SPECTROSCOPIC AND PHOTOGRAPHIC OBSERVATIONS

MADE AT THE

ROYAL OBSERVATORY, GREENWICH,

1887.

(EXTRACTED FROM THE GREENWICH OBSERVATIONS, 1887.)

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GREENWICH SPECTROSCOPIC AND PHOTOGRAPHIC RESULTS, 1887.

INTRODUCTION.

§ 13. *Spectroscopic Observations in the Year* 1887.

The spectroscope used for these observations was mounted on the South-east equatoreal, 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 $17^{ft.}$ $10^{in.}$

This section contains:—Measures of Displacement of Lines in the Spectra of Stars, Moon, and Sky; Collected Results for Motions of Stars in the line of Sight; and Observations of the Spectra of γ Cassiopeiæ, α Orionis, and β Lyræ.

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. $1^{rev.}$ 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.

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 5°.

With regard to the observations of the spectra of γ Cassiopeiæ, α Orionis, and β Lyræ, it is sufficient to remark that a curve has been laid down in the usual manner, connecting micrometer readings and wave-lengths for the Single-prism Spectroscope, and that a correction for index-error has been deduced from observations of comparison-lines, and applied to the observed readings to reduce them to the standard curve from which the corresponding wave-lengths have been read off. The tabular wave-lengths of comparison-lines have been taken from Ångström's *Spectre Normal du Soleil.*

§ 14. *Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk on Photographs taken at the Royal Observatory, Greenwich, at Dehra Dûn in India, and at the Royal Alfred Observatory, Mauritius, in the year* 1887; *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 Colonel C. T. Haig, R.E., 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 both wet and dry processes have been used, bromo-iodized collodion having been used with iron development, and bromo-iodized gelatine dry plates with alkaline development.

Photographs of the Sun were taken at Greenwich on 185 days, and Indian photographs on 150 days with Mauritius photographs on 26 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 1887.

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 Faculæ 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 1887:—

E. W. Maunder	- - M	A. E. Pilkington	EP
H. P. Hollis	- - H		

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° 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° 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°, 90°, 180°, and 270° 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.

The zero of position-angles for the Dallmeyer Photoheliograph, employed at Greenwich, has generally been determined throughout 1887 by the measurement of a plate which had

been exposed to the Sun's rays twice, with an interval of about 115 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.
	h	° ′
1886, December	30. 11	— 0. 43
1887, January	17. 11	— 1. 0
February	5. 10	— 0. 47
March	11. 12	— 0. 53
April	2. 11	— 0. 32
	11. 12	— 0. 6
	20. 12	— 0. 14
May	26. 11	+ 0. 2
	31. 12	— 0. 21
October	8. 12	+ 0. 5
	22. 11	— 0. 2
	25. 11	0. 0
November	28. 12	+ 0. 33
December	9. 12	+ 0. 27
1888, March	1. 12	+ 0. 34

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

equatoreal wire, a correction for the inclination of the Sun's path being applied to the reading of the position-circle so obtained, and a further correction of – 0°. 7′ for the error of perpendicularity of the wires. 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.		Correction for Zero.
	h	° ′
1887, June	9. 12	0. 0
July	12. 13	+ 0. 13
August	3. 11	– 0. 3
	6. 12	+ 0. 13
September	8. 12	+ 0. 21
	9. 11	+ 0. 29
October	25. 13	+ 0. 12
December	2. 12	+ 0. 32
	3. 12	+ 0. 23
	9. 12	+ 0. 36
1888, February	1. 11	+ 0. 27

The wire-frame was found, on July 12, to have been disturbed, the peg which keeps it in its place having fallen out. The peg was replaced before the transits were taken. The wire-frame was again found to be loose on September 8. A set of transits was taken on this day, and a screw-clamp was made for the wire-frame, which was fitted to it on September 9. After the wire-frame had been securely fixed, a fresh set of transits was taken.

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 readings of the position-circle in 1887 have been as follows :—

From 1887, January 1	- - -	356°·4
March 13	- - -	356°·0

The correction for zero of position adopted for any date has been the mean of the determinations of that zero made next before and next after that date. 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 faculæ, 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 $c = \sin 57''\cdot5 = \frac{1}{3600}$ 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 δr 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 δr 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 $\delta \mathrm{R} = + c \,.\, \tan^2 z \times \mathrm{R} \times \frac{1}{2} \left\{ \frac{1 + \cos 2 (\theta_0 - v)}{2} + \frac{1 + \cos 2 (\theta_0 + 90^\circ - v)}{2} \right\} = + \frac{1}{2} c \mathrm{R} \,.\, \tan^2 z$, where R is the Sun's mean radius and θ_0 , $\theta_0 + 90^\circ$ the position-angles of the two diameters measured. Thus the final correction to r becomes—

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

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.
°		′	°		′	°		′
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	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 ρ, ρ' the angular distances of a

* 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.

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 ρ and log cos ρ 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, λ 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 χ 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—

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

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 χ 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—

$$\tan G = \tan\omega \cos\odot$$
$$\tan H = \tan I \cos(\odot - N)$$

where ω 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, ω in the computation of the Tables are 7° 15′, 74°, and 23° 27′·5 respectively.

The Heliographic Longitude of the Spot is found from l, the Heliographic Longitude from Node, by subtracting the Reduction to 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 the epoch 1854·0. The period of rotation assumed is 25·38 days.

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.

§ 15. *Ledgers of Areas and Positions of Spot-groups upon the Sun's Disk deduced from the measurement of the Solar photographs for each day in the year* 1887.

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 umbræ 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 umbræ 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 umbræ and whole spots and the mean longitude and latitude for the period of observation.

§ 16. *Total Projected Areas of Umbræ, Whole Spots, and Faculæ, for each day (uncorrected for foreshortening), Mean Areas of Umbræ, Whole Spots, and Faculæ, and Mean Heliographic Latitude of Spots, for each Synodic Rotation of the Sun, and for the Year* 1887.

This section requires no further explanation.

W. H. M. CHRISTIE.

1888, *August* 31.

§ 14. *Observations of Comet b* 1900 *from Photographs taken with the* 26-*inch Refractor of the Thompson Equatorial or with the Astrographic Equatorial in the year* 1900.

The Thompson Equatorial, carrying the 26-inch photographic refractor at one end of the declination axis, and the 30-inch reflector at the other, is briefly described in the *Introduction.* The focal length of the refractor is approximately 22 feet 5 inches, giving a scale of 30″·2 to the millimetre; while that of the astrographic telescope is approximately 11 feet 3½ inches, giving a scale of 1′ to the millimetre nearly.

The photographs are taken on plates 16 centimetres square, on which a *réseau* of cross lines 5 millimetres apart is printed in the same manner as for the Photographic Map of the Heavens.

The measurement of the photographs was made with the Astrographic Micrometer, which has a glass diaphragm with cross-scales at the focus of the microscope. These scales are divided into 100 parts, and the micrometer is readily adjusted, so that 100 divisions of the scale are equal very nearly to the distance between two *réseau* lines as viewed with the microscope. The intersection of the scales is made to bisect the object, and the positions of the *réseau* lines on each side are read off on the scales by estimation to the thousandth part of a *réseau* interval. The rectangular co-ordinates of the images are thus obtained in units of 1 *réseau* interval, which for the astrographic telescope is approximately 5′, and for the 26-inch refractor 2½′.

The plates are in all cases measured in reversed positions to eliminate personality. Where several images of the same object are obtained on a plate, they are all measured and the means taken. The magnifying power used is 15.

The determination of Right Ascension and Declination is made by Prof. Turner's method (*Monthly Notices, R. A. S.*, vol. liv., p. 11), as follows:—

With an assumed R.A. and Dec. of the centre of the plate, the "Standard Co-ordinates," ξ and η, of those stars which are used as reference stars are computed by the formula

$$\xi = \tan(\alpha - A)\cos\phi\sec(\phi - D),$$
$$\eta = \tan(\phi - D),$$
$$\text{where } \tan\phi = \tan\delta\sec(\alpha - A).$$

In this formula α is the R.A. of the star,
A ,, ,, centre of the plate,
δ is the Dec. of the star,
D ,, ,, centre of the plate,
and ϕ is an auxiliary angle.

The "Standard Co-ordinates" of the reference stars are compared with the measured co-ordinates x, y; and from equations of the form

$$\xi - x = ax + by + c$$
$$\eta - y = dx + ey + f$$

the constants of each plate a, b, c, d, e, f are deduced. By means of these constants the "Standard Co-ordinates" of any object on the plate are obtained by applying corrections $ax' + by' + c$, $dx' + ey' + f$ to the measured co-ordinates x', y', from which the R.A. and Dec. are deduced by inversion of the trigonometrical formulæ given above.

It should be noticed that the R.A. and Dec. obtained in this way are referred to the equinox of the catalogue of the reference stars used, and that the position of a comet or planet obtained in this way is corrected for the part of the aberration arising from the Earth's motion.

In each case the uncorrected measures of the co-ordinates of the reference stars and the comet are given, and the deduced R.A. and Dec. for the equinox of the catalogue. For the reference stars the comparison with the assumed R.A. and Dec. is also given.

The adopted plate-constants and the Apparent R.A. and Dec. reduced to the equinox 1900 are given in separate tables.

§ 15. *Measures of Positions and Areas of Sun Spots and Faculæ on Photographs taken at the Royal Observatory, Greenwich, at Dehra Dûn in India, and at the Royal Alfred Observatory, Mauritius, in the year* 1900; *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 either with the Thompson or with the Dallmeyer Photoheliograph. The Thompson Photoheliograph which was in regular use for the greater part of the year, is a photographic refractor of 9 inches aperture, presented to the Royal Observatory by Sir Henry Thompson, which has been fitted with an enlarging doublet by Ross, and with a camera and shutter for rapid exposure so as to take photographs of the Sun on a scale of about 7·5 inches to the solar diameter. The Dallmeyer Photoheliograph, which was substituted for the

Thompson while the former was in use for the Eclipse expedition to Portugal, from 1900 March 9 to 1900 June 12, is an instrument used in the Transit of Venus expedition to New Zealand, which, as now adapted, gives a solar image of 8 inches diameter on the photographic plate.

The photographs have been taken throughout the year on gelatine dry plates, "Lantern" plates supplied by R. W. Thomas and Co. being used, with hydroquinone development.

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 wet-plates have been generally used in connexion with iron development; but a few "Lantern" dry-plates have also been taken.

The Mauritius photographs were taken under the superintendence of Mr. T. F. Claxton, 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 145 days, and Indian photographs on 186 days with Mauritius photographs on 29 days have been received from the Solar Physics Committee to complete the total of 360 days for which there are either Greenwich, Indian, or Mauritius photographs of the Sun available for measurement in 1900.

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 Faculæ 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 1900:—

P. H. Cowell	C	C. C. Lacey	CL
E. W. Maunder	M	T. G. Staples	TS

The *third* column gives the No. of the group, and the letter for the spot. The groups are numbered in 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° 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 eyepiece, 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° 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 circular 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°, 90°, 180°, and 270° 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-spider-lines which serve to determine the zero of position-angles on the photograph.

The zero of position-angles for the Thompson and Dallmeyer Photoheliographs, employed at Greenwich, has been determined by the measurement of a plate which has 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 about a 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 approximately 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:—

THOMPSON PHOTOHELIOGRAPH, to 1900 March 9.

Date, Greenwich Civil Time.		Correction for Zero.
	d h	° ′
1899 December	2. 13	+ 0. 30
	23. 12	+ 0. 18
1900 February	8. 12	+ 0. 29
March	9. 12	+ 0. 29

A correction of +0°·5 for zero of position has been applied to all photographs taken with the Thompson Photoheliograph up to 1900 March 9.

DALLMEYER PHOTOHELIOGRAPH, 1900 March 9 to June 12.

Date, Greenwich Civil Time.		Correction for Zero.
	d h	° ′
1900 May	26. 13	− 0. 10
	29. 12	− 0. 0
June	10. 11	− 0. 10

A correction of $-0^{\circ}\cdot1$ for zero of position has been applied to all photographs taken with the Dallmeyer photoheliograph from 1900 March 9 to 1900 June 12.

THOMPSON PHOTOHELIOGRAPH, from 1900 June 12.

Date, Greenwich Civil Time.		Correction for Zero.
	d h	° ′
1900 June	21. 12	− 0. 22
July	24. 11	− 0. 26
August	13. 11	− 0. 24
	31. 12	− 0. 20
October	8. 11	− 0. 18
November	8. 11	− 0. 18
December	14. 10	− 0. 28
	29. 11	− 0. 19
1901 January	15. 11	− 0. 13
February	15. 11	− 0. 8

A correction of $-0^{\circ}\cdot3$ for zero of position has been applied to all photographs taken with the Thompson Photoheliograph since 1900 June 12.

The Thompson Photoheliograph was mounted on the tube of the 26-inch Thompson Photographic refractor throughout the year, excepting during the period 1900 March 9 to June 12 when it was dismounted for use in the observation of the total Solar eclipse of 1900 May 28, at Ovar in Portugal. The Thompson Photoheliograph is not fitted with a position-circle, and the position-angle of the wires, which are approximately parallel and perpendicular to the circle of declination cannot be altered.

The Dallmeyer Photoheliograph was mounted on the tube of the 26-inch Thompson Photographic refractor during the period 1900 March 9 to June 12, when the Thompson Photoheliograph was removed. The Dallmeyer Photoheliograph was dismounted on 1900 June 12, and placed in the upper floor of the Museum.

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 position-circle was set to the reading 354°·0 throughout 1900.

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 faculæ, 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 $c = \sin 57''\cdot5 = \frac{1}{3600}$ 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 $\delta\, \mathrm{R} = +\, c\,.\tan^2 z \times \mathrm{R} \times \frac{1}{2}\left\{\frac{1 + \cos 2\,(\theta_0 - v)}{2} + \frac{1 + \cos 2\,(\theta_0 + 90^\circ - v)}{2}\right\} = +\, \frac{1}{2}\, c\, \mathrm{R}\,.\tan^2 z$, where R is the Sun's mean radius and θ_0, $\theta_0 + 90^\circ$ the position-angles of the two diameters measured. Thus the final correction to r becomes—

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

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.
°		′	°		′	°		′
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.

$\theta - v$	$\theta - v$	$-\frac{\text{Sin } 2(\theta - v)}{2}$	$\frac{\text{Cos } 2(\theta - v)}{2}$	$\theta - v$	$\theta - v$	$-\frac{\text{Sin } 2(\theta - v)}{2}$	$\frac{\text{Cos } 2(\theta - v)}{2}$
°	°			°	°		
0	180	·00	+ ·50	90	270	·00	− ·50
5	185	− ·09	+ ·49	95	275	+ ·09	− ·49
10	190	− ·17	+ ·47	100	280	+ ·17	− ·47
15	195	− ·25	+ ·43	105	285	+ ·25	− ·43
20	200	− ·32	+ ·38	110	290	+ ·32	− ·38
25	205	− ·38	+ ·32	115	295	+ ·38	− ·32
30	210	− ·43	+ ·25	120	300	+ ·43	− ·25
35	215	− ·47	+ ·17	125	305	+ ·47	− ·17
40	220	− ·49	+ ·09	130	310	+ ·49	− ·09
45	225	− ·50	·00	135	315	+ ·50	·00
50	230	− ·49	− ·09	140	320	+ ·49	+ ·09
55	235	− ·47	− ·17	145	325	+ ·47	+ ·17
60	240	− ·43	− ·25	150	330	+ ·43	+ ·25
65	245	− ·38	− ·32	155	335	+ ·38	+ ·32
70	250	− ·32	− ·38	160	340	+ ·32	+ ·38
75	255	− ·25	− ·43	165	345	+ ·25	+ ·43
80	260	− ·17	− ·47	170	350	+ ·17	+ ·47
85	265	− ·09	− ·49	175	355	+ ·09	+ ·49
90	270	·00	− ·50	180	360	·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 disk, R the measured radius of the Sun on the photograph, (R) the tabular semidiameter of the Sun in arc, and ρ, ρ' the angular distances of a

* "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.

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 ρ and log. cos ρ, 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, λ 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 χ 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—

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

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 χ 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—

$$\tan G = \tan\omega\cos\odot$$
$$\tan H = \tan I\cos(\odot - N)$$

where ω 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, ω in the computation of the tables are $7^\circ.15'$, $74^\circ.23'$, 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 as nearly as possible 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.

§ 16. *Ledgers of Areas and Heliographic Positions of Groups of Sun-Spots deduced from the measurement of the Solar photographs for each day in the year* 1900.

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

umbræ 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 umbræ 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 umbræ and whole spots and the mean longitude and latitude for the period of observation.

§ 17. *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* 1900.

This section requires no further explanation.

As a general remark applying to every class of observation above mentioned, it is proper to state that the original entries of observations are in all cases preserved. The greater part of the regular observations with the transit-circle are entered in small memorandum books, in which the entries are made with a metallic pencil whose marks are not easily effaced; and some observations are written down at once with ink in the skeleton forms in which the calculations are to be made, or in the copy which is sent to the press. The sheets punctured by the prickers of the electro-magnets in registration of transits by the chronographic method are also preserved. The proof-sheets are read with the first skeleton forms in which the observations are entered; and in which, in fact, the examination for accidental errors, &c., is made. The solar photographs which have been measured are preserved.

W. H. M. CHRISTIE.

Royal Observatory, Greenwich.
1903, *February* 16.

ROYAL OBSERVATORY, GREENWICH.

SPECTROSCOPIC OBSERVATIONS

MADE AT THE

ROYAL OBSERVATORY, GREENWICH,

1887.

MEASURES of DISPLACEMENT of LINES in the SPECTRA of STARS, MOON, AND SKY 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 1887.

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 $18\frac{1}{2}°$ from A to H, equivalent to that produced by four flint prisms of 60°, is obtained; and with a train of two a dispersion of about 80°, equivalent to that produced by sixteen flint prisms of 60°. One half-prism has been always employed. The dispersions have been inferred from measurements of the distance between b_1 and b_4 as compared with the wave-length measure.

$1^{rev.}$ of the micrometer corresponds with one "half-prism" to 10·4 tenth-metres or 375 miles per second for the *b* lines, and to 7·91 tenth-metres or 304 miles per second for the F line.

$1^{rev.}$ of the screw for opening the slit corresponds to 0·01 inch, or about 10″.

The slit lies north and south when the reading of the Position Circle is 6°.

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, 1887. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Stars in Miles per Second.		REMARKS.
					Measured.	Estimated.		Measured.	Estimated.	
d h m				r	r					
Jan. 26. 21. 25	M	Capella	F	0·200	−0·009	$-\frac{1}{10}$	+ 12·6	− 15·3	− 21·0	Spectrum bright but tremulous. Definition fair. Star-line not very well seen in first observation, probably giving an incorrect result.
21. 35	M	,,	F	0·200	+0·081	$+\frac{1}{3}$	+ 12·6	+ 12·0	+ 15·4	
21. 50	M	,,	F	0·200	+0·054	$+\frac{1}{4}$	+ 12·6	+ 3·8	+ 8·4	
22. 0	M	,,	F	0·200	+0·090	$+\frac{1}{2}$	+ 12·6	+ 14·7	+ 29·5	
22. 15	M	β Persei	F	0·200	−0·248	− 1	+ 16·6	− 91·9	− 100·7	Spectrum very tremulous. Star-line very ill-defined and difficult to bisect. There was a decided displacement towards the blue.
22. 30	M	,,	F	0·200	−0·242	− 1	+ 16·6	− 90·1	− 100·7	
22. 55	M	,,	F	0·200	−0·261	− 1	+ 16·6	− 95·9	− 100·7	
23. 10	M	,,	F	0·200	−0·216	$-\frac{2}{3}$	+ 16·6	− 82·2	− 72·7	
23. 35	M	Rigel	F	0·200	+0·040	$+\frac{1}{4}$	+ 12·7	− 0·6	+ 8·3	Spectrum very tremulous. Star-line very faint.
23. 50	M	,,	F	0·200	+0·139	$+\frac{1}{2}$	+ 12·7	+ 29·5	+ 29·4	
27. 0. 15	M	Sirius.....	F	0·200	−0·055	$-\frac{1}{4}$	+ 6·0	− 22·7	− 27·0	Spectrum very tremulous. Definition bad. Displacement appeared small towards the blue.
0. 25	M	,,	F	0·200	−0·075	$-\frac{1}{4}$	+ 6·0	− 28·8	− 27·0	
										Position Circle, 6°.
Jan. 28. 19. 35	M	β Persei	F	0·230	−0·069	$-\frac{1}{4}$	+ 16·8	− 37·8	− 42·2	Spectrum faint, but fairly steady. Definition of star-line poor.
19. 50	M	,,	F	0·230	+0·024	$+\frac{1}{6}$	+ 16·8	− 9·5	+ 3·5	
20. 0	M	,,	F	0·230	+0·049	$+\frac{1}{6}$	+ 16·8	− 1·9	+ 3·5	
20. 10	M	,,	F	0·230	0·000	0	+ 16·8	− 16·8	− 16·8	
20. 30	M	Aldebaran.....	F	0·230	+0·111	$+\frac{2}{5}$	+ 16·4	+ 17·3	+ 24·2	Spectrum faint. Definition poor. Star-line only occasionally seen well.
20. 45	M	,,	F	0·230	+0·134	$+\frac{1}{2}$	+ 16·4	+ 24·3	+ 34·3	
										Position Circle, 6°.
Jan. 31. 19. 10	M	Moon	F	0·160	+0·008			− 2·4		The coincidence of the two spectra appeared perfect.
19. 15	M	,,	F	0·160	+0·017			+ 5·1		
19. 20	M	,,	F	0·160	+0·008			+ 2·4		
19. 25	M	,,	F	0·160	−0·011			− 3·3		
19. 30	M	,,	F	0·160	+0·019			+ 5·8		
19. 45	M	β Persei	F	0·160	−0·023	$-\frac{1}{10}$	+ 17·0	− 24·0	− 21·9	Spectrum fairly bright and steady. Definition bad. Displacement evidently very slight.
20. 5	M	,,	F	0·160	−0·017	$-\frac{1}{20}$	+ 17·0	− 22·1	− 19·4	
20. 25	M	,,	F	0·160	−0·010	$-\frac{1}{20}$	+ 17·0	− 20·0	− 19·4	
20. 45	M	,,	F	0·160	+0·030	$+\frac{1}{6}$	+ 17·0	− 7·9	− 7·3	
21. 0	M	,,	F	0·160	−0·003	0	+ 17·0	− 17·9	− 17·0	

Date, 1887. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement. Measured.	Displacement. Estimated.	Earth's Motion in Miles per Second.	Concluded Motion of Stars in Miles per Second. Measured.	Concluded Motion of Stars in Miles per Second. Estimated.	REMARKS.
d h m				r	r					
Jan. 31. 21. 15	M	Rigel	F	0·160	+ 0·123	+ ½	+ 13·5	+ 23·9	+ 10·8	Spectrum bright but tremulous. Definition fair.
21. 25	M	,,	F	0·160	+ 0·123	+ ½	+ 13·5	+ 23·9	+ 10·8	
21. 30	M	γ Orionis	F	0·160	− 0·023	− 1/10	+ 14·4	− 21·4	− 19·3	Spectrum fairly bright and steady. Definition fair.
21. 35	M	,,	F	0·160	− 0·038	− ⅕	+ 14·4	− 25·9	− 24·1	
21. 50	M	β Tauri	F	0·160	− 0·040	− ⅕	+ 14·6	− 26·7	− 24·3	Star-line seen only by glimpses.
22. 0	M	,,	F	0·160	− 0·025	− 1/10	+ 14·6	− 22·2	− 19·5	Position Circle, 6°.
Feb. 2. 22. 40	M	β Persei.....	F	0·152	− 0·331	− 1½	+ 17·1	− 117·6	− 122·8	Spectrum faint and tremulous. Star-line not seen well. Direct comparison shewed large displacement towards the blue.
22. 50	M	,,	F	0·152	− 0·246	− 1	+ 17·1	− 91·8	− 87·6	
23. 0	M	,,	F	0·152	− 0·326	− 1¼	+ 17·1	− 116·1	− 105·2	
23. 10	M	,,	F	0·152	− 0·302	− 1¼	+ 17·1	− 108·8	− 105·2	
23. 30	M	Moon	F	0·152	+ 0·024			+ 7·3		The coincidence of the two spectra appeared perfect.
23. 33	M	,,	F	0·152	+ 0·009			+ 3·5		
23. 36	M	,,	F	0·152	− 0·012			− 4·6		
23. 39	M	,,	F	0·152	− 0·005			− 1·9		
23. 42	M	,,	F	0·152	+ 0·010			+ 3·8		
3. 0. 5	M	Rigel	F	0·152	+ 0·062	+ ¼	+ 13·8	+ 5·0	+ 3·8	Spectrum very tremulous. Star-line seen with great difficulty.
0. 15	M	,,	F	0·152	+ 0·118	+ ½	+ 13·8	+ 22·0	+ 21·5	
0. 20	M	Sirius.....	F	0·152	+ 0·107	+ ½	+ 7·6	+ 24·9	+ 27·7	Spectrum bright but tremulous. Star-line seen well. Definition fair. Direct comparison seemed to show that the displacement was practically *nil*, if anything very slight towards the red.
0. 25	M	,,	F	0·152	+ 0·040	+ ⅕	+ 7·6	+ 4·5	+ 6·5	
0. 30	M	,,	F	0·152	+ 0·105	+ ⅖	+ 7·6	+ 24·3	+ 20·6	
0. 35	M	,,	F	0·152	+ 0·025	+ 1/10	+ 7·6	0·0	− 0·5	
0. 40	M	,,	F	0·152	+ 0·093	+ ⅖	+ 7·6	+ 20·7	+ 20·6	
0. 45	M	,,	F	0·152	+ 0·030	+ 1/10	+ 7·6	+ 1·5	− 0·5	
0. 50	M	Procyon.....	F	0·152	+ 0·064	+ ¼	+ 6·2	+ 13·2	+ 11·4	Spectrum bright and fairly steady. Definition good. Star-line fairly well seen.
1. 0	M	,,	F	0·152	+ 0·110	+ ½	+ 6·2	+ 27·2	+ 29·0	
1. 20	M	Castor	F	0·152	− 0·073	− 3/10	+ 8·0	− 30·1	− 29·2	Spectrum fairly bright and steady. Star-line fairly well seen. Displacement large towards the blue.
1. 30	M	,,	F	0·152	− 0·111	− ½	+ 8·0	− 41·7	− 43·2	Position Circle, 6°.
Feb. 12. 21. 0	M	Sirius.....	F	0·138	+ 0·026	+ 1/10	+ 9·6	− 1·7	− 2·9	Spectrum exceedingly tremulous.
21. 15	M	,,	F	0·138	− 0·005	0	+ 9·6	− 11·5	− 9·6	
21. 30	M	,,	F	0·138	− 0·029	− 1/10	+ 9·6	− 18·4	− 16·3	
21. 40	M	,,	F	0·138	− 0·036	− 1/10	+ 9·6	− 20·5	− 16·3	
22. 0	M	Rigel	F	0·138	+ 0·057	+ ¼	+ 15·0	+ 2·3	+ 1·7	Spectrum very tremulous. Star-line very difficult to see.
22. 15	M	,,	F	0·138	+ 0·048	+ ¼	+ 15·0	− 0·4	+ 1·7	
22. 25	M	γ Orionis	F	0·138	+ 0·146	+ ⅔	+ 16·3	+ 28·0	+ 28·2	Spectrum fairly steady. Definition fairly good.
22. 35	M	,,	F	0·138	+ 0·134	+ ⅗	+ 16·3	+ 24·4	+ 23·8	Position Circle, 6°.
Feb. 15. 22. 45	M	β Persei.....	F	0·138	− 0·183	− ¾	+ 17·4	− 73·0	− 67·5	Spectrum faint. Star-line faint and diffused and seen with difficulty. Definition poor.
22. 50	M	,,	F	0·138	− 0·161	− ⅔	+ 17·4	− 66·3	− 61·9	
23. 0	M	,,	F	0·138	− 0·078	− ⅓	+ 17·4	− 41·1	− 39·7	
23. 10	M	,,	F	0·138	− 0·065	− ⅓	+ 17·4	− 37·1	− 39·7	
23. 15	M	,,	F	0·138	− 0·070	− ¼	+ 17·4	− 38·7	− 34·1	
23. 20	M	,,	F	0·138	− 0·106	− ½	+ 17·4	− 49·6	− 50·8	
23. 35	M	Capella	F	0·138	+ 0·070	+ ⅓	+ 15·9	+ 5·4	+ 6·4	Spectrum steady and fairly bright, but definition poor.
23. 50	M	,,	F	0·138	+ 0·156	+ ¾	+ 15·9	+ 31·5	+ 34·2	
16. 0. 10	M	Castor	F	0·138	+ 0·072	+ ⅓	+ 11·5	+ 10·4	+ 10·8	Spectrum fairly bright and steady, but definition poor. Star-line seen with much difficulty.
0. 20	M	,,	F	0·138	− 0·123	− ½	+ 11·5	− 48·9	− 44·9	
0. 30	M	,,	F	0·138	+ 0·038	+ ⅕	+ 11·5	+ 0·1	+ 1·9	
0. 40	M	,,	F	0·138	− 0·069	− ¼	+ 11·5	− 32·5	− 28·2	
0. 55	M	Pollux	F	0·138	− 0·092	− ⅓	+ 10·8	− 38·8	− 33·1	Spectrum bright and fairly steady, but definition poor. Star-line seen with much difficulty.
1. 10	M	,,	F	0·138	− 0·129	− ½	+ 10·8	− 50·0	− 44·2	Position Circle, 6°.

