	4				2158	0.939	116.8	144.9	-23.7	11	51	
			2156a	0.757	233.1	25.8	-23.7	51	216	611c	Nov. 8	Centre	2158	0.961	118.5	137.4	-26.6	0	12	
			0.714	255.0	28.5	-7.4			250					(210.9)	(+3.4)	(45)	(254)	(391)		
Oct. 29	Centre				(344.6)	(+4.5)	(82)	(279)	(1826)	312.231	HA,M	2158a	0.841	121.8	148.9	-24.2	26	139		
302.308	HA,M		0.865	297.3	29.4	+25.7			749	I.										
			0.834	258.7	26.4	-6.9			390			2158	0.873	120.7	144.9	-24.6	9	53	773c	
		I.	2156	0.935	247.6	37.1	-19.1	0	24			2158	0.891	120.6	142.5	-25.2	0	9		
			2156a	0.865	239.6	25.2	-23.3	47	190	1968c	Nov. 9	Centre			(200.3)	(+3.3)	(35)	(204)	(773)	
Oct. 30	Centre				(331.1)	(+4.4)	(47)	(214)	(3107)	313.442	ST,HA	2158	0.702	131.6	149.1	-25.1	2	35		
303.180	HA,M		0.923	260.0	25.8	-7.5			212			2158a	0.707	130.0	148.1	-24.3	7	69		
			0.905	294.6	23.6	-24.0			585			2158	0.743	128.3	144.6	-24.9	3	34		
		I.	2156a	0.936	242.9	24.7	-23.5	20	142	504c	Nov. 10	Centre			(184.4)	(+3.2)	(12)	(138)	154	
Oct. 31	Centre				(319.6)	(+4.3)	(20)	(142)	(1301)	314.364	HA,M	2158	0.586	142.6	149.2	-24.8	5	17		
304.228	HA,M		0.978	295.6	24.3	+25.9			91	I.										
			0.966	293.7	21.2	+24.0			252			2158a	0.596	140.6	147.7	-24.5	14	61	224c	
		I.	2165a	0.989	245.3	24.6	-23.7	21	99	1928f	Nov. 11	Centre	2158	0.636	137.0	143.7	-24.9	3	6	
Nov. 1	Centre				(305.9)	(+4.2)	(21)	(99)	(535)	315.429	ST,HA	2158	0.488	162.9	149.0	-24.9	0	4		
305.209	HA,M		0.841	232.9	34.2	-27.8			275			2158a	0.491	160.7	147.9	-24.7	3	49		
		I.	0.851	107.3	236.8	-12.4			160			Centre			(158.1)	(+2.9)	(3)	(53)	(0)	
Nov. 2	Centre				(292.9)	(+4.1)	(0)	(0)	(435)	316.230	HA,M	2158a	0.468	179.3	147.2	-25.0	8	45		
306.170	HA,M		0.903	237.0	33.8	-27.4			112	I.										
Nov. 3	Centre				(280.2)	(+4.0)	(0)	(0)	(112)	317.437	ST,HA	2158a	0.527	207.7	147.3	-25.1	0	11		
307.398	Centre				(264.0)	(+3.8)	(0)	(0)	(0)	Nov. 14	Centre				(131.7)	(+2.7)	(0)	(11)	(0)	
308.510	Centre				(249.4)	(+3.7)	(0)	(0)	(0)	318.499	ST,HA									
Nov. 5	Centre				(236.6)	(+3.6)	(0)	(0)	(0)	Nov. 15	Centre									
309.477	Centre																			
Nov. 6	Centre																			

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Group 2158. Nov. 7-14. A regular spot *a* followed by several smaller spots. A considerable portion of *a* has been detached from the main body of the spot by Nov. 10. The smaller spots have all disappeared by Nov. 13, leaving *a* alone.

Measures of Positions and Areas of Sun Spots and Faculæ on Photographs—*continued.*

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.			
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).			
1890. 319 <sup>h</sup> .210 Nov. 16	HA,M	Centre	0.942 0.913	111.5 61.1	66.0 44.4	-59.2 +27.3	(108.3)	(+2.5)	(0)	(0)	548 176	(724)	1890. 326 <sup>h</sup> .314 Nov. 23	HA,M	Centre	0.853 0.875 0.896 0.828 0.947	67.9 68.3 70.0 89.3 111.8	317.8 315.1 312.1 318.9 305.4	+19.6 +19.7 +18.6 +1.5 -20.0	15 0 48	63 35 179	741c 119 102 (962)
320.535 Nov. 17	ST,HA	Centre	0.845 0.825 0.871 0.859 0.929 0.962	237.7 116.3 58.5 70.1 118.0 63.6	142.8 142.5 33.5 32.8 26.3 17.6	-25.4 -20.0 +28.3 +18.3 -24.9 +26.0	(90.8)	(+2.3)	(0)	(0)	326 305 50 31 287 190	(1189)	327.400 Nov. 24	ST,HA	Centre	0.714 0.740 0.771 0.816 0.823 0.839 0.857	63.8 64.5 67.2 64.1 62.7 64.3 62.6	317.8 315.4 312.1 308.4 308.0 305.9 304.2	+19.4 +19.7 +18.4 +21.7 +23.0 +22.2 +24.0	0 0 12 0 0 0 0	84 20 162 47 13 17 33	555c 501c (1056)
321.186 Nov. 18	HA,M	Centre	0.907 0.748 0.771 0.846 0.913 0.909	239.9 119.5 55.7 121.3 120.0 63.4	142.8 38.5 36.6 29.7 20.7 18.8	-26.0 -20.0 +27.2 -24.6 -26.1 +24.9	(82.2)	(+2.2)	(0)	(0)	368 435 162 135 725 173	(1998)	328.185 Nov. 25	HA,M	Centre	0.821 0.809 0.580 0.647 0.695 0.725 0.748 0.759 0.772	302.6 243.6 58.8 63.4 60.9 60.6 61.3 57.5 60.3	40.9 40.5 318.7 312.8 309.8 307.4 305.3 305.3 303.3	+27.1 -20.2 +18.6 +18.0 +20.8 +21.9 +22.0 +25.0 +23.4	11 26 10 0 8 10 2	104 150 80 7 66 42 31	(155)
322.185 Nov. 19	HA,M	Centre	0.964 0.812 0.799 0.880	241.5 123.2 59.8 57.5	140.4 20.8 19.6 11.0	-26.7 -25.0 +25.0 +29.3	(69.1)	(+2.1)	(0)	(0)	273 673 110 98	(1154)	329.171 Nov. 20	HA,M	Centre	0.913 0.905 0.844 0.860 0.760 0.724 0.417 0.474 0.486 0.531 0.552 0.587 0.575 0.634 0.621	244.5 300.3 311.0 227.2 235.6 305.4 42.7 47.2 52.9 50.4 54.8 52.3 55.9 48.5 53.6	39.9 38.8 27.3 27.1 20.4 17.7 319.7 315.4 313.0 311.1 308.5 307.1 306.7 305.3 304.4	-22.5 +27.7 +34.3 -34.9 -24.5 +25.7 +18.9 +19.9 +18.1 +20.8 +19.6 +22.0 +19.8 +25.8 +22.6	18 2 31 60 0 3 0 2 19	119 9 145 232 26 29 24 21 102	(1346)
323.368 Nov. 20	HA,M	Centre	0.945 0.733	118.1 134.4	346.1 16.8	-25.6 -29.2	(53.5)	(+2.0)	(0)	(0)	132 166	(298)	329.171 Nov. 21	HA,M	Centre	0.913 0.905 0.844 0.860 0.760 0.724 0.417 0.474 0.486 0.531 0.552 0.587 0.575 0.634 0.621	244.5 300.3 311.0 227.2 235.6 305.4 42.7 47.2 52.9 50.4 54.8 52.3 55.9 48.5 53.6	39.9 38.8 27.3 27.1 20.4 17.7 319.7 315.4 313.0 311.1 308.5 307.1 306.7 305.3 304.4	-22.5 +27.7 +34.3 -34.9 -24.5 +25.7 +18.9 +19.9 +18.1 +20.8 +19.6 +22.0 +19.8 +25.8 +22.6	18 2 31 60 0 3 0 2 19	119 9 145 232 26 29 24 21 102	(1346)
324.286 Nov. 21	HA,M	Centre	0.982 0.936	116.7 288.4	118.2 110.1	-25.8 +17.9	(41.4)	(+1.9)	(0)	(0)	64 96	(160)	329.171 Nov. 22	HA,M	Centre	0.913 0.905 0.844 0.860 0.760 0.724 0.417 0.474 0.486 0.531 0.552 0.587 0.575 0.634 0.621	244.5 300.3 311.0 227.2 235.6 305.4 42.7 47.2 52.9 50.4 54.8 52.3 55.9 48.5 53.6	39.9 38.8 27.3 27.1 20.4 17.7 319.7 315.4 313.0 311.1 308.5 307.1 306.7 305.3 304.4	-22.5 +27.7 +34.3 -34.9 -24.5 +25.7 +18.9 +19.9 +18.1 +20.8 +19.6 +22.0 +19.8 +25.8 +22.6	18 2 31 60 0 3 0 2 19	119 9 145 232 26 29 24 21 102	(1346)
325.424 Nov. 22	ST,HA	Centre	0.927 0.940 0.962	88.8 69.6 71.3	318.6 317.3 312.6	+1.7 +19.7 +18.6	(26.4)	(+1.7)	(1)	(113)	89 45 68 414	(503)	329.171 Nov. 26	HA,M	Centre	0.913 0.905 0.844 0.860 0.760 0.724 0.417 0.474 0.486 0.531 0.552 0.587 0.575 0.634 0.621	244.5 300.3 311.0 227.2 235.6 305.4 42.7 47.2 52.9 50.4 54.8 52.3 55.9 48.5 53.6	39.9 38.8 27.3 27.1 20.4 17.7 319.7 315.4 313.0 311.1 308.5 307.1 306.7 305.3 304.4	-22.5 +27.7 +34.3 -34.9 -24.5 +25.7 +18.9 +19.9 +18.1 +20.8 +19.6 +22.0 +19.8 +25.8 +22.6	18 2 31 60 0 3 0 2 19	119 9 145 232 26 29 24 21 102	(1346)

The Groups of Spots are numbered in the order of their appearance. When there is no number in the third column it is to be understood that there is a Facula unaccompanied by a Spot. The positions of Faculæ relative to the Spots with which they are associated are indicated by the letters *n, s, p, f, c*, denoting respectively north, south, preceding, following, concentric. The longitude and latitude of the centre of the disk are given in brackets. The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 2159, Nov. 22-Dec. 4. Two spots, *a* and *b*, on Nov. 22. A third *c* is seen between them on Nov. 23. The group rapidly increases in size on the succeeding days and on Nov. 25 consists principally of five large regular spots *a, b, d, e* and *f*; *c* not being seen on that day; *b* has broken into two spots *g* and *h* by Nov. 30. Only *d* remains by Dec. 3.

Measures of Positions and Areas of Sun Spots and Faculae on Photographs—continued.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).	
1890. 330 <sup>h</sup> 29 <sup>m</sup> 8 <sup>s</sup>	HA, M		0.968	296.5	36.4	+25.9			162	1890. 333 <sup>h</sup> 20 <sup>m</sup> 5 <sup>s</sup>	HA, M		0.981	300.7	1.1	+30.2				
I.			0.968	245.4	35.7	-23.5			416	I.			0.878	228.9	337.3	-34.7			47	
			0.903	290.0	29.1	+23.0			103		2159a		0.655	299.0	321.0	+19.0	22	87	189	
			0.883	238.9	19.7	-26.3			459		2159g		0.572	300.3	314.9	+17.3	6	13		
			0.828	301.5	14.0	+26.3			447		2159h		0.540	299.9	313.0	+16.2	3	10		
			0.865	227.4	13.0	-35.0			142		2159d		0.556	307.2	311.9	+20.2	67	266		
		2159a	0.314	4.7	320.6	+19.3	27	142			2159e		0.518	315.1	307.0	+22.1	0	13		
		2159c	0.343	16.3	316.3	+20.3	1	9			2159f		0.495	320.4	303.9	+23.0	5	26		
		2159b	0.326	25.4	313.8	+18.1	29	146		Nov. 30	Centre		0.979	74.8	206.1	+15.0			256	
		2159d	0.377	24.8	312.5	+21.1	70	291						(283.9)	(+0.7)	(103)	(415)	(492)		
		2159	0.415	22.9	312.1	+23.5	0	11		334 <sup>h</sup> 21 <sup>m</sup> 4 <sup>s</sup>	HA, M		0.949	234.4	337.8	-33.3			131	
		2159	0.401	29.4	310.0	+21.4	2	12		I.		2159a	0.801	293.5	321.4	+19.0	13	50		
		2159	0.410	36.2	307.3	+20.3	3	29			2159h	0.709	292.3	313.5	+16.0	0	5			
		2159f	0.466	37.3	304.4	+22.7	40	177			2159d	0.709	298.2	312.1	+20.0	65	238			
Nov. 27	Centre		0.953	106.2	251.0	-15.1			84		2159	0.680	296.8	310.2	+18.3	0	2			
					(322.2)	(+1.1)	(172)	(817)	(1813)		2159e	0.671	304.4	307.3	+22.7	0	17			
										2159f	0.635	307.8	303.6	+23.3	0	10				
												0.902	73.1	207.2	+15.5			98		
										Dec. 1	Centre			(270.6)	(+0.6)	(78)	(322)	(841)		
331 <sup>h</sup> 18 <sup>m</sup> 7 <sup>s</sup>	HA, M		0.954	244.5	20.6	-23.9			318	335 <sup>h</sup> 18 <sup>m</sup> 4 <sup>s</sup>	HA, M	2159a	0.909	290.8	321.6	+19.6	9	44	385nf	
M.			0.934	298.2	17.3	+26.6			611	I.		2159h	0.845	288.4	314.0	+15.7	0	4	1023c	
			0.924	236.1	9.4	-26.6			167		2159d	0.834	293.6	311.9	+19.8	60	222			
		2159a	0.355	331.4	320.8	+19.1	17	114		Dec. 2	Centre		0.796	297.6	307.1	+21.9	0	3		
		2159b	0.295	349.9	313.6	+17.8	27	129						(257.8)	(+0.5)	(69)	(273)	(1408)		
		2159d	0.337	353.9	312.7	+20.5	48	257		336 <sup>h</sup> 42 <sup>m</sup> 3 <sup>s</sup>	HA, M	2159d	0.947	290.9	311.3	+19.8	38	226	701nf	
		2159	0.332	343.8	316.1	+19.4	3	16		I.				(241.4)	(+0.3)	(38)	(226)	(701)		
		2159	0.343	9.6	307.0	+20.7	2	37		Dec. 3	Centre									
Nov. 28	Centre		0.383	16.3	303.9	+22.4	28	145		337 <sup>h</sup> 36 <sup>m</sup> 8 <sup>s</sup>	HA, M		0.976	299.3	304.4	+28.5			120	
					(310.5)	(+1.0)	(125)	(698)	(1096)	I.		2159d	0.970	294.1	303.6	+23.4			280	
												0.992	289.6	311.2	+19.5	0	221	101f		
										Dec. 4	Centre			(229.0)	(+0.2)	(0)	(221)	(501)		
										338 <sup>h</sup> 19 <sup>m</sup> 1 <sup>s</sup>	HA, M		0.945	116.7	150.1	-24.7			126	
										I.				(218.2)	(+0.1)	(0)	(0)	(126)		
										Dec. 5	Centre									
										339 <sup>h</sup> 30 <sup>m</sup> 0 <sup>s</sup>	HA, M		0.871	119.8	146.8	-25.6			115	
Nov. 29	Centre		0.386	344.6	303.6	+22.6	9	88		I.		0.956	117.0	132.8	-25.7			108		
					(297.3)	(+0.9)	(71)	(548)	(220)	Dec. 6	Centre			(203.5)	(-0.0)	(0)	(0)	(223)		

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Measures of Positions and Areas of Sun Spots and Faculae on Photographs—continued.

Greenwich Civil Time.	Measures.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measures.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).	
1890. 352 <sup>d</sup> .296	HA,M	2162	0.891	238.3	92.0	-28.7	9	33	} 297 <sup>c</sup> } 205 <sup>c</sup>	1890. 356 <sup>d</sup> .267	HA,M		0.870	240.2	37.6	-26.8			403	
I.		2162	0.874	239.4	90.0	-27.3	13	91		I.		2165	0.881	305.8	35.3	+29.8			211	
		2162	0.861	238.2	88.1	-27.9	4	17		Dec. 23	Centre		0.795	295.7	28.9	+18.7			287	
		2162	0.858	239.2	88.0	-27.0	0	4					0.714	55.4	300.7	+22.2	0	19	495 <sup>c</sup>	
		2162	0.837	235.9	84.6	-29.0	6	14							(340.0)	(-2.2)	0	(19)	(1396)	
		2162	0.805	237.9	81.8	-26.4	0	7												
		2162	0.803	236.3	81.1	-27.5	4	21												
		2164a	0.337	0.6	32.2	+17.9	8	10												
		2164	0.351	2.5	31.5	+18.7	3	7												
		2164	0.364	8.8	29.0	+19.3	0	2												
		2164b	0.358	14.7	26.9	+18.5	5	23												
		2164b	0.965	66.4	319.9	+22.2			195	Dec. 24	HA,M		0.943	238.6	32.7	-30.3			347	
Dec. 19	Centre				(32.4)	(-1.7)	(52)	(229)	(697)	Dec. 24	Centre		0.917	292.2	28.1	+19.3			204	
													0.513	39.6	303.8	+21.1	0	9	(551)	
															(324.2)	(-2.3)	0	(9)		
353.182	HA,M	2162	0.954	241.6	89.9	-26.3	0	21	204 <sup>c</sup>	358.339	HA,M		0.971	288.5	27.2	+17.4			194	
M.		2162	0.915	239.2	82.4	-27.0	0	3	85 <sup>c</sup>	I.			0.888	301.3	10.2	+26.2			96	
		2162	0.884	240.7	78.5	-24.7	0	3					0.877	241.0	11.4	-26.4			155	
		2164a	0.404	328.9	33.4	+18.4	0	22					0.832	224.1	0.0	-38.2			207	
		2164	0.386	332.7	31.4	+18.2	0	9		Dec. 25	Centre		0.415	17.9	304.9	+20.8	2	8	(652)	
		2164	0.381	338.2	29.3	+18.9	0	4							(312.7)	(-2.4)	(2)	(8)		
		2164b	0.361	345.3	26.2	+18.6	2	31												
		2165a	0.954	68.9	310.1	+19.5	0	15	157 <sup>n</sup>											
Dec. 20	Centre				(20.7)	(-1.8)	(2)	(108)	(446)	359.305	HA,M		0.936	240.1	7.5	-28.8			113	
													0.946	297.8	7.3	+25.2			125	
354.396	HA,M		0.974	241.6	81.3	-28.1			561	I.			0.883	229.9	356.4	-36.1			83	
I.		2164a	0.895	290.9	65.5	+17.2			135				0.878	309.0	353.3	+32.0			66	
		2164b	0.592	306.0	35.0	+18.5	3	16					0.406	345.4	306.1	+20.4	1	4		
		2165a	0.503	314.7	26.8	+18.8	1	12					2165	0.423	356.1	301.7	+22.3	3	15	
			0.851	63.9	310.0	+20.8	0	10	591 <sup>n</sup> f	Dec. 26	Centre		0.404	1.5	299.3	+21.1	7	27		
			0.874	59.2	308.7	+25.4			365				0.944	123.6	231.5	-32.4			129	
			0.937	64.9	298.1	+22.7			191						(299.9)	(-2.6)	(11)	(46)	(516)	
Dec. 21	Centre				(4.7)	(-2.0)	(4)	(38)	(1843)	360.298	HA,M		0.952	239.9	357.7	-29.4			115	
													0.937	233.2	353.5	-35.3			81	
355.183	HA,M		0.948	288.2	64.0	+16.5			139	I.			2165	0.487	329.1	302.6	+22.0	0	4	
I.		2164b	0.774	238.4	40.9	-25.3			174				2165	0.486	331.7	301.4	+22.7	0	5	
			0.633	303.6	28.0	+18.7	0	11					2165	0.463	333.1	300.0	+21.7	0	5	
			0.873	58.5	298.6	+25.9			324	Dec. 27	Centre		2165c	0.442	333.7	299.0	+20.6	2	24	
Dec. 22	Centre				(354.3)	(-2.1)	(0)	(11)	(637)						(287.0)	(-2.7)	(2)	(38)	(196)	

The Groups of Spots are numbered in the order of their appearance. When there is no number in the third column it is to be understood that there is a Facula unaccompanied by a Spot. The positions of Faculae relative to the Spots with which they are associated are indicated by the letters *n, s, p, f, c*, denoting respectively north, south, preceding, following, concentric. The longitude and latitude of the centre of the disk are given in brackets. The Areas of Spots and Faculae are expressed in millionths of the Sun's visible Hemisphere.