Date, 1887. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement. Measured.	Displacement. Estimated.	Earth's Motion in Miles per Second.	Concluded Motion of Stars in Miles per Second. Measured.	Concluded Motion of Stars in Miles per Second. Estimated.	REMARKS.
d h m				r	r					
Feb. 16. 19. 32	M	γ Cassiopeiæ...	F	0·138	−0·139	− 3/5	+ 12·0	− 54·2	− 52·3	The bright F line which was very distinct with the single-prism spectroscope was a very difficult object with the half-prism spectroscope and could not be held steadily. It was a narrow line and seemed to elude bisection. Spectrum not seen well at second observation, seen best at sixth.
19. 39	M	,,	F	0·138	−0·063	− 1/2	+ 12·0	− 31·1	− 45·6	
19. 40	M	,,	F	0·138	+0·240	+ 2/3	+ 12·0	+ 60·9	+ 32·7	
19. 41	M	,,	F	0·138	+0·076	+ 1/2	+ 12·0	+ 11·1	+ 21·6	
19. 43	M	,,	F	0·138	+0·066	+ 1/2	+ 12·0	+ 8·0	+ 10·4	
19. 45	M	,,	F	0·138	+0·091	+ 1/2	+ 12·0	+ 15·6	+ 21·6	
20. 0	M	γ Andromedæ.	F	0·138	−0·042	− 1/5	+ 16·1	− 28·8	− 29·5	Spectrum faint, but fairly steady. Star-line faint and seen with difficulty. Displacement evidently small.
20. 2	M	,,	F	0·138	+0·060	+ 3/10	+ 16·1	+ 2·1	+ 4·0	
20. 10	M	β Persei	F	0·138	−0·199	− 3/4	+ 17·4	− 77·8	− 67·7	Spectrum bright and fairly steady, but definition poor. Star-line seen best in last observation.
20. 12	M	,,	F	0·138	−0·179	− 3/4	+ 17·4	− 71·8	− 67·7	
20. 14	M	,,	F	0·138	−0·099	− 1/2	+ 17·4	− 47·5	− 51·0	
20. 16	M	,,	F	0·138	−0·068	− 1/4	+ 17·4	− 38·0	− 34·2	
20. 18	M	,,	F	0·138	+0·044	+ 1/4	+ 17·4	− 4·0	− 0·6	
20. 20	M	,,	F	0·138	−0·024	− 1/10	+ 17·4	− 24·7	− 24·1	
20. 27	M	α Persei	F	0·138	+0·076	+ 1/2	+ 16·3	+ 6·8	+ 17·3	Star-line of the Procyon type. The central line was not seen well, although the spectrum was bright and fairly steady.
20. 30	M	,,	F	0·138	0·000	0	+ 16·3	− 16·3	− 16·3	
20. 33	M	,,	F	0·138	−0·012	− 1/10	+ 16·3	− 19·9	− 23·0	
20. 35	M	,,	F	0·138	−0·013	− 1/10	+ 16·3	− 20·3	− 23·0	
20. 43	M	Aldebaran.....	F	0·138	+0·149	+ 3/4	+ 18·4	+ 26·9	+ 31·9	Spectrum fairly bright and steady. Star-line rather faint.
20. 48	M	,,	F	0·138	+0·136	+ 2/3	+ 18·4	+ 22·9	+ 26·3	
20. 53	M	Rigel	F	0·138	+0·057	+ 1/3	+ 15·4	+ 1·9	+ 7·0	Spectrum bright, but very tremulous. Star-line faint. Definition poor.
20. 55	M	,,	F	0·138	+0·012	+ 1/10	+ 15·4	− 11·8	− 8·7	
21. 10	M	δ Orionis	F	0·138	+0·040	+ 1/6	+ 15·8	− 3·7	− 2·4	Spectrum somewhat faint and tremulous. Star-line faint in first two observations, but seen better in the last two. Definition poor.
21. 12	M	,,	F	0·138	+0·118	+ 1/2	+ 15·8	+ 20·0	+ 17·8	
21. 21	M	,,	F	0·138	+0·114	+ 1/2	+ 15·8	+ 18·8	+ 17·8	
21. 22	M	,,	F	0·138	+0·087	+ 1/2	+ 15·8	+ 10·6	+ 17·8	
21. 29	M	ε Orionis	F	0·138	+0·162	+ 3/4	+ 15·6	+ 33·6	+ 34·7	Spectrum fairly bright, but tremulous. Star-line narrow and fairly dark.
21. 31	M	,,	F	0·138	+0·051	+ 1/4	+ 15·6	− 0·1	+ 1·2	
21. 37	M	ζ Orionis	F	0·138	−0·109	− 1/3	+ 15·4	− 48·5	− 37·8	Spectrum fairly bright and steady. Star-line narrow and fairly dark.
21. 40	M	,,	F	0·138	+0·038	+ 1/4	+ 15·4	− 3·8	+ 1·4	
21. 41	M	,,	F	0·138	−0·002	0	+ 15·4	− 16·0	− 15·4	
21. 43	M	,,	F	0·138	−0·035	− 1/5	+ 15·4	− 26·0	− 28·8	
21. 50	M	γ Orionis	F	0·138	+0·017	+ 1/4	+ 16·8	− 11·7	0·0	Spectrum bright and somewhat tremulous. Star-line fairly dark.
21. 51	M	,,	F	0·138	−0·050	− 1/4	+ 16·8	− 32·0	− 33·6	
21. 52	M	,,	F	0·138	+0·105	+ 1/3	+ 16·8	+ 15·1	+ 5·6	
21. 54	M	,,	F	0·138	−0·017	− 1/10	+ 16·8	− 21·9	− 23·5	
22. 2	M	β Tauri	F	0·138	+0·042	+ 1/10	+ 17·2	− 4·5	− 10·5	Spectrum very bright and steady. Star-line fairly dark and not very diffused at edges.
22. 4	M	,,	F	0·138	+0·006	+ 1/10	+ 17·2	− 15·4	− 10·5	
22. 19	M	κ Orionis	F	0·138	−0·104	− 1/3	+ 14·1	− 45·7	− 36·5	Spectrum faint and tremulous. Star-line faint and seen with much difficulty.
22. 21	M	,,	F	0·138	+0·010	0	+ 14·1	− 11·1	− 14·1	
22. 27	M	γ Geminorum .	F	0·138	−0·291	−1	+ 14·4	−102·8	− 81·5	Spectrum bright and fairly steady. Star-line very broad and diffused.
22. 29	M	,,	F	0·138	−0·106	− 1/2	+ 14·4	− 46·6	− 48·0	
22. 37	M	Sirius	F	0·138	+0·052	+ 1/3	+ 10·3	+ 5·5	+ 12·1	Spectrum very bright, but exceedingly tremulous.
22. 38	M	,,	F	0·138	+0·100	+ 1/2	+ 10·3	+ 20·1	+ 23·3	
22. 40	M	,,	F	0·138	−0·067	− 1/4	+ 10·3	− 30·7	− 27·1	
22. 42	M	,,	F	0·138	−0·059	− 1/3	+ 10·3	− 28·2	− 32·7	
22. 44	M	,,	F	0·138	+0·125	+ 1/2	+ 10·3	+ 27·7	+ 23·3	
22. 45	M	,,	F	0·138	−0·082	− 1/2	+ 10·3	− 35·2	− 43·9	
22. 57	M	Procyon.....	F	0·138	−0·011	0	+ 10·0	− 13·3	− 10·0	Spectrum bright, but very tremulous. Star-line narrow but faint.
22. 58	M	,,	F	0·138	−0·008	0	+ 10·0	− 12·4	− 10·0	
23. 0	M	,,	F	0·138	+0·031	+ 1/4	+ 10·0	− 0·6	+ 6·8	
23. 1	M	,,	F	0·138	−0·021	− 1/10	+ 10·0	− 16·4	− 16·7	Position Circle, 6°.
Feb. 17. 12. 0	M	Sky.....	F	0·138						Sky spectrum was compared with that of hydrogen. No want of coincidence could be detected. Position Circle, 6°.

Date, 1887. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement. Measured.	Displacement. Estimated.	Earth's Motion in Miles per Second.	Concluded Motion of Stars in Miles per Second. Measured.	Concluded Motion of Stars in Miles per Second. Estimated.	REMARKS.
				r	r					
July d h m 4. 22. 25	M	Arcturus	F	0·167	−0·088	− ½	+ 15·0	− 41·7	− 48·4	Spectrum tremulous and rather faint.
22. 45	M	,,	F	0·167	−0·098	− ⅖	+ 15·0	− 44·8	− 41·7	Star-line not well seen. Observation made with difficulty.
										Position Circle, 6°.
July 11. 22. 15	M	Arcturus	F	0·160	−0·107	− ½	+ 15·2	− 47·7	− 47·7	Definition poor, although the spectrum
23. 0	M	,,	F	0·160	−0·078	− ⅖	+ 15·2	− 38·9	− 41·2	was bright.
23. 15	M	α Coronæ	F	0·160	+0·108	+ ½	+ 11·8	+ 21·0	+ 20·7	Spectrum somewhat faint and unsteady.
23. 30	M	,,	F	0·160	+0·106	+ ½	+ 11·8	+ 20·4	+ 20·7	
23. 45	M	α Ophiuchi ...	F	0·160	−0·073	− ⅓	+ 6·9	− 29·1	− 28·6	Spectrum tremulous and somewhat faint.
23. 55	M	,,	F	0·160	−0·023	− 1/10	+ 6·9	− 13·9	− 13·4	Definition poor.
12. 0. 10	M	α Lyræ	F	0·160	−0·092	− ⅓	+ 0·8	− 28·8	− 33·3	Spectrum bright. Star-line fairly well
0. 20	M	,,	F	0·160	−0·153	− ¾	+ 0·8	− 47·3	− 49·6	seen.
0. 45	M	α Aquilæ	F	0·160	−0·139	− ¾	− 2·9	− 39·3	− 40·4	Spectrum bright and fairly steady. Star-
0. 55	M	,,	F	0·160	−0·142	− ⅔	− 2·9	− 40·2	− 40·4	line fairly well seen.
1. 15	M	Moon	F	0·160	+0·017			+ 5·1		No want of coincidence could be perceived.
1. 18	M	,,	F	0·160	−0·025			− 7·6		Moon spectrum rather faint.
1. 21	M	,,	F	0·160	+0·003			+ 0·9		
1. 24	M	,,	F	0·160	−0·006			− 1·8		
1. 27	M	,,	F	0·160	+0·012			+ 3·6		
										Position Circle, 6°.
Aug. 22. 22. 31	M	α Lyræ	F	0·135	−0·146	− ⅗	+ 6·1	− 50·5	− 55·5	Spectrum bright and steady. Definition
22. 46	M	,,	F	0·135	−0·169	− ⅗	+ 6·1	− 57·4	− 55·5	good.
22. 56	M	γ Lyræ	F	0·135	−0·133	− ½	+ 6·5	− 46·9	− 47·6	Spectrum faint. Star-line seen with much
23. 11	M	,,	F	0·135	−0·201	− ⅗	+ 6·5	− 67·6	− 55·9	difficulty. Measures rough.
23. 31	M	ζ Aquilæ	F	0·135	−0·028	− 1/10	+ 9·6	− 18·1	− 17·8	Spectrum very faint. Star-line seen with
23. 46	M	,,	F	0·135	−0·087	− ⅓	+ 9·6	− 36·0	− 37·0	great difficulty. Measures rough.
23. 0. 1	M	α Aquilæ	F	0·135	−0·105	− ⅗	+ 7·7	− 39·6	− 40·6	Spectrum bright. Star-line somewhat
0. 11	M	,,	F	0·135	−0·195	− ⅘	+ 7·7	− 66·9	− 73·6	faint.
0. 26	M	α Cygni	F	0·135	−0·127	− ½	− 0·7	− 37·9	− 40·4	Spectrum bright and steady. Definition
0. 36	M	,,	F	0·135	−0·161	− ⅗	− 0·7	− 48·2	− 48·7	good.
1. 11	M	α Cephei	F	0·135	−0·123	− ⅓	− 4·3	− 33·1	− 36·8	Spectrum fairly bright. Star-line seen
1. 31	M	,,	F	0·135	−0·218	− ¼	− 4·3	− 61·9	− 57·4	fairly well.
										Position Circle, 6°.
Aug. 24. 21. 23	M	α Coronæ Bor.	F	0·090	−0·064	− 3/10	+ 12·1	− 31·5	− 30·8	Spectrum faint. Measures made with
21. 53	M	,,	F	0·090	−0·073	− 3/10	+ 12·1	− 34·3	− 30·8	extreme difficulty.
22. 18	M	α Ophiuchi ...	F	0·090	−0·091	− ⅓	+ 13·7	− 41·3	− 34·4	Spectrum faint. Star-line not well seen.
22. 43	M	,,	F	0·090	−0·106	− ⅓	+ 13·7	− 45·9	− 34·4	
23. 8	M	α Lyræ	F	0·090	−0·189	− ⅔	+ 6·3	− 63·7	− 47·8	Spectrum bright, but star-line ill-defined
23. 28	M	,,	F	0·090	−0·185	− ⅔	+ 6·3	− 62·5	− 47·8	and very difficult to bisect.
23. 58	M	α Aquilæ	F	0·090	−0·132	− ½	+ 8·1	− 48·2	− 39·2	Spectrum fairly bright. Star-line difficult
25. 0. 13	M	,,	F	0·090	−0·146	− ½	+ 8·1	− 52·5	− 39·2	to bisect.
										Position Circle, 6°.
Aug. 31. 22. 35	M	α Lyræ	F	0·163	−0·189	− ⅔	+ 6·9	− 64·3	− 63·2	Spectrum unsteady and definition poor.
22. 38	M	,,	F	0·163	−0·112	− ⅔	+ 6·9	− 40·9	− 63·2	Spectrum faint for so bright a star.
22. 47	M	,,	F	0·163	−0·128	− ½	+ 6·9	− 45·8	− 49·1	Spectrum and star-line seen a little better
22. 56	M	,,	F	0·163	−0·155	− ⅗	+ 6·9	− 54·0	− 57·5	than in first two measures.
23. 10	M	α Aquilæ	F	0·163	−0·262	− ¾	+ 9·7	− 89·2	− 73·0	Spectrum fairly bright and steady, but
23. 14	M	,,	F	0·163	−0·105	− ⅓	+ 9·7	− 41·6	− 60·3	star-line very ill-defined.
23. 18	M	,,	F	0·163	−0·230	− ⅗	+ 9·7	− 79·5	− 60·3	
23. 22	M	,,	F	0·163	−0·211	− ⅗	+ 9·7	− 73·8	− 60·3	
23. 27	M	α Cygni	F	0·163	−0·139	− ½	+ 0·7	− 42·9	− 42·9	Spectrum fairly steady and star-line fairly
23. 33	M	,,	F	0·163	−0·169	− ⅗	+ 0·7	− 52·0	− 51·3	well defined.
23. 40	M	Moon	F	0·163	−0·022			− 6·7		The coincidence of the two spectra
23. 43	M	,,	F	0·163	+0·018			+ 5·5		appeared perfect.
23. 46	M	,,	F	0·163	+0·017			+ 5·1		
23. 49	M	,,	F	0·163	+0·017			+ 5·1		
23. 52	M	,,	F	0·163	−0·017			− 5·1		

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d h m				r	r					
Sept. 1. 0. 0		α Pegasi.....	F	0·163	−0·137	− ½	− 4·0	− 37·6	− 38·2	Spectrum faint; star-line ill-defined, measures rough.
0. 2	M	,,	F	0·163	−0·069	− ¼	− 4·0	− 17·0	− 17·1	
0. 4	M	,,	F	0·163	−0·113	− ⅗	− 4·0	− 30·3	− 46·6	
0. 6	M	,,	F	0·163	−0·075	− ¼	− 4·0	− 18·8	− 17·1	
0. 10	M	γ Pegasi.....	F	0·163	−0·139	− ⅓	− 8·7	− 33·5	− 19·4	Spectrum faint but steady. Definition fair.
0. 13	M	,,	F	0·163	−0·129	− ½	− 8·7	− 30·5	− 33·5	
0. 16	M	,,	F	0·163	−0·061	− ⅓	− 8·7	− 9·8	− 19·4	
0. 19	M	,,	F	0·163	−0·085	− ⅓	− 8·7	− 17·1	− 19·4	
0. 25	M	α Andromedæ.	F	0·163	−0·076	− ⅓	− 9·2	− 13·9	− 18·9	Spectrum fairly bright and steady. Star-line ill-defined.
0. 30	M	,,	F	0·163	−0·136	− ½	− 9·2	− 32·1	− 33·0	Position Circle, 6°.
Sept. 2. 21. 3	M	α Lyræ	F	0·163	−0·155	− ⅗	+ 7·1	− 54·2	− 57·7	Spectrum bright and steady. Definition good.
21. 23	M	,,	F	0·163	−0·109	− ⅖	+ 7·1	− 40·2	− 40·9	Position Circle, 6°.
Oct. 10. 20. 53	M	α Lyræ	F	0·460	−0·208	− ⅓	+ 8·7	− 71·9	− 64·5	Definition fair.
20. 58	M	,,	F	0·460	−0·101	− ¼	+ 8·7	− 39·3	− 50·5	
21. 8	M	α Aquilæ	F	0·460	−0·012	0	+ 15·7	− 19·3	− 15·7	Spectrum bright and steady. Star-line seen very well.
21. 13	M	,,	F	0·460	+0·026	0	+ 15·7	− 7·8	− 15·7	
21. 43	M	δ Cygni	F	0·460	+0·165	+ ¼	+ 7·1	+ 43·0	+ 34·7	Spectrum faint. Star-line seen with some difficulty.
21. 52	M	,,	F	0·460	−0·185	− ¼	+ 7·1	− 63·3	− 48·9	
22. 0	M	,,	F	0·460	−0·131	− ¼	+ 7·1	− 46·9	− 48·9	
22. 10	M	,,	F	0·460	−0·086	− ⅕	+ 7·1	− 33·2	− 40·5	Position Circle, 6°.
Oct. 11. 12. 13	M	Sky.....	F	0·460	−0·030			− 9·1		No want of coincidence could be detected, but the sky spectrum and also the hydrogen spectrum were faint and not well seen.
12. 16	M	,,	F	0·460	+0·038			+ 11·5		
12. 19	M	,,	F	0·460	+0·042			+ 12·7		
12. 22	M	,,	F	0·460	+0·016			+ 4·8		
12. 25	M	,,	F	0·460	+0·021			+ 6·4		Position Circle, 6°.
Oct. 14. 20. 17	M	α Lyræ	F	0·200	−0·154	− ⅔	+ 8·7	− 55·5	− 52·2	Spectrum not very bright. Star-line bisected with some difficulty.
20. 27	M	,,	F	0·200	−0·074	− ⅓	+ 8·7	− 31·2	− 30·5	
20. 47	M	α Aquilæ	F	0·200	+0·014	+ 1/10	+ 15·9	− 11·7	− 6·8	Spectrum rather faint, but star-line seen fairly well.
20. 51	M	,,	F	0·200	−0·020	− ¼	+ 15·9	− 22·0	− 38·7	
20. 55	M	γ Cygni	F	0·200	−0·079	− ⅓	+ 8·5	− 32·5	− 39·0	Spectrum and star-line faint. Star-line seen fairly well at time of bisection.
20. 59	M	,,	F	0·200	−0·060	− ¼	+ 8·5	− 26·7	− 31·3	
21. 7	M	α Cygni	F	0·200	−0·118	− ⅓	+ 6·8	− 42·6	− 37·3	Spectrum faint but steady. Star-line distinct and steady.
21. 11	M	,,	F	0·200	−0·094	− ¼	+ 6·8	− 35·4	− 29·6	
21. 19	M	ε Cygni	F	0·200	−0·015	0	+ 9·9	− 14·4	− 9·9	Spectrum faint. Star-line seen with extreme difficulty.
21. 23	M	,,	F	0·200	+0·071	+ ¼	+ 9·9	+ 11·6	+ 12·9	
21. 37	M	α Cephei	F	0·200	−0·190	− ¾	+ 1·2	− 58·9	− 69·7	Spectrum faint. Star-line broad, dark, and diffused at edges.
21. 43	M	,,	F	0·200	−0·201	− ½	+ 1·2	− 62·2	− 46·9	
21. 51	M	ε Pegasi	F	0·200	+0·138	+ ½	+ 13·3	+ 28·6	+ 32·4	Spectrum faint. Star-line faint but sharp. Seen with some difficulty.
21. 55	M	,,	F	0·200	+0·124	+ ½	+ 13·3	+ 24·3	+ 32·4	
22. 5	M	α Pegasi	F	0·200	0·000	0	+ 8·5	− 8·5	− 8·5	Spectrum faint. Star-line broad and diffused, but dark.
22. 9	M	,,	F	0·200	+0·019	+ 1/10	+ 8·5	− 2·7	+ 0·6	
22. 47	M	α Andromedæ.	F	0·200	+0·003	0	+ 2·5	− 1·6	− 2·5	Spectrum rather faint but steady. Star-line seen fairly well.
22. 57	M	,,	F	0·200	−0·025	− 1/10	+ 2·5	− 10·1	− 11·6	
23. 12	M	γ Pegasi	F	0·200	−0·028	− 1/10	+ 4·3	− 12·8	− 13·4	Spectrum faint. Star-line diffused. Measures made with great difficulty.
23. 25	M	,,	F	0·200	−0·114	− ⅖	+ 4·3	− 38·9	− 40·9	
23. 45	M	α Arietis	F	0·200	−0·013	− 1/10	− 4·7	+ 0·8	− 4·4	Spectrum faint. Star-line seen with extreme difficulty.
15. 0. 5	M	,,	F	0·200	−0·021	− 1/10	− 4·7	− 1·7	− 4·4	
0. 40	M	Aldebaran.....	F	0·200	+0·115	+ ⅖	− 13·5	+ 48·4	+ 50·1	Spectrum somewhat faint. Star-line seen with much difficulty.
0. 55	M	,,	F	0·200	+0·109	+ ⅓	− 13·5	+ 46·6	+ 44·0	Position Circle, 6°.

Date, 1887. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement. Measured.	Displacement. Estimated.	Earth's Motion in Miles per Second.	Concluded Motion of Stars in Miles per Second. Measured.	Concluded Motion of Stars in Miles per Second. Estimated.	REMARKS.
d h m				r	r					
Oct. 19. 20. 2	M	α Pegasi	F	0·200	−0·053	− 1/5	+ 9·8	− 25·9	− 28·1	Spectrum faint but steady. Star-line dark. Definition fair.
20. 17	M	,,	F	0·200	−0·032	− 1/10	+ 9·8	− 19·5	− 18·9	
20. 37	M	α Andromedæ.	F	0·200	−0·085	− 1/10	+ 3·9	− 29·7	− 31·3	Spectrum faint but steady. Star-line rather faint. Definition fair.
20. 52	M	,,	F	0·200	−0·061	− 1/5	+ 3·9	− 22·4	− 22·2	
21. 7	M	γ Pegasi	F	0·200	−0·009	0	+ 5·7	− 8·4	− 5·7	Spectrum faint but steady, and star-line seen only occasionally.
21. 22	M	,,	F	0·200	−0·089	− 1/3	+ 5·7	− 32·7	− 36·2	
21. 47	M	β Cassiopeiæ ...	F	0·200	+0·103	+ 1/3	− 1·5	+ 32·8	+ 32·0	Observations made with very great difficulty. Spectrum faint but steady. Star-line, broad, faint, and diffused. Measures rough.
22. 7	M	,,	F	0·200	−0·061	− 1/5	− 1·5	− 17·0	− 16·8	
22. 32	M	α Cassiopeiæ...	F	0·200	+0·042	+ 1/10	− 2·2	+ 14·9	+ 11·3	Spectrum faint but steady. Observations made with extreme difficulty.
22. 47	M	,,	F	0·200	+0·035	+ 1/10	− 2·2	+ 12·8	+ 11·3	
23. 7	M	γ Cassiopeiæ...	F	0·200	−0·047	− 1/5	− 3·4	− 10·8	− 14·9	Spectrum steady, but rather faint. The hydrogen line in the star was distinctly a bright line, but not much brighter than the spectrum. It appeared broader and more diffused than usual.
23. 17	M	,,	F	0·200	−0·088	− 1/3	− 3·4	− 23·3	− 27·1	
23. 37	M	β Persei.....	F	0·200	−0·196	− 2/3	− 8·1	− 51·4	− 52·8	Spectrum steady and fairly bright. Star-line seen fairly well.
23. 42	M	,,	F	0·200	−0·214	− 2/3	− 8·1	− 56·9	− 52·8	
23. 47	M	,,	F	0·200	−0·193	− 2/3	− 8·1	− 49·9	− 52·8	
23. 57	M	,,	F	0·200	−0·183	− 2/3	− 8·1	− 47·5	− 52·8	
20. 0. 7	M	α Persei	F	0·200	−0·127	− 2/5	− 9·0	− 29·6	− 27·6	Spectrum steady and fairly bright. Star-line seen fairly well.
0. 17	M	,,	F	0·200	−0·109	− 2/5	− 9·0	− 24·1	− 27·6	
0. 27	M	Aldebaran ...	F	0·200	+0·121	+ 2/5	− 12·4	+ 49·1	+ 49·0	Spectrum rather tremulous. Star-line not seen well and only by glimpses. Definition poor.
0. 32	M	,,	F	0·200	+0·059	+ 1/5	− 12·4	+ 30·3	+ 30·7	
0. 37	M	,,	F	0·200	+0·169	+ 3/5	− 12·4	+ 63·7	+ 67·2	
0. 57	M	Rigel.....	F	0·200	+0·098	+ 1/3	− 12·0	+ 41·8	+ 42·5	Spectrum tremulous. Definition poor. Star-line not well seen.
1. 12	M	,,	F	0·200	+0·036	+ 1/5	− 12·0	+ 22·9	+ 30·3	Position Circle, 6°.
Oct. 21. 21. 35	M	α Andromedæ	F	0·200	−0·008	0	+ 4·5	− 6·9	− 4·5	Spectrum fairly bright and steady for the last two observations. The spectrum was faint for the first two observations.
21. 45	M	,,	F	0·200	−0·151	− 1/2	+ 4·5	− 50·3	− 50·2	
21. 50	M	,,	F	0·200	−0·035	− 1/10	+ 4·5	− 15·1	− 13·6	
22. 0	M	,,	F	0·200	−0·066	− 3/10	+ 4·5	− 24·5	− 31·9	
22. 10	M	β Arietis	F	0·200	+0·151	+ 1/2	− 1·4	+ 47·2	+ 47·1	Spectrum faint, but star-line dark and seen fairly well.
22. 15	M	,,	F	0·200	+0·161	+ 3/5	− 1·4	+ 50·3	+ 56·2	
22. 24	M	α Arietis	F	0·200	−0·092	− 1/3	− 2·6	− 25·3	− 27·9	Spectrum somewhat faint. Star-line exceedingly faint and only seen by glimpses. Measures very rough.
22. 27	M	,,	F	0·200	+0·155	+ 3/5	− 2·6	+ 49·7	+ 57·4	
22. 30	M	,,	F	0·200	+0·085	+ 2/5	− 2·6	+ 28·4	+ 39·2	
22. 33	M	,,	F	0·200	+0·081	+ 1/3	− 2·6	+ 27·2	+ 33·1	
22. 40	M	β Persei.....	F	0·200	−0·378	− 1	− 7·6	− 107·2	− 83·7	Spectrum bright and steady. Star-line seen very well. Displacement evidently large towards the blue.
22. 44	M	,,	F	0·200	−0·299	− 3/4	− 7·6	− 83·2	− 60·9	
22. 48	M	,,	F	0·200	−0·293	− 3/4	− 7·6	− 81·4	− 60·9	
22. 52	M	,,	F	0·200	−0·201	− 3/5	− 7·6	− 53·4	− 47·2	
23. 10	M	α Persei	F	0·200	−0·156	− 3/5	− 8·6	− 38·7	− 46·2	Spectrum bright, but rather tremulous. Star-line somewhat difficult to hold. Definition variable.
23. 20	M	,,	F	0·200	−0·267	− 3/4	− 8·6	− 72·5	− 59·9	
23. 25	M	Capella	F	0·200	+0·094	+ 2/5	− 13·5	+ 42·0	+ 50·1	Spectrum bright and steady. Star-line seen fairly well.
23. 28	M	,,	F	0·200	+0·214	+ 2/3	− 13·5	+ 78·5	+ 74·4	
23. 31	M	,,	F	0·200	+0·049	+ 1/4	− 13·5	+ 28·4	+ 36·3	
23. 35	M	,,	F	0·200	+0·154	+ 2/5	− 13·5	+ 60·3	+ 50·1	
23. 40	M	β Aurigæ	F	0·200	+0·046	+ 1/4	− 15·0	+ 28·9	+ 37·8	Spectrum bright and steady. Star-line seen fairly well.
23. 45	M	,,	F	0·200	+0·127	+ 1/3	− 15·0	+ 53·6	+ 45·5	
23. 50	M	β Tauri.....	F	0·200	−0·058	− 1/10	− 14·7	− 2·9	+ 5·6	Spectrum fairly bright and steady. Star-line seen fairly well occasionally, especially during the third observation. Not seen well at the second.
23. 54	M	,,	F	0·200	−0·192	− 1/2	− 14·7	− 43·6	− 31·0	
23. 58	M	,,	F	0·200	−0·063	− 1/4	− 14·7	− 4·4	− 8·1	
22. 0. 3	M	,,	F	0·200	−0·139	− 1/3	− 14·7	− 27·5	− 15·8	
0. 7	M	γ Orionis	F	0·200	−0·029	− 1/10	− 13·8	+ 5·0	+ 4·7	Spectrum fairly bright and steady. Definition good. Star-line well seen.
0. 10	M	,,	F	0·200	−0·005	0	− 13·8	+ 12·3	+ 13·8	
0. 13	M	Rigel.....	F	0·200	−0·012	0	− 11·6	+ 8·0	+ 11·6	Spectrum bright but tremulous. Star-line never held steadily for long. Seen best at the first, fifth, and sixth observations.
0. 16	M	,,	F	0·200	−0·077	− 1/4	− 11·6	− 11·8	− 11·2	
0. 18	M	,,	F	0·200	+0·149	+ 1/1	− 11·6	+ 56·8	+ 42·1	
0. 20	M	,,	F	0·200	+0·148	+ 1/2	− 11·6	+ 56·5	+ 57·3	
0. 22	M	,,	F	0·200	+0·052	+ 1/4	− 11·6	+ 27·4	+ 34·4	
0. 25	M	,,	F	0·200	+0·078	+ 3/10	− 11·6	+ 35·3	+ 39·0	