Group 2165, Dec. 20-28. A small spot, *a*, on Dec 20 and 21. The group is not seen on Dec. 22. A small spot, *b*, is seen on Dec. 24 and the succeeding days. Several small spots, of which *c*, the last, is the largest, are seen following *b* on Dec. 26. *b* has disappeared by Dec. 27. Only *c* remains by Dec. 28.

## Measures of Positions and Areas of Sun Spots and Faculæ on Photographs—concluded.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position. Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position. Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ.
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).						Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).	Area for each Group (and for Day).
1890. 361 <sup>h</sup> 275 I. Dec. 28	HA, M	2165c	0.919 0.554 0.812 0.929	180.7 315.2 131.0 55.5	276.0 298.6 226.6 (274.1)	-69.2 +20.5 -34.0 (-2.8)	2 (2)	7 (7)	59 173 105 (337)	1890. 363 <sup>h</sup> 311 I. Dec. 30	HA, M	2166a Centre	0.898 0.702	300.0 42.4	306.3 214.8 (247.3)	+25.0 +28.6 (-3.0)	0 (0)	10 (10)	466 101 <sup>f</sup> (567)
362 <sup>h</sup> 230 I. Dec. 29	HA, M	2166a Centre	0.902 0.823	296.3 51.4	322.0 214.4 (261.4)	+22.1 +28.8 (-2.9)	3 (3)	31 (31)	154 158 <sup>f</sup> (312)	364 <sup>h</sup> 291 I. Dec. 31	HA, M	2166a 2166 Centre	0.919 0.614 0.632	299.2 32.2 33.9	297.6 213.6 211.7 (235.3)	+25.2 +28.2 +28.6 (-3.2)	0 3 (3)	6 11 (17)	358  (358)

The Groups of Spots are numbered in the order of their appearance. When there is no number in the third column it is to be understood that there is a Facula unaccompanied by a Spot. The positions of Faculæ relative to the Spots with which they are associated are indicated by the letters *n*, *s*, *p*, *f*, *c*, denoting respectively north, south, preceding, following, concentric. The longitude and latitude of the centre of the disk are given in brackets. The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 2166, 1890 Dec. 29-1891 Jan. 1. A small faint spot *a*. A cluster of very small faint spots is seen following it on Dec. 31.

ROYAL OBSERVATORY, GREENWICH.

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# LEDGERS

OF

AREAS AND POSITIONS OF GROUPS OF SUN SPOTS

DEDUCED FROM THE MEASUREMENT

OF THE

# SOLAR PHOTOGRAPHS,

FOR EACH DAY IN THE YEAR

1890.

AREAS and HELIOGRAPHIC POSITIONS of GROUPS of SUN SPOTS DEDUCED FOR EACH DAY from the MEASUREMENTS of the PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DŪN IN INDIA, and at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1890.

NOTE.—The Greenwich Civil Time at which the photograph was taken is expressed by the month, day of the month (civil reckoning), and decimal of a day, reckoned from Greenwich Mean Midnight.

The Projected Area of the Umbrae and Whole Spots is the area as it is measured on the photograph, uncorrected for the effect of foreshortening, and expressed in millionths of the Sun's apparent disk.

The Column "Longitude from Central Meridian" gives the Mean heliographic longitude of the group, reckoned from the meridian passing through the centre of the Sun's disk at the moment of observation; longitudes west of the centre being reckoned as positive.

Dates for which no numbers are given indicate days for which no photographic record is at present available.

Date. Greenwich Civil Time.	Projected Area of		Area for Group.		Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.	Date. Greenwich Civil Time.	Projected Area of		Area for Group.		Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
	Umbra.	Whole Spot.	Umbra.	Whole Spot.					Umbra.	Whole Spot.	Umbra.	Whole Spot.			
Group 2111.								Group 2114.							
1889. <sup>a</sup>					°	°	°	1890. <sup>a</sup>					°	°	°
Dec. 27 <sup>h</sup> 26 <sup>m</sup> 6 <sup>s</sup>	6	34	28	150	341 <sup>o</sup> 2	— 8 <sup>o</sup> 9	— 83 <sup>o</sup> 9	Jan. 17 <sup>h</sup> 18 <sup>m</sup> 3 <sup>s</sup>	0	22	0	13	154 <sup>o</sup> 3	+23 <sup>o</sup> 9	+ 4 <sup>o</sup> 8
28 <sup>h</sup> 21 <sup>m</sup> 3 <sup>s</sup>	13	61	18	86	343 <sup>o</sup> 2	— 8 <sup>o</sup> 6	— 69 <sup>o</sup> 6	18 <sup>h</sup> 42 <sup>m</sup> 7 <sup>s</sup>	0	25	0	16	154 <sup>o</sup> 2	+22 <sup>o</sup> 8	+ 21 <sup>o</sup> 1
29 <sup>h</sup> 18 <sup>m</sup> 7 <sup>s</sup>	35	91	32	82	343 <sup>o</sup> 6	— 8 <sup>o</sup> 8	— 56 <sup>o</sup> 3	19 <sup>h</sup> 44 <sup>m</sup> 2 <sup>s</sup>	24	104	17	74	156 <sup>o</sup> 7	+22 <sup>o</sup> 8	+ 36 <sup>o</sup> 9
30 <sup>h</sup> 26 <sup>m</sup> 3 <sup>s</sup>	20	104	14	71	343 <sup>o</sup> 5	— 9 <sup>o</sup> 2	— 42 <sup>o</sup> 2	20 <sup>h</sup> 43 <sup>m</sup> 3 <sup>s</sup>	53	323	48	293	157 <sup>o</sup> 0	+22 <sup>o</sup> 5	+ 50 <sup>o</sup> 3
31 <sup>h</sup> 45 <sup>m</sup> 8 <sup>s</sup>	22	120	12	67	343 <sup>o</sup> 9	— 9 <sup>o</sup> 1	— 26 <sup>o</sup> 1	21 <sup>h</sup> 42 <sup>m</sup> 3 <sup>s</sup>	36	241	47	330	157 <sup>o</sup> 5	+23 <sup>o</sup> 2	+ 63 <sup>o</sup> 9
								22 <sup>h</sup> 42 <sup>m</sup> 2 <sup>s</sup>	8	69	26	215	158 <sup>o</sup> 1	+22 <sup>o</sup> 7	+ 77 <sup>o</sup> 6
1890.								Means ...	...	...	23	157	156 <sup>o</sup> 30	+22 <sup>o</sup> 98	...
Jan. 1 <sup>h</sup> 45 <sup>m</sup> 4 <sup>s</sup>	19	109	10	57	344 <sup>o</sup> 0	— 9 <sup>o</sup> 3	— 12 <sup>o</sup> 6	Group 2115.							
2 <sup>h</sup> 29 <sup>m</sup> 8 <sup>s</sup>	32	134	16	67	344 <sup>o</sup> 0	— 9 <sup>o</sup> 3	— 1 <sup>o</sup> 5	Jan. 30 <sup>h</sup> 21 <sup>m</sup> 6 <sup>s</sup>	1	6	1	5	293 <sup>o</sup> 7	+24 <sup>o</sup> 9	— 44 <sup>o</sup> 1
3 <sup>h</sup> 28 <sup>m</sup> 0 <sup>s</sup>	23	93	12	48	344 <sup>o</sup> 4	— 9 <sup>o</sup> 5	+ 11 <sup>o</sup> 9	31 <sup>h</sup> 34 <sup>m</sup> 1 <sup>s</sup>	17	55	11	37	294 <sup>o</sup> 3	+24 <sup>o</sup> 5	— 28 <sup>o</sup> 8
4 <sup>h</sup> 21 <sup>m</sup> 3 <sup>s</sup>	17	74	9	41	344 <sup>o</sup> 4	— 9 <sup>o</sup> 5	+ 24 <sup>o</sup> 1	Feb. 1 <sup>h</sup> 29 <sup>m</sup> 2 <sup>s</sup>	4	29	2	18	293 <sup>o</sup> 5	+24 <sup>o</sup> 8	— 17 <sup>o</sup> 0
5 <sup>h</sup> 20 <sup>m</sup> 3 <sup>s</sup>	15	47	9	29	344 <sup>o</sup> 4	— 9 <sup>o</sup> 6	+ 37 <sup>o</sup> 2	Means ...	...	...	5	20	293 <sup>o</sup> 83	+24 <sup>o</sup> 73	...
6 <sup>h</sup> 21 <sup>m</sup> 2 <sup>s</sup>	8	33	7	26	345 <sup>o</sup> 0	— 9 <sup>o</sup> 6	+ 51 <sup>o</sup> 1	Group 2116.							
7 <sup>h</sup> 42 <sup>m</sup> 9 <sup>s</sup>	0	14	0	17	344 <sup>o</sup> 9	— 9 <sup>o</sup> 8	+ 67 <sup>o</sup> 0	Feb. 28 <sup>h</sup> 40 <sup>m</sup> 2 <sup>s</sup>	0	15	0	21	24 <sup>o</sup> 3	— 30 <sup>o</sup> 5	+ 70 <sup>o</sup> 8
Means ...	...	...	14	62	343 <sup>o</sup> 92	— 9 <sup>o</sup> 27	...	Means ...	...	...	0	21	24 <sup>o</sup> 30	— 30 <sup>o</sup> 50	...
Group 2112.								Group 2113.							
Jan. 6 <sup>h</sup> 21 <sup>m</sup> 2 <sup>s</sup>	0	21	0	23	230 <sup>o</sup> 3	+ 6 <sup>o</sup> 0	— 63 <sup>o</sup> 6	Jan. 9 <sup>h</sup> 50 <sup>m</sup> 9 <sup>s</sup>	0	29	0	19	285 <sup>o</sup> 4	— 28 <sup>o</sup> 8	+ 34 <sup>o</sup> 9
Means ...	...	...	0	23	230 <sup>o</sup> 3	+ 6 <sup>o</sup> 0	...	Means ...	...	...	0	19	285 <sup>o</sup> 4	— 28 <sup>o</sup> 8	...