Date, 1887. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement. Measured.	Displacement. Estimated.	Earth's Motion in Miles per Second.	Concluded Motion of Stars in Miles per Second. Measured.	Concluded Motion of Stars in Miles per Second. Estimated.	REMARKS.
d h m				r	r					
Oct. 22. 0. 30	M	Aldebaran.....	F	0·200	+0·080	+ 2/5	− 11·9	+ 36·2	+ 48·5	Spectrum rather faint for this star. Definition poor.
0. 33	M	,,	F	0·200	+0·125	+ 1/2	− 11·9	+ 49·8	+ 57·6	
0. 36	M	,,	F	0·200	+0·145	+ 1/2	− 11·9	+ 55·9	+ 57·6	
0. 40	M	,,	F	0·200	+0·065	+ 1/4	− 11·9	+ 31·6	+ 34·7	Position Circle, 6°.
Oct. 22. 12. 0	M	Sky	F	0·200	−0·006			− 1·8		The coincidence of the two spectra appeared perfect.
12. 5	M	,,	F	0·200	+0·034			+ 10·3		
12. 10	M	,,	F	0·200	−0·005			− 1·5		
12. 15	M	,,	F	0·200	−0·008			− 2·4		
12. 20	M	,,	F	0·200	+0·017			+ 5·1		Position Circle, 6°.
Oct. 24. 21. 38	M	α Pegasi.....	F	0·250	−0·067	− 1/4	+ 11·1	− 31·4	− 32·8	Spectrum fairly bright and steady. Definition good.
21. 58	M	,,	F	0·250	−0·066	− 1/4	+ 11·1	− 31·1	− 32·8	
22. 14	M	Moon	F	0·250	−0·027			− 8·2		The coincidence of the two spectra appeared perfect. Both spectra seen well.
22. 17	M	,,	F	0·250	+0·009			+ 2·7		
22. 20	M	,,	F	0·250	+0·005			+ 1·5		
22. 23	M	,,	F	0·250	−0·008			− 2·4		
22. 27	M	,,	F	0·250	−0·001			− 0·3		
22. 37	M	β Persei	F	0·250	−0·217	− 3/10	− 6·8	− 59·1	− 19·2	Spectrum bright, but rather tremulous. Star-line fairly well seen.
22. 47	M	,,	F	0·250	−0·159	− 3/10	− 6·8	− 41·5	− 19·2	
23. 5	M	,,	F	0·250	−0·083	− 2/5	− 6·8	− 18·4	− 27·9	
23. 17	M	,,	F	0·250	−0·134	− 1/2	− 6·8	− 33·9	− 36·6	
23. 24	M	α Persei	F	0·250	−0·134	− 1/2	− 7·9	− 32·8	− 35·5	Spectrum bright, but rather tremulous. Star-line fairly well seen.
23. 30	M	,,	F	0·250	−0·197	− 2/5	− 7·9	− 51·9	− 44·2	
23. 40	M	Capella	F	0·250	−0·004	0	− 13·0	+ 11·8	+ 13·0	Spectrum bright but tremulous. Star-line seen well at intervals.
23. 44	M	,,	F	0·250	+0·157	+ 3/5	− 13·0	+ 60·7	+ 65·1	
23. 48	M	,,	F	0·250	+0·093	+ 1/3	− 13·0	+ 41·2	+ 42·0	
23. 52	M	,,	F	0·250	+0·089	+ 2/5	− 13·0	+ 40·0	+ 47·7	
23. 57	M	β Aurigæ	F	0·250	+0·078	+ 1/3	− 14·5	+ 38·2	+ 43·5	Spectrum bright and fairly steady. Star-line fairly well seen.
25. 0. 2	M	,,	F	0·250	+0·040	+ 1/10	− 14·5	+ 26·6	+ 23·2	
0. 8	M	α Aldebaran ...	F	0·250	+0·228	+ 2/3	− 11·1	+ 80·3	+ 69·0	Spectrum bright and fairly steady, but star-line faint and seen with difficulty.
0. 13	M	,,	F	0·250	+0·099	+ 1/3	− 11·1	+ 41·2	+ 40·1	
0. 19	M	Rigel	F	0·250	+0·149	+ 1/2	− 11·1	+ 56·3	+ 54·5	Spectrum bright and star-line well seen.
0. 21	M	,,	F	0·250	+0·079	+ 1/10	− 11·1	+ 35·1	+ 19·8	
0. 28	M	γ Orionis	F	0·250	−0·049	− 1/5	− 13·3	− 1·6	− 4·1	Spectrum bright but tremulous. Star-line difficult to bisect.
0. 31	M	,,	F	0·250	+0·062	+ 1/5	− 13·3	+ 32·1	+ 35·0	
0. 34	M	,,	F	0·250	−0·029	− 1/10	− 13·3	+ 4·5	+ 4·6	
0. 36	M	,,	F	0·250	+0·058	+ 1/4	− 13·3	+ 30·9	+ 35·0	
0. 40	M	β Tauri	F	0·250	−0·112	− 1/2	− 14·1	− 19·9	− 29·3	Spectrum bright and fairly steady. Star-line seen fairly well.
0. 43	M	,,	F	0·250	−0·040	− 1/5	− 14·1	+ 2·0	− 3·3	
0. 46	M	,,	F	0·250	−0·043	− 1/5	− 14·1	+ 1·0	− 3·3	
0. 49	M	,,	F	0·250	+0·001	0	− 14·1	+ 14·4	+ 14·1	
0. 53	M	δ Orionis	F	0·250	−0·069	− 1/4	− 13·0	− 8·0	− 8·7	Spectrum fairly bright, but tremulous. Star-line seen much better than usual with this star.
0. 56	M	,,	F	0·250	+0·002	0	− 13·0	+ 13·6	+ 13·0	
0. 59	M	,,	F	0·250	−0·018	− 1/20	− 13·0	+ 7·5	+ 8·7	
1. 2	M	,,	F	0·250	+0·024	+ 1/5	− 13·0	+ 5·7	+ 30·4	
1. 8	M	ε Orionis	F	0·250	+0·090	+ 1/4	− 13·1	+ 40·4	+ 34·8	Spectrum bright but tremulous. Star-line seen better than usual.
1. 12	M	,,	F	0·250	+0·051	+ 1/4	− 13·1	+ 28·6	+ 34·8	
1. 16	M	ζ Orionis	F	0·250	−0·065	− 1/10	− 13·2	− 6·5	+ 4·5	Spectrum bright and tremulous. Star-line seen better than usual with this star, but held with difficulty.
1. 19	M	,,	F	0·250	+0·048	+ 1/10	− 13·2	+ 27·8	+ 21·9	
1. 22	M	,,	F	0·250	−0·018	0	− 13·2	+ 7·7	+ 13·2	
1. 25	M	,,	F	0·250	+0·015	+ 1/20	− 13·2	+ 17·7	+ 17·5	
1. 30	M	Gt. Nebula in Orion.	F	0·250	−0·141	− 1/3	− 5·0	− 37·8	− 24·0	Lines in Nebula very faint and bisections very rough.
1. 33	M	,,	F	0·250	+0·011	+ 1/20	− 5·0	+ 8·3	+ 9·3	
1. 36	M	,,	F	0·250	+0·007	+ 1/20	− 5·0	+ 7·1	+ 9·3	
1. 39	M	,,	F	0·250	−0·143	− 1/3	− 5·0	− 38·4	− 24·0	
1. 42	M	,,	F	0·250	−0·097	− 1/3	− 5·0	− 24·5	− 24·0	
1. 45	M	,,	F	0·250	+0·019	+ 1/20	− 5·0	+ 10·8	+ 9·3	

Date, 1887. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement. Measured.	Displacement. Estimated.	Earth's Motion in Miles per Second.	Concluded Motion of Stars in Miles per Second. Measured.	Concluded Motion of Stars in Miles per Second. Estimated.	REMARKS.
d h m				r	r					
Oct. 25. 1. 53	M	Sirius	F	0·250	−0·057	− ¼	− 13·6	− 3·7	− 8·1	Spectrum very bright, but very tremulous.
1. 57	M	,,	F	0·250	+0·108	+ ⅓	− 13·6	+ 46·4	+ 42·6	Direct comparison failed to show any
2. 1	M	,,	F	0·250	+0·154	+ ½	− 13·6	+ 60·4	+ 57·0	distinct displacement in either direction.
2. 5	M	,,	F	0·250	+0·048	+ ⅕	− 13·6	+ 28·2	+ 31·0	
2. 9	M	,,	F	0·250	+0·128	+ ⅖	− 13·6	+ 52·5	+ 48·3	
2. 13	M	,,	F	0·250	+0·066	+ ¼	− 13·6	+ 33·6	+ 35·3	
										Position Circle, 6°.
Oct. 28. 21. 52	M	β Pegasi	b_1	0·140	−0·131	− ⅓	+ 9·6	− 58·8	− 51·5	Spectrum somewhat faint and a little
21. 58	M	,,	b_1	0·140	−0·121	− ⅓	+ 9·6	− 55·0	− 51·5	tremulous. Definition good.
22. 4	M	,,	b_4	0·140	−0·065	− ⅕	+ 9·6	− 34·0	− 34·4	
22. 10	M	,,	b_4	0·140	−0·129	− ⅖	+ 9·6	− 58·0	− 39·1	
22. 16	M	,,	b_4	0·140	−0·121	− ⅖	+ 9·6	− 55·0	− 59·1	
22. 22	M	,,	b_4	0·140	−0·184	− ⅗	+ 9·6	− 78·6	− 83·9	
22. 32	M	β Ceti	b_1	0·140	−0·133	− ⅖	+ 9·8	− 59·7	− 60·1	Spectrum rather faint and very tremulous.
22. 37	M	,,	b_1	0·140	−0·172	− ½	+ 9·8	− 74·3	− 72·7	Star-line faint and difficult to see. The b_1 line was narrow and sharp.
22. 42	M	Moon	b_1	0·140	−0·006			− 2·2		The coincidence of the spectra appeared
22. 44	M	,,	b_1	0·140	−0·003			− 1·1		perfect.
22. 46	M	,,	b_1	0·140	−0·002			− 0·7		
22. 48	M	,,	b_1	0·140	−0·003			− 1·1		
22. 50	M	,,	b_1	0·140	−0·004			− 1·5		
23. 2	M	β Andromedæ	b_1	0·140	+0·111	+ ¼	+ 1·9	+ 39·7	+ 29·5	Spectrum fairly bright but tremulous.
23. 12	M	,,	b_1	0·140	+0·068	+ ⅕	+ 1·9	+ 23·6	+ 23·3	Measures considered good.
23. 22	M	α Arietis	b_1	0·140	+0·043	+ 1/10	− 0·3	+ 16·4	+ 12·9	Spectrum fairly bright but tremulous.
23. 27	M	,,	b_1	0·140	−0·058	− ⅕	− 0·3	− 21·5	− 24·9	Displacement evidently very small.
23. 32	M	,,	b_1	0·140	+0·052	+ ¼	− 0·3	+ 19·8	+ 31·7	Star-line somewhat broad, diffused, and
23. 37	M	,,	b_1	0·140	−0·017	0	− 0·3	− 6·1	+ 0·3	not very dark.
23. 42	M	α Ceti	b_1	0·140	+0·020	+ 1/10	− 2·4	+ 9·9	+ 15·0	It seems clear that the edge of the dark
23. 46	M	,,	b_1	0·140	−0·034	− 1/10	− 2·4	− 10·3	− 10·2	fluted band in this star is not the b_4 line.
23. 50	M	,,	b_1	0·140	−0·002	0	− 2·4	+ 1·7	+ 2·4	Assuming the observations of the b_1 line
23. 54	M	,,	b_1	0·140	+0·001	0	− 2·4	+ 2·1	+ 2·4	to be correct, the wave length of the edge
23. 58	M	α Ceti	b_4	0·140	−0·389	−1½	− 2·4	−143·6	−183·4	of the band, corrected for motion of earth
Oct. 29. 0. 1	M	,,	b_4	0·140	−0·354	−1¼	− 2·4	−130·5	−152·5	and star, will be $\lambda = 5162·63$, Angström's value, 5166·88, for b_4 being assumed.
0. 10	M	Aldebaran	b_1	0·140	+0·085	+ ⅓	− 10·1	+ 42·0	+ 52·0	Spectrum bright but tremulous. Star-line
0. 15	M	,,	b_1	0·140	+0·097	+ 3/10	− 10·1	+ 46·5	+ 47·8	seen with difficulty.
0. 17	M	,,	b_1	0·140	+0·037	+ 1/10	− 10·1	+ 24·0	+ 22·7	
0. 20	M	,,	b_1	0·140	+0·123	+ ⅖	− 10·1	+ 56·3	+ 60·4	
0. 30	M	Capella	b_1	0·140	+0·112	+ ⅖	− 12·1	+ 54·1	+ 62·4	Spectrum very tremulous. Star-line seen
0. 35	M	,,	b_1	0·140	+0·059	+ 3/10	− 12·1	+ 34·3	+ 49·8	with difficulty, although the spectrum
0. 40	M	,,	b_1	0·140	+0·175	+ ⅞	− 12·1	+ 77·8	+ 75·0	was very bright.
0. 45	M	,,	b_1	0·140	+0·087	+ ⅓	− 12·1	+ 44·7	+ 54·0	
0. 55	M	α Orionis	b_1	0·140	+0·152	+ ½	− 14·1	+ 71·2	+ 77·0	Spectrum bright, but very tremulous.
1. 5	M	,,	b_1	0·140	+0·142	+ ½	− 14·1	+ 67·4	+ 77·0	Star-lines difficult to hold steadily.
1. 15	M	,,	b_4	0·140	+0·174	+ ½	− 14·1	+ 79·4	+ 76·0	
1. 25	M	,,	b_4	0·140	+0·162	+ ½	− 14·1	+ 74·9	+ 76·0	
1. 35	M	Pollux	b_1	0·140	−0·206	− ⅗	− 18·0	− 59·3	− 57·5	Spectrum bright, but very tremulous.
1. 42	M	,,	b_1	0·140	−0·107	− ⅓	− 18·0	− 22·2	− 23·9	Star-line difficult to hold steadily.
1. 48	M	,,	b_1	0·140	−0·197	− ⅗	− 18·0	− 55·9	− 57·5	
1. 55	M	,,	b_1	0·140	−0·252	− ⅘	− 18·0	− 76·6	− 65·8	
2. 17	M	Procyon	b_1	0·140	+0·075	+ ¼	− 17·6	+ 45·8	+ 49·0	Spectrum bright, but very tremulous.
2. 24	M	,,	b_1	0·140	+0·189	+ ⅗	− 17·6	+ 88·5	+ 93·1	Star-line very faint and difficult to
2. 32	M	,,	b_1	0·140	+0·077	+ ¼	− 17·6	+ 46·5	+ 49·0	observe.
2. 42	M	,,	b_1	0·140	+0·047	+ ⅕	− 17·6	+ 35·2	+ 42·8	
										Position Circle, 6°.
Oct. 31. 20. 40	M	α Cygni	b_1	0·120	−0·220	− ⅔	+ 8·4	− 91·0	− 76·5	Spectrum bright but tremulous. Defini-
20. 50	M	,,	b_1	0·120	−0·232	− ¾	+ 8·4	− 95·5	− 85·0	tion bad. Star-line faint and seen with great difficulty.
21. 5	M	γ Cygni	b_1	0·120	−0·008	0	+ 9·8	− 12·8	− 9·8	Spectrum faint and tremulous. Definition
21. 15	M	,,	b_1	0·120	−0·089	− ⅓	+ 9·8	− 43·2	− 43·8	bad. Star-line seen with difficulty.
21. 25	M	,,	b_1	0·120	−0·008	0	+ 9·8	− 12·8	− 9·8	
21. 35	M	,,	b_1	0·120	−0·007	0	+ 9·8	− 12·4	− 9·8	

Date, 1887. Greenwich Civil Time.	Observer.	Object.	Line.	Width of Slit.	Displacement.		Earth's Motion in Miles per Second.	Concluded Motion of Stars in Miles per Second.		REMARKS.
					Measured.	Estimated.		Measured.	Estimated.	
d h m				r	r					
Oct. 31. 21. 45	M	ε Cygni	b_1	0·120	−0·042	$-\frac{1}{10}$	+ 11·5	− 27·2	− 21·7	Spectrum faint and tremulous. Definition bad. Star-line faint and difficult to see. Measures rough and made with extreme difficulty.
21. 52	M	,,	b_1	0·120	+0·010	0	+ 11·5	− 7·7	− 11·5	
22. 0	M	,,	b_1	0·120	+0·030	$+\frac{1}{10}$	+ 11·5	− 0·2	− 1·3	
22. 10	M	,,	b_1	0·120	−0·002	0	+ 11·5	− 12·2	− 11·5	
22. 30	M	ε Pegasi	b_1	0·120	+0·140	$+\frac{1}{2}$	+ 16·0	+ 36·6	+ 35·0	Spectrum faint and tremulous. Definition bad. Star-line faint and difficult to see.
22. 50	M	,,	b_1	0·120	−0·028	$-\frac{1}{10}$	+ 16·0	− 26·5	− 26·2	
23. 20	M	β Pegasi.....	b_1	0·120	−0·046	$-\frac{1}{5}$	+ 10·3	− 27·6	− 30·7	Spectrum rather faint and tremulous. Star-line seen with difficulty.
23. 30	M	,,	b_1	0·120	−0·009	0	+ 10·3	− 13·7	− 10·3	
23. 43	M	α Cassiopeiæ...	b_1	0·120	+0·164	$+\frac{3}{5}$	+ 0·5	+ 61·1	+ 60·8	Spectrum fairly bright and steady. Star-line seen fairly well.
23. 52	M	,,	b_1	0·120	+0·152	$+\frac{1}{2}$	+ 0·5	+ 56·5	+ 50·5	
Nov. 1. 0. 4	M	β Andromedæ	b_1	0·120	+0·045	$+\frac{1}{5}$	+ 2·8	+ 14·1	+ 17·6	Spectrum fairly bright and steady. Star-line dark and fairly well seen. Observation considered good.
0. 12	M	,,	b_1	0·120	+0·112	$+\frac{2}{5}$	+ 2·8	+ 39·2	+ 38·1	
0. 24	M	γ Andromedæ	b_1	0·120	−0·035	$-\frac{1}{10}$	− 1·2	− 11·9	− 9·0	Spectrum fairly bright and steady. Star-line faint and seen with difficulty.
0. 30	M	,,	b_1	0·120	−0·077	$-\frac{3}{10}$	− 1·2	− 27·7	− 29·4	
0. 43	M	Moon	b_1	0·120	+0·004			+ 1·5		The two spectra were exactly coincident, both being exceedingly bright, distinct, and well-defined.
0. 46	M	,,	b_1	0·120	−0·009			− 3·4		
0. 49	M	,,	b_1	0·120	−0·003			− 1·1		
0. 52	M	,,	b_1	0·120	−0·002			− 0·7		
0. 55	M	,,	b_1	0·120	−0·004			− 1·5		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 1887.

(F for the Star or Moon is compared with Hβ of Hydrogen, and b_1, b_2, b_4 with Mg, Mg_1, Mg_3 of Magnesium.)

(+ denotes Recession; − Approach.)

Date, 1887.	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.
α ANDROMEDÆ. F line broad and nebulous. Estimated total breadth, 18 tenth-metres; central and more condensed portion, 8 tenth-metres.									
September 1	M	2	1	6	0·163	F	− 9·2	− 23·0	− 26·0
October 14	M	2	1	6	0·200	F	+ 2·5	− 5·9	− 7·1
19	M	2	1	6	0·200	F	+ 3·9	− 26·1	− 26·8
21	M	4	1	6	0·200	F	+ 4·5	− 24·2	− 25·1
β CASSIOPEIÆ. F line broad, faint, and diffused at the edges.									
October 19	M	2	1	6	0·200	F	− 1·5	+ 7·9	+ 7·6
γ PEGASI. F line broad and diffused at the edges.									
September 1	M	4	1	6	0·163	F	− 8·7	− 22·7	− 23·2
October 14	M	2	1	6	0·200	F	+ 4·3	− 25·9	− 27·2
19	M	2	1	6	0·200	F	+ 5·7	− 20·6	− 21·0
α CASSIOPEIÆ. F line narrow but faint; *b* lines fairly distinct.									
October 19	M	2	1	6	0·200	F	− 2·2	+ 13·9	+ 11·3
31	M	2	1	6	0·120	b_1	+ 0·5	+ 58·8	+ 55·7

Date, 1887.	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.
β CETI. *b* lines faint, but narrow and sharp.									
October 28	M	2	1	6	0·140	b_1	+ 9·8	− 67·0	− 66·4
γ CASSIOPELÆ. F line brighter, but not much brighter than the continuous spectrum. Narrow on Feb. 16; broader and more diffused than usual on Oct. 19.									
February 16	M	6	1	6	0·138	F	+ 12·0	+ 1·7	− 1·9
October 19	M	2	1	6	0·200	F	− 3·4	− 17·1	− 21·0
β ANDROMEDÆ. *b* lines narrow, sharp, and fairly dark.									
October 28	M	2	1	6	0·140	b_1	+ 1·9	+ 31·7	+ 26·4
November 1	M	2	1	6	0·120	b_1	+ 2·8	+ 26·7	+ 27·9
β ARIETIS. F line dark, broad, and diffused.									
October 21	M	2	1	6	0·200	F	− 1·4	+ 48·8	+ 51·7
γ ANDROMEDÆ. The two components of this double star have been observed together as one star. *b* lines narrow and sharp, but faint.									
February 16	M	2	1	6	0·138	F	+ 16·1	− 13·4	− 12·8
November 1	M	2	1	6	0·120	b_1	− 1·2	− 19·8	− 19·2
α ARIETIS. F line narrow and sharp, but very faint. *b* lines somewhat broad and diffused, and not very dark.									
October 15	M	2	1	6	0·200	F	− 4·7	− 0·5	− 4·4
21	M	4	1	6	0·200	F	− 2·6	+ 20·0	+ 25·5
28	M	4	1	6	0·140	b_1	− 0·3	+ 2·2	+ 5·0

Date, 1887.	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.	Concluded Motion of Star in Miles per Second. Estimated.
α CETI.									
Third type spectrum. The *b* lines stand out on the background of a shaded band, which is however but faint in this star.									
October 29	M	4	1	6	0·140	b_1	− 2·4	+ 0·9	+ 2·4
29	M	2	1	6	0·140	*	− 2·4	−137·1	−168·0
* Measure of the dark line forming the sharp edge of the fluted band, and coincident in most spectra of the type with b_4. It appears clear that it is not so in this star, and, assuming the observations of the b_1 line to be correct, the wave length of the edges of the band, corrected for motion of earth and star, will be λ = 5162·63, Angström's value, 5166·88, for b_4 being assumed.									
β PERSEI.									
F line broad; estimated breadth, 18 to 20 tenth-metres. The character of the line is not always the same. Usually it is nebulous without any central condensation, but on rare occasions has been observed as dark and sharply defined. Estimated breadth on Jan. 28, 13 tenth-metres.									
January 26	M	4	1	6	0·200	F	+ 16·6	− 90·0	− 93·7
28	M	4	1	6	0·230	F	+ 16·8	− 16·5	− 13·0
31	M	5	1	6	0·160	F	+ 17·0	− 18·4	− 17·0
February 2	M	4	1	6	0·152	F	+ 17·1	−108·6	−105·2
15	M	6	1	6	0·138	F	+ 17·4	− 51·0	− 49·0
16	M	6	1	6	0·138	F	+ 17·4	− 44·0	− 40·9
October 20	M	4	1	6	0·200	F	− 8·1	− 51·4	− 52·8
21	M	4	1	6	0·200	F	− 7·6	− 81·3	− 63·2
24	M	4	1	6	0·250	F	− 6·8	− 38·7	− 25·7
α PERSEI.									
The F line in this spectrum resembles that of Procyon, viz., a narrow but rather faint line on a broad nebulous band. The breadth of this band is difficult to estimate, but would appear to be about 18 tenth-metres.									
February 16	M	4	1	6	0·138	F	+ 16·3	− 12·4	− 11·3
October 20	M	2	1	6	0·200	F	− 9·0	− 26·9	− 27·6
21	M	2	1	6	0·200	F	− 8·6	− 55·6	− 53·1
24	M	2	1	6	0·250	F	− 7·9	− 42·4	− 39·9
α TAURI (*Aldebaran*).									
F line narrow, sharp, and fairly dark; *b* lines narrow, sharp, and distinct.									
January 28	M	2	1	6	0·230	F	+ 16·4	+ 20·8	+ 29·3
February 16	M	2	1	6	0·138	F	+ 18·4	+ 24·9	+ 29·1
October 15	M	2	1	6	0·200	F	− 13·5	+ 47·5	+ 47·1
20	M	3	1	6	0·200	F	− 12·4	+ 47·7	+ 49·3
22	M	4	1	6	0·200	F	− 11·9	+ 43·4	+ 49·6
25	M	2	1	6	0·250	F	− 11·1	+ 60·8	+ 54·6
29	M	4	1	6	0·140	b_1	− 10·1	+ 42·2	+ 45·7

Date, 1887.		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.
α AURIGÆ (*Capella*). F line narrow and sharp, but not very dark; *b* lines narrow, sharp, and fairly dark.										
January	26	M	4	1	6	0·200	F	+ 12·6	+ 3·8	+ 8·1
February	16	M	2	1	6	0·138	F	+ 15·9	+ 18·5	+ 20·3
October	22	M	4	1	6	0·200	F	− 13·5	+ 52·3	+ 52·7
	25	M	4	1	6	0·250	F	− 13·0	+ 38·4	+ 41·9
	29	M	4	1	6	0·140	b_1	− 12·1	+ 52·7	+ 60·3
β ORIONIS (*Rigel*). F line narrow, sharp, and fairly dark; estimated breadth, 0·9 tenth-metre.										
January	27	M	2	1	6	0·200	F	+ 12·7	+ 14·5	+ 18·9
	31	M	2	1	6	0·160	F	+ 13·5	+ 23·9	+ 10·8
February	3	M	2	1	6	0·152	F	+ 13·8	+ 13·5	+ 12·7
	12	M	2	1	6	0·138	F	+ 15·0	+ 1·0	+ 1·7
	16	M	2	1	6	0·138	F	+ 15·4	− 5·0	− 0·9
October	20	M	2	1	6	0·200	F	− 12·0	+ 32·4	+ 36·4
	22	M	6	1	6	0·200	F	− 11·6	+ 28·7	+ 28·8
	25	M	2	1	6	0·250	F	− 11·1	+ 45·7	+ 37·2
γ ORIONIS. F line fairly dark, but not very narrow, and slightly diffused at the edges. Estimated breadth, 6 tenth-metres. No strongly marked central condensation.										
January	31	M	2	1	6	0·160	F	+ 14·4	− 23·7	− 21·7
February	12	M	2	1	6	0·138	F	+ 16·3	+ 26·2	+ 26·0
	16	M	4	1	6	0·138	F	+ 16·8	− 12·6	− 12·9
October	22	M	2	1	6	0·200	F	− 13·8	+ 8·7	+ 9·3
	25	M	4	1	6	0·250	F	− 13·3	+ 16·5	+ 17·6
β TAURI. F line broad, diffused, and fairly dark. Breadth about 13 tenth-metres; central condensation, 3 tenth-metres.										
January	31	M	2	1	6	0·160	F	+ 14·6	− 24·5	− 21·9
February	16	M	2	1	6	0·138	F	+ 17·2	− 10·0	− 10·5
October	22	M	4	1	6	0·200	F	− 14·7	− 19·6	− 12·3
	25	M	4	1	6	0·250	F	− 14·1	− 0·6	− 5·5