AREAS and HELIOGRAPHIC POSITIONS of GROUPS of SUN SPOTS—*continued.*

Date. Greenwich Civil Time.	Projected Area of		Area for Group.		Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.	Date. Greenwich Civil Time.	Projected Area of		Area for Group.		Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
	Umbra.	Whole Spot.	Umbra.	Whole Spot.					Umbra.	Whole Spot.	Umbra.	Whole Spot.			
Group 2117.								Group 2122.							
1890. <sub>a</sub> Mar. 4 <sup>h</sup> 50 <sup>m</sup> 5	20	176	36	322	193 <sup>o</sup> 4	+ 32 <sup>o</sup> 7	- 66 <sup>o</sup> 0	1890. <sub>a</sub> Apr. 12 <sup>h</sup> 39 <sup>m</sup> 8	11	81	8	55	136 <sup>o</sup> 4	+ 26 <sup>o</sup> 3	+ 29 <sup>o</sup> 9
5 <sup>h</sup> 41 <sup>m</sup> 7	38	263	45	317	192 <sup>o</sup> 8	+ 32 <sup>o</sup> 7	- 54 <sup>o</sup> 7	13 <sup>h</sup> 38 <sup>m</sup> 9	0	13	0	11	136 <sup>o</sup> 9	+ 25 <sup>o</sup> 4	+ 43 <sup>o</sup> 4
6 <sup>h</sup> 16 <sup>m</sup> 0	54	330	52	321	191 <sup>o</sup> 9	+ 32 <sup>o</sup> 8	- 45 <sup>o</sup> 7	Means ...	...	...	4	33	136 <sup>o</sup> 6 <sup>5</sup>	+ 25 <sup>o</sup> 8 <sup>5</sup>	...
7 <sup>h</sup> 33 <sup>m</sup> 5	87	351	67	270	191 <sup>o</sup> 4	+ 32 <sup>o</sup> 4	- 30 <sup>o</sup> 8	Group 2123.							
8 <sup>h</sup> 32 <sup>m</sup> 8	72	356	50	246	190 <sup>o</sup> 8	+ 32 <sup>o</sup> 5	- 18 <sup>o</sup> 3	Apr. 28 <sup>h</sup> 46 <sup>m</sup> 8							
9 <sup>h</sup> 50 <sup>m</sup> 9	62	288	41	191	190 <sup>o</sup> 0	+ 32 <sup>o</sup> 8	- 3 <sup>o</sup> 5	2	12	2	7	234 <sup>o</sup> 2	+ 25 <sup>o</sup> 7	- 20 <sup>o</sup> 0	
10 <sup>h</sup> 16 <sup>m</sup> 2	44	303	29	199	189 <sup>o</sup> 6	+ 33 <sup>o</sup> 0	+ 4 <sup>o</sup> 7	29 <sup>h</sup> 40 <sup>m</sup> 0	9	86	5	50	234 <sup>o</sup> 0	+ 26 <sup>o</sup> 0	- 7 <sup>o</sup> 9
11 <sup>h</sup> 44 <sup>m</sup> 3	32	174	23	124	188 <sup>o</sup> 9	+ 33 <sup>o</sup> 5	+ 20 <sup>o</sup> 8	30 <sup>h</sup> 22 <sup>m</sup> 8	0	96	0	56	233 <sup>o</sup> 2	+ 26 <sup>o</sup> 2	+ 2 <sup>o</sup> 2
12 <sup>h</sup> 40 <sup>m</sup> 8	30	126	24	101	188 <sup>o</sup> 2	+ 33 <sup>o</sup> 6	+ 32 <sup>o</sup> 9	May 1 <sup>h</sup> 39 <sup>m</sup> 3	0	52	0	32	234 <sup>o</sup> 1	+ 26 <sup>o</sup> 6	+ 18 <sup>o</sup> 5
13 <sup>h</sup> 36 <sup>m</sup> 6	0	33	0	32	187 <sup>o</sup> 4	+ 33 <sup>o</sup> 2	+ 44 <sup>o</sup> 8	Means ...	...	...	2	36	233 <sup>o</sup> 88	+ 26 <sup>o</sup> 13	...
14 <sup>h</sup> 40 <sup>m</sup> 1	0	7	0	10	187 <sup>o</sup> 1	+ 33 <sup>o</sup> 3	+ 58 <sup>o</sup> 0	Group 2124.							
Means ...	...	...	33	194	190 <sup>o</sup> 14	+ 32 <sup>o</sup> 91	...	Apr. 28 <sup>h</sup> 46 <sup>m</sup> 8	2	12	2	7	234 <sup>o</sup> 2	+ 25 <sup>o</sup> 7	- 20 <sup>o</sup> 0
Group 2118.								Apr. 29 <sup>h</sup> 40 <sup>m</sup> 0							
Mar. 12 <sup>h</sup> 40 <sup>m</sup> 8	0	6	0	10	87 <sup>o</sup> 9	+ 19 <sup>o</sup> 8	- 67 <sup>o</sup> 4	29 <sup>h</sup> 40 <sup>m</sup> 0	9	86	5	50	234 <sup>o</sup> 0	+ 26 <sup>o</sup> 0	- 7 <sup>o</sup> 9
Means ...	...	...	0	10	87 <sup>o</sup> 90	+ 19 <sup>o</sup> 80	...	30 <sup>h</sup> 22 <sup>m</sup> 8	0	96	0	56	233 <sup>o</sup> 2	+ 26 <sup>o</sup> 2	+ 2 <sup>o</sup> 2
Group 2119.								May 1 <sup>h</sup> 39 <sup>m</sup> 3							
Mar. 22 <sup>h</sup> 52 <sup>m</sup> 2	0	9	0	6	32 <sup>o</sup> 6	+ 27 <sup>o</sup> 0	+ 10 <sup>o</sup> 6	Means ...	...	...	2	36	233 <sup>o</sup> 88	+ 26 <sup>o</sup> 13	...
23 <sup>h</sup> 13 <sup>m</sup> 0	0	10	0	6	34 <sup>o</sup> 1	+ 26 <sup>o</sup> 9	+ 20 <sup>o</sup> 2	Group 2125.							
Means ...	...	...	0	6	33 <sup>o</sup> 35	+ 26 <sup>o</sup> 95	...	May 8 <sup>h</sup> 23 <sup>m</sup> 3	0	4	0	6	52 <sup>o</sup> 8	- 29 <sup>o</sup> 5	- 72 <sup>o</sup> 4
Group 2120.								9 <sup>h</sup> 20 <sup>m</sup> 2							
Apr. 10 <sup>h</sup> 30 <sup>m</sup> 9	1	10	1	6	144 <sup>o</sup> 2	+ 21 <sup>o</sup> 1	+ 10 <sup>o</sup> 1	10 <sup>h</sup> 44 <sup>m</sup> 7	28	148	21	110	53 <sup>o</sup> 5	- 28 <sup>o</sup> 2	- 57 <sup>o</sup> 7
Means ...	...	...	1	6	144 <sup>o</sup> 20	+ 21 <sup>o</sup> 10	...	11 <sup>h</sup> 55 <sup>m</sup> 7	40	196	24	120	55 <sup>o</sup> 1	- 27 <sup>o</sup> 4	- 42 <sup>o</sup> 4
Group 2121.								12 <sup>h</sup> 52 <sup>m</sup> 3							
Apr. 11 <sup>h</sup> 40 <sup>m</sup> 2	0	21	0	11	107 <sup>o</sup> 1	- 25 <sup>o</sup> 8	- 12 <sup>o</sup> 6	12 <sup>h</sup> 52 <sup>m</sup> 3	24	120	14	70	54 <sup>o</sup> 4	- 27 <sup>o</sup> 8	- 14 <sup>o</sup> 0
12 <sup>h</sup> 39 <sup>m</sup> 8	8	52	4	28	105 <sup>o</sup> 0	- 25 <sup>o</sup> 6	- 1 <sup>o</sup> 5	13 <sup>h</sup> 58 <sup>m</sup> 5	6	43	3	24	55 <sup>o</sup> 5	- 27 <sup>o</sup> 3	+ 1 <sup>o</sup> 1
13 <sup>h</sup> 38 <sup>m</sup> 9	0	20	0	11	103 <sup>o</sup> 5	- 25 <sup>o</sup> 8	+ 10 <sup>o</sup> 0	14 <sup>h</sup> 40 <sup>m</sup> 5	0	0	0	0	...	...	...
14 <sup>h</sup> 43 <sup>m</sup> 1	0	0	0	0	...	...	...	15 <sup>h</sup> 40 <sup>m</sup> 8	0	0	0	0	...	...	...
15 <sup>h</sup> 40 <sup>m</sup> 7	0	26	0	17	103 <sup>o</sup> 3	- 26 <sup>o</sup> 9	+ 36 <sup>o</sup> 5	16 <sup>h</sup> 39 <sup>m</sup> 8	0	0	0	0	...	...	...
16 <sup>h</sup> 51 <sup>m</sup> 3	0	17	0	14	101 <sup>o</sup> 5	- 27 <sup>o</sup> 0	+ 49 <sup>o</sup> 3	17 <sup>h</sup> 41 <sup>m</sup> 5	0	9	0	9	58 <sup>o</sup> 0	- 26 <sup>o</sup> 7	+ 54 <sup>o</sup> 3
17 <sup>h</sup> 32 <sup>m</sup> 3	1	3	1	2	101 <sup>o</sup> 4	- 26 <sup>o</sup> 4	+ 59 <sup>o</sup> 9	Means ...	...	...	7	37	54 <sup>o</sup> 84	- 27 <sup>o</sup> 84	...
Means ...	...	...	1	12	103 <sup>o</sup> 63	- 26 <sup>o</sup> 25	...	Group 2125.							
Group 2122.								May 11 <sup>h</sup> 55 <sup>m</sup> 7							
Apr. 11 <sup>h</sup> 40 <sup>m</sup> 2	0	21	0	11	107 <sup>o</sup> 1	- 25 <sup>o</sup> 8	- 12 <sup>o</sup> 6	3	36	3	34	135 <sup>o</sup> 3	+ 22 <sup>o</sup> 0	+ 54 <sup>o</sup> 0	
12 <sup>h</sup> 39 <sup>m</sup> 8	8	52	4	28	105 <sup>o</sup> 0	- 25 <sup>o</sup> 6	- 1 <sup>o</sup> 5	Means ...	...	...	3	34	135 <sup>o</sup> 30	+ 22 <sup>o</sup> 00	...
13 <sup>h</sup> 38 <sup>m</sup> 9	0	20	0	11	103 <sup>o</sup> 5	- 25 <sup>o</sup> 8	+ 10 <sup>o</sup> 0	5 H 2							