Date, 1887.	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.
δ ORIONIS. F line faint and ill-defined; breadth about 4 tenth-metres.									
February 16	M	4	1	6	0·138	F	+ 15·8	+ 11·4	+ 12·8
October 25	M	4	1	6	0·250	F	− 13·0	+ 4·7	+ 10·9
ε ORIONIS. F line narrow and fairly dark; breadth about 1 tenth-metre.									
February 16	M	2	1	6	0·138	F	+ 15·6	+ 16·8	+ 18·0
October 25	M	2	1	6	0·250	F	− 13·1	+ 34·5	+ 34·8
ζ ORIONIS. F line narrow and fairly dark; breadth about 1 tenth-metre.									
February 16	M	4	1	6	0·138	F	+ 15·4	− 23·6	− 20·1
October 25	M	4	1	6	0·250	F	− 13·2	+ 11·7	+ 14·3
κ ORIONIS. F line faint as seen on Feb. 16.									
February 16	M	2	1	6	0·138	F	+ 14·1	− 28·4	− 25·3
α ORIONIS. Third type spectrum. The *b* lines stand out on the background of a shaded band from which it is often difficult to separate them.									
October 29	M	2	1	6	0·140	b_1	− 14·1	+ 69·3	+ 77·0
29	M	2	1	6	0·140	b_4	− 14·1	+ 77·2	+ 76·0

Date, 1887.	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.	Concluded Motion of Star in Miles per Second. Estimated.
β AURIGÆ. F line dark, broad, and nebulous.									
October 22	M	2	1	6	0·200	F	− 15·0	+ 41·3	+ 41·7
25	M	2	1	6	0·250	F	− 14·5	+ 32·4	+ 33·4
γ GEMINORUM. F line dark, but very broad and very diffused at the edges. Estimated breadth, 21 tenth-metres; central condensation, 8 tenth-metres.									
February 16	M	2	1	6	0·138	F	+ 14·4	− 74·7	− 64·8
α CANIS MAJORIS (*Sirius*). F line dark, but very broad and diffused at the edges. Estimated breadth, 20 tenth-metres; central condensation, 5 tenth-metres. On Feb. 12, the total breadth of the line, including a faint shading on either side, was estimated at 29 tenth-metres. The line appeared more steeply shaded towards the red than towards the blue.									
January 27	M	2	1	6	0·230	F	+ 6·0	− 25·8	− 27·0
February 3	M	6	1	6	0·152	F	+ 7·6	+ 12·7	+ 12·4
12	M	4	1	6	0·138	F	+ 9·6	− 13·0	− 11·3
16	M	6	1	6	0·138	F	+ 10·3	− 6·8	− 7·5
October 25	M	6	1	6	0·250	F	− 13·6	+ 36·2	+ 34·4
α GEMINORUM (*Castor*). The two components of this double star have been observed together as one star. F line very broad and nebulous. Estimated breadth about 14 tenth-metres, with a faint shading on either side to a total breadth of about 34 tenth-metres; no central condensation.									
February 3	M	2	1	6	0·152	F	+ 8·0	− 35·9	− 36·2
16	M	4	1	6	0·138	F	+ 11·5	− 17·7	− 15·1
α CANIS MINORIS (*Procyon*). F line narrow, but rather faint and on a back ground of a diffused shading. Estimated breadth of line, 1 tenth-metre; of shading, 13 tenth-metres; *b* line narrow and very faint.									
February 3	M	2	1	6	0·152	F	+ 6·2	+ 20·2	+ 20·2
16	M	4	1	6	0·138	F	+ 10·0	− 10·7	− 7·5
October 29	M	4	1	6	0·140	b_1	− 17·6	+ 54·0	+ 58·5

Date, 1887.	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.
β GEMINORUM (*Pollux*). F line narrow but faint. *b* lines narrow and sharp but faint.									
February 16	M	2	1	6	0·138	F	+ 10·8	− 44·4	− 38·7
October 29	M	4	1	6	0·140	b_1	− 18·0	− 53·5	− 51·2
α BOÖTIS (*Arcturus*). F line narrow and sharp. *b* lines dark, narrow, and sharp.									
July 4	M	2	1	6	0·167	F	+ 15·0	− 43·3	− 45·1
11	M	2	1	6	0·160	F	+ 15·2	− 43·3	− 44·5
α CORONÆ BOREALIS. F line dark and very broad, but not very diffused at the edges. Estimated breadth, 18 tenth-metres. No marked central condensation.									
July 11	M	2	1	6	0·160	F	+ 11·8	+ 20·7	+ 20·7
August 24	M	2	1	6	0·090	F	+ 12·1	− 32·9	− 30·8
α OPHIUCHI. F line dark, very broad, and diffused at the edges. Estimated breadth, 34 tenth-metres; central portion, 10 tenth-metres.									
July 12	M	2	1	6	0·160	F	+ 6·9	− 21·5	− 21·0
August 24	M	2	1	6	0·090	F	+ 13·7	− 43·6	− 34·4
α LYRÆ (*Vega*). F line dark, broad, and diffused at the edges. Estimated breadth, 16 tenth-metres; central condensation, 4 tenth-metres.									
July 12	M	2	1	6	0·160	F	+ 0·8	− 38·1	− 41·5
August 22	M	2	1	6	0·135	F	+ 6·1	− 54·0	− 55·5
24	M	2	1	6	0·090	F	+ 6·3	− 63·1	− 47·8
31	M	4	1	6	0·163	F	+ 6·9	− 51·3	− 58·3
September 2	M	2	1	6	0·163	F	+ 7·1	− 47·2	− 49·3
October 10	M	2	1	6	0·460	F	+ 8·7	− 55·6	− 57·5
14	M	2	1	6	0·200	F	+ 8·7	− 43·4	− 41·4

Date, 1887.	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.
γ LYRÆ. F line broad, diffused, and faint.									
August 22	M	2	1	6	0·135	F	+ 6·5	− 57·3	− 51·8
ζ AQUILÆ. F line broad, nebulous, and faint.									
August 23	M	2	1	6	0·135	F	+ 9·6	− 27·1	− 27·4
δ CYGNI. F line broad, diffused, and faint.									
October 10	M	4	1	6	0·460	F	+ 7·1	− 25·1	− 25·9
α AQUILÆ (*Altair*). F line dark, very broad, and diffused at the edges. Estimations of breadth very discordant, ranging from 13 to 31 tenth-metres.									
July 12	M	2	1	6	0·160	F	− 2·9	− 39·8	− 40·4
August 23	M	2	1	6	0·135	F	+ 7·7	− 53·3	− 57·1
25	M	2	1	6	0·090	F	+ 8·1	− 50·3	− 39·2
31	M	4	1	6	0·163	F	+ 9·7	− 71·0	− 63·5
October 10	M	2	1	6	0·460	F	+ 15·7	− 13·6	− 15·7
14	M	2	1	6	0·200	F	+ 15·9	− 16·9	− 22·8
γ CYGNI. F line narrow, but faint; *b* lines narrow, but not very dark.									
October 14	M	2	1	6	0·200	F	+ 8·5	− 29·6	− 35·2
31	M	4	1	6	0·120	b_1	+ 9·8	− 20·3	− 18·3

Date, 1887.		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.
					α CYGNI. F line narrow and fairly dark ; *b* lines narrow but faint.					
August	23	M	2	1	6	0·135	F	− 0·7	− 43·1	− 44·6
	31	M	2	1	6	0·163	F	+ 0·7	− 47·5	− 47·1
October	14	M	2	1	6	0·200	F	+ 6·8	− 39·0	− 33·5
	31	M	2	1	6	0·120	b_1	+ 8·4	− 93·3	− 80·8
					ε CYGNI. F line narrow and very faint ; *b* lines narrow and faint.					
October	14	M	2	1	6	0·200	F	+ 9·9	− 1·4	+ 1·5
	31	M	4	1	6	0·120	b_1	+ 11·5	− 11·8	− 11·5
					α CEPHEI. F line broad, diffused, and dark.					
August	23	M	2	1	6	0·135	F	− 4·3	− 47·5	− 47·1
October	14	M	2	1	6	0·200	F	+ 1·2	− 60·6	− 58·3
					ε PEGASI. F line narrow and sharp, but rather faint ; *b* lines narrow and faint.					
October	14	M	2	1	6	0·200	F	+ 13·3	+ 26·5	+ 32·4
	31	M	2	1	6	0·120	b_1	+ 16·0	+ 5·1	+ 4·4
					β PEGASI. Third type spectrum. The *b* lines stand out on the back ground of a shaded band, from which it is often difficult to separate them.					
October	28	M	2	1	6	0·140	b_1	+ 9·6	− 56·9	− 51·5
	28	M	4	1	6	0·140	b_4	+ 9·6	− 56·6	− 54·1
	31	M	2	1	6	0·120	b_1	+ 10·3	− 20·7	− 20·5

Date, 1887.	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.
α PEGASI. F line broad and diffused at the edges.									
September 1	M	4	1	6	0·163	F	− 4·0	− 25·9	− 29·8
October 14	M	2	1	6	0·200	F	+ 8·5	− 5·6	− 4·0
19	M	2	1	6	0·200	F	+ 9·8	− 22·7	− 23·5
24	M	2	1	6	0·250	F	+ 11·1	− 31·3	− 32·8
GREAT NEBULA IN ORION.									
October 25	M	6	1	6	0·250	F	− 5·0	− 12·4	− 7·4
MOON.									
January 31	M	5	1	6	0·160	F	...	+ 1·5	...
February 3	M	5	1	6	0·152	F	...	+ 1·6	...
July 12	M	5	1	6	0·160	F	...	0·0	...
August 31	M	5	1	6	0·163	F	...	+ 0·8	...
October 24	M	5	1	6	0·250	F	...	− 1·3	...
28	M	5	1	6	0·140	b_1	...	− 1·3	...
November 1	M	5	1	6	0·120	b_1	...	− 1·0	...
SKY.									
February 17	M	...	1	6	0·138	F	...	0·0	...
October 11	M	5	1	6	0·460	F	...	+ 5·3	...
22	M	5	1	6	0·200	F	...	+ 1·9	...

OBSERVATIONS of the SPECTRA of γ CASSIOPEIÆ, α ORIONIS, and β LYRÆ made at the ROYAL OBSERVATORY, GREENWICH, in the Year 1887.

γ CASSIOPEIÆ.

1887, February 16.
Observer, M.

With the single-prism spectroscope the bright F line was very distinct, both when a cylindrical lens was used before the slit and when it was not. But the C line was not seen at all.

With the half-prism spectroscope, one prism train direct, the bright F line was a very difficult object, and could not be held steadily. It was a narrow line, but so faint that it was generally lost as the pointer was moved up to it, so that it was exceedingly difficult to get measures of its position, and those obtained were only rough. The C line was not looked for with this dispersion. The entire spectrum was only poorly defined.

1887, October 19.
Observer, M.

The spectrum was steady, but rather faint. The F line was distinctly a bright line, but was not much brighter than the continuous spectrum. The F line appeared broader and more diffused than usual. The C line was not looked for. The half-prism spectroscope, with one prism train, direct, was used.

. . . . . .

1887 December 5.
Observer, M.

The single-prism spectroscope was used upon this star. The D_3 line was looked for, but could not be seen. F was occasionally just glimpsed as a bright line; very little brighter than the continuous spectrum, barely distinguishable from it at the best, and often not distinguishable at all.

. . . . . .

But C was *brilliant*, so bright that it could not be possibly overlooked; though the observer had never seen the C line bright in this star before, nor ever failed to see F bright.

No measures were obtained, the sky clouding over before they could be arranged for.

1887, December 16.
Observer, M.

The half-prism spectroscope, one prism train reversed, was used, both with a cylindrical lens before the slit, and with no cylindrical lens at all. With no cylindrical lens, C was unmistakably seen as a bright line, but it was not at all strikingly bright; it had to be looked for, and did not force itself on the attention. The F line was not detected without a cylindrical lens, but with it was seen as a bright line, quite unmistakable when carefully searched for, but faint and narrow. D_3 was not seen at all. C could not be seen when the cylindrical lens was used, as the entire red end of the spectrum was lost; the spectrum being about 14″ in width. Perhaps this was partly owing to cloud, for light cloud was constantly passing, and twice entirely stopped the work of observation for a considerable time. Later on the single-prism spectroscope was used, and, as with the half-prism spectroscope, C was seen as a bright line when no cylindrical lens was used, but could not be seen at all when the cylindrical lens was placed before the slit. The half-prism spectroscope was also used again with precisely the same results as before.

α ORIONIS.

1887, December 16.
Observer, M.

The spectrum of this star was examined with the single-prism spectroscope, and was seen remarkably well; the definition of the great bands and fine lines and fainter bands being very fine. The spectrum of the star was compared with the spectra of Sodium, Manganese, and Carbon, all three as given by a Bunsen flame. The carbon band at λ 5164 was coincident (within the limits of observation with this dispersion) with the bright space towards the blue of Band VI., and the Sodium lines were clearly represented by two dark lines near the middle of Band II., but the two bands of Manganese observed, not only did not coincide with any great band of the spectrum, but were very far distant from any of them. There were, indeed, faint fine lines about the neighbourhood of either manganese band, but the entire spectrum from end to end is full of such lines, and no fluting nor anything corresponding to one could be detected near the place of these two bands. A third manganese band was very close to Band II. of the stellar spectrum.

The following measures were obtained of the dark sharp edges of several of the principal fluted bands in the star spectrum. The sodium lines, and the bright sharp edges of two of the manganese bands, and a few fine but dark lines of the stellar spectrum were also measured at the same time :—

α Orionis.	Bunsen Flame.	Wave length, tenth-metres.
Band I.		6173
	Sodium lines	5892
Band II.		5859
Line		5822
Line		5779
	Manganese band	5577
Line		5497
Band V.		5445
Line		5418
	Manganese band	5348
Band VI.		5164
Band VII.		4954
Band VIII.		4780
Band IX.		4603

The sharp edge of another dark band in the extreme red of the stellar spectrum was estimated to be at λ 6540 ±.

Ångström's value for the wave length of the D lines, 5892 tenth-metres was assumed.

The bands are numbered as in the observations of β Pegasi on 1876, October 18.

β LYRÆ.

1887, December 16.
Observer, M.

The half-prism spectroscope, one prism train reversed, was employed upon this star. With a cylindrical lens before the slit, no lines, bright or dark, were detected in any part of the spectrum. When the cylindrical lens was removed there was a suspicion of a bright line at or near C, but there was no trace of any line near D_3 or F. The star was lost in cloud before the position of the suspected bright line near C could be determined. The slit was used with various widths; the narrowest clearly separating between the two D lines of the sodium flame; the widest sufficiently wide, or perhaps more than sufficiently wide, to admit all the light of the star.

ROYAL OBSERVATORY, GREENWICH.

MEASURES OF POSITIONS AND AREAS

OF

SPOTS AND FACULÆ

UPON THE SUN'S DISK

ON

PHOTOGRAPHS

TAKEN WITH THE

PHOTOHELIOGRAPHS

AT GREENWICH, IN INDIA, AND IN MAURITIUS,

WITH THE DEDUCED

HELIOGRAPHIC LONGITUDES AND LATITUDES.

1887.

MEASURES of POSITIONS and AREAS of SPOTS and FACULÆ upon the SUN'S DISK on PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DÛN in INDIA, and at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the Year 1887.

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 Greenwich Midnight, January 1d. 0h.
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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
1d.193	H,EP		0·947	256·9	124·3	−13·5			175
I.		1944b	0·872	262·1	113·6	− 8·5	13	90	366c
		1946	0·345	132·4	37·6	−16·7	19	84	
Jan. 2							(32)	(174)	(541)
2·244	EP,H	1944b	0·955	262·5	111·9	− 8·2	8	52	393c
M.		1946	0·228	173·0	37·5	−16·5	10	63	
Jan. 3							(18)	(115)	(393)
3·226	EP,H		0·987	262·6	107·1	− 7·9			380
M.		1946	0·298	222·0	38·1	−16·3	10	49	
			0·949	75·9	316·2	+12·1			159
Jan. 4							(10)	(49)	(539)
4·471	EP,H	1946	0·507	243·7	37·9	−16·2	11	30	
M.			0·841	72·2	314·8	+12·8			159
			0·961	72·4	297·8	+15·8			216
Jan. 5							(11)	(30)	(375)
5·186	EP,H	1946	0·626	248·6	37·6	−16·2	8	38	
M.			0·780	67·9	312·3	+14·5			95
			0·919	69·6	296·3	+17·1			396
Jan. 6							(8)	(38)	(491)
6·182	EP,H	1946	0·774	252·4	37·1	−16·0	7	17	
M.			0·803	64·3	297·9	+17·8			133
			0·949	63·8	279·5	+23·3			314
Jan. 7							(7)	(17)	(447)
7·161	H,EP		0·949	193·5	15·3	−70·2			60
I.		1946	0·894	253·3	37·6	−16·8	6	16	108f
			0·876	61·2	278·3	+22·7			211
Jan. 8							(6)	(16)	(379)

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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
8d.191									
M.									
Jan. 9							(0)	(0)	(0)
10·306									
I.									
Jan. 11							(0)	(0)	(0)
11·189									
M.									
Jan. 12							(0)	(0)	(0)
12·196									
M.									
Jan. 13							(0)	(0)	(0)
13·164	H,EP		0·858	288·8	311·6	+13·9			287
I.			0·912	196·7	292·8	−64·5			23
			0·928	176·2	243·8	−72·2			119
Jan. 14							(0)	(0)	(429)
14·248	H,EP		0·961	284·1	313·3	+12·1			193
I.			0·869	292·2	298·0	−16·5			265
			0·910	180·4	251·8	−70·0			56
Jan. 15							(0)	(0)	(514)
15·170	EP,H		0·940	291·2	295·9	+18·0			118
M.			0·984	295·3	276·7	+23·8			212
			0·800	304·7	274·7	+23·7			94
			0·941	184·0	214·8	−74·6			50
Jan. 16							(0)	(0)	(474)
16·464	H,EP		0·931	297·5	275·7	+23·3			187
			0·950	99·8	139·8	−10·9			93
Jan. 17							(0)	(0)	(280)

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 Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Jan. 7. Photograph over-exposed. Jan. 9. Definition poor. Jan. 11. Film of the photograph broken.
Group 1944, 1886 Dec. 23–1887 Jan. 3. A large regular spot, *a*, followed by a stream of smaller spots. *a* has suffered a great change in shape by Dec. 28, and has become an elongated spot with several distinct nuclei. The smaller spots have disappeared by Dec. 29, and *a* has broken up by Dec. 30, principally into two regular spots, *b* and *c*. Only *b* remains by Jan. 2.
Group 1946, 1886 Dec. 28–1887 Jan. 8. A regular spot.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
17d·326	EP,H		0·984	295·3	276·7	+23·8			212
M.			0·941	184·0	214·8	−74·6			50
Jan. 18							(0)	(0)	(262)
18·326	EP,H	1947	0·480	240·2	213·2	−18·4	2	6	
M.			0·940	98·0	117·0	− 9·3			197
Jan. 19							(2)	(6)	(197)
19·463	H,EP	1947	0·682	249·3	214·3	−17·8	0	3	
		1948	0·441	117·1	148·4	−16·3	0	14	
		1948	0·476	117·4	146·2	−17·3	0	17	
Jan. 20							(0)	(34)	(0)
20·519	H,EP	1948	0·243	144·0	150·0	−16·6	6	30	
		1948	0·297	138·2	146·5	−17·9	0	4	
Jan. 21							(6)	(34)	(0)
21·151	H,M		0·875	250·7	211·2	−19·5			202
I.		1948	0·193	182·7	150·8	−16·5	6	34	
Jan. 22							(6)	(34)	(202)
22·302	H,M		0·972	251·9	212·3	−18·9			168
			0·917	196·5	174·6	−65·9			103
I.			0·939	183·1	146·2	−74·8			158
		1948	0·331	234·8	151·3	−16·2	5	18	
			0·879	91·5	73·5	− 4·0			128
			0·911	76·2	71·2	+10·2			66
Jan. 23							(5)	(18)	(623)
23·467	EP,H	1949*a*	0·976	91·8	42·3	− 3·0	0	169	131 *c*
M.									
Jan. 24							(0)	(169)	(131)
24·456	H,EP	1950	0·841	88·4	49·6	− 1·8	3	28	61 *c*
		1949*a*	0·905	90·8	41·8	− 3·2	18	239	93 *c*
		1951*a*	0·966	91·9	31·6	− 3·3	11	60	} 123 *c*
		1951	0·967	90·4	31·5	− 1·9	0	23	
Jan. 25							(32)	(350)	(277)
25·462	H,EP	1950	0·686	86·5	50·3	− 1·7	0	3	
		1949*a*	0·784	89·5	41·8	− 3·2	16	167	40 *c*
		1951	0·854	88·6	35·0	− 1·8	0	7	
		1951*a*	0·884	90·9	31·3	− 3·5	9	41	103 *c*
Jan. 26							(25)	(218)	(143)
1887.				°	°	°			
26d·177	H,EP		0·907	254·6	149·6	−16·4			189
			0·831	263·9	140·5	− 8·4			77
I.		1950	0·556	83·8	50·7	− 1·4	0	3	
		1949*a*	0·669	88·1	42·2	− 3·1	32	152	} 165 *c*
		1949	0·718	87·7	38·4	− 2·4	0	11	
		1951	0·763	87·9	34·6	− 2·2	0	22	} 205 *c*
		1951*a*	0·798	90·1	31·2	− 3·6	11	44	
			0·941	90·8	13·9	− 2·8			188
Jan. 27							(43)	(232)	(824)
27·279	M,H		0·978	253·5	148·4	−17·4			166
			0·970	270·5	145·3	− 1·1			47
I.			0·923	256·0	137·4	−15·2			85
			0·820	260·4	124·8	−11·3			74
		1949*a*	0·458	85·0	42·4	− 2·9	20	127	
		1951*a*	0·622	89·3	31·1	− 4·2	10	24	
			0·941	173·2	45·1	−74·4			63
			0·839	88·8	12·6	− 2·3			83
Jan. 28							(30)	(151)	(518)
28·302	EP,H		0·898	291·1	116·4	+16·0			92
			0·866	259·8	116·3	−11·9			223
I.		1949*a*	0·254	79·2	41·6	− 3·1	17	162	
		1949	0·323	78·5	37·6	− 2·0	0	8	
		1951	0·355	80·9	35·6	− 2·4	0	2	
		1951	0·389	81·4	33·5	− 2·2	0	3	
		1951*a*	0·432	88·4	30·4	− 4·7	4	11	
			0·963	89·6	341·8	− 1·3			78
Jan. 29							(21)	(186)	(393)
29·493	H,EP		0·944	256·3	111·7	−14·9			102
			0·906	263·7	105·6	− 8·3			92
		1949	0·078	288·7	44·5	− 4·6	0	6	
		1949*a*	0·067	313·1	43·1	− 3·4	13	144	
		1949	0·035	310·1	41·8	− 4·7	3	48	
		1949	0·059	21·6	39·0	− 2·9	0	1	
		1951	0·138	81·1	32·5	− 4·8	2	8	
		1951	0·165	79·4	31·0	− 4·2	0	22	
Jan. 30							(18)	(229)	(194)
30·209	M,H		0·980	254·8	110·3	−16·1			121
		1949	0·249	277·2	45·1	− 4·2	0	12	
I.		1949	0·221	273·2	43·5	− 5·3	0	4	
		1949*a*	0·218	280·4	43·2	− 3·7	37	140	

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 Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Jan. 21. Photograph under-exposed. Jan. 23 and 24. Photograph over-exposed. Jan. 25 and 28. Definition poor.

Jan. 29. Sun's image distorted and limb defective, the photographic film being torn.

Group 1947, Jan. 19–20. A very small spot. Group 1948, Jan. 20–23. Two small faint spots on Jan. 20 and 21. The following spot has disappeared by Jan. 22.

Group 1949, Jan. 24–Feb. 4. A regular spot, *a*. A small spot follows *a* on Jan. 27. *a* has begun to extend a little on the following side by Jan. 27; by Jan. 28, the following portion of the spot has become almost detached; by Jan. 29, a considerable portion is entirely detached, and small spots have appeared near *a*, the appearance of the group having greatly changed during the three days. These, with one exception, are measured with *a* on Jan. 29, but separately on the following days when they are more distant from it. Only *a* remains by Feb. 3.

Group 1950, Jan. 25–27. A small faint spot.

Group 1951, Jan. 25–31. Two spots close together on Jan. 25. The smaller has disappeared by Jan. 26, but another has appeared following it in the same latitude. This has disappeared by Jan. 28. The larger spot, *a*, has become elongated by Jan. 28, and only half of it remains by Jan. 29, on which day some very small spots are seen near it. *a* has further broken up into three spots by Jan. 30, two of which are measured together. Only two spots remain by Jan 31.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
30d·209	M,H	1949	0·191	286·7	41·3	− 2·9	0	4	
		1949	0·184	275·9	41·3	− 5·0	7	108	
I.		1949	0·160	286·8	39·6	− 3·4	0	2	
		1951	0·038	19·8	30·1	− 4·1	0	6	
		1951	0·031	318·7	32·0	− 4·8	0	16	
			0·915	75·8	336·6	+10·4			63
			0·861	66·3	335·6	+16·8			82
Jan. 31							(44)	(292)	(266)
31·328	EP,H	1952	0·864	251·5	76·0	−19·1	0	5	112 *f*
		1949	0·496	271·5	45·9	− 4·7	1	10	
I.		1949*a*	0·473	273·9	44·2	− 3·6	27	113	
		1949	0·436	271·7	41·9	− 4·8	0	40	
		1949	0·437	276·0	41·8	− 3·0	0	24	
			0·950	180·0	16·1	−77·7			78
			0·971	71·8	302·4	+16·0			147
Feb. 1							(28)	(192)	(337)
32·432	H,EP		0·949	252·3	70·6	+14·6			65
		1949*a*	0·685	271·8	44·8	− 3·3	15	101	
		1949	0·651	269·3	42·3	− 5·2	0	20	
		1949	0·642	272·1	41·5	− 3·5	0	13	
		1953	0·922	101·1	294·0	−12·6	0	18	44 *c*
			0·877	69·3	303·8	+14·9			94
			0·960	63·5	292·7	+23·2			50
Feb. 2							(15)	(152)	(253)
33·350	EP,H	1949*a*	0·830	270·2	45·6	− 3·4	21	105	277 *f*
		1954*a*	0·716	64·9	308·1	+13·0	2	17	
I.		1954*b*	0·739	66·6	305·8	+12·6	5	24	80 *n f*
		1953	0·824	100·2	293·8	−12·0	4	13	
			0·890	61·1	292·5	+22·2			111
			0·901	71·8	288·2	+13·4			44
			0·977	63·3	276·5	+24·3			279
Feb. 3							(32)	(159)	(791)
34·203	EP,H	1949*a*	0·926	268·9	46·1	− 3·5	17	85	517 *c*
		1954*a*	0·563	55·9	309·9	+12·8	4	23	
I.		1954*b*	0·611	59·2	305·9	+12·9	9	32	
		1953	0·698	101·0	294·0	−12·2	1	11	
			0·812	53·7	292·5	+24·4			89
			0·932	60·3	275·5	+24·7			322
Feb. 4							(31)	(151)	(928)
1887.				°	°	°			
35d·419	H,EP		0·950	268·5	34·1	− 3·5			257
		1954*a*	0·385	31·3	310·5	+12·9	5	16	
		1954*b*	0·434	40·6	305·5	+13·0	0	7	
Feb. 5							(5)	(23)	(257)
36·547	H,EP	1954*a*	0·334	349·6	310·9	+12·6	3	19	
Feb. 6							3)	(19)	(0)
37·162	EP,H		0·940	192·9	340·6	−71·4			109
I.			0·968	172·0	255·5	−78·8			105
Feb. 7							(0)	(0)	(214)
38·177	EP,H		0·940	176·8	273·3	−76·2			68
I.			0·941	110·1	216·0	−21·1			78
Feb. 8							(0)	(0)	(146)
39·231 I. Feb. 9							(0)	(0)	(0)
40·159 I.	H,M		0·818	293·4	310·7	+14·8			100
Feb. 10							(0)	(0)	(100)
41·472 M.	EP,H		0·922	287·1	307·1	+12·9			134
Feb. 11							(0)	(0)	(134)
42·435	H,EP		0·809	307·8	274·6	+24·9			112
Feb. 12							(0)	(0)	(112)
43·166	H,EP		0·901	285·3	282·2	+10·6			54
I.			0·863	302·8	272·6	+23·8			135
Feb. 13							(0)	(0)	(189)
44·188 M.	EP,H		0·949	297·2	273·2	+23·1			150
Feb. 14							(0)	(0)	(150)
45·260 I.	H,EP		0·921	104·2	125·0	−15·7			238
Feb. 15							(0)	(0)	(238)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Feb. 11. Photograph over-exposed.
Group 1953, Feb. 2–4. A small spot.

Group 1952, Feb. 1. A very small spot.
Group 1954, Feb. 3–6. Two small spots, *a* and *b*. *b* has disappeared by Feb. 6.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
46d·476	EP, H		0·893	158·2	133·4	−61·2			102
			0·889	105·8	113·3	−17·2			55
			0·911	98·9	110·5	−11·0			45
Feb. 16							(0)	(0)	(202)
47·224	H, EP	1955	0·256	250·5	181·6	−11·7	4	9	
I.		1955	0·219	243·9	179·0	−12·4	0	3	
			0·813	103·1	112·7	−14·7			114
Feb. 17							(4)	(12)	(114)
48·330	H, EP		0·926	183·8	165·0	−73·9			92
		1955	0·508	262·4	182·8	− 9·9	5	43	
I.		1955	0·442	256·2	178·1	−12·3	2	22	
		1956	0·954	77·6	81·5	+ 9·6	5	46	322 *f*
			0·949	165·2	102·1	−71·6			134
			0·963	90·0	78·0	− 1·9			129
Feb 18							(12)	(111)	(677)
49·207	H, EP	1955	0·679	264·1	183·8	− 9·2	11	34	
		1955	0·656	264·1	182·0	− 9·3	5	10	
I.		1955	0·637	261·4	180·5	−11·0	0	11	
		1955	0·602	259·4	177·9	−12·1	0	23	
		1956	0·874	75·1	82·2	+ 9·3	2	26	368 *s f*
		1957	0·861	89·6	81·4	− 3·3	0	10	
		1957	0·880	89·0	79·3	− 2·5	0	4	80 *c*
		1958*a*	0·959	75·6	69·6	+11·6	30	119	257 *f*
Feb. 19							(48)	(237)	(705)
50·480	EP, H	1955	0·863	263·8	184·1	− 8·9	0	47	
		1955	0·828	261·0	180·3	−11·4	0	16	212 *c*
M.		1955	0·811	260·1	178·6	−12·2	0	8	
		1956	0·705	68·9	82·3	+ 9·4	7	15	
		1958*a*	0·841	71·5	69·7	+11·4	13	72	290 *c*
			0·760	71·9	77·2	+ 8·8			275
			0·946	94·2	52·6	− 6·3			96
Feb. 20							(20)	(158)	(873)
51·459	EP, H		0·923	260·8	179·1	−11·2			157
		1956	0·541	60·1	82·8	+ 9·4	3	19	
		1958*a*	0·709	66·1	69·9	+11·3	9	71	89 *f*
		1959	0·958	96·9	37·2	− 8·6	0	79	312 *c*
			0·879	92·1	49·4	− 5·2			86
Feb. 21							(12)	(169)	(644)
1887.				°	°	°			
52d·166	H, EP		0·980	260·1	181·2	−11·1			310
			0·931	182·0	109·2	−75·5			160
I.		1956	0·421	48·1	83·4	+ 9·6	2	6	
		1958*a*	0·602	59·7	69·9	+11·6	16	73	
		1959	0·865	96·1	41·5	− 8·8	0	18	
		1959	0·904	95·2	36·8	− 7·7	15	63	388 *c*
			0·929	171·5	73·9	−72·9			63
			0·779	92·3	50·5	− 6·3			179
Feb. 22							(33)	(160)	(1100)
53·149	EP, M	1960	0·339	36·3	77·1	+ 8·9	2	7	
		1960	0·336	40·6	76·1	+ 7·8	0	4	
I.		1958*a*	0·450	45·0	69·9	+11·8	15	78	
		1959	0·712	95·7	43·1	− 9·1	10	28	
		1959	0·722	95·1	42·3	− 8·6	2	10	133 *f*
		1959	0·742	95·7	40·6	− 9·0	0	3	
		1959	0·789	94·2	36·5	− 7·7	0	11	247 *c*
			0·918	177·8	81·7	−73·5			119
Feb. 23							(29)	(141)	(499)
54·274	H, EP		0·866	259·7	134·5	−12·5			150
		1958*a*	0·330	10·4	70·5	+11·7	15	59	
I.		1959	0·496	96·8	44·2	− 9·6	0	6	
		1959	0·543	95·2	41·0	− 8·9	0	7	
		1959	0·604	94·3	36·7	− 8·4	0	30	
			0·912	178·9	70·6	−72·7			94
Feb. 24							(15)	(102)	(244)
55·458	EP, H	1958*a*	0·382	328·4	70·2	+11·9	5	33	
		1959	0·279	98·5	42·2	− 9·3	0	20	
		1959	0·365	96·5	37·0	− 9·1	0	19	
Feb. 25							(5)	(72)	(0)
56·429	EP, H	1958*a*	0·527	307·4	70·7	+12·1	5	25	
			0·940	176·6	31·8	−76·4			94
			0·924	169·4	13·3	−71·5			45
Feb. 26							(5)	(25)	(139)
57·586	EP, H	1958	0·731	291·9	73·9	+10·6	0	15	
		1958*a*	0·708	295·4	71·1	+12·2	0	17	
		1958*b*	0·702	292·0	71·6	+ 9·8	0	6	
Feb. 27							(0)	(38)	(0)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 1955, Feb. 17–20. Two very small spots on Feb. 17. Two compact clusters of small spots on Feb. 18. An irregular stream of small spots measured in four parts on Feb. 19, and in three on Feb. 20.

Group 1956, Feb. 18–22. A small regular spot.

Group 1957, Feb. 19. Two very small spots.

Group 1958. Feb. 19–March 2. A regular spot, *a*. Two other spots are seen near it on Feb. 27. Of these the following one, *b*, has become a large spot by Feb. 28. A number of small spots, mostly measured in one cluster, are also seen on this and succeeding days. *b* has broken up by March 1, but is still measured as one spot. *a* has disappeared by March 2.

Group 1959, Feb. 21–25. Several small spots irregularly arranged, and varying in number and arrangement from day to day.

Group 1960, Feb. 23. A few very small spots, measured in two clusters.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
58d·447	M, H		0·888	284·1	79·5	+ 9·0			157
			0·873	273·3	79·4	− 0·7			46
			0·817	295·8	68·8	+16·2			76
			0·755	291·2	64·6	+10·8			33
			0·946	181·8	27·2	−78·0			88
		1958	0·841	290·1	72·8	+12·6	0	8	
		1958*b*	0·823	287·6	71·6	+10·0	23	177	145 *c*
		1958*a*	0·821	290·2	70·8	+12·1	0	8	
			0·950	172·0	344·8	−76·4			63
Feb. 28							(23)	(193)	(608)
59·190	H, EP		0·930	197·7	57·3	−67·5			52
		1958	0·928	284·1	75·2	+10·2	0	47	
I.		1958	0·926	286·4	74·4	+12·2	0	1	388 *c*
		1958*a*	0·903	286·7	71·1	+11·7	0	5	
		1958*b*	0·900	284·9	71·1	+10·0	18	117	
			0·943	179·2	5·8	−77·4			120
Mar. 1							(18)	(170)	(560)
60·230	H, EP		0·840	270·0	52·6	− 4·0			64
			0·762	263·4	45·5	− 9·8			155
			0·930	194·5	37·6	−69·7			35
		1958	0·990	282·0	75·5	+10·7	0	39	
I.		1958*b*	0·972	281·8	70·1	+ 9·6	0	95	332 *c*
			0·951	174·9	331·6	−78·0			52
			0·927	61·9	293·3	+22·6			37
Mar. 2							(0)	(134)	(675)
61·356	H, EP		0·870	266·1	41·4	− 7·0			499
I.									
Mar. 3							(0)	(0)	(499)
62·146	H, EP		0·944	264·7	41·3	− 7·4			517
			0·935	178·9	325·8	−76·4			56
I.			0·911	56·1	272·5	+26·8			80
Mar. 4							(0)	(0)	(653)
63·119	EP, H		0·936	181·3	322·6	−76·4			53
I.			0·881	53·4	264·8	+27·3			182
Mar. 5							(0)	(0)	(235)
64·030									
Mar. 6							(0)	(0)	(0)

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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
65d·207	EP, H		0·945	259·1	1·9	−12·7			152
I.			0·978	93·3	211·9	− 4·8			86
Mar. 7							(0)	(0)	(238)
66·359	EP, H		0·908	93·2	209·5	− 5·9			168
I.									
Mar. 8							(0)	(0)	(168)
67·179	EP, H		0·961	98·1	189·3	− 9·8			108
I.									
Mar. 9							(0)	(0)	(108)
68·172	M, H	1961	0·550	261·4	284·5	−10·8	0	7	
		1961	0·546	264·2	284·2	− 9·2	0	2	
I.		1961	0·526	260·7	282·8	−11·0	0	6	
			0·903	98·9	185·9	−11·1			157
Mar. 10							(0)	(15)	(157)
69·474	H, EP	1961	0·781	264·3	285·5	− 9·0	1	9	102 *c*
Mar. 11							(1)	(9)	(102)
70·500									
M.									
Mar. 12							(0)	(0)	(0)
71·496									
Mar. 13							(0)	(0)	(0)
72·243	H, EP		0·955	298·6	264·3	+24·6			136
I.			0·920	307·5	254·8	+30·4			139
Mar. 14							(0)	(0)	(275)
73·305									
I.									
Mar. 15							(0)	(0)	(0)
74·314	EP, M		0·878	294·6	226·6	+17·6			19
			0·792	89·5	117·5	− 4·0			27
I.			0·914	118·4	103·6	−28·8			65
			0·982	80·0	92·3	+ 8·4			124
Mar. 16							(0)	(0)	(235)

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Group 1961, March 10-11. Three very small faint spots on March 10. One very small spot on March 11.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
75d·291	H, EP	1962*a*	0·977	75·5	81·6	+12·5	15	52	} 524 *c*
		1962	0·987	76·0	78·5	+12·6	0	20	
I.			0·893	59·0	100·7	+23·5			36
			0·911	81·0	92·7	+ 5·2			84
Mar. 17							(15)	(72)	(644)
76·418	H, EP	1962*a*	0·884	72·0	83·0	+12·4	9	59	460 *c*
Mar. 18							(9)	(59)	(460)
77·430	H, EP	1962*a*	0·750	66·5	84·3	+12·4	9	62	286 *c*
		1963	0·980	86·2	51·0	+ 2·3	0	32	77 *c*
			0·929	88·1	60·9	− 0·9			22
			0·941	96·6	58·2	− 8·6			115
Mar. 19							(9)	(94)	(500)
78·164	H, EP	1962*a*	0·639	60·1	84·8	+12·8	16	50	
		1962	0·676	61·1	82·0	+13·5	0	10	
I.		1962	0·698	61·4	80·3	+14·1	2	11	
		1963	0·934	84·6	51·0	+ 2·5	16	32	188 *c*
			0·778	69·9	71·4	+10·9			169
			0·904	95·4	54·2	− 7·9			293
			0·979	86·8	41·6	+ 1·7			136
Mar. 20							(34)	(103)	(786)
79·552	H, EP	1962	0·435	35·0	86·2	+14·1	0	2	
		1962*a*	0·426	38·3	85·4	+12·8	6	30	
		1962	0·475	47·8	80·0	+12·1	0	3	
		1963	0·761	80·7	52·4	+ 2·5	0	18	87 *c*
		1964	0·963	77·5	28·5	+10·0	0	24	85 *f*
			0·870	84·2	41·2	+ 1·6			178
			0·870	91·1	40·5	− 4·4			61
Mar. 21							(6)	(77)	(411)
80·512	H, EP	1962*a*	0·345	7·5	85·7	+13·0	5	24	
		1962	0·306	9·1	85·5	+10·6	0	3	
		1962	0·373	16·9	81·9	+14·0	0	39	
		1963	0·594	76·4	53·1	+ 2·4	0	13	
		1964	0·882	74·5	28·8	+10·2	0	10	228 *f*
			0·926	181·3	92·8	−74·4			100
			0·936	168·0	49·8	−71·8			37
			0·900	68·1	28·0	+16·3			48
Mar. 22							(5)	(89)	(413)
1887.				°	°	°			
81d·346	EP, M	1964	0·782	70·4	28·8	+10·7	0	10	112 *f*
I.									
Mar. 23							(0)	(10)	(112)
82·165	EP, M	1964	0·717	65·7	24·7	+12·1	0	5	75 *c*
I.									
Mar. 24							(0)	(5)	(75)
83·444	H, EP	1965	0·605	102·4	12·4	−12·8	0	6	} 45 *c*
		1965	0·643	103·6	9·6	−14·0	0	12	
Mar. 25							(0)	(18)	(45)
84·444	H, M		0·807	295·4	85·5	+15·9			493
		1965	0·393	108·7	14·0	−13·4	2	13	
		1965	0·444	110·1	11·0	−14·9	3	16	
		1965	0·446	105·7	10·4	−13·0	0	8	
		1965	0·471	106·5	8·8	−13·6	1	8	
			0·963	75·1	324·3	+12·4			106
Mar. 26							(6)	(45)	(599)
85·506	EP, M		0·907	288·8	84·4	+13·9			429
		1965	0·240	120·7	10·2	−13·6	4	15	
			0·894	67·9	323·0	+16·3			87
Mar. 27							(4)	(15)	(516)
86·431	EP, M		0·943	287·2	77·9	+13·8			286
Mar. 28							(0)	(0)	(286)
87·434	H, EP		0·966	286·2	69·2	+13·7			95
			0·863	270·3	56·5	− 3·1			111
			0·780	285·7	46·0	+ 7·9			188
Mar. 29							(0)	(0)	(394)
88·338	H, EP		0·907	262·4	50·5	− 9·6			167
			0·880	276·7	45·8	+ 2·8			285
			0·724	294·3	27·4	+12·6			84
		1966	0·182	353·1	346·2	+ 3·9	0	4	
		1966	0·158	343·2	347·6	+ 2·2	0	5	
Mar. 30							(0)	(9)	(536)

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Group 1962, March 17–22. Two spots on March 17. Of these only the preceding spot, *a*, is seen on the succeeding days. *a* is accompanied by some small spots on March 20 and the succeeding days.

Group 1963, March 19–22. A small regular spot.

Group 1964, March 21–24. A small spot. The spot seen on March 24 seems to be quite different from that seen on March 21–23.

Group 1965, March 25–27. Two small spots on March 25; four on March 26; one on March 27.

Group 1966, March 30. Five very small spots measured in two clusters.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
89d·186	H,EP		0·945	272·6	44·4	+ 0·3			321
			0·843	289·5	28·2	+12·6			95
			0·916	181·7	339·1	−72·6			56
		1967*a*	0·330	4·7	332·3	+12·6	0	7	
		1967*b*	0·353	9·7	330·4	+13·8	6	16	
			0·950	68·5	265·8	+18·0			135
Mar. 31							(6)	(23)	(607)
90·500	H,EP		0·951	284·2	26·4	+11·4			115
			0·830	260·2	12·9	−11·7			103
I.		1967*a*	0·434	319·5	333·2	+13·1	0	13	
		1967*b*	0·404	326·5	329·7	+13·4	8	14	
			0·827	64·1	265·5	+17·2			72
			0·909	55·5	258·9	+27·7			94
Apr. 1							(8)	(27)	(384)
91·434	H,M		0·929	258·7	13·0	−12·9			84
		1967*b*	0·532	297·4	329·7	+13·0	2	8	
Apr. 2							(2)	(8)	(84)
92·196	H,EP	1967*b*	0·667	297·9	331·2	+13·1	2	10	
I.									
Apr. 3							(2)	(10)	(0)
93·432	H,EP	1967*b*	0·852	290·3	332·9	+13·7	0	4	111 *c*
Apr. 4							(0)	(4)	(111)
94·199	H,EP		0·907	287·9	330·0	+13·4			140
I.									
Apr. 5							(0)	(0)	(140)
96·161									
I.									
Apr. 7							(0)	(0)	(0)
97·498	H, M		0·959	196·7	279·2	−70·4			46
Apr. 8							(0)	(0)	(46)
98·509	H,EP		0·961	197·1	268·1	−70·4			58
			0·854	311·1	258·8	+30·2			56
Apr. 9							(0)	(0)	(114)
1887.				°	°	°			
99d·137	EP, M		0·911	104·1	136·4	−15·2			111
I.									
Apr. 10							(0)	(0)	(111)
100·148									
I.									
Apr. 11							(0)	(0)	(0)
101·414	H, EP	1968	0·987	72·5	94·0	+16·2	0	40	197 *c*
Apr. 12							(0)	(40)	(197)
102·288	H, EP	1968	0·940	70·3	93·9	+16·3	0	23	429 *c*
I.									
Apr. 13							(0)	(23)	(429)
103·403	H, EP		0·819	68·9	94·5	+13·8			159
			0·909	73·5	83·2	+12·5			96
Apr. 14							(0)	(0)	(255)
104·514	H, EP	1969	0·981	93·7	52·5	− 4·7	0	9	} 205 *c*
		1969	0·988	93·7	50·3	− 4·5	0	4	
			0·831	75·7	77·2	+ 8·7			59
Apr. 15							(0)	(13)	(264)
105·394	H, EP	1969	0·893	89·9	56·8	− 2·4	0	9	} 274 *c*
		1969	0·927	92·6	51·9	− 4·5	0	25	
Apr. 16							(0)	(34)	(274)
106·477	H, EP		0·839	92·0	48·6	− 4·6			169
Apr. 17							(0)	(0)	(169)
107·546	H, EP	1970*a*	0·774	67·7	44·1	+13·6	0	8	} 43 *c*
		1970*b*	0·803	69·8	41·0	+12·8	1	12	
Apr. 18							(1)	(20)	(43)
108·514	H, EP	1969	0·418	85·7	54·0	− 2·9	0	11	
		1969	0·458	89·7	51·4	− 4·4	0	3	
		1970*a*	0·624	60·1	44·9	+13·8	10	110	
		1970*b*	0·673	64·7	40·2	+12·7	2	34	
			0·952	86·1	7·0	+ 2·1			142
Apr. 19							(12)	(158)	(142)

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 Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 1967, March 31–April 4. Two small spots, *a* and *b*, on March 31. They have moved apart from each other by April 1; *a* has disappeared by April 2.

Group 1968, April 12–13. A small spot.

Group 1969, April 15–19. Two small spots on April 15 and April 19. The group is not seen on April 17 and 18. Three small spots are seen on April 16, two of which, apparently corresponding to the two seen on April 15, are measured together.

Group 1970, April 18–27. Two small spots, *a* and *b*. Both have increased in size by April 19, especially *a*. *b* has disappeared by April 22. One or two very small spots are seen near *a* on April 21 and 22.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
109d.495	M, H	1970	0·449	49·4	45·5	+12·3	1	18	
		1970*a*	0·467	47·0	45·3	+13·8	9	99	
		1970*b*	0·512	55·2	40·4	+12·4	2	41	
			0·882	83·9	4·6	+ 3·0			108
Apr. 20							(12)	(158)	(108)
110·469	EP, H	1970*a*	0·342	21·9	45·4	+13·6	15	108	
		1970	0·347	32·0	42·1	+12·3	0	8	
		1970*b*	0·376	36·0	39·9	+12·9	0	3	
Apr. 21							(15)	(119)	(0)
111·417	EP, H		0·853	292·6	95·4	+16·4			225
		1970*a*	0·328	344·8	45·5	+13·6	16	101	
		1970	0·318	349·1	43·9	+13·4	0	2	
		1970	0·295	354·4	42·1	+12·2	0	2	
Apr. 22							(16)	(105)	(225)
112·432	M, H		0·912	287·8	90·2	+14·1			192
		1970*a*	0·429	315·0	45·0	+13·1	18	67	
Apr. 23							(18)	(67)	(192)
113·551	M, H	1970*a*	0·607	298·5	45·3	+12·9	10	72	
Apr. 24							(10)	(72)	(0)
114·125	H, EP		0·908	262·1	69·9	− 9·1			61
			0·779	269·2	55·6	− 3·6			187
I.		1970*a*	0·695	293·3	45·1	+12·4	14	49	
Apr. 25							(14)	(49)	(248)
115·417	EP, H		0·890	269·7	50·2	− 2·4			195
		1970*a*	0·867	287·4	45·2	+12·7	6	24	204 *c*
Apr. 26							(6)	(24)	(399)
116·415	M, H		0·946	275·6	44·7	+ 3·9			9
			0·936	265·5	43·8	− 5·8			153
		1970*a*	0·952	284·8	44·7	+12·6	0	16	163 *f*
		1971*a*	0·951	76·2	263·9	+11·7	9	101	} 199 *c*
		1971*b*	0·978	76·1	257·9	+12·6	0	12	
			0·899	90·0	270·4	− 2·0			63
Apr. 27							(9)	(129)	(587)
117d.429	EP, H	1971*a*	0·853	73·4	264·4	+11·7	9	77	51 *c*
		1971*b*	0·911	74·8	257·2	+12·7	3	20	80 *c*
Apr. 28							(12)	(97)	(131)
118·285	H, EP		0·862	278·1	268·3	+ 4·8			155
		1971*a*	0·738	69·1	264·9	+12·3	21	91	120 *c*
I.		1971*b*	0·818	71·4	257·2	+12·6	9	28	197 *c*
			0·853	53·7	258·9	+27·7			93
			0·977	94·7	231·8	− 5·5			251
Apr. 29							(30)	(119)	(816)
119·471	EP, H		0·943	276·4	3·8	+ 4·7			104
		1971*a*	0·537	59·1	265·9	+12·4	5	38	
		1971*c*	0·621	64·9	259·0	+11·9	0	15	
		1971*b*	0·644	65·4	257·2	+12·3	4	15	
			0·883	93·7	231·9	− 5·2			271
Apr. 30							(9)	(68)	(375)
120·546	H, EP	1971*c*	0·442	52·3	258·8	+11·9	0	17	
		1971*b*	0·463	53·9	257·2	+12·1	0	12	
			0·755	95·1	230·6	− 6·5			187
May 1							(0)	(29)	(187)
121·126	H, EP	1971*c*	0·347	38·0	259·4	+12·0	0	4	
		1971*b*	0·370	41·8	257·5	+12·2	0	3	
I.		1972	0·614	92·5	234·2	− 4·7	1	8	
		1972	0·675	95·6	229·6	− 6·7	1	11	
		1973*a*	0·991	76·8	190·9	+12·6	0	370	
			0·959	167·3	228·6	−72·2			182
May 2							(2)	(396)	(182)
122·577	H, EP	1973	0·904	74·8	190·0	+12·0	57	521	439 *c*
May 3							(57)	(521)	(439)
123·292	H, EP	1972	0·154	100·0	234·8	− 5·2	1	6	
		1972	0·199	102·7	232·3	− 6·2	0	7	
I.		1973*a*	0·820	71·7	190·7	+12·7	64	285	}
		1973	0·851	71·8	187·5	+13·4	0	26	} 441 *c*
		1973	0·860	74·3	186·0	+11·5	13	102	
May 4							(78)	(426)	(441)

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 Faculæ 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 Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Apr. 22, 23, 27, and May 3. Photographs somewhat over-exposed.

Group 1971, April 27–May 2. A regular spot, *a*, followed by a smaller spot, *b*. *a* diminishes in size, and has disappeared by May 1. A third spot, *c*, has appeared between *a* and *b* by April 30.

Group 1972, May 2–10. Four very small spots on May 2, three of which being close together are measured as one. The Group is not seen on May 3. Two very small spots on May 4. Two spots, *a* and *b*, are seen on May 5, a little larger than and apparently not the same two as those seen on May 4. *b* has divided into two spots by May 6, *a* by May 7, but both are measured as one. One component of *b* has disappeared by May 8, and the other by May 9. Two fresh spots are seen on May 8, one of which, *c*, is also seen on the succeeding days.

Group 1973, May 2–14. A large regular spot, *a*, followed generally by a number of small spots, which change as to number, size, and arrangement from day to day. *a* has a double nucleus, and has divided into two spots by May 13. The smaller and following portion has disappeared by May 14. *a* is measured together with the spots which follow it on May 3, as it appears to be connected with them on that day, all together forming a very large spot of irregular outline. On May 4, the different spots of the group are distinctly separated from each other.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
124d.555	H,EP	1972*a*	0·142	269·3	234·9	− 3·6	8	30	
		1972*b*	0·108	259·7	232·9	− 4·6	0	23	
		1973*a*	0·628	64·5	191·4	+12·8	62	274	
		1973	0·671	62·7	188·8	+15·1	0	8	
		1973	0·666	65·4	188·5	+13·3	0	7	
May 5							(70)	(342)	(0)
125·101	H,EP	1972*a*	0·276	266·4	235·5	− 4·3	10	28	
		1972*b*	0·232	264·6	232·8	− 4·6	2	10	
I.		1973*a*	0·542	59·2	191·1	+13·1	59	272	
		1973	0·564	62·2	188·9	+12·3	0	2	
		1973	0·577	63·4	187·8	+12·0	0	7	
		1973	0·586	61·5	187·6	+13·6	0	8	
May 6							(71)	(327)	(0)
126·554	H,EP		0·905	286·7	263·2	+13·6			116
		1972*a*	0·601	266·3	237·2	− 4·9	0	39	
		1972*b*	0·544	265·3	233·1	− 5·3	0	21	
		1973*a*	0·323	28·8	191·2	+13·1	54	268	
		1973	0·336	39·5	187·7	+11·8	0	9	
May 7							(54)	(337)	(116)
127·207	H,EP		0·940	284·2	260·1	+12·2			180
		1972*a*	0·730	266·5	238·4	− 4·7	6	20	
I.		1972	0·713	264·2	237·0	− 6·5	0	3	
		1972*c*	0·683	264·5	234·6	− 6·1	2	12	
		1972*b*	0·666	266·0	233·3	− 5·1	2	6	
		1974	0·136	189·8	193·0	−10·9	4	25	
		1974*a*	0·145	170·6	190·2	−11·4	7	21	
		1973*a*	0·280	1·3	191·2	+13·0	53	267	
		1973	0·284	9·3	188·9	+13·0	0	9	
		1973	0·288	13·0	187·8	+13·0	4	16	
			0·891	91·2	128·7	− 2·6			126
May 8							(78)	(379)	(306)
128·450	H,EP	1972*a*	0·900	266·2	239·3	− 4·8	0	11	} 306 *c*
		1972*c*	0·858	264·8	234·2	− 6·0	0	10	
		1974	0·345	248·7	194·2	−10·2	2	40	
		1974	0·307	247·4	191·8	− 9·8	0	7	
		1974*a*	0·294	240·7	190·3	−11·3	9	37	
		1973*a*	0·385	314·7	191·4	+12·7	35	260	
1887.				°	°	°			
128d.450	H,EP	1973	0·358	321·6	188·3	+13·2	0	11	
		1975	0·692	91·3	131·5	− 3·2	0	17	54 *c*
		1976*a*	0·961	81·2	102·1	+ 7·6	0	22	126 *f*
			0·984	71·9	97·2	+17·2			85
May 9							(46)	(415)	(571)
129·548	H,EP		0·928	182·3	167·2	−70·7			124
		1972	0·974	265·9	237·6	− 4·7	0	34	} 468 *c*
		1972*c*	0·959	264·6	234·2	− 6·0	0	5	
		1974	0·570	257·6	194·9	− 9·5	8	19	
		1974	0·535	257·7	192·5	− 9·1	0	3	
		1974	0·535	253·6	192·1	−11·2	0	2	
		1974*a*	0·507	252·9	190·2	−11·1	2	15	
		1973*a*	0·566	297·4	191·5	+12·5	35	263	
		1975	0·462	90·8	133·3	− 3·1	0	15	
		1975	0·503	89·3	130·6	− 2·3	0	13	
		1975	0·521	92·3	129·4	− 3·8	0	5	
		1975	0·541	88·5	128·1	− 1·7	0	3	
		1976*a*	0·856	78·9	102·9	+ 7·9	0	12	} 109 *c*
		1976	0·887	79·8	99·2	+ 7·7	0	6	
May 10							(45)	(395)	(701)
130·246	H,EP		0·988	264·3	232·6	− 6·1			304
		1974	0·692	259·9	194·9	− 9·1	0	12	
I.		1974	0·674	256·8	193·2	−11·0	0	8	
		1974	0·660	259·0	192·4	− 9·4	0	6	
		1974*a*	0·638	256·4	190·5	−10·9	0	8	
		1973*a*	0·683	292·3	191·7	+12·8	36	216	
		1973	0·622	301·4	185·0	+16·4	0	4	
		1975	0·305	89·6	133·8	− 2·7	0	13	
		1975	0·335	90·7	132·0	− 3·0	1	7	
		1975	0·360	88·6	130·5	− 2·2	2	10	
		1976*a*	0·769	76·8	102·5	+ 8·2	5	13	75 *c*
		1977*a*	0·992	91·8	68·9	− 2·2	0	29	258 *nf*
			0·833	66·2	98·5	+17·9			102
			0·837	66·7	97·9	+17·6			90
			0·918	89·2	85·1	− 0·4			59
			0·926	76·0	85·1	+11·8			132
			0·936	97·6	82·1	− 8·1			111
May 11							(44)	(326)	(1131)
131·260	H,EP		0·819	259·1	192·8	−10·5			144
I.		1973*a*	0·829	287·5	192·1	+12·8	36	217	287 *c*