AREAS and HELIOGRAPHIC POSITIONS of GROUPS of SUN SPOTS—*continued.*

Date. Greenwich Civil Time.	Projected Area of		Area for Group.		Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.	Date. Greenwich Civil Time.	Projected Area of		Area for Group.		Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
	Umbra.	Whole Spot.	Umbra.	Whole Spot.					Umbra.	Whole Spot.	Umbra.	Whole Spot.			
Group 2134.								Group 2137.							
1890. <sub>4</sub> July 22 <sup>59</sup> 1 23 <sup>47</sup> 6	0 1	3 7	0 1	6 10	139 <sup>4</sup> 137 <sup>7</sup>	— 34 <sup>8</sup> — 34 <sup>4</sup>	— 68 <sup>6</sup> — 58 <sup>5</sup>	1890. <sub>4</sub> July 29 <sup>39</sup> 8 30 31 <sup>18</sup> 5	2 0	34 0	2 0	32 0	65 <sup>3</sup> ...	— 21 <sup>7</sup> ...	— 52 <sup>6</sup> ...
Means ...	...	...	1	8	138 <sup>55</sup>	— 34 <sup>60</sup>	...	Aug. 1 <sup>42</sup> 6 2 <sup>18</sup> 3	0 3	44 42	0 2	25 24	73 <sup>4</sup> 74 <sup>1</sup>	— 22 <sup>8</sup> — 21 <sup>1</sup>	— 4 <sup>5</sup> + 6 <sup>3</sup>
Group 2135.								Group 2138.							
July 22 <sup>59</sup> 1 23 <sup>47</sup> 6 24 <sup>48</sup> 7 25 <sup>39</sup> 4 26 <sup>45</sup> 7 27 <sup>36</sup> 2 28 <sup>40</sup> 8 29 <sup>39</sup> 8 30 31 <sup>18</sup> 5	10 26 37 40 48 42 31 43 7	71 155 229 254 294 299 243 247 27	30 34 34 27 28 22 16 23 4	223 218 207 176 173 160 125 128 17	127 <sup>8</sup> 127 <sup>9</sup> 127 <sup>9</sup> 128 <sup>8</sup> 128 <sup>5</sup> 128 <sup>3</sup> 128 <sup>7</sup> 128 <sup>5</sup> 129 <sup>8</sup>	— 6 <sup>9</sup> — 6 <sup>9</sup> — 7 <sup>0</sup> — 6 <sup>7</sup> — 6 <sup>6</sup> — 6 <sup>4</sup> — 6 <sup>3</sup> — 6 <sup>2</sup> — 5 <sup>5</sup>	— 80 <sup>2</sup> — 68 <sup>3</sup> — 55 <sup>0</sup> — 42 <sup>1</sup> — 28 <sup>4</sup> — 16 <sup>5</sup> — 2 <sup>3</sup> + 10 <sup>6</sup> + 35 <sup>6</sup>	Aug. 1 <sup>42</sup> 6	0	5	0	4	130 <sup>1</sup>	— 5 <sup>8</sup>	+ 52 <sup>2</sup>
Means ...	...	...	22	143	128 <sup>63</sup>	— 6 <sup>43</sup>	...	Aug. 5 <sup>45</sup> 9 6 <sup>40</sup> 0 7 <sup>59</sup> 2	0 18 0	38 78 58	0 10 0	23 44 33	6 <sup>6</sup> 6 <sup>4</sup> 5 <sup>7</sup>	— 21 <sup>1</sup> — 20 <sup>7</sup> — 20 <sup>1</sup>	— 17 <sup>9</sup> — 5 <sup>7</sup> + 9 <sup>4</sup>
Group 2136.								Group 2139.							
July 28 <sup>40</sup> 8 29 <sup>39</sup> 8 30 31 <sup>18</sup> 5	11 26 No 39	54 127 photograph. 231	30 33 27	149 163 162	50 <sup>3</sup> 50 <sup>5</sup> 50 <sup>3</sup>	+ 18 <sup>5</sup> + 18 <sup>5</sup> + 18 <sup>3</sup>	— 80 <sup>7</sup> — 67 <sup>4</sup> — 43 <sup>9</sup>	Aug. 11 <sup>50</sup> 1	1	15	1	10	243 <sup>4</sup>	+ 26 <sup>9</sup>	+ 38 <sup>7</sup>
Means ...	...	...	21	110	51 <sup>30</sup>	+ 18 <sup>03</sup>	...	Means ...	...	...	1	10	243 <sup>40</sup>	+ 26 <sup>90</sup>	...
Group 2140.								Group 2140.							
July 28 <sup>40</sup> 8 29 <sup>39</sup> 8 30 31 <sup>18</sup> 5	11 26 No 39	54 127 photograph. 231	30 33 27	149 163 162	50 <sup>3</sup> 50 <sup>5</sup> 50 <sup>3</sup>	+ 18 <sup>5</sup> + 18 <sup>5</sup> + 18 <sup>3</sup>	— 80 <sup>7</sup> — 67 <sup>4</sup> — 43 <sup>9</sup>	Aug. 24 <sup>47</sup> 9 25 <sup>40</sup> 2 26 <sup>41</sup> 1 27 <sup>59</sup> 1 28 <sup>40</sup> 0	6 0 0 0 0	35 37 0 11 15	4 0 0 13 0	22 25 0 13 34	151 <sup>2</sup> 151 <sup>8</sup> ... 150 <sup>2</sup> 154 <sup>5</sup>	— 21 <sup>0</sup> — 21 <sup>1</sup> ... — 20 <sup>7</sup> — 20 <sup>4</sup>	+ 18 <sup>0</sup> + 30 <sup>8</sup> ... + 58 <sup>2</sup> + 73 <sup>2</sup>
Means ...	...	...	21	110	51 <sup>30</sup>	+ 18 <sup>03</sup>	...	Means ...	...	...	1	19	151 <sup>93</sup>	— 20 <sup>80</sup>	...

AREAS and HELIOGRAPHIC POSITIONS of GROUPS of SUN SPOTS— <i>continued.</i>															
Date. Greenwich Civil Time.	Projected Area of		Area for Group.		Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.	Date. Greenwich Civil Time.	Projected Area of		Area for Group.		Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
	Umbra.	Whole Spot.	Umbra.	Whole Spot.					Umbra.	Whole Spot.	Umbra.	Whole Spot.			
Group 2141.							Group 2145.								
1890. <sub>a</sub> Aug. 25 <sup>h</sup> 40 <sup>m</sup> 2	10	32	21	66	43 <sup>o</sup> 2	+ 20 <sup>o</sup> 5	- 77 <sup>o</sup> 8	1890. <sub>a</sub> Sept. 6 <sup>h</sup> 137	0	4	0	5	261 <sup>o</sup> 1	+ 24 <sup>o</sup> 0	- 64 <sup>o</sup> 8
26 <sup>h</sup> 411	29	138	35	171	40 <sup>o</sup> 6	+ 20 <sup>o</sup> 9	- 67 <sup>o</sup> 1	7 <sup>h</sup> 486	0	30	0	23	260 <sup>o</sup> 5	+ 24 <sup>o</sup> 2	- 47 <sup>o</sup> 6
27 <sup>h</sup> 591	97	625	82	535	38 <sup>o</sup> 0	+ 21 <sup>o</sup> 7	- 54 <sup>o</sup> 0	8 <sup>h</sup> 394	0	5	0	3	262 <sup>o</sup> 4	+ 23 <sup>o</sup> 2	- 33 <sup>o</sup> 7
28 <sup>h</sup> 400	153	1031	107	724	37 <sup>o</sup> 9	+ 21 <sup>o</sup> 4	- 43 <sup>o</sup> 4	9 <sup>h</sup> 477	16	105	9	58	261 <sup>o</sup> 3	+ 23 <sup>o</sup> 7	- 20 <sup>o</sup> 5
29 <sup>h</sup> 428	208	1423	123	845	37 <sup>o</sup> 7	+ 21 <sup>o</sup> 5	- 30 <sup>o</sup> 0	10 <sup>h</sup> 451	15	105	8	56	259 <sup>o</sup> 9	+ 24 <sup>o</sup> 2	- 8 <sup>o</sup> 3
30 <sup>h</sup> 402	241	1607	131	867	38 <sup>o</sup> 4	+ 21 <sup>o</sup> 5	- 16 <sup>o</sup> 5	11 <sup>h</sup> 422	13	79	7	41	258 <sup>o</sup> 3	+ 25 <sup>o</sup> 6	+ 2 <sup>o</sup> 2
31 <sup>h</sup> 359	242	1734	126	901	38 <sup>o</sup> 6	+ 21 <sup>o</sup> 6	- 3 <sup>o</sup> 7	12 <sup>h</sup> 369	0	55	0	30	258 <sup>o</sup> 8	+ 24 <sup>o</sup> 8	+ 15 <sup>o</sup> 2
Sept. 1 <sup>h</sup> 422	290	1661	158	881	39 <sup>o</sup> 5	+ 21 <sup>o</sup> 3	+ 11 <sup>o</sup> 3	13 <sup>h</sup> 429	0	21	0	12	257 <sup>o</sup> 6	+ 25 <sup>o</sup> 3	+ 28 <sup>o</sup> 0
2 <sup>h</sup> 428	205	1451	119	837	40 <sup>o</sup> 7	+ 21 <sup>o</sup> 2	+ 25 <sup>o</sup> 8	14 <sup>h</sup> 205	0	9	0	6	257 <sup>o</sup> 5	+ 25 <sup>o</sup> 7	+ 38 <sup>o</sup> 1
3 <sup>h</sup> 501	140	935	97	638	42 <sup>o</sup> 2	+ 21 <sup>o</sup> 1	+ 41 <sup>o</sup> 4	Means ...	...	...	3	29	259 <sup>o</sup> 71	+ 24 <sup>o</sup> 52	...
4 <sup>h</sup> 178	128	633	105	516	43 <sup>o</sup> 4	+ 20 <sup>o</sup> 9	+ 51 <sup>o</sup> 6	Group 2146.							
5 <sup>h</sup> 448	45	309	61	417	44 <sup>o</sup> 2	+ 20 <sup>o</sup> 8	+ 69 <sup>o</sup> 2	Sept. 8 <sup>h</sup> 394	6	24	5	20	251 <sup>o</sup> 1	- 24 <sup>o</sup> 3	- 45 <sup>o</sup> 0
6 <sup>h</sup> 137	32	185	76	417	44 <sup>o</sup> 7	+ 20 <sup>o</sup> 4	+ 78 <sup>o</sup> 8	9 <sup>h</sup> 477	3	13	2	9	251 <sup>o</sup> 2	- 24 <sup>o</sup> 2	- 30 <sup>o</sup> 6
Means ...	...	...	96	601	40 <sup>o</sup> 70	+ 21 <sup>o</sup> 14	...	Means ...	...	...	4	15	251 <sup>o</sup> 15	- 24 <sup>o</sup> 25	...
Group 2142.							Group 2147.								
Sept. 1 <sup>h</sup> 422	0	45	0	28	5 <sup>o</sup> 9	- 19 <sup>o</sup> 2	- 22 <sup>o</sup> 3	Sept. 9 <sup>h</sup> 477	0	4	0	4	239 <sup>o</sup> 3	- 28 <sup>o</sup> 6	- 42 <sup>o</sup> 5
2 <sup>h</sup> 428	18	119	10	68	8 <sup>o</sup> 1	- 19 <sup>o</sup> 2	- 6 <sup>o</sup> 8	Means ...	...	...	0	4	239 <sup>o</sup> 30	- 28 <sup>o</sup> 60	...
3 <sup>h</sup> 501	11	63	6	36	7 <sup>o</sup> 3	- 19 <sup>o</sup> 2	+ 6 <sup>o</sup> 5	Group 2148.							
4 <sup>h</sup> 178	4	51	3	30	7 <sup>o</sup> 2	- 19 <sup>o</sup> 2	+ 15 <sup>o</sup> 4	Sept. 11 <sup>h</sup> 422	0	8	0	8	200 <sup>o</sup> 5	- 22 <sup>o</sup> 8	- 55 <sup>o</sup> 6
5 <sup>h</sup> 448	4	53	3	35	6 <sup>o</sup> 5	- 19 <sup>o</sup> 2	+ 31 <sup>o</sup> 5	12 <sup>h</sup> 369	0	17	0	14	201 <sup>o</sup> 1	- 22 <sup>o</sup> 2	- 42 <sup>o</sup> 5
6 <sup>h</sup> 137	14	80	10	61	6 <sup>o</sup> 0	- 19 <sup>o</sup> 6	+ 40 <sup>o</sup> 1	Means ...	...	...	0	11	200 <sup>o</sup> 80	- 22 <sup>o</sup> 50	...
7 <sup>h</sup> 486	54	333	56	354	4 <sup>o</sup> 9	- 19 <sup>o</sup> 5	+ 56 <sup>o</sup> 8	Group 2149.							
8 <sup>h</sup> 394	19	148	29	238	3 <sup>o</sup> 9	- 19 <sup>o</sup> 6	+ 67 <sup>o</sup> 8	Sept. 15 <sup>h</sup> 597	0	27	0	128	119 <sup>o</sup> 8	- 20 <sup>o</sup> 0	- 81 <sup>o</sup> 7
9 <sup>h</sup> 477	0	45	0	177	1 <sup>o</sup> 4	- 19 <sup>o</sup> 3	+ 79 <sup>o</sup> 6	16 <sup>h</sup> 370	6	53	11	92	121 <sup>o</sup> 6	- 19 <sup>o</sup> 9	- 69 <sup>o</sup> 2
Means ...	...	...	13	114	5 <sup>o</sup> 69	- 19 <sup>o</sup> 33	...	17 <sup>h</sup> 434	13	121	14	129	120 <sup>o</sup> 2	- 20 <sup>o</sup> 3	- 56 <sup>o</sup> 6
Group 2143.							Group 2144.								
Sept. 6 <sup>h</sup> 137	0	7	0	12	34 <sup>o</sup> 7	- 22 <sup>o</sup> 8	+ 68 <sup>o</sup> 8	18 <sup>h</sup> 479	14	107	11	83	119 <sup>o</sup> 9	- 19 <sup>o</sup> 9	- 43 <sup>o</sup> 1
Means ...	...	...	0	12	34 <sup>o</sup> 70	- 22 <sup>o</sup> 80	...	19 <sup>h</sup> 412	0	54	0	36	120 <sup>o</sup> 3	- 20 <sup>o</sup> 0	- 30 <sup>o</sup> 4
Group 2144.							Group 2145.								
Sept. 6 <sup>h</sup> 137	5	24	3	16	355 <sup>o</sup> 4	- 19 <sup>o</sup> 8	+ 29 <sup>o</sup> 5	Means ...	...	...	7	94	120 <sup>o</sup> 36	- 20 <sup>o</sup> 02	...
Means ...	...	...	3	16	355 <sup>o</sup> 40	- 19 <sup>o</sup> 80	...	Group 2146.							