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 Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 1974, May 8–11. A small spot, *a*, preceded by a few small spots, forming with *a* a short straight stream.
Group 1975, May 9–11. A small spot on May 9. A few small spots in a short straight stream on May 10 and 11.
Group 1976, May 9–11. A small spot, *a*, with a small companion on May 10.
Group 1977, May 11–14. A small spot, *a*, followed on May 13 by another small spot, *b*. *a* has disappeared by May 14.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots: Area of UMBRA for each Spot (and for Day).	Spots: Area of WHOLE for each Spot (and for Day).	Faculæ: Area for each Group (and for Day).
1887.				°	°	°			
131d·260	H, EP	1977 *a*	0·933	90·8	69·4	− 1·8	1	11	259 *f*
I.			0·825	98·1	82·7	− 8·3			42
May 12							(37)	(228)	(732)
132·575	H, EP		0·950	260·3	192·4	−10·1			184
		1973 *a*	0·952	283·7	191·5	+12·1	10	141	359 *c*
		1973	0·942	284·7	189·5	+12·8	0	18	
		1977 *a*	0·770	89·6	70·4	− 1·5	0	11	130 *c*
		1977 *b*	0·782	86·8	69·5	+ 0·8	0	10	
			0·907	87·4	55·8	+ 1·2			122
May 13							(10)	(180)	(795)
133·499	H, EP	1973 *a*	0·994	282·7	191·1	+12·3	0	154	279 *c*
		1978 *a*	0·496	103·2	79·3	− 8·7	0	6	
		1978 *b*	0·534	102·5	76·7	− 8·8	0	30	
		1977	0·626	84·5	70·0	+ 1·5	0	10	
			0·870	92·8	48·1	− 3·7			100
May 14							(0)	(200)	(379)
134·548	H, EP	1978 *c*	0·284	119·9	80·1	−10·4	0	24	
		1978 *a*	0·280	112·3	79·4	− 8·4	2	14	
		1978 *b*	0·323	111·8	76·9	− 9·2	0	39	
May 15							(2)	(77)	(0)
135·526	H, EP		0·790	268·3	133·6	− 2·8			141
		1978 *c*	0·135	182·1	81·9	−10·0	12	74	
		1978 *a*	0·113	159·7	79·3	− 8·4	0	6	
		1978	0·139	159·8	78·8	− 9·8	9	35	
		1978 *b*	0·144	143·6	76·7	− 8·9	14	126	
		1979 *a*	0·874	97·8	20·9	− 8·0	3	20	92 *c*
		1979	0·903	96·9	17·2	− 7·2	0	5	
May 16							(38)	(266)	(233)
136·118	H, EP		0·852	268·4	132·1	− 2·5			130
		1978 *c*	0·205	232·9	83·3	− 9·3	17	125	
I.		1978 *d*	0·183	211·8	79·5	−11·1	2	7	
		1978 *b*	0·134	207·7	77·4	− 9·0	43	199	
		1980	0·074	57·7	70·2	+ 0·1	0	5	
		1980	0·116	40·4	69·5	+ 2·9	0	10	
		1979 *a*	0·799	98·5	21·0	− 8·1	12	22	93 *c*
		1979	0·845	97·0	16·3	− 7·1	0	3	
May 17							(74)	(371)	(223)
1887.				°	°	°			
137d·148	H, EP		0·950	267·8	131·8	− 2·9			160
		1978 *c*	0·450	253·0	86·0	− 9·5	32	150	
I.		1978	0·425	250·6	84·1	−10·0	2	6	
		1978	0·413	253·9	83·7	− 8·5	0	14	
		1978	0·408	248·5	82·8	−10·6	12	26	
		1978	0·378	248·1	81·0	−10·0	0	11	
		1978 *d*	0·357	242·2	78·9	−11·6	8	12	
		1978 *b*	0·315	246·5	77·1	− 9·2	50	271	
			0·886	160·4	26·1	−58·1			45
May 18							(104)	(490)	(205)
138·274	H, EP		0·830	283·2	100·2	+ 9·8			76
			0·804	296·3	95·0	+19·5			88
I.		1978 *c*	0·681	258·6	87·7	− 9·2	40	205	
		1978	0·650	257·2	85·2	− 9·8	24	102	
		1978	0·616	256·0	82·5	−10·2	0	2	
		1978 *d*	0·563	253·1	78·4	−11·1	0	10	
		1978 *b*	0·544	256·6	77·6	− 8·9	64	382	
May 19							(128)	(701)	(164)
139·524	H, EP	1978 *c*	0·869	260·2	88·7	− 9·5	29	259	
		1978	0·826	260·9	84·0	− 8·5	0	8	
		1978	0·825	259·0	83·8	−10·1	0	23	
		1978	0·814	261·1	82·8	− 8·3	0	27	
		1978	0·800	260·4	81·5	− 8·8	0	14	387 *c*
		1978	0·779	259·2	79·4	− 9·5	10	74	
		1978	0·759	261·8	77·7	− 7·4	3	48	
		1978 *b*	0·745	259·9	76·4	− 8·7	19	135	
May 20							(61)	(588)	(387)
140·432	H, EP	1978 *c*	0·958	260·6	89·8	− 9·5	25	164	
		1978	0·943	260·8	87·0	− 9·2	5	108	
		1978	0·931	259·9	85·0	−10·0	0	28	
		1978	0·922	262·6	83·7	− 7·5	3	37	
		1978	0·910	261·8	82·0	− 8·2	5	68	264 *c*
		1978	0·892	260·4	79·5	− 9·3	0	66	
		1978	0·878	262·6	77·8	− 7·3	0	18	
		1978 *b*	0·864	260·9	76·1	− 8·7	16	110	
May 21							(54)	(599)	(264)
142·461	EP, H		0·914	264·0	55·7	− 6·1			127
May 23							(0)	(0)	(127)

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 Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

May 13 and 15. Photograph somewhat over-exposed.
Group 1978, May 14–21. Two small faint spots, *a* and *b*, on May 14. A third, *c*, is seen near them on May 15. *a* has disappeared by May 17, but *b* and *c* rapidly increase in size. On May 16 and 17 both *b* and *c* are compact clusters of spots. By May 18 the spots composing each cluster have coalesced to form one large spot; and the group consists of two large spots, *b* and *c*, with a stream of small spots between them. *b* breaks up after May 19, and *c* breaks up after May 20.
Group 1979, May 16–17. A small spot, *a*, with a very small companion.
Group 1980, May 17. Two very small faint spots.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
143d·180									
I.									
May 24							(0)	(0)	(0)
144·319	H,EP		0·986	96·0	45·5	− 6·2			210
I.			0·882	73·8	25·7	+13·6			147
May 25							(0)	(0)	(357)
145·406	EP,H		0·937	269·6	20·2	− 0·8			106
		1981	0·922	271·1	17·8	+ 0·6	0	11	
			0·933	98·6	242·3	− 8·5			458
May 26							(0)	(11)	(564)
146·085	H,EP		0·948	266·7	13·1	− 3·5			95
I.			0·899	186·2	314·7	−64·2			64
			0·862	97·6	242·7	− 7·1			572
May 27							(0)	(0)	(731)
147·161	H,EP	1982 *a*	0·266	297·9	301·3	+ 6·3	5	14	
		1982 *b*	0·222	304·2	298·3	+ 6·3	0	7	
I.		1983 *a*	0·366	12·3	283·0	+20·0	7	12	
		1983 *b*	0·383	18·4	280·3	+20·3	7	11	
			0·716	99·6	242·5	− 7·5			354
May 28							(19)	(44)	(354)
148·123	H,EP	1982 *a*	0·471	284·8	302·1	+ 6·2	4	26	
		1982 *c*	0·447	284·2	300·7	+ 5·5	0	3	
I.		1982 *b*	0·417	286·8	298·6	+ 6·2	8	34	
		1983 *a*	0·373	337·4	283·7	+19·3	8	20	
		1983 *b*	0·375	347·5	279·9	+20·6	2	10	
May 29							(22)	(93)	(0)
149·265	H,EP	1982 *a*	0·689	280·3	302·8	+ 6·6	6	22	
		1982 *d*	0·652	281·2	299·8	+ 6·7	0	3	
I.		1982 *b*	0·634	280·2	298·6	+ 5·9	6	18	
		1983 *a*	0·515	311·8	283·8	+19·4	3	8	
		1983 *b*	0·490	318·1	280·3	+20·6	0	2	
		1984	0·923	77·3	193·4	+11·4	0	10	259 *c*
			0·906	102·2	195·6	−11·3			110
			0·943	70·2	191·0	+18·4			165
May 30							(15)	(63)	(534)
1887.				°	°	°			
150d·407	EP,H	1982 *a*	0·856	279·5	302·9	+ 7·8	0	8	
		1982 *d*	0·824	278·9	299·6	+ 7·0	0	5	151 *c*
		1982 *b*	0·818	277·9	299·1	+ 6·1	0	6	
		1985	0·138	197·3	247·1	− 8·1	0	7	
		1985	0·136	182·2	245·0	− 8·4	0	3	
			0·942	176·5	234·8	−70·6			67
			0·819	78·3	190·6	+ 9·2			133
			0·865	68·2	187·1	+18·4			87
			0·955	100·5	172·4	−10·2			450
May 31							(0)	(29)	(888)
151·571	EP,H		0·950	277·6	300·8	+ 7·1			164
		1986 *a*	0·867	102·5	170·0	−11·0	0	35	231 *c*
		1986 *b*	0·899	102·3	166·0	−11·2	0	20	
June 1							(0)	(55)	(395)
152·373	H,EP		0·904	293·0	281·2	+20·6			133
			0·812	291·7	270·7	+17·2			41
I.		1986	0·724	102·1	173·1	− 8·9	0	6	
		1986 *a*	0·768	103·9	169·5	−10·8	8	40	
		1986	0·776	102·2	168·6	− 9·6	0	5	202 *c*
		1986 *b*	0·810	103·8	165·6	−11·3	12	64	
June							(20)	(115)	(376)
153·214	H,EP		0·970	291·5	282·3	+20·8			177
			0·905	287·9	271·1	+16·1			82
I.		1986	0·605	103·8	171·3	− 8·5	0	10	
		1986 *a*	0·634	106·4	169·6	−10·4	13	143	
		1986	0·659	104·1	167·4	− 9·4	0	14	
		1986 *b*	0·682	106·6	166·0	−11·4	11	52	
June 3							(24)	(219)	(259)
154·404	EP,H		0·837	261·3	248·1	− 7·3			284
			0·902	194·2	218·8	−60·9			92
		1986	0·362	115·5	172·6	− 9·1	0	3	
		1986	0·384	117·6	171·7	−10·3	0	4	
		1986 *a*	0·404	115·9	170·2	−10·3	5	47	
June 4							(5)	(54)	(376)
155·204	H,EP		0·904	261·7	245·5	− 7·5			378
I.		1986 *a*	0·246	132·0	170·7	− 9·5	2	20	
			0·950	175·0	166·7	−70·9			62
June 5							(2)	(20)	(440)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 1981, May 26. A small faint spot.

Group 1982, May 28–31. Two small spots, *a* and *b*. A third spot, *c*, is seen between them on May 29, and a close pair, *d*, measured as one, on May 30. Only one component of *d* remains by May 31.

Group 1983, May 28–30. Two small spots, *a* and *b*. *a* has divided into two portions, but is still measured as one, on May 30.

Group 1984, May 30. A small faint spot.

Group 1985, May 31. Two very small faint spots.

Group 1986, June 1–5. Two small faint spots, *a* and *b*, on June 1. Both *a* and *b* have increased in size by June 2, and other small spots have appeared near them. *b* has disappeared by June 4, and *a* has broken up into a cluster of small spots, which are still measured together. *a* has diminished still further by June 5.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day.)	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
156d·487	H,EP		0·961	259·9	237·7	− 9·6			100
		1987	0·928	103·5	97·0	−12·4	18	76	
I.		1987	0·937	104·5	95·7	−13·5	0	77	411 *c*
		1987*a*	0·937	99·9	95·3	− 9·2	0	625	
		1987	0·950	105·8	93·4	−15·0	0	9	
			0·933	66·6	97·3	+21·8			102
June 6							(18)	(787)	(613)
157·321	H,EP	1987*b*	0·848	104·5	96·3	−12·1	13	102	
		1987	0·855	106·4	95·8	−13·8	0	8	962 *c*
I.		1987*a*	0·859	100·4	94·7	− 8·8	158	504	
June 7							(171)	(614)	(962)
158·502	H,EP	1987*b*	0·681	108·4	96·4	−12·1	13	81	105 *c*
		1987*a*	0·692	103·1	94·8	− 8·7	102	502	
			0·810	106·8	85·0	−13·3			205
			0·845	85·1	80·2	+ 4·4			33
			0·851	87·7	79·5	− 1·7			50
June 8							(115)	(583)	(393)
159·438	H,EP		0·921	288·5	191·0	+17·2			104
		1987*b*	0·526	114·4	95·9	−12·1	12	81	
		1987*a*	0·527	107·0	94·6	− 8·5	100	508	
		1988*a*	0·961	89·6	51·4	+ 0·5	4	50	466 *c*
		1988*b*	0·976	89·1	47·9	+ 1·0	0	41	
			0·915	96·5	59·3	− 5·7			79
June 9							(116)	(680)	(649)
160·417	H,EP		0·871	258·9	172·0	− 9·3			276
		1987	0·355	134·7	97·2	−13·8	0	3	
		1987*b*	0·357	128·7	95·7	−12·2	1	81	
		1987*a*	0·335	117·8	94·9	− 8·3	106	512	
		1988*a*	0·866	89·2	52·4	+ 1·1	7	16	323 *c*
		1988*b*	0·902	88·9	48·0	+ 1·3	0	28	
June 10							(114)	(640)	(599)
161·434	H,EP		0·950	257·4	169·7	−11·7			462
		1987*b*	0·241	166·5	95·4	−12·7	6	44	
		1987*a*	0·170	156·9	94·9	− 8·2	103	496	
		1987	0·227	157·7	93·7	−11·3	0	5	
		1987	0·268	151·7	91·2	−12·8	0	3	
		1988*a*	0·713	89·0	53·4	+ 1·3	4	8	207 *c*
		1988*b*	0·771	88·7	48·5	+ 1·5	5	40	
June 11							(118)	(596)	(669)
1887.				°	°	°			
162d·517	H,EP		0·973	256·7	161·4	−12·8			27
			0·946	251·1	154·0	−17·5			67
		1987	0·241	242·1	96·8	− 5·6	0	11	
		1987*b*	0·304	218·3	95·6	−13·7	5	24	
		1987*a*	0·241	229·2	95·1	− 8·2	112	522	
		1988*a*	0·508	89·1	54·1	+ 1·3	0	5	
		1988*b*	0·565	90·6	50·2	+ 0·4	0	12	
		1988*b*	0·579	89·6	49·3	+ 1·0	8	18	
June 12							(125)	(592)	(94)
163·440	H,EP	1987*b*	0·462	237·8	95·9	−14·1	0	12	
		1987*a*	0·415	247·6	94·9	− 8·1	107	501	
		1988*b*	0·369	90·1	50·6	+ 0·9	4	13	
June 13							(111)	(526)	(0)
164·425	H,EP	1987*b*	0·643	247·1	96·6	−13·6	0	4	
		1987*a*	0·601	254·9	94·9	− 8·1	118	503	
		1988*b*	0·129	91·1	51·8	+ 1·0	0	3	
June 14							(118)	(510)	(0)
165·447	H,EP		0·787	251·3	95·9	−14·6			68
		1987*a*	0·768	258·5	95·0	− 8·0	100	483	
June 15							(100)	(483)	(68)
166·412	H,EP	1987*a*	0·890	260·6	95·0	− 7·7	95	437	291 *sf*
June 16							(95)	(437)	(291)
167·417	EP,H	1987*a*	0·971	261·8	95·1	− 7·6	67	296	189 *sf*
		1989	0·166	258·9	28·8	− 0·4	0	8	
		1989	0·090	259·4	24·6	+ 0·6	5	23	
June 17							(72)	(327)	(189)
168·106	EP,H		0·948	272·2	81·7	+ 2·6			140
			0·706	271·2	55·3	+ 2·0			183
I.		1987*a*	0·996	262·3	94·9	− 7·5	0	311	440 *sf*
		1989	0·331	264·9	29·7	− 0·2	3	8	
		1989	0·306	262·5	28·1	− 0·8	0	5	
		1989	0·286	262·6	26·9	− 0·6	0	9	
		1989	0·260	265·8	25·5	+ 0·5	0	4	
		1989	0·239	268·5	24·3	+ 1·2	8	18	
		1990*a*	0·977	96·3	293·3	− 5·8	0	16	161 *f*
June 18							(11)	(371)	(924)

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 Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

June 6. Photograph under-exposed. The Umbra of Spot 1987*a* not visible probably on this account. June 15. Photograph over-exposed.
Group 1987, June 6–18. A very large regular spot, *a*, accompanied on June 6 by two spots which have coalesced by June 7 to form one large spot, *b*. One or two very small spots are also occasionally seen in the neighbourhood of the group.
Group 1988, June 9–14. Two spots, *a* and *b*. *b* forms a cluster of three small spots on June 11. One of these spots has moved forward and is measured by itself on June 12. Only one small spot remains on June 13.
Group 1989, June 17–21. A number of small spots in a straight stream. The following portion of the group has become a regular spot, *a*, by June 19.
Group 1990, June 18–25. A small spot, *a*, on June 18. A second, *b*, follows it on June 20 and the succeeding days, and a third, *c*, appears between them on June 22. *a* and *c* have disappeared and *b* has broken up into three very small spots by June 24. Only one very small spot remains by June 25.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
169d·501	EP,H		0·885	269·6	54·0	+ 0·5			89
		1989	0·609	267·6	29·3	− 0·1	4	48	
		1989	0·578	266·3	27·1	− 0·8	0	13	
		1989*a*	0·545	268·2	24·9	+ 0·5	15	122	
		1990*a*	0·855	97·4	293·8	− 5·4	0	12	111 *f*
June 19							(19)	(195)	(200)
170·420	EP,H	1989	0·773	269·4	30·2	+ 0·8	0	24	
		1989*a*	0·710	268·9	24·8	+ 0·5	6	58	
		1990*a*	0·726	99·4	293·8	− 5·5	0	30	94 *c*
		1990*b*	0·758	98·7	291·2	− 5·3	6	34	
June 20							(12)	(146)	(94)
171·263	H,EP	1989	0·866	270·5	28·5	+ 1·5	0	4	205 *c*
		1989*a*	0·822	270·1	23·8	+ 1·2	4	36	
M.		1990*a*	0·577	102·1	294·3	− 5·2	1	20	
		1990*b*	0·635	102·3	290·3	− 6·2	5	37	
June 21							(10)	(97)	(205)
172·416	EP,H		0·953	269·5	25·5	+ 0·2			188
		1990*a*	0·350	109·8	294·2	− 4·8	1	13	
		1990*c*	0·390	108·3	291·7	− 5·1	0	3	
		1990*b*	0·417	109·2	290·2	− 6·0	1	20	
June 22							(2)	(36)	(188)
173·476	EP,H	1990*a*	0·173	133·4	292·1	− 4·6	0	5	
		1990*c*	0·194	130·6	290·8	− 5·1	0	1	
		1990*b*	0·216	132·7	290·1	− 6·2	0	29	
June 23							(0)	(35)	(0)
174·143	M,EP	1990	0·137	179·8	290·5	− 5·5	0	3	
		1990	0·154	178·4	290·2	− 6·5	2	10	
I.		1990	0·168	177·8	290·1	− 7·3	0	2	
			0·919	101·0	224·7	− 9·2			64
June 24							(2)	(15)	(64)
175·196	H,M	1990	0·271	240·0	290·2	− 5·5	0	4	
I.									
June 25							(0)	(4)	(0)
176·241	H,M		0·930	75·4	194·7	+14·5			110
I.									
June 26							(0)	(0)	(110)

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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887				°	°	°			
177d·440	EP,H	1991*a*	0·940	103·3	177·9	−11·6	42	194	614 *c*
		1991*b*	0·949	100·6	176·1	− 9·2	0	98	
			0·791	71·5	195·5	+16·2			48
			0·922	66·8	180·5	+22·4			59
June 27							(42)	(292)	(721)
178·513	EP,H		0·896	263·3	295·7	− 4·7			73
		1991*a*	0·834	105·8	177·9	−11·5	38	223	340 *c*
		1991*b*	0·852	103·1	175·6	− 9·6	0	17	
June 28							(38)	(240)	(413)
179·492	EP,H		0·964	261·8	293·5	− 7·1			163
		1991*a*	0·696	110·5	178·1	−11·8	35	210	181 *c*
		1991*b*	0·719	107·3	175·7	−10·2	3	10	
June 29							(38)	(220)	(344)
180·273	H,M	1991*a*	0·562	116·1	178·6	−11·7	36	163	
		1991*b*	0·585	111·6	176·1	− 9·9	3	8	
I.			0·739	78·8	162·2	+10·3			72
June 30							(39)	(171)	(72)
181·413	EP,H		0·889	264·1	256·5	− 3·7			123
		1991*a*	0·366	134·7	179·0	−11·9	33	171	
		1991*b*	0·374	127·1	176·7	−10·0	0	12	
		1991	0·419	121·9	173·2	− 9·9	0	4	
July 1							(33)	(187)	(123)
182·528	EP,H	1991*a*	0·260	178·7	179·3	−11·8	35	179	
		1991	0·218	172·2	177·9	− 9·2	0	9	
		1991	0·242	154·4	173·5	− 9·4	0	13	
		1991	0·229	147·5	172·5	− 8·0	0	10	
		1992*a*	0·993	98·0	97·2	− 7·5	31	200	197 *c*
July 2							(66)	(411)	(197)
183·551	EP,H	1991*a*	0·345	221·3	179·5	−11·8	36	181	
		1991	0·286	206·8	173·6	−11·5	0	13	
		1992*a*	0·939	99·3	97·2	− 7·5	30	196	91 *c*
			0·965	104·0	92·7	−12·6			334
July 3							(66)	(390)	(425)

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 Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

June 21. Photograph much over-exposed. Definition bad.

Group 1991, June 27–July 8. A large regular spot, *a*, with a smaller spot, *b*, near it; *b* has disappeared by July 2. Other small spots are seen near *a* on July 1, 2, and 3.

Group 1992, July 2–14. A large regular spot, *a*, with two companions, *b* and *c*, on July 4 and the succeeding days; *c* has disappeared by July 6, and *b* by July 11, but several other small spots are seen near *a* on July 5, 8, and 9.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
184d·434	EP,H	1991*a*	0·495	238·8	179·8	−11·7	33	159	
		1992*a*	0·854	101·0	96·8	− 7·5	34	195	
		1992*b*	0·862	99·1	95·6	− 6·1	7	41	122 *c*
		1992*c*	0·879	100·5	93·8	− 7·6	0	5	
			0·851	112·2	99·1	−16·8			76
			0·919	103·9	89·1	−11·3			317
July 4							(74)	(400)	(515)
185·577	EP,H	1991*a*	0·693	249·1	180·4	−11·7	29	157	
		1993*a*	0·386	185·0	141·2	−19·0	1	40	
		1993	0·380	180·9	139·6	−18·7	0	12	
		1993*b*	0·390	176·2	137·6	−19·3	3	16	
		1992*a*	0·690	104·8	97·1	− 7·5	28	186	
		1992	0·694	99·6	96·1	− 4·1	0	8	
		1992*b*	0·704	102·2	95·6	− 6·0	12	36	88 *c*
		1992*c*	0·729	103·9	93·8	− 7·6	0	3	
		1992	0·738	106·2	93·4	− 9·5	0	2	
		1994*a*	0·989	83·6	57·5	+ 6·9	0	138	
			0·814	107·8	86·9	−12·3			234
			0·940	95·6	69·8	− 4·0			73
July 5							(73)	(598)	(395)
186·558	EP,M		0·875	285·6	187·0	+15·4			62
		1991*a*	0·833	253·3	180·7	−11·7	30	158	328 *f*
		1993*a*	0·481	214·8	143·2	−19·8	35	152	
		1993	0·449	210·3	140·1	−19·2	0	1	
		1993*b*	0·436	204·5	137·3	−19·7	9	64	
		1992*a*	0·526	110·6	96·7	− 7·5	32	188	
		1992*b*	0·536	107·2	95·4	− 6·0	4	29	
		1994*a*	0·938	84·2	56·5	+ 6·7	15	144	
		1994	0·961	85·2	52·3	+ 5·6	0	3	263 *c*
		1994*b*	0·973	83·2	49·6	+ 7·5	18	191	
July 6							(143)	(930)	(653)
187·404	EP,M	1991*a*	0·924	255·6	181·0	−11·8	20	126	354 *f*
		1993*a*	0·599	229·9	144·0	−19·4	28	189	
		1993	0·551	226·6	140·0	−18·8	0	5	
		1993	0·517	225·1	137·6	−18·0	0	4	
		1993*b*	0·528	221·9	137·0	−19·7	18	78	
		1992*a*	0·361	121·6	97·1	− 7·4	34	175	
		1992*b*	0·368	116·2	95·8	− 5·8	8	34	
1887.				°	°	°			
187d·404	EP,M	1994*a*	0·856	84·6	56·3	+ 6·6	18	159	
		1994	0·886	85·5	52·7	+ 5·7	0	13	366 *c*
		1994*b*	0·911	83·2	49·5	+ 7·7	25	243	
			0·889	94·1	52·8	− 1·9			45
			0·971	89·2	39·1	+ 1·7			54
July 7							(151)	(1026)	(819)
188·458	EP,M	1991*a*	0·987	257·3	180·7	−11·9	0	105	349 *f*
		1993*a*	0·744	240·0	144·0	−19·0	28	170	
		1993	0·688	237·9	138·9	−18·4	0	4	
		1993*b*	0·666	234·3	136·1	−19·7	7	32	
		1992*a*	0·208	159·8	97·1	− 7·4	25	173	
		1992*b*	0·189	151·0	95·9	− 5·7	5	19	
		1992	0·249	158·5	95·9	− 9·6	0	3	
		1992	0·257	151·7	94·1	− 9·3	0	6	
		1992	0·239	147·7	93·8	− 7·9	0	5	
		1994*a*	0·703	84·5	56·6	+ 6·6	26	126	
		1994	0·741	85·4	53·4	+ 6·0	0	8	429 *c*
		1994	0·762	81·6	51·7	+ 8·9	0	35	
		1994*b*	0·786	82·8	49·4	+ 8·0	31	203	
			0·781	96·5	50·5	− 2·7			49
			0·907	89·7	36·3	+ 1·9			152
July 8							(122)	(889)	(979)
189·471	EP,M	1993*a*	0·866	246·0	144·0	−18·4	31	151	134 *c*
		1993*b*	0·794	242·1	135·5	−19·2	0	9	
		1992*a*	0·254	219·2	97·0	− 7·4	31	169	
		1992*b*	0·222	220·8	96·0	− 5·8	2	10	
		1992	0·208	224·5	96·1	− 4·6	0	3	
		1992	0·193	227·0	95·8	− 3·7	0	5	
		1994*a*	0·517	84·4	56·7	+ 6·2	26	116	
		1994	0·560	83·7	53·8	+ 6·7	0	6	
		1994	0·575	80·0	52·9	+ 8·9	0	10	
		1994*b*	0·628	81·8	49·0	+ 8·2	34	197	
July 9							(124)	(676)	(134)
190·492	EP,M	1993*a*	0·950	249·1	143·2	−18·4	20	135	97 *f*
		1992*a*	0·433	243·7	97·0	− 7·4	36	171	
		1992*b*	0·403	246·9	95·9	− 5·4	0	13	
		1994*a*	0·300	81·7	56·8	+ 6·3	26	100	
		1994*b*	0·432	78·3	48·9	+ 8·6	33	155	
July 10							(115)	(574)	(97)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

July 8. Photograph over-exposed.

July 10. Definition of photograph spoiled by dust on magnifier of the photoheliograph.