AREAS and HELIOGRAPHIC POSITIONS of GROUPS of SUN SPOTS—concluded.															
Date. Greenwich Civil Time.	Projected Area of		Area for Group.		Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.	Date. Greenwich Civil Time.	Projected Area of		Area for Group.		Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
	Umbr.	Whole Spot.	Umbr.	Whole Spot.					Umbr.	Whole Spot.	Umbr.	Whole Spot.			
Group 2159.								Group 2163.							
1890. <sub>a</sub> Nov. 22:424	1	69	1	113	314.5	+ 19.1	- 71.9	1890. <sub>a</sub> Dec. 14:229	6	51	4	34	60.9	+ 17.6	- 38.2
23:314	59	261	63	277	313.8	+ 19.0	- 60.8	15:359	3	22	2	13	61.3	+ 19.6	- 22.8
24:400	16	472	12	376	312.0	+ 20.2	- 48.4	Means ...	...	...	3	24	61.10	+ 18.60	...
25:185	99	708	67	480	311.2	+ 20.2	- 38.9	Group 2164.							
26:171	226	1190	135	707	311.4	+ 20.3	- 25.6	Dec. 18:366	15	48	8	27	29.2	+ 18.3	- 15.4
27:298	316	1504	172	817	312.2	+ 20.6	- 10.0	19:296	30	80	16	42	29.0	+ 18.4	- 3.4
28:187	237	1318	125	698	312.2	+ 20.2	+ 1.7	20:182	10	124	5	66	29.5	+ 18.5	+ 8.8
29:191	127	996	71	548	312.2	+ 20.3	+ 14.9	21:396	7	46	4	28	31.5	+ 18.6	+ 26.8
30:205	165	674	103	415	313.3	+ 20.0	+ 29.4	22:183	0	17	0	11	28.0	+ 18.7	+ 33.7
Dec. 1:214	100	450	78	322	313.0	+ 20.0	+ 42.4	Means ...	...	...	7	35	29.44	+ 18.50	...
2:184	74	289	69	273	313.4	+ 19.6	+ 55.6	Group 2165.							
3:423	24	147	38	226	311.3	+ 19.8	+ 69.9	Dec. 20:182	0	9	0	15	310.1	+ 19.5	- 70.6
4:368	0	58	0	221	311.2	+ 19.5	+ 82.2	21:396	0	11	0	10	310.0	+ 20.8	- 54.7
Means ...	...	...	72	421	312.44	+ 19.91	...	22:183	0	0	0	0	...	...	...
Group 2160.								Group 2161.							
Dec. 7:232	0	11	0	9	234.8	- 31.7	+ 43.6	Dec. 23:267	0	27	0	19	300.7	+ 22.2	- 39.3
8:302	1	14	1	16	238.4	- 32.4	+ 61.2	24:472	0	15	0	9	303.8	+ 21.1	- 20.4
9:307	0	13	0	23	235.8	- 31.2	+ 71.9	25:339	4	15	2	8	304.9	+ 20.8	- 7.8
Means ...	...	...	0	16	236.33	- 31.77	...	26:305	18	84	11	46	300.7	+ 21.4	+ 0.8
Group 2161.								Group 2162.							
Dec. 11:192	0	4	0	4	83.0	+ 19.2	- 56.0	27:298	3	67	2	38	299.7	+ 21.2	+ 12.7
Means ...	...	...	0	4	83.00	+ 19.20	...	28:275	4	12	2	7	298.6	+ 20.5	+ 24.5
Group 2162.								Group 2166.							
Dec. 13:462	13	136	8	85	84.0	- 27.8	- 25.2	Dec. 29:230	3	36	3	31	214.4	+ 28.8	- 47.0
14:229	19	185	11	106	85.8	- 27.7	- 13.3	30:311	0	15	0	10	214.8	+ 28.6	- 32.5
15:359	23	196	13	110	85.3	- 27.6	- 1.2	31:291	4	27	3	17	212.4	+ 28.5	- 22.9
16.	No photograph.							1891.							
17:405	17	219	11	140	87.4	- 27.7	+ 30.2	Jan. 1:560	0	24	0	14	211.7	+ 28.6	- 5.9
18:366	33	231	24	175	87.5	- 27.8	+ 42.9	Means ...	...	...	2	18	213.33	+ 28.63	-
19:296	37	191	36	187	88.4	- 27.6	+ 56.0								
20:182	0	20	0	27	87.8	- 26.2	+ 67.1								

ROYAL OBSERVATORY, GREENWICH.

TOTAL PROJECTED AREAS OF SUN SPOTS AND FACULÆ

FOR EACH DAY,

AND

MEAN AREAS AND MEAN HELIOGRAPHIC LATITUDE

OF

SUN SPOTS AND FACULÆ

FOR EACH ROTATION OF THE SUN,

AND FOR THE YEAR

1890.

TOTAL PROJECTED AREAS OF SUN SPOTS AND FACULE FOR EACH DAY IN THE YEAR 1890.

TOTAL PROJECTED AREAS OF SUN SPOTS AND FACULE FOR EACH DAY IN THE YEAR 1890.

The Projected Area is the area as it is measured on the photograph, uncorrected for the effect of foreshortening, and expressed in millionths of the Sun's apparent disk.

The Greenwich Civil Time is expressed by the month, day of the month (civil reckoning) and decimal of a day, reckoned from Greenwich Mean Midnight.