Group 1993, July 5–11. A stream of small spots on July 5, measured in three clusters. The first and last spots, *a* and *b*, have greatly increased by July 6, and the *intermediate spots have almost disappeared.*

Group 1994, July 5–18, Two regular spots, *a* and *b*. A few small spots are occasionally seen between them.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for day).
1887.				°	°	°			
191d·582	EP,M	1993*a*	0·997	251·1	143·2	−18·4	0	77	134 *f*
		1992*a*	0·635	253·4	97·4	− 7·2	29	172	
		1994*a*	0·054	50·4	57·3	+ 6·0	29	131	
		1994	0·106	54·2	54·8	+ 7·7	0	4	
		1994	0·163	58·6	51·6	+ 8·9	0	3	
		1994*b*	0·203	65·2	49·0	+ 8·9	24	142	
July 11							(82)	(529)	(134)
192·492	M,EP	1992*a*	0·783	257·2	97·8	− 7·3	31	188	187 *c*
		1994*a*	0·175	280·5	57·6	+ 6·0	32	141	
		1994	0·147	293·6	55·5	+ 7·5	0	5	
		1994*b*	0·089	344·7	49·1	+ 9·1	19	103	
July 12							(82)	(437)	(187)
193·429	M,EP		0·885	250·7	94·9	−14·9			112
		1992*a*	0·896	260·0	97·8	− 7·0	28	176	220 *c*
		1994*a*	0·390	274·8	58·2	+ 5·8	27	150	
		1994*b*	0·261	289·4	49·7	+ 9·1	18	105	
July 13							(73)	(431)	(332)
194·418	H,EP		0·924	271·9	89·8	+ 3·5			176
			0·936	254·2	89·7	−13·1			463
I.		1992*a*	0·975	261·4	98·5	− 7·4	30	186	236 *c*
		1994*a*	0·592	273·2	58·6	+ 5·5	31	138	
		1994*b*	0·467	280·7	49·8	+ 8·9	21	103	
July 14							(82)	(427)	(875)
195·459	M,EP	1994*a*	0·765	273·5	58·3	+ 5·6	23	130	95 *c*
		1994*b*	0·664	278·2	49·9	+ 8·8	22	85	
July 15							(45)	(215)	(95)
196·460	M,EP	1994*a*	0·889	273·9	58·1	+ 5·6	16	107	215 *c*
		1994*b*	0·815	277·4	49·9	+ 8·7	19	86	
July 16							(35)	(193)	(215)
197·458	EP,M	1994*a*	0·970	274·4	58·0	+ 5·4	16	68	125 *c*
		1994*b*	0·926	277·0	50·0	+ 8·2	10	52	
July 17							(26)	(120)	(125)
198·465	EP,M	1994*b*	0·990	277·8	50·9	+ 8·4	0	50	77 *c*
			0·946	96·1	258·4	− 4·2			121
July 18							(0)	(50)	(198)

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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
199d·432									
July 19							(0)	(0)	(0)
200·406									
July 20							(0)	(0)	(0)
201·477									
July 21							(0)	(0)	(0)
202·419									
July 22							(0)	(0)	(0)
203·418	EP,M	1995	0·257	157·0	257·3	− 8·5	0	9	
		1995	0·283	157·2	256·7	− 9·9	4	11	
		1995	0·289	149·4	254·6	− 9·2	8	30	
July 23							(12)	(50)	(0)
204·455	EP,M	1995	0·304	211·4	258·6	− 9·8	0	8	
		1995	0·299	203·4	256·3	−10·6	0	5	
		1995	0·271	196·3	253·8	− 9·8	5	32	
		1996*a*	0·938	106·4	182·0	−13·4	0	18	344 *f*
July 24							(5)	(63)	(344)
205·089	H,M		0·921	258·2	306·6	− 8·6			69
		1995	0·401	230·4	259·3	− 9·6	1	17	
I.		1995	0·381	225·5	257·1	−10·3	6	14	
		1995	0·358	219·0	254·3	−10·9	1	10	
		1995	0·340	220·2	253·9	− 9·7	11	26	
		1995	0·327	218·3	252·9	− 9·5	0	2	
		1995	0·239	197·1	245·1	− 7·8	0	2	
		1995	0·224	190·6	243·5	− 7·3	1	4	
		1996*a*	0·881	107·9	182·0	−13·0	4	19	603 *f*
July 25							(24)	(94)	(672)
206·531	EP,M	1995*a*	0·694	249·3	263·1	−10·0	11	137	
		1995*b*	0·637	246·6	258·3	−10·2	17	78	
		1995	0·584	244·9	254·3	− 9·7	6	39	
		1996*a*	0·691	115·8	182·4	−13·2	3	14	
July 26							(37)	(268)	(0)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 1995, July 23–29. A few small spots in a straggling stream on July 23 and the succeeding days. The group has greatly increased in size by July 26, and then consists of three portions; *a* a large regular spot; *b* a chain of spots in the form of a horse-shoe, the concavity of which is turned towards *a*, and a little stream of spots following *b*. The components of *b* have coalesced by July 27, but considerable portions become separated from it again on the succeeding days.
Group 1996, July 24–28. A small spot, *a*, followed on July 28 by a very small companion.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
207d·403	EP, M	1995*a*	0·839	254·5	265·4	− 9·8	49	254	
		1995*b*	0·768	251·1	258·0	−10·6	13	250	
		1995	0·738	252·9	255·8	− 8·6	0	9	303 *c*
		1995	0·730	250·0	254·5	−10·4	0	18	
		1996*a*	0·555	124·4	182·5	−13·3	2	11	
			0·951	112·0	142·0	−18·9			110
July 27							(64)	(542)	(413)
208·437	M, EP	1995*a*	0·948	257·8	266·6	− 9·7	53	272	
		1995	0·902	257·6	259·5	− 8·6	0	30	
		1995*b*	0·889	254·6	257·3	−10·9	39	325	334 *c*
		1995	0·876	257·5	256·2	− 8·1	0	13	
		1996*a*	0·396	143·6	182·8	−13·1	0	4	
		1996	0·408	139·2	180·9	−12·6	0	4	
			0·865	116·1	141·5	−19·2			156
July 28							(92)	(648)	(490)
209·206	H, EP	1995*a*	0·991	259·6	267·6	− 9·5	40	318	
		1995	0·977	258·1	262·7	−10·3	0	127	
M.		1995	0·966	259·1	260·2	− 9·0	3	57	334 *c*
		1995*b*	0·954	256·2	257·2	−11·3	15	296	
		1995	0·945	258·6	256·0	− 8·8	0	15	
July 29							(58)	(813)	(334)
210·544	H, EP	1997*a*	0·927	104·6	102·9	−11·2	0	30	480 *c*
		1998	0·954	100·2	97·6	− 7·9	0	64	
July 30							(0)	(94)	(480)
211·458	H, EP	1997*a*	0·823	107·5	104·0	−10·7	3	35	
		1998	0·874	102·2	97·5	− 7·7	9	79	
		1999	0·938	99·4	88·3	− 6·7	0	27	
		1999	0·948	97·6	86·3	− 5·3	19	220	493 *c*
		2000	0·938	80·1	86·6	+11·3	5	70	241 *c*
			0·926	109·2	92·0	−15·3			107
July 31							(36)	(431)	(841)
212·530	H, EP	1997*a*	0·654	113·6	105·2	−10·5	3	19	
		1997	0·678	113·5	103·4	−11·1	0	4	
		1997	0·717	115·1	100·9	−13·3	0	3	

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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
212d·530	H, EP	1998	0·737	106·1	97·2	− 7·7	11	76	
		1999	0·833	102·0	87·7	− 6·6	1	17	
		1999	0·848	101·5	86·1	− 6·5	10	67	394 *c*
		1999	0·840	98·8	86·5	− 4·2	17	188	
		2000	0·827	80·5	86·6	+11·1	5	115	129 *c*
			0·973	78·9	65·3	+12·3			89
Aug. 1							(47)	(489)	(612)
213·588	H, EP	1997	0·470	126·6	106·2	−10·7	3	21	
		1998	0·562	113·4	97·5	− 7·7	11	79	
		1999*a*	0·659	102·8	88·8	− 3·8	12	88	
		1999	0·670	106·7	88·6	− 6·5	0	7	
		1999	0·662	101·3	87·9	− 2·9	0	15	
		1999	0·681	106·3	87·7	− 6·5	0	9	
		1999	0·693	101·5	86·0	− 3·5	0	17	
		1999*c*	0·702	105·2	85·9	− 6·2	7	58	
		1999*b*	0·702	102·8	85·5	− 4·6	10	85	
		1999	0·729	102·3	83·3	− 4·8	0	9	
		2000	0·668	79·7	86·8	+11·4	6	61	
			0·896	84·4	64·8	+ 7·7			154
Aug. 2							(49)	~~(49)~~ (449)	(154)
214·406	H, EP		0·888	256·5	178·6	− 9·1			108
		1997*a*	0·345	145·9	106·5	−10·6	2	26	
		1998	0·412	123·2	97·6	− 7·3	12	76	
		1999*a*	0·493	109·5	90·1	− 4·0	10	74	
		1999	0·531	112·6	88·4	− 6·5	0	21	
		1999	0·536	104·9	86·7	− 2·7	0	29	
		1999*b*	0·557	107·8	85·8	− 4·7	8	41	
		1999*c*	0·562	109·6	85·8	− 5·7	4	65	
		1999	0·589	105·8	83·3	− 4·2	0	15	
		2000	0·520	77·7	86·7	+11·6	7	38	
			0·867	84·8	57·5	+ 7·5			226
Aug. 3							(43)	(385)	(334)
215·402	H, EP		0·969	256·7	178·5	−11·3			142
			0·950	249·0	173·0	−17·7			172
		1997*a*	0·287	186·7	106·5	−10·4	6	14	
		1998	0·262	152·5	97·6	− 7·3	8	75	
		1999*a*	0·298	127·4	90·9	− 4·4	4	88	
		1999	0·336	128·4	89·3	− 6·2	0	3	

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

July 30 and Aug. 2. Definition poor. Photograph taken through haze.

Aug. 9. Photograph over-exposed.

Group 1997, July 30–Aug. 7. A small regular spot, *a*, with two small companions on Aug. 1, and one on Aug. 5.

Group 1998, July 30–Aug. 9. A regular spot.

Group 1999, July 31–Aug. 10. An irregular stream of spots changing its appearance from day to day. Three regular spots *a*, *b*, and *c* have formed in the stream by Aug. 2. Of these *a* has partly broken up by Aug. 4, but re-formed again by Aug. 6; and *b* has partly broken up by Aug. 5, but re-formed by Aug. 6. *c* has entirely broken up by Aug. 6, and *b* by Aug. 8.

Group 2000, July 31–Aug. 5. A somewhat faint spot. It has divided into two portions by Aug. 4, but is measured as one on Aug. 4 and 5.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
215d·402	H,EP	1999	0·351	126·8	88·3	− 6·2	0	2	
		1999	0·341	117·4	87·1	− 3·2	0	10	
		1999	0·336	114·0	86·8	− 2·0	0	9	
		1999 *b*	0·363	119·8	86·3	− 4·6	1	22	
		1999 *c*	0·380	122·0	85·8	− 5·8	10	51	
		1999	0·434	122·0	82·9	− 7·6	0	4	
		1999	0·410	114·5	82·7	− 4·1	1	14	
		2000	0·314	70·8	87·0	+11·7	1	12	
Aug. 4							(31)	(304)	(314)
216·406	H,EP		0·831	244·1	142·7	−17·5			111
		1997	0·413	219·8	106·9	−12·5	0	2	
		1997*a*	0·389	222·4	106·7	−10·6	1	9	
		1998	0·263	205·2	97·6	− 7·6	14	79	
		1999*a*	0·195	183·6	92·0	− 5·0	14	196	
		1999	0·152	173·2	90·3	− 2·4	0	9	
		1999*b*	0·188	157·5	87·2	− 3·8	11	54	
		1999	0·212	159·2	87·0	− 5·2	0	7	
		1999*c*	0·234	157·0	86·0	− 6·2	3	24	
		1999	0·203	150·0	85·5	− 3·9	0	5	
		2000	0·120	35·4	87·3	+11·9	1	7	
Aug. 5							(44)	(392)	(111)
217·487	H, M	1997*a*	0·556	240·6	106·5	−10·3	0	9	
		1998	0·421	236·7	97·8	− 7·4	10	72	
		1999*a*	0·336	235·0	93·1	− 5·1	21	217	
		1999	0·295	227·7	89·7	− 5·2	0	14	
		1999	0·268	219·5	86·9	− 5·7	0	28	
		1999 *b*	0·240	225·5	86·9	− 3·4	11	48	
		1999	0·228	215·9	84·8	− 4·4	7	25	
Aug. 6							(49)	(413)	(0)
218·206	EP,H	1997 *a*	0·669	246·7	106·0	−10·4	0	4	
M.		1998	0·546	245·8	97·5	− 7·5	11	71	
		1999*a*	0·472	246·0	93·1	− 5·4	26	201	
		1999	0·428	244·3	90·2	− 4·9	0	10	
		1999	0·394	237·1	86·9	− 6·4	8	61	
		1999*b*	0·371	243·1	86·8	− 3·7	10	45	
		1999	0·347	237·9	84·6	− 4·6	5	37	
Aug. 7							(60)	(429)	(0)
1887.				°	°	°			
219d·538	H,EP	1998	0·761	254·9	97·6	− 7·1	5	26	
		1999	0·626	255·3	87·2	− 4·0	3	75	
		1999*a*	0·710	256·1	93·6	− 5·2	27	197	
		1999	0·657	253·2	89·1	− 6·0	7	25	
Aug. 8							(42)	(323)	(0)
220·573	H,EP		0·944	259·3	105·6	− 7·9			141
			0·942	249·5	103·4	−16·8			65
		1998	0·887	258·4	97·3	− 7·2	6	26	
		1999*a*	0·852	260·3	93·6	− 4·8	15	191	367 *c*
		1999	0·817	258·7	89·8	− 5·4	1	12	
		1999	0·796	260·2	88·0	− 3·8	0	40	
Aug. 9							(22)	(269)	(573)
221·512	H,EP		0·873	283·2	85·1	+14·7			70
		1999*a*	0·942	263·0	93·2	− 4·3	0	154	316 *c*
		1999	0·919	260·6	89·3	− 6·0	0	8	
		1999	0·902	261·5	87·1	− 4·8	0	5	
Aug. 10							(0)	(167)	(386)
222·572	H,EP		0·954	284·7	83·3	+15·9			107
			0·949	260·9	80·2	− 6·5			572
Aug. 11							(0)	(0)	(679)
223·602	H,M		0·868	276·2	56·9	+ 8·7			235
Aug. 12							(0)	(0)	(235)
224·573	H,EP		0·941	276·7	54·1	+ 8·5			104
		2001*a*	0·950	102·4	273·5	− 9·6	6	101	378 *c*
		2001*b*	0·969	101·5	269·5	− 9·4	0	92	
		2002*a*	0·989	81·6	261·4	+ 9·3	0	81	
Aug. 13							(6)	(274)	(482)
225·536	H,EP		0·850	231·3	19·1	−27·7			97
		2001*a*	0·855	105·8	274·3	− 9·8	12	76	578 *c*
		2001*b*	0·896	103·9	269·1	− 9·3	0	47	
		2002*a*	0·932	82·6	261·5	+ 9·3	13	69	146 *c*
Aug. 14							(25)	(192)	(821)
226·535	EP,H	2001*a*	0·722	110·4	274·2	− 9·7	11	80	276 *f*
		2001*b*	0·778	107·7	268·9	− 9·2	0	20	
		2002*a*	0·828	83·2	261·2	+ 9·4	13	80	95 *f*
Aug. 15							(24)	(180)	(371)

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 Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 2001, Aug. 13–21. A regular spot, *a*, with a faint companion, *b*. *b* has disappeared by Aug. 17. Another companion is seen on Aug. 18, and yet another on Aug. 19.
Group 2002, Aug. 13–22. A regular spot, *a*. One very small companion is seen on Aug. 18, and two on Aug. 20.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
227d·338	H,EP	2001*a*	0·586	117·4	275·1	− 9·9	18	81	
		2001*b*	0·651	112·8	269·5	− 9·2	0	7	
I.		2003	0·765	119·1	262·6	−16·9	0	7	
		2002*a*	0·704	83·5	261·8	+ 9·4	14	87	60 *c*
			0·763	77·8	256·9	+13·7			69
			0·755	114·0	261·9	−13·1			357
Aug. 16							(32)	(182)	(486)
228·243	H, M	2001*a*	0·431	131·2	275·6	−10·0	14	80	
I.		2002*a*	0·541	82·6	262·0	+ 9·8	17	80	
Aug. 17							(31)	(160)	(0)
229·661	M, H	2001*a*	0·286	183·5	277·1	− 9·6	9	52	
		2001	0·230	182·6	276·7	− 6·3	0	4	
		2002*a*	0·248	77·0	262·0	+ 9·9	16	84	
		2002	0·255	82·6	261·4	+ 8·5	0	1	
Aug. 18							(25)	(141)	(0)
230·586	EP,H	2001*a*	0·379	220·2	278·2	−10·1	4	26	
		2001	0·287	226·2	275·8	− 4·7	0	2	
		2002*a*	0·062	27·5	262·2	+10·0	6	40	
			0·835	87·2	207·1	+ 6·2			126
Aug. 19							(10)	(68)	(126)
231·554	M, H	2001*a*	0·537	238·4	278·8	−10·2	4	17	
		2002*a*	0·193	287·2	262·0	+10·0	5	17	
		2002	0·180	283·1	261·4	+ 9·1	0	1	
		2002	0·162	292·3	259·9	+10·4	0	2	
		2004	0·968	107·5	178·5	−15·0	0	24	272 *c*
Aug. 20							(9)	(61)	(272)
232·183	H, M	2001*a*	0·647	244·5	279·2	−10·6	0	8	
M.		2002*a*	0·329	280·5	262·0	+10·0	4	13	
		2004	0·924	109·4	178·7	−14·9	0	24	137
Aug. 21							(4)	(45)	(137)
233·452	EP,H	2002*a*	0·578	278·1	261·5	+10·4	4	15	
		2004	0·796	114·9	177·9	−15·0	0	12	155 *c*
Aug. 22							(4)	(27)	(155)
234·475	M, H		0·892	255·0	273·4	−10·0			386
			0·931	112·3	148·1	−17·8			56
Aug. 23							(0)	(0)	(442)
1887.				°	°	°			
235d·467	EP,H		0·932	254·1	265·7	−12·0			341
			0·862	280·3	259·6	+12·5			146
Aug. 24							(0)	(0)	(487)
236·087	H, M		0·970	267·8	266·9	− 0·4			41
I.			0·951	253·8	260·7	−13·0			463
			0·927	281·0	260·0	+12·8			264
Aug. 25							(0)	(0)	(768)
237·414	H, M		0·961	278·5	248·4	+10·2			428
I.			0·962	266·4	247·2	− 1·5			112
			0·952	290·3	247·0	+21·4			65
Aug. 26							(0)	(0)	(605)
238·569	M, H	2005*a*	0·934	272·3	227·7	+ 4·7	0	16	} 105 *c*
		2005*b*	0·911	271·2	224·2	+ 4·1	0	16	
			0·892	100·8	86·2	−23·4			299
Aug. 27							(0)	(32)	(404)
239·231	H, M	2005*a*	0·982	273·5	229·0	+ 4·8	0	48	
		2005*b*	0·955	271·9	222·6	+ 4·0	0	18	143 *sf*
M.			0·827	91·5	94·0	+ 2·9			77
			0·854	103·0	92·9	− 7·1			177
Aug. 28							(0)	(66)	(397)
240·433	EP,H		0·813	103·5	81·3	− 6·6			168
			0·838	113·6	81·2	−15·3			57
			0·894	82·4	69·9	+10·0			286
Aug. 29							(0)	(0)	(511)
241·407	EP,H		0·897	255·9	182·5	− 9·2			84
			0·910	247·5	182·2	−17·0			66
			0·969	94·1	45·9	− 2·1			70
Aug. 30							(0)	(0)	(220)
242·405									
Aug. 31							(0)	(0)	(0)
243·406									
I.									
Sept. 1							(0)	(0)	(0)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Aug. 24 and 27. Photograph partly fogged. Definition bad.
Group 2003, Aug. 16. A very small spot.
Group 2004, Aug. 21–22. A small spot.
Group 2005, Aug. 27–28. Two small spots, *a* and *b*.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
244d·289									
I.									
Sept. 2							(0)	(0)	(0)
245·451	EP, H	2006*a*	0·412	238·7	88·2	− 5·6	0	19	
		2006*b*	0·366	232·1	84·4	− 6·0	3	33	
Sept. 3							(3)	(52)	(0)
246·464	EP, H	2006*b*	0·543	246·1	84·1	− 6·5	0	22	
Sept. 4							(0)	(22)	(0)
247·656	M, H		0·893	259·0	100·2	− 6·5			328
			0·842	267·4	95·6	+ 1·7			64
Sept. 5							(0)	(0)	(392)
248·144	EP, M		0·930	261·5	99·2	− 5·1			542
			0·886	239·0	87·5	−23·2			82
I.			0·828	256·5	86·0	− 6·9			273
Sept. 6							(0)	(0)	(897)
249·426	EP, H		0·943	260·7	84·2	− 6·3			168
Sept. 7							(0)	(0)	(168)
250·473	M, H		0·979	100·0	284·6	− 8·2			89
Sept. 8							(0)	(0)	(89)
251·556	EP, H		0·943	102·4	278·3	− 9·2			305
Sept. 9							(0)	(0)	(305)
252·467	EP, H		0·869	105·5	277·1	− 9·6			259
Sept. 10							(0)	(0)	(259)
253·513	EP, H		0·893	108·0	260·8	−12·5			215
			0·976	99·6	245·0	− 7·7			118
Sept. 11							(0)	(0)	(333)
254·574	EP, H		0·831	114·7	255·5	−15·9			151
			0·895	101·4	245·1	− 6·9			130
Sept. 12							(0)	(0)	(281)
1887.				°	°	°			
255d·459	M, H	2007	0·783	104·8	246·0	− 6·9	0	10	36*c*
Sept. 13							(0)	(10)	(36)
256·436	M, H		0·975	264·3	358·7	− 3·9			127
		2007	0·632	109·8	245·8	− 6·6	2	15	
		2008	0·782	90·6	231·0	+ 4·1	1	11	} 68
		2008	0·790	87·9	230·0	+ 6·1	0	20	
Sept. 14							(3)	(46)	(195)
257·481	M, H	2007	0·440	120·9	246·4	− 6·3	0	6	
		2008*a*	0·569	93·5	234·0	+ 4·0	23	150	
		2008*b*	0·627	90·1	229·7	+ 5·6	15	100	
Sept. 15							(38)	(256)	(0)
258·538	H, M	2008*a*	0·335	98·6	235·5	+ 3·9	42	191	
		2008	0·408	97·0	231·0	+ 3·7	0	7	
		2008*b*	0·430	91·6	229·3	+ 5·8	16	118	
Sept. 16							(58)	(316)	(0)
259·185	H, EP	2008*a*	0·184	107·1	236·1	+ 3·9	31	182	
M.		2008	0·267	101·4	231·0	+ 3·9	10	42	
		2008*b*	0·294	93·2	229·1	+ 5·9	15	201	
Sept. 17							(56)	(425)	(0)
260·193	H, EP		0·808	256·3	284·9	− 6·7			177
			0·787	246·1	280·5	−13·8			58
M.		2008*a*	0·094	227·2	236·8	+ 3·5	33	176	
		2008	0·052	181·6	233·0	+ 4·2	4	31	
		2008	0·095	163·3	231·3	+ 1·9	0	36	
		2008	0·067	151·1	231·1	+ 3·7	5	19	
		2008*b*	0·069	107·6	229·1	+ 5·9	38	246	
Sept. 18							(80)	(508)	(235)
261·275	H, EP		0·950	264·0	289·5	− 3·4			52
			0·902	253·5	280·4	−11·6			304
I.			0·792	247·4	267·5	−13·2			52
		2008*a*	0·322	259·1	237·0	+ 3·3	28	146	
		2008	0·273	257·6	234·0	+ 3·5	0	18	
		2008	0·258	260·1	233·3	+ 4·4	4	17	
		2008	0·218	252·4	230·6	+ 3·1	0	1	
		2008*b*	0·183	265·8	229·1	+ 6·3	35	255	
Sept. 19							(67)	(437)	(408)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Sept. 3. Photograph taken through haze.

Group 2006, Sept. 3–4. Two small spots, *a* and *b*. Only *b* remains by Sept. 4.

Group 2007, Sept. 13–15. A small spot.

Group 2008, Sept. 14–24. Three small spots, two of which are measured together on Sept. 14. Two large regular spots, *a* and *b*, on Sept. 15. A number of small spots are seen between them on the succeeding days. *a* is not seen on Sept. 24.

Sept. 13. Photograph much out of centre of plate.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
262d·453	M,H	2008*a*	0·571	265·6	237·8	+ 3·6	25	136	
		2008	0·532	264·7	235·0	+ 3·2	4	31	
		2008	0·517	267·1	234·2	+ 4·6	0	3	
		2008	0·512	264·4	233·6	+ 3·3	0	9	
		2008	0·484	268·1	232·1	+ 5·3	0	2	
		2008	0·486	264·0	231·9	+ 3·3	0	26	
		2008	0·476	272·7	231·6	+ 7·5	0	2	
		2008*b*	0·440	271·5	229·3	+ 7·0	27	188	
Sept. 20							(56)	(397)	(0)
263·290	H,EP		0·935	251·4	258·2	−14·6			284
			0·833	254·9	246·3	− 8·5			61
I.		2008*a*	0·723	267·3	238·2	+ 2·9	22	138	
		2008	0·703	269·7	236·8	+ 4·8	0	5	
		2008	0·696	266·2	236·0	+ 2·4	15	54	
		2008	0·642	267·9	232·0	+ 4·1	0	2	
		2008	0·642	266·0	231·8	+ 2·9	0	2	
		2008	0·621	269·3	230·5	+ 5·1	0	3	
		2008*b*	0·607	272·7	229·6	+ 7·2	22	156	
Sept. 21							(59)	(360)	(345)
264·491	M,H		0·961	259·8	248·7	− 7·8			69
		2008*a*	0·886	269·6	238·5	+ 2·9	26	137	
		2008	0·876	268·7	237·2	+ 2·3	4	29	264 *c*
		2008	0·856	268·8	234·9	+ 2·6	0	12	
		2008*b*	0·807	274·8	230·3	+ 8·0	11	108	
		2008	0·794	273·2	229·0	+ 6·8	0	10	175 *c*
			0·944	99·3	245·6	− 6·3			412
Sept. 22							(41)	(296)	(920)
265·304	EP,M	2008*a*	0·961	270·8	239·5	+ 2·7	24	161	
		2008	0·953	269·5	237·7	+ 1·7	0	39	
I.		2008	0·922	273·0	232·9	+ 5·5	0	11	
		2008*b*	0·904	275·2	230·5	+ 7·7	23	130	1007 *c*
			0·878	103·2	106·0	− 8·1			234
			0·917	113·4	103·3	−18·2			42
			0·916	94·5	99·9	− 1·3			73
			0·976	102·6	90·0	−10·6			154
Sept. 23							(47)	(341)	(1510)
1887.				°	°	°			
266d·085	H,EP	2008	0·975	272·4	232·4	+ 3·9	0	102	426 *c*
		2008*b*	0·964	276·0	230·1	+ 7·6	13	71	
I.		2009	0·664	238·9	190·9	−14·4	1	4	
		2009	0·655	236·7	189·6	−15·4	5	10	
			0·788	103·2	104·8	− 6·0			320
			0·936	105·8	88·2	−12·1			340
Sept. 24							(19)	(187)	(1086)
267·282	H,EP		0·774	103·8	90·4	− 6·2			224
I.			0·884	122·3	84·4	−24·3			139
Sept. 25							(0)	(0)	(363)
268·311	H,EP		0·929	267·4	193·6	+ 0·2			13
			0·890	252·5	185·7	−12·1			149
I.			0·885	261·6	132·0	− 4·2			16
Sept. 26							(0)	(0)	(178)
269·437									
Sept. 27							(0)	(0)	(0)
270·576									
Sept. 28							(0)	(0)	(0)
271·418	EP,H		0·981	93·9	6·6	− 2·5			262
Sept. 29							(0)	(0)	(262)
272·430	EP,H		0·926	97·3	4·6	− 4·2			395
Sept. 30							(0)	(0)	(395)
273·460	EP,H		0·794	253·9	108·2	− 8·5			206
			0·818	100·7	4·3	− 4·8			153
Oct. 1							(0)	(0)	(359)
274·237	H,EP		0·862	257·9	105·4	− 6·9			342
			0·725	252·0	91·5	− 8·2			92
I.		2010*a*	0·676	254·7	88·2	− 5·3	1	7	
		2010*b*	0·660	254·5	87·0	− 5·1	7	26	
		2010*c*	0·628	253·6	84·6	− 4·9	4	21	
Oct. 2							(12)	(54)	(434)

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 Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Sept. 20. Photograph much out of centre of plate.
Group 2009, Sept. 24. Two very small spots.
Group 2010, Oct. 2–4. Three small spots, *a*, *b*, and *c*, on October 2. A fourth spot is seen on October 3. Only *a* and *c* remain by October 4.

Sept. 29. Photograph taken through haze.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
275d·163	H,EP		0·931	261·8	102·8	− 5·2			429
		2010*a*	0·817	259·0	88·7	− 5·1	7	38	
I.		2010*b*	0·800	258·4	87·0	− 5·2	0	11	299 *c*
		2010	0·795	259·8	86·8	− 4·1	0	4	
		2010*c*	0·779	258·4	85·1	− 4·8	10	33	
Oct. 3							(17)	(86)	(728)
276·140	H,EP		0·904	243·4	82·2	−20·7			132
			0·828	254·0	75·9	− 9·3			64
I.		2010*a*	0·929	261·6	89·5	− 5·4	5	20	
		2010*c*	0·901	261·3	85·5	− 4·9	9	44	339 *c*
		2011*a*	0·487	234·1	46·0	−10·6	3	14	
		2011*b*	0·468	230·0	43·8	−11·4	2	11	
Oct. 4							(19)	(89)	(535)
277·143	H,EP		0·976	262·6	85·6	− 5·8			156
			0·935	257·1	76·5	− 9·6			71
I.			0·913	246·8	71·0	−18·1			85
		2011*a*	0·653	246·2	46·4	−10·2	0	3	
		2011*b*	0·629	242·5	43·8	−11·6	0	2	
Oct. 5							(0)	(5)	(312)
278·276	H,EP	2011	0·835	251·8	48·1	−11·3	0	2	
		2011*a*	0·819	253·3	46·9	− 9·8	0	3	
I.		2011	0·814	248·2	45·2	−13·6	1	8	160 *n*
			0·930	102·9	287·7	− 9·5			285
Oct. 6							(1)	(13)	(445)
279·328	H,EP		0·917	254·8	44·6	−11·3			121
I.			0·858	107·3	283·9	−11·3			222
Oct. 7							(0)	(0)	(343)
280·135	EP, M		0·972	256·3	44·2	−11·7			100
I.			0·918	106·1	265·5	−12·1			116
Oct. 8							(0)	(0)	(216)
281·203	H,EP		0·842	112·5	262·1	−15·1			94
I.			0·935	90·1	246·5	+ 2·1			228
Oct. 9							(0)	(0)	(322)
282·273	H,EP		0·895	262·3	4·1	− 4·1			152
I.			0·871	87·2	240·8	+ 5·5			508
Oct. 10							(0)	(0)	(660)

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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
283d·423	H,EP		0·971	262·9	1·6	− 5·4			66
			0·809	84·9	232·2	+ 7·7			80
Oct. 11							(0)	(0)	(146)
284·502									
Oct. 12							(0)	(0)	(0)
285·227									
I.									
Oct. 13							(0)	(0)	(0)
286·312									
I.									
Oct. 14							(0)	(0)	(0)
287·396									
Oct. 15							(0)	(0)	(0)
288·545									
Oct. 16							(0)	(0)	(0)
289·468	H,EP		0·963	93·2	132·8	− 1·5			103
Oct. 17							(0)	(0)	(103)
290·147	H,EP		0·907	251·7	260·0	+14·0			107
I.		2012	0·886	94·3	135·7	− 1·2	0	9	83 *c*
		2012	0·900	95·1	134·0	− 2·1	4	23	
Oct. 18							(4)	(32)	(190)
291·175	H,EP		0·903	268·0	248·3	+ 0·6			192
			0·811	274·0	238·4	+ 6·4			212
I.		2013	0·611	112·4	149·4	− 9·0	0	2	
		2012	0·746	96·0	136·4	− 0·8	0	5	92 *c*
		2012	0·763	96·7	135·0	− 1·6	17	151	
			0·933	102·2	116·8	− 9·3			98
			0·941	93·2	114·3	− 1·2			85
Oct. 19							(17)	(158)	(679)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 2011, Oct. 4–6. Two compact clusters of very small spots, *a* and *b*, on Oct 4. One very small spot remains of each cluster on Oct. 5. *b* has disappeared by Oct. 6, but two other small spots are seen near *a* on that day.