Greenwich Civil Time.	Projected Area.			Greenwich Civil Time.	Projected Area.			Greenwich Civil Time.	Projected Area.			Greenwich Civil Time.	Projected Area.		
	Umbrae.	Whole Spots.	Faculae.		Umbrae.	Whole Spots.	Faculae.		Umbrae.	Whole Spots.	Faculae.		Umbrae.	Whole Spots.	Faculae.
1890 Jan. 1 <sup>5</sup>	19	109	0	1890 Feb. 22 <sup>2</sup>	0	0	0	1890 April 14 <sup>4</sup>	0	0	167	1890 June 4 <sup>2</sup>	0	0	79
2 <sup>3</sup>	32	134	0	23 <sup>2</sup>	0	0	0	15 <sup>4</sup>	0	26	129	5 <sup>5</sup>	0	25	96
3 <sup>3</sup>	23	93	0	24 <sup>5</sup>	0	0	0	16 <sup>5</sup>	0	17	194	6 <sup>2</sup>	0	47	50
4 <sup>2</sup>	17	74	0	25 <sup>4</sup>	0	0	0	17 <sup>3</sup>	1	3	177	7 <sup>5</sup>	42	141	579
5 <sup>2</sup>	15	47	94	26 <sup>2</sup>	0	0	0	18 <sup>3</sup>	0	0	173	8 <sup>2</sup>	20	98	402
6 <sup>2</sup>	8	53	502	27 <sup>4</sup>	0	0	42	19 <sup>2</sup>	0	0	67	9 <sup>4</sup>	0	15	167
7 <sup>4</sup>	0	14	163	28 <sup>4</sup>	0	15	71	20 <sup>2</sup>	0	0	0	10 <sup>4</sup>	2	19	158
8 <sup>2</sup>	0	0	297	March 1 <sup>3</sup>	0	0	0	21 <sup>4</sup>	0	0	0	11 <sup>4</sup>	0	0	0
9 <sup>5</sup>	0	29	0	2 <sup>4</sup>	0	0	0	22 <sup>5</sup>	0	0	0	12 <sup>2</sup>	0	0	0
10 <sup>4</sup>	0	0	0	3 <sup>4</sup>	0	0	0	23 <sup>4</sup>	0	0	0	13 <sup>2</sup>	0	0	0
11 <sup>2</sup>	0	0	350	4 <sup>5</sup>	20	176	488	24 <sup>3</sup>	0	0	0	14 <sup>3</sup>	0	0	0
12 <sup>5</sup>	0	0	206	5 <sup>4</sup>	38	263	656	25 <sup>2</sup>	0	0	48	15 <sup>4</sup>	0	0	0
13 <sup>3</sup>	0	0	138	6 <sup>2</sup>	54	330	708	26 <sup>4</sup>	0	0	180	16 <sup>4</sup>	0	0	0
14 <sup>3</sup>	0	0	0	7 <sup>3</sup>	87	351	869	27 <sup>2</sup>	0	0	0	17 <sup>3</sup>	0	0	0
15 <sup>2</sup>	0	0	0	8 <sup>3</sup>	72	356	309	28 <sup>5</sup>	2	12	0	18 <sup>4</sup>	0	0	0
16 <sup>3</sup>	0	0	364	9 <sup>5</sup>	62	288	0	29 <sup>4</sup>	9	86	0	19 <sup>4</sup>	0	0	0
17 <sup>2</sup>	0	22	300	10 <sup>2</sup>	44	303	0	30 <sup>2</sup>	0	96	66	20 <sup>4</sup>	0	0	0
18 <sup>4</sup>	0	25	0	11 <sup>4</sup>	32	174	280	May 1 <sup>4</sup>	0	52	78	21 <sup>2</sup>	0	0	0
19 <sup>4</sup>	24	104	212	12 <sup>4</sup>	30	132	517	2 <sup>4</sup>	0	0	0	22 <sup>4</sup>	0	0	255
20 <sup>4</sup>	53	323	529	13 <sup>4</sup>	0	33	623	3 <sup>4</sup>	0	0	0	23 <sup>5</sup>	0	0	0
21 <sup>4</sup>	36	241	392	14 <sup>4</sup>	0	7	738	4 <sup>2</sup>	0	0	227	24 <sup>5</sup>	0	0	0
22 <sup>4</sup>	8	69	374	15 <sup>5</sup>	0	0	177	5 <sup>5</sup>	0	0	104	25 <sup>5</sup>	0	0	0
23 <sup>4</sup>	0	0	0	16 <sup>6</sup>	0	0	0	6 <sup>6</sup>	0	0	0	26 <sup>3</sup>	0	0	61
24 <sup>2</sup>	0	0	426	17 <sup>4</sup>	0	0	58	7 <sup>2</sup>	0	0	0	27 <sup>5</sup>	0	0	141
25 <sup>2</sup>	0	0	338	18 <sup>5</sup>	0	0	0	8 <sup>2</sup>	0	4	77	28 <sup>5</sup>	0	0	122
26 <sup>4</sup>	0	0	165	19 <sup>2</sup>	0	0	0	9 <sup>2</sup>	7	32	163	29 <sup>3</sup>	0	0	138
27 <sup>5</sup>	0	0	178	20 <sup>...</sup>	...	...	...	10 <sup>4</sup>	28	148	0	30 <sup>6</sup>	0	0	92
28 <sup>4</sup>	0	0	0	21 <sup>5</sup>	0	0	145	11 <sup>6</sup>	43	231	120	July 1 <sup>5</sup>	0	0	0
29 <sup>4</sup>	0	0	40	22 <sup>5</sup>	0	9	137	12 <sup>5</sup>	24	120	85	2 <sup>2</sup>	0	0	0
30 <sup>2</sup>	1	6	47	23 <sup>1</sup>	0	10	102	13 <sup>6</sup>	6	43	0	3 <sup>4</sup>	0	0	0
31 <sup>3</sup>	17	55	0	24 <sup>4</sup>	0	0	0	14 <sup>4</sup>	0	0	0	4 <sup>4</sup>	0	23	63
Feb. 1 <sup>3</sup>	4	29	87	25 <sup>6</sup>	0	0	89	15 <sup>4</sup>	0	0	0	5 <sup>4</sup>	32	210	531
2 <sup>2</sup>	0	0	0	26 <sup>5</sup>	0	0	0	16 <sup>4</sup>	0	4	14	6 <sup>3</sup>	72	294	962
3 <sup>3</sup>	0	0	91	27 <sup>2</sup>	0	0	0	17 <sup>4</sup>	6	72	776	7 <sup>5</sup>	51	416	1365
4 <sup>3</sup>	0	0	0	28 <sup>5</sup>	0	0	0	18 <sup>5</sup>	8	106	302	8 <sup>5</sup>	70	457	0
5 <sup>5</sup>	0	0	99	29 <sup>4</sup>	0	0	0	19 <sup>6</sup>	14	54	205	9 <sup>2</sup>	84	388	39
6 <sup>3</sup>	0	0	94	30 <sup>2</sup>	0	0	0	20 <sup>5</sup>	11	52	364	10 <sup>5</sup>	49	323	0
7 <sup>3</sup>	0	0	155	31 <sup>4</sup>	0	0	0	21 <sup>6</sup>	2	28	58	11 <sup>6</sup>	34	208	0
8 <sup>4</sup>	0	0	229	April 2 <sup>4</sup>	0	0	0	22 <sup>4</sup>	0	15	124	12 <sup>5</sup>	19	77	68
9 <sup>4</sup>	0	0	0	3 <sup>4</sup>	0	0	0	23 <sup>4</sup>	0	7	38	13 <sup>5</sup>	18	93	1030
10 <sup>4</sup>	0	0	0	4 <sup>5</sup>	0	0	55	24 <sup>4</sup>	0	6	0	14 <sup>4</sup>	6	74	760
11 <sup>5</sup>	0	0	0	5 <sup>4</sup>	0	0	0	25 <sup>4</sup>	0	0	0	15 <sup>4</sup>	0	0	582
12 <sup>4</sup>	0	0	0	6 <sup>2</sup>	0	0	0	26 <sup>2</sup>	0	0	0	16 <sup>3</sup>	0	0	325
13 <sup>4</sup>	0	0	28	7 <sup>2</sup>	0	0	0	27 <sup>5</sup>	0	0	316	17 <sup>3</sup>	0	0	0
14 <sup>2</sup>	0	0	0	8 <sup>4</sup>	0	0	0	28 <sup>5</sup>	0	0	320	18 <sup>4</sup>	0	0	0
15 <sup>3</sup>	0	0	75	9 <sup>5</sup>	0	0	0	29 <sup>5</sup>	0	0	0	19 <sup>5</sup>	0	0	29
16 <sup>4</sup>	0	0	115	10 <sup>3</sup>	1	10	0	30 <sup>4</sup>	0	3	119	20 <sup>6</sup>	0	0	0
17 <sup>2</sup>	0	0	279	11 <sup>4</sup>	0	21	0	31 <sup>4</sup>	0	0	25	21 <sup>6</sup>	0	0	0
18 <sup>4</sup>	0	0	119	12 <sup>4</sup>	19	133	0	June 1 <sup>5</sup>	0	0	64	22 <sup>6</sup>	11	74	86
19 <sup>2</sup>	0	0	0	13 <sup>4</sup>	0	33	235	2 <sup>6</sup>	0	0	0	23 <sup>5</sup>	27	162	437
20 <sup>2</sup>	0	0	0					3 <sup>6</sup>	0	0	40	24 <sup>5</sup>	37	229	437
21 <sup>2</sup>	0	0	0									25 <sup>4</sup>	40	254	130

TOTAL PROJECTED AREAS OF SUN SPOTS AND FACULÆ—concluded.

Greenwich Civil Time.	Projected Area.			Greenwich Civil Time.	Projected Area.			Greenwich Civil Time.	Projected Area.			Greenwich Civil Time.	Projected Area.						
	Umbræ.	Whole Spots.	Faculæ.																
1890 July	26.5	48	294	0	1890 Sept.	3.5	151	998	167	1890 Oct.	13.4	0	0	75	1890 Nov.	22.4	1	69	289
	27.4	42	299	78		4.2	132	684	1820		14.2	0	0	399		23.3	59	261	853
	28.4	42	298	344		5.4	50	362	1434		15.2	0	0	262		24.4	16	472	1277
	29.4	71	408	458		6.1	51	301	1071		16.2	0	0	0		25.2	99	708	183
	30.2	...	...	...		7.5	54	363	820		17.3	0	0	38		26.2	226	1190	1346
	31.2	46	258	0		8.4	25	177	766		18.4	0	0	576		27.3	317	1504	1510
Aug.	1.4	50	282	259		9.5	19	167	396		19.3	4	25	308		28.2	237	1318	764
	2.2	48	297	564		10.5	15	105	0		20.4	16	343	896		29.2	127	996	143
	3.5	44	240	422		11.4	13	87	45		21.5	150	1095	1409		30.2	165	674	307
	4.6	29	132	96		12.4	0	72	199		22.4	175	1350	1851					
	5.5	12	108	0		13.4	0	21	0		23.2	254	1453	2232	Dec.	1.2	100	450	1031
	6.4	24	102	91		14.2	0	9	1098		24.2	171	1267	1655		2.2	74	289	1504
	7.6	0	58	0		15.6	0	27	206		25.3	186	1139	0		3.4	24	147	522
	8.4	0	0	338		16.4	6	53	326		26.5	148	987	0		4.4	0	58	224
	9.5	0	0	380		17.4	35	263	496		27.4	138	623	0		5.2	0	0	83
	10.6	0	0	499		18.5	62	361	513		28.2	123	440	1058		6.3	0	0	178
	11.5	1	15	291		19.4	26	202	0		29.3	100	353	2245		7.2	0	11	420
	12.2	0	0	0		20.4	15	77	103		30.3	48	210	2938		8.3	1	14	231
	13.4	0	0	0		21.5	0	0	195		31.2	14	102	1028		9.3	0	13	165
	14.5	0	0	0		22.4	0	0	451							10.2	0	0	95
	15.5	0	0	0		23.4	0	0	1136	Nov.	1.2	1	30	286		11.2	0	4	0
	16.5	0	0	0		24.4	4	41	736		2.2	0	0	470		12.3	0	0	155
	17.5	0	0	0		25.4	56	353	490		3.2	0	0	97		13.5	13	136	231
	18.4	0	0	0		26.2	...	...	...		4.4	0	0	0		14.2	25	235	144
	19.2	0	0	0		27.5	46	271	0		5.5	0	0	0		15.4	26	218	1578
	20.4	0	0	77		28.2	39	180	308		6.5	0	0	0		16.2	...	...	...
	21.2	0	0	101		29.3	8	101	101		7.3	0	39	63		17.4	17	219	969
	22.4	0	0	0		30.4	28	300	0		8.4	36	199	280		18.4	48	278	625
	23.5	0	0	0	Oct.	1.2	27	120	548		9.2	37	213	742		19.3	67	270	633
	24.5	6	35	75		2.6	9	41	1380		10.4	17	194	74		20.2	10	152	302
	25.4	10	69	202		3.4	0	0	1382		11.4	34	134	355		21.4	7	57	170
	26.4	29	138	414		4.4	0	0	458		12.4	6	92	0		22.2	0	17	631
	27.6	97	637	1113		5.6	0	21	473		13.2	15	79	0		23.3	0	27	1620
	28.4	153	1046	110		6.4	5	36	716		14.4	0	18	0		24.5	0	15	396
	29.4	208	1423	70		7.4	6	32	368		15.5	0	0	301		25.3	4	15	565
	30.4	241	1607	89		8.4	0	4	260		16.2	0	0	518		26.3	18	84	392
	31.4	242	1734	0		9.4	0	0	89		17.5	0	0	1098		27.3	3	67	129
Sept.	1.4	290	1707	0		10.5	0	0	660		18.2	0	0	1987		28.3	4	12	329
	2.4	223	1571	39		11.4	0	0	97		19.2	0	0	1166		29.2	0	36	304
						12.4	0	0	178		20.4	0	0	314		30.3	0	15	553
											21.3	0	0	93		31.3	4	27	284

MEAN AREAS OF SUN SPOTS AND FACULÆ ON PHOTOGRAPHS

MEAN AREAS of SUN SPOTS and FACULÆ, as measured on PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DÛN, INDIA, and in MAURITIUS, for each ROTATION of the SUN, from 1890 January 1 to 1890 December 21.

The Mean Areas have been formed by taking the Means of the Areas for each day of observation throughout each Rotation of the Sun, the Projected Areas being the areas as measured on the photographs and expressed in millionths of the Sun's apparent disk, and the Areas corrected for foreshortening being expressed in millionths of the Sun's visible hemisphere.

The rotations adopted in the following table (which is in continuation of those for the years 1873-1889 printed in the Greenwich Observations for 1884 and succeeding years) correspond to the synodic rotation of the Sun, and the commencement of each is defined by the coincidence of the assumed prime meridian with the central meridian, the assumed prime meridian being that meridian which passed through the ascending node at mean noon on January 1, 1854, and the assumed period of the Sun's sidereal rotation being 25.38 days. The rotations adopted in the volumes of Greenwich Observations, 1877 to 1883, correspond on the other hand to the sidereal rotation of the Sun, the commencement of each being defined by the coincidence of the assumed prime meridian with the ascending node. The numeration of the rotations is in continuation of Carrington's series (*Observations of Solar Spots made at Redhill* by R. C. Carrington, F.R.S.), No. 1 being the rotation commencing 1853, November 9. The dates of commencement of the rotations are given in GREENWICH CIVIL TIME, reckoning from midnight.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Mean of Daily Areas.					
			Projected.			Corrected for Foreshortening.		
			Umbrae.	Whole Spots.	Faculae.	Umbrae.	Whole Spots.	Faculae.
485	1890 January 1 <sup>a</sup> 1'19	28	8.4	47.8	180	7.2	45.3	213
486	January 28.54	27	0.8	3.3	54.0	0.5	2.2	71.8
487	February 24.87	26	16.9	94.1	229	14.1	83.7	264
488	March 24.19	28	0.8	8.7	45.9	0.5	5.5	52.1
489	April 20.47	27	4.6	33.3	81.1	3.0	23.0	93.5
490	May 17.70	27	3.7	22.8	130	2.9	17.1	152
491	June 13.90	27	13.3	78.2	140	11.0	68.4	155
492	July 11.10	26	24.9	150	238	19.2	115	296
493	August 7.31	28	59.0	394	142	36.3	241	156
494	September 3.56	26	26.3	176	489	22.6	160	536
495	September 30.83	27	47.7	316	604	36.2	247	598
496	October 28.12	28	18.1	104	626	16.1	96.9	658
497	November 24.43	26	60.9	344	520	38.4	224	644

MEAN AREAS of SUN SPOTS, and FACULÆ, as measured on PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DÛN, INDIA, and in MAURITIUS, for the YEAR 1890.

The Mean Projected Areas are expressed in millionths of the Sun's apparent disk.

The Mean Areas corrected for foreshortening are expressed in millionths of the Sun's visible hemisphere.

Year.	No. of Days on which Photographs were taken.	Mean of Daily Areas.					
		Projected.			Corrected for Foreshortening.		
		Umbrae.	Whole Spots.	Faculae.	Umbrae.	Whole Spots.	Faculae.
1890	361	21.3	133	273	15.5	99.4	304

MEAN HELIOGRAPHIC LATITUDE of SUN SPOTS, as measured on PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DÛN, INDIA, and in MAURITIUS, for each ROTATION of the SUN, from 1890 January 1 to 1890 December 21.

The numbers given in the accompanying table have been formed as follows :—

The Heliographic Latitude of each Spot for each day has been multiplied by its Area (corrected for foreshortening), and the sum of the products for Spots North of the Sun's Equator has been divided by the sum of the corresponding Areas to form Mean Heliographic Latitude of Spotted Area North of Equator; similarly for Spots South of the Equator. In forming the Mean Heliographic Latitude of entire Spotted Area the algebraic sum of the products for Spots North and South of the Equator has been divided by the sum of the Areas; and for the Mean Distance from the Equator for all Spots, the numerical sum of the products, without regard to the sign of the latitude, has been similarly divided.

The Mean Areas have been formed by dividing the sum of the Daily Areas (corrected for foreshortening) by the number of days of observation for each Rotation of the Sun, and are expressed in millionths of the Sun's visible hemisphere.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Spots NORTH of the Equator.		Spots SOUTH of the Equator.		Mean Heliographic Latitude of entire Spotted Area.	Mean Distance from Equator of all Spots.
			Mean of Daily Areas.	Mean Heliographic Latitude.	Mean of Daily Areas.	Mean Heliographic Latitude.		
485	1890 Jan. 1 <sup>a</sup> 19	28	34.4	22.54	10.9	10.72	+ 14.58	19.71
486	Jan. 28.54	27	2.2	24.47	0.0	...	+ 24.47	24.47
487	Feb. 24.87	26	82.9	32.76	0.8	30.43	+ 32.15	32.74
488	Mar. 24.19	28	2.6	25.55	3.0	26.28	- 2.21	25.94
489	Apr. 20.47	27	8.3	24.37	14.7	28.02	- 9.04	26.70
490	May 17.70	27	2.0	20.97	15.1	26.79	- 21.30	26.12
491	June 13.90	27	0.0	...	68.4	23.58	- 23.58	23.58
492	July 11.10	26	32.0	18.28	83.0	11.55	- 3.22	13.39
493	Aug. 7.31	28	231	21.20	9.3	19.67	+ 19.66	21.17
494	Sept. 3.56	26	88.8	21.39	70.9	21.33	+ 2.43	21.37
495	Sept. 30.83	27	4.0	20.47	243	23.08	- 22.37	23.03
496	Oct. 28.12	28	27.4	19.49	69.5	23.94	- 11.67	22.68
497	Nov. 24.43	26	190	20.10	33.8	27.81	+ 12.87	21.26

MEAN HELIOGRAPHIC LATITUDE of SUN SPOTS, as measured on PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DÛN, INDIA, and in MAURITIUS, for the YEAR 1890.

YEAR.	No. of Days on which Photographs were taken.	Spots NORTH of the Equator.		Spots SOUTH of the Equator.		Mean Heliographic Latitude of entire Spotted Area.	Mean Distance from Equator of all Spots.
		Mean of Daily Areas.	Mean Heliographic Latitude.	Mean of Daily Areas.	Mean Heliographic Latitude.		
1890	361	53.1	22.20	46.3	21.75	+ 1.73	21.99

NOTE.—In the computations for forming the corresponding Tables given in the Volumes for 1884 and 1885 the latitudes of the Spots were only taken to the nearest whole degree, the next higher whole degree being adopted whenever the fractional part of the latitude amounted to or exceeded .5. Thus, under 8°, for example, would be included all Spots from 7°.5 to 8°.4, both inclusive; and the corresponding mean latitude should have been taken as 7°.95 instead of 8°. The Mean Heliographic Latitudes, therefore, both for Spots North and Spots South of the Equator, and the Mean Distances from the Equator of all Spots, both for the rotations and for entire years, require a correction of - 0°.05. The Mean Latitude of the entire Spotted Area requires the following correction :—

$$- 0°.05 \times \frac{\text{Mean Area N.} - \text{Mean Area S.}}{\text{Mean Area N.} + \text{Mean Area S.}}$$

These corrections have been applied in computing the Mean Heliographic Latitudes and Mean Distance from the Equator given in the above Tables for 1890, and in the corresponding Tables for the years 1886 to 1889.