Group 2012, Oct. 18–27. Two small spots on Oct. 18. The group undergoes the most striking changes on the succeeding days. On Oct. 19 it is a large spot with a small companion. The large spot has divided into two parts by Oct. 20, and coalesced again to form one large spot by Oct. 21. It has broken up again by Oct. 23, and forms a straight stream of small spots which diminish in number and in size from day to day.

Group 2013, Oct. 19–20. A very small spot on Oct. 19. Three very small spots on Oct. 20.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
292d·200	H,EP		0·897	275·1	234·5	+ 6·9			328
		2013	0·450	124·1	148·5	− 9·6	0	9	
I.		2013	0·467	124·0	147·5	−10·2	2	9	
		2013	0·488	122·4	145·9	−10·3	0	3	
		2012	0·583	99·8	135·7	− 1·3	11	51	
		2012	0·615	98·5	133·3	− 1·0	13	134	
		2014*a*	0·909	95·9	106·0	− 3·1	0	8	194*c*
			0·864	106·4	113·1	−11·3			272
Oct. 20							(26)	(214)	(794)
293·466	H,EP	2012	0·351	105·7	134·2	− 0·5	28	311	
		2014*a*	0·741	98·8	106·9	− 3·0	2	7	
			0·881	97·0	92·9	− 3·7			222
			0·969	94·9	78·9	− 3·4			100
Oct. 21							(30)	(318)	(322)
294·427	H,EP	2012	0·139	131·9	135·2	− 0·3	12	267	
		2014*a*	0·568	102·5	107·5	− 2·8	0	7	
Oct. 22							(12)	(274)	(0)
295·532	H,EP	2012	0·185	244·0	136·2	+ 0·4	12	127	
		2012	0·147	227·8	132·8	− 0·6	2	9	
		2014	0·329	113·7	109·1	− 2·7	0	2	
		2014	0·334	110·9	108·5	− 2·0	0	2	
Oct. 23							(14)	(140)	(0)
296·463	H,EP	2012	0·401	259·5	137·5	+ 0·5	8	86	
		2012	0·367	257·1	135·3	0·0	0	9	
		2012	0·338	253·7	133·2	− 0·7	0	6	
		2015*a*	0·385	219·6	128·9	−12·3	0	5	
		2014	0·143	128·9	108·0	− 0·2	0	3	
		2014	0·223	130·0	104·6	− 3·3	0	6	
Oct. 24							(8)	(115)	(0)
297·435	H,EP	2012	0·593	263·9	137·5	+ 0·4	7	42	
		2015*a*	0·562	238·8	130·9	−12·6	0	6	
		2015*b*	0·532	237·9	128·8	−12·1	0	7	
		2014	0·177	226·2	108·8	− 2·2	0	6	
Oct. 25							(7)	(61)	(0)
1887.				°	°	°			
298d·428	H,EP	2012	0·786	265·8	140·1	− 0·3	2	4	
		2012	0·767	266·3	138·4	+ 0·3	5	18	
		2012	0·753	266·4	137·2	+ 0·5	0	2	
		2015*b*	0·706	246·9	130·2	−12·5	1	5	
		2015*c*	0·699	248·3	130·0	−11·4	5	12	
		2014	0·379	251·6	109·7	− 2·4	0	1	
		2014	0·399	252·6	111·0	− 2·4	0	1	
		2014	0·416	253·7	112·2	− 2·3	0	1	
Oct. 26							(13)	(44)	(0)
299·283	H,EP	2012	0·878	267·6	138·3	+ 0·2	2	11	} 342 *c*
		2012	0·827	265·0	132·5	− 1·5	0	2	
I.		2015*c*	0·826	252·9	130·6	−11·3	2	10	172*f*
		2014	0·539	258·4	109·0	− 2·3	0	6	
		2014	0·507	255·7	106·5	− 3·1	0	5	
Oct. 27							(4)	(34)	(514)
300·210	H,EP		0·944	267·9	135·3	− 0·4			323
			0·918	255·2	129·7	−11·6			100
I.		2014	0·698	263·2	108·6	− 1·4	0	8	
		2014	0·697	261·1	108·3	− 2·8	0	6	
			0·961	102·1	352·4	−10·3			85
Oct. 28							(0)	(14)	(508)
301·428	H,EP		0·908	252·4	111·8	−13·9			94
		2014	0·882	265·2	110·3	− 2·1	0	2	182 *c*
Oct. 29							(0)	(2)	(276)
302·504	H,EP		0·974	253·5	109·7	−14·9			65
			0·902	265·8	108·3	− 2·8			205
			0·866	259·8	93·6	− 6·5			135
Oct. 30							(0)	(0)	(405)
303·449	H,EP		0·943	253·6	90·8	−13·9			133
		2016	0·687	268·3	65·5	+ 2·0	2	22	
Oct. 31							(2)	(22)	(133)
304·157	H,EP		0·972	257·0	88·0	−11·6			146
		2016	0·815	268·8	67·4	+ 1·5	0	2	
I.		2016	0·801	269·1	66·0	+ 1·8	0	1	
			0·900	102·2	310·2	− 9·1			101
			0·958	97·2	300·4	− 5·7			54
Nov. 1							(0)	(3)	(301)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Oct. 23. Photograph taken through haze. Definition poor.

Oct. 31. Photograph under-exposed. Definition poor.

Group 2014, Oct. 20–29. A very small spot, *a*, on Oct. 20, 21, and 22. It has divided into two by Oct. 23, and disappeared by Oct. 24. Two very small spots are seen near its place on Oct. 24, and either one, two, or three on the succeeding days.

Group 2015, Oct. 24–27. A very small spot *a* on Oct. 24. A second, *b*, is seen near it on Oct. 25. *a* has disappeared by Oct. 26, and *b* by Oct. 27, but a third spot, *c*, is seen on Oct. 26 and 27.

Group 2016, Oct. 31–Nov. 1. A very small spot on Oct. 31. Three very small spots, of which the two preceding are measured together on Nov. 1.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
305d·439	H, EP		0·940	270·6	65·9	+ 2·0			49
			0·883	100·5	295·1	− 7·3			82
Nov. 2							(0)	(0)	(131)
306·158	H, EP		0·968	270·5	61·9	+ 1·5			133
			0·878	109·0	287·8	−14·5			119
I.			0·964	96·8	272·8	− 5·5			34
Nov. 3							(0)	(0)	(286)
307·407	H, EP		0·974	89·5	253·3	+ 1·4			93
Nov. 4							(0)	(0)	(93)
308·409	H, EP	2017*a*	0·989	98·1	236·2	− 7·4	11	130	
			0·907	89·8	251·9	+ 1·7			35
			0·965	84·0	241·9	+ 6·8			159
Nov. 5							(11)	(130)	(194)
309·475	H, EP	2017*a*	0·928	100·0	235·8	− 7·9	21	143	251*c*
			0·905	83·5	238·1	+ 7·4			130
Nov. 6							(21)	(143)	(381)
310·191	H, EP	2018	0·387	83·1	270·8	+ 5·9	0	3	
		2018	0·414	85·3	269·0	+ 5·2	0	4	
I.		2017*a*	0·854	101·7	236·0	− 8·1	22	134	271*c*
			0·838	83·3	236·6	+ 7·5			193
Nov. 7							(22)	(141)	(464)
311·162	H, EP	2018	0·169	69·0	271·5	+ 6·9	0	2	
I.		2017*a*	0·724	104·8	235·8	− 8·2	22	116	208 *s f*
Nov. 8							(22)	(118)	(208)
312·304	H, EP	2017*a*	0·528	111·2	235·8	− 8·1	20	112	
I.									
Nov. 9							(20)	(112)	(0)
313·296	H, EP		0·901	344·0	284·9	+62·5			80
		2017*a*	0·337	124·8	236·2	− 8·0	18	95	
I.		2017	0·362	120·8	234·2	− 7·6	0	1	
Nov. 10							(18)	(96)	(80)
1887.				°	°	°			
314d·572	H, EP	2017*a*	0·192	181·9	236·1	− 8·0	13	72	160*c*
		2019	0·976	108·9	160·2	−17·7	0	9	
		2020	0·992	108·3	154·5	−17·7	0	80	
Nov. 11							(13)	(161)	(160)
315·227	H, EP		0·901	261·8	290·5	− 6·0			89
			0·868	252·3	285·1	−13·7			111
I.		2017*a*	0·253	221·7	236·7	− 7·9	12	62	
		2017	0·240	217·3	235·4	− 8·0	0	3	
		2019	0·931	110·8	160·9	−18·1	0	16	286*c*
		2020	0·967	109·7	154·0	−18·1	14	90	
Nov. 12							(26)	171	(486)
316·172	H, EP		0·962	264·3	288·2	− 4·7			52
		2017*a*	0·423	243·9	237·1	− 8·0	9	44	
I.		2019	0·838	113·8	161·1	−18·0	3	25	164*c*
		2020	0·894	112·2	154·1	−18·3	18	111	
Nov. 13							(30)	(180)	(216)
317·186	H, EP	2017*a*	0·615	253·3	237·5	− 7·9	6	30	
I.		2019	0·697	119·8	161·9	−18·1	4	27	151*c*
		2020	0·779	116·4	154·1	−18·3	22	83	
Nov. 14							(32)	(140)	(151)
318·168	H, EP		0·916	268·3	254·3	− 0·5			106
			0·815	278·7	242·6	+ 8·6			140
I.		2017*a*	0·775	257·2	237·8	− 8·2	2	13	
		2019	0·546	130·0	162·2	−18·1	0	26	
		2020	0·644	123·6	153·9	−18·7	3	43	
			0·944	93·8	117·9	− 2·7			490
Nov. 15							(5)	(82)	(736)
319·186	H, EP		0·879	278·0	236·2	+ 8·2			253
			0·720	255·8	219·5	− 8·4			62
I.		2017*a*	0·899	259·6	237·9	− 8·2	0	8	250 *s f*
		2019	0·405	150·7	162·8	−18·1	2	15	
		2020	0·498	136·7	153·7	−18·9	2	15	
			0·863	94·4	115·6	− 2·5			326
Nov. 16							(4)	(38)	(891)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Nov. 11. Photograph thin. Definition poor.
Group 2017, Nov. 5–16. A regular spot, *a*, with a very small companion on Nov. 10 and 12.
Group 2018, Nov. 7–8. Three very small spots, of which the two following are measured together on Nov. 7. One very small spot on Nov. 8.
Group 2019, Nov. 11–20. A very small spot on Nov. 11. A second is seen close to it, and is measured with it on Nov. 12 and the succeeding days until Nov. 17, when the group consists of three spots, which are all measured separately. Only one spot is seen on Nov. 18 and the succeeding days.
Group 2020, Nov. 11–16. A regular spot. It has divided into two nearly equal portions, which are, however, still measured together, by Nov. 15. Both portions have disappeared by Nov. 17.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.						°	°	°	
320d·449	H, EP	2019	0·347	205·7	167·0	−15·8	1	4	
		2019	0·356	194·9	163·5	−17·7	11	22	
		2019	0·346	190·0	161·6	−17·5	0	3	
			0·867	100·6	98·9	− 8·0			109
Nov. 17							(12)	(29)	(109)
321·318	H, EP	2019	0·440	219·3	163·6	−17·7	3	11	
I.			0·830	106·4	92·4	−12·2			82
			0·890	92·8	84·1	− 1·5			88
Nov. 18							(3)	(11)	(170)
322·448	H, EP	2019	0·600	235·3	162·8	−18·1	0	8	
Nov. 19							(0)	(8)	(0)
323·214	H, EP	2019	0·717	242·5	163·4	−17·8	1	5	
I.							(1)	(5)	(0)
Nov. 20									
324·196	H, EP		0·844	247·9	163·5	−17·4			109
I.			0·769	242·3	154·8	−19·6			121
Nov. 21							(0)	(0)	(230)
325·154	H, EP		0·936	249·9	163·5	−18·1			126
I.			0·887	246·1	155·6	−20·1			115
Nov. 22							(0)	(0)	(241)
326·011									
M									
Nov. 23							(0)	(0)	(0)
327·201									
M									
Nov. 24							(0)	(0)	(0)
328·263									
M									
Nov. 25							(0)	(0)	(0)
329·220	H, EP		0·955	267·4	115·0	− 2·1			196
I.			0·858	262·4	101·0	− 5·8			240
Nov. 26							(0)	(0)	(436)

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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
330d·199	H, EP		0·933	261·2	97·9	− 7·8			265
I.			0·916	251·3	94·2	−16·6			106
Nov. 27							(0)	(0)	(371)
331·214	H, EP		0·977	256·8	93·1	−12·7			120
			0·912	270·3	81·8	+ 0·7			59
I.			0·934	180·8	18·2	−67·8			251
			0·944	88·7	305·7	+ 1·6			122
Nov. 28							(0)	(0)	(552)
332·173	H, EP		0·944	186·3	20·1	−68·7			224
I.			0·909	99·9	298·8	− 8·6			94
Nov. 29							(0)	(0)	(318)
333·294	H, EP		0·870	110·3	290·3	−17·1			98
I.									
Nov. 30							(0)	(0)	(98)
334·215									
I.									
Dec. 1							(0)	(0)	(0)
335·194	H, EP		0·882	86·4	262·2	+ 3·5			219
I.			0·989	81·7	242·5	+ 8·4			59
Dec. 2							(0)	(0)	(278)
336·518	H, M	2021*a*	0·986	96·1	226·3	− 6·0	0	30	226 *c*
		2021*b*	0·989	98·2	225·2	− 8·1	48	459	
			0·933	98·3	237·9	− 7·5			79
Dec. 3							(48)	(489)	(305)
337·189	M, H		0·957	179·0	263·7	−72·6			158
		2021*a*	0·949	95·9	226·3	− 5·5	9	73	709 *c*
I.		2021*b*	0·958	98·4	224·6	− 8·0	73	370	
		2021*c*	0·970	98·1	222·0	− 7·8	0	103	
		2021*d*	0·987	98·4	217·1	− 8·2	54	304	
			0·865	78·2	238·3	+10·3			118
			0·884	98·2	235·9	− 7·1			131
Dec. 4							(136)	(850)	(1116)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Nov. 17. Photograph thin. Definition poor.

Nov. 23–24. Definition poor.

Nov. 25. Double image of Sun. Photograph taken for zero of position.

Group 2021, Dec. 3–15. A very fine group of spots in a long stream. Four considerable spots, *a*, *b*, *c*, and *d*, are seen on Dec. 4. Of these *a* and *b* have partially coalesced by Dec. 5 and are henceforward lettered as *c*. *d* and *e* are measured together on Dec. 7 and 9. A number of small spots are seen close to the larger spots on each day up to Dec. 14, on which day *d* alone remains.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
338d·436	H,EP	2021*d*	0·832	98·7	225·2	− 7·2	71	416	
		2021*e*	0·864	98·9	221·8	− 7·6	0	199	298 *c*
		2021*c*	0·890	99·6	218·7	− 8·5	18	193	
Dec. 5							(89)	(808)	(298)
339·198	M,H	2021	0·714	95·5	225·8	− 3·9	0	1	
		2021*d*	0·735	99·7	224·3	− 7·1	75	440	
I.		2021*e*	0·767	99·6	221·5	− 7·4	0	133	
		2021	0·779	100·7	220·5	− 8·3	0	11	522 *c*
		2021	0·781	97·0	220·0	− 5·5	3	20	
		2021*c*	0·802	100·9	218·4	− 8·7	29	213	
		2021	0·805	103·3	218·3	−10·7	0	15	
Dec. 6							(107)	(833)	(522)
340·503	H,EP	2021 *d*&*e*	0·514	102·9	223·7	− 6·7	38	609	
		2021*c*	0·589	105·6	219·0	− 9·2	32	154	
Dec. 7							(70)	(763)	(0)
341·211	EP,H	2021*d*	0·369	109·0	224·0	− 7·1	60	360	
		2021	0·392	99·1	221·8	− 3·7	0	2	
I.		2021*e*	0·411	105·4	221·1	− 6·5	16	160	
		2021	0·438	115·6	220·9	−11·0	2	9	
		2021	0·457	113·8	219·4	−10·8	0	3	
		2021*c*	0·462	109·8	218·6	− 9·2	19	136	
Dec. 8							(97)	(670)	(0)
342·427	H,M	2021 *d*&*e*	0·142	141·2	223·3	− 6·7	20	505	
		2021	0·196	150·1	222·7	−10·2	0	9	
		2021*c*	0·224	132·4	218·8	− 9·1	5	43	
		2022*a*	0·460	121·5	204·6	−14·2	6	42	
		2022	0·516	119·5	200·8	−15·0	0	15	
Dec. 9							(31)	(614)	(0)
343·181	M,H		0·935	247·7	286·1	−20·9			74
		2021*d*	0·161	222·4	224·8	− 7·3	67	394	
I.		2021	0·111	226·2	223·1	− 5·0	0	4	
		2021	0·189	203·0	222·8	−10·5	0	12	
		2021*f*	0·152	203·4	222·0	− 8·5	5	63	
		2021*e*	0·111	211·9	221·9	− 5·9	0	67	
		2021	0·085	193·4	219·6	− 5·2	0	13	
1887.				°	°	°			
343d·181	M,H	2021*c*	0·151	178·9	218·3	− 9·2	7	28	
		2022*a*	0·325	137·7	205·5	−14·3	18	99	
		2022	0·396	130·5	200·4	−15·3	12	30	
			0·820	72·3	165·0	+14·1			53
			0·850	110·6	162·1	−17·7			96
Dec. 10							(109)	(710)	(223)
344·189	EP,M	2021*d*	0·359	249·7	225·1	− 7·7	40	337	
		2021	0·349	239·7	223·1	−10·7	1	7	
I.		2021*f*	0·325	242·5	222·2	− 9·2	5	68	
		2021*e*	0·310	250·2	222·3	− 6·6	3	54	
		2021	0·284	239·5	219·6	− 8·8	2	7	
		2021*c*	0·281	234·7	218·7	− 9·9	0	3	
		2022*a*	0·241	183·0	206·0	−14·5	19	89	
		2022	0·254	172·1	203·2	−15·1	2	5	
		2022	0·268	161·9	200·4	−15·3	3	10	
Dec. 11							(75)	(580)	(0)
345·207	EP,H		0·904	242·3	253·9	−25·2			74
		2023	0·756	260·3	240·5	− 7·8	0	2	
I.		2023	0·734	261·7	238·7	− 6·6	2	7	
		2021*d*	0·566	257·0	225·6	− 8·0	43	339	
		2021*f*	0·525	253·1	222·4	− 9·5	0	21	
		2021*e*	0·514	257·9	222·2	− 6·9	0	46	
		2021	0·460	247·1	217·4	−11·0	0	6	
		2022*a*	0·344	226·8	206·8	−14·4	11	55	
		2022	0·288	214·4	201·5	−14·5	0	31	
			0·922	94·0	124·9	− 4·0			176
Dec. 12							(56)	(507)	(250)
346·177	M,H		0·928	269·0	247·1	− 1·3			67
			0·874	261·0	239·7	− 8·3			84
I.		2021*d*	0·731	259·6	225·6	− 8·2	48	337	
		2021*f*	0·705	257·3	223·2	− 9·6	2	14	
		2021*e*	0·694	260·2	222·6	− 7·4	0	18	
		2022*a*	0·512	242·4	207·0	−14·5	1	18	
			0·893	111·7	117·6	−19·7			40
			0·947	92·8	108·1	− 2·9			104
Dec. 13							(51)	(387)	(295)
347·427	H,M	2021*d*	0·892	261·6	225·4	− 8·0	48	324	223 *f*
		2024*a*	0·984	97·5	83·1	− 7·5	40	307	
Dec. 14							(88)	(631)	(223)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Dec. 7, 9, and 14. Definition poor. Photograph under-exposed.

Group 2022, Dec. 9–13. A stream of small spots, of which the leader, *a*, is the largest. *a* is always measured by itself; the smaller spots are usually measured together. Only *a* remains by Dec. 13.

Group 2023, Dec. 12. Two very small spots.

Group 2024, Dec. 14–26. A very fine group, consisting of a large regular spot, *a*, accompanied by a long stream of smaller spots. The spots and clusters which make up the group undergo very frequent and considerable changes. The smaller spots have been grouped for measurement as far as possible in the same manner on different days, but the changes which have taken place prevent the correspondence from being perfect. *c* and *d* have combined to form *h* by Dec. 18, and *a* and *f* to form *l* by Dec. 23. Only *l* and a few small companions remain by Dec. 23.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
348d·191	EP,H		0·819	253·5	206·4	−14·1			161
		2021*d*	0·956	262·1	225·3	− 7·9	47	295	725 *c*
I.		2024*a*	0·944	97·6	82·2	− 7·5	117	513	
		2024*b*	0·955	100·6	80·2	−10·4	4	17	
		2024*c*	0·968	97·6	77·3	− 7·7	33	291	460 *c*
		2024	0·981	96·8	74·0	− 6·9	0	59	
		2024*d*	0·987	96·1	72·1	− 6·2	48	150	
Dec. 15							(249)	(1325)	(1346)
349·551	H,EP	2024*a*	0·794	98·3	82·5	− 7·4	77	489	
		2024*b*	0·822	100·7	79·9	− 9·5	0	36	
		2024	0·826	98·5	79·4	− 7·8	7	83	281 *c*
		2024*c*	0·855	98·8	76·3	− 8·2	17	185	
		2024*d*	0·894	97·3	71·6	− 7·1	7	126	
Dec. 16							(108)	(919)	(281)
350·474	H,EP	2024*e*	0·620	103·5	85·0	− 9·4	0	41	
		2024*a*	0·648	99·7	82·6	− 7·4	67	423	
		2024*f*	0·674	102·8	81·1	− 9·0	0	29	
		2024*b*	0·686	100·1	79·7	− 8·0	11	123	
		2024	0·706	101·4	78·2	− 9·0	0	24	
		2024*c*	0·731	100·1	76·0	− 8·4	20	160	
		2024*d*	0·771	98·3	72·4	− 7·3	11	57	
		2024*g*	0·774	95·7	72·0	− 5·4	4	19	
Dec. 17							(113)	(876)	(0)
351·473	H,EP	2024*e*	0·420	108·5	85·6	− 9·1	3	25	
		2024*h*	0·421	104·9	85·2	− 7·6	2	38	
		2024*a*	0·470	102·7	81·9	− 7·3	60	396	
		2024*f*	0·486	108·4	81·5	−10·2	11	106	
		2024	0·534	104·5	77·9	− 8·9	0	2	
		2024*k*	0·578	102·0	74·6	− 8·1	15	122	
		2024*g*	0·611	96·6	71·9	− 5·2	3	12	
Dec. 18							(94)	(701)	(0)
352·288	M,H		0·900	254·2	162·0	−14·9			92
		2024*h*	0·252	114·5	85·2	− 7·7	10	69	
I.		2024*a*	0·301	109·4	81·9	− 7·4	75	436	
		2024*f*	0·330	116·4	81·1	−10·0	16	113	
		2024	0·349	103·3	78·6	− 6·2	0	2	
		2024*k*	0·423	106·7	74·4	− 8·5	30	142	
		2024*g*	0·458	99·3	71·6	− 5·8	4	11	
Dec. 19							(135)	(773)	(92)
1887.				°	°	°			
353d·207	EP,H		0·943	257·3	156·6	−12·6			31
		2024*h*	0·114	165·6	84·8	− 8·1	7	48	
I.		2024*f*	0·165	152·3	82·0	−10·2	17	56	
		2024*a*	0·126	142·1	81·9	− 7·5	78	415	
		2024	0·179	128·8	78·3	− 8·2	5	69	
		2024*k*	0·238	118·5	74·3	− 8·2	14	116	
		2024*g*	0·261	106·5	71·9	− 6·0	2	18	
Dec. 20							(123)	(722)	(31)
354·282	H,M		0·894	257·1	135·3	−12·4			37
			0·867	266·8	132·3	− 3·7			84
I.		2024*h*	0·247	243·4	85·2	− 8·2	6	38	
		2024*f*	0·229	232·3	83·0	− 9·9	24	219	
		2024*a*	0·198	241·6	82·5	− 7·3	81	417	
		2024	0·167	224·4	79·2	− 8·8	9	82	
		2024	0·142	233·8	79·0	− 6·7	0	6	
		2024*k*	0·124	203·3	75·2	− 8·4	3	23	
		2024*g*	0·063	190·6	73·1	− 5·5	0	5	
		2024	0·113	175·1	71·8	− 8·4	0	7	
		2025*a*	0·370	121·5	53·6	−12·9	11	39	
		2025	0·405	117·7	50·9	−12·6	0	8	
Dec. 21							(134)	(844)	(121)
355·214	EP,H		0·933	267·4	128·9	− 3·2			126
		2024*f*	0·416	251·5	83·6	− 9·4	26	205	
I.		2024*a*	0·394	255·2	82·6	− 7·6	71	437	
		2024	0·308	248·9	76·9	− 7·3	7	67	
		2024*g*	0·243	254·6	73·7	− 5·6	0	17	
		2025*a*	0·218	153·4	54·4	−13·2	5	46	
		2025	0·199	149·8	54·3	−11·9	0	4	
		2025	0·231	139·3	51·3	−12·0	2	20	
			0·946	173·7	40·9	−71·6			72
			0·864	44·0	11·5	+37·0			65
Dec. 22							(111)	(796)	(263)
356·301	M,H	2024*l*	0·611	259·5	82·9	− 8·1	78	650	
		2024	0·537	256·9	77·5	− 8·8	0	66	
I.		2025*a*	0·248	217·3	54·6	−13·5	13	51	
		2025	0·209	208·9	51·6	−12·7	1	18	
			0·935	86·1	336·9	+ 2·8			38
Dec. 23							(92)	(785)	(38)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 2025, Dec. 21–27. A few small spots in a straggling stream, of which the leader *a* is the largest. The rest of the group are measured together.

Measures of Positions and Areas of Spots and Faculæ upon the Sun's Disk—*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 Longitude.	Heliographic Latitude.	Spots. Area of UMBRA for each Spot (and for Day).	Spots. Area of WHOLE for each Spot (and for Day).	Faculæ. Area for each Group (and for Day).
1887.				°	°	°			
357d·210	M, H		0·935	256·4	102·6	−13·5			101
		2024*l*	0·760	260·8	82·8	− 8·5	91	619	
I.		2024	0·709	263·0	78·6	− 6·6	0	3	235 *c*
		2024	0·699	259·7	77·6	− 8·9	3	29	
		2025*a*	0·399	239·9	54·4	−13·7	9	44	
		2025	0·354	239·3	51·8	−12·6	0	21	
Dec. 24							(103)	(716)	(336)
358·214	EP,H	2024*l*	0·891	261·6	83·3	− 8·6	83	661	697 *c*
		2024	0·846	261·1	78·0	− 8·8	0	5	
I.		2025*a*	0·582	250·5	54·6	−13·1	7	16	
		2025	0·547	250·5	52·3	−12·6	0	13	
Dec. 25							(90)	(695)	(697)
359·483	H, M	2024*l*	0·984	262·1	83·6	− 8·2	27	368	669 *f*
		2025*a*	0·794	255·1	55·7	−13·3	1	10	
		2025	0·774	253·9	53·6	−14·0	0	9	
Dec. 26							(28)	(387)	(669)
360·262	M, H		0·984	259·8	73·4	−10·6			451
			0·951	187·7	19·0	−72·7			55
I.		2025*a*	0·887	255·9	55·7	−13·7	0	16	
1887.				°	°	°			
360d·262	M, H	2025	0·875	255·8	54·2	−13·7	2	8	127 *c*
I.			0·957	176·8	341·5	−75·2			29
			0·947	164·8	312·6	−67·8			68
Dec. 27							(2)	(24)	(730)
361·252	EP,H		0·949	257·1	52·0	−13·1			257
I.			0·921	169·0	313·7	−67·1			65
Dec. 28							(0)	(0)	(322)
362·219	H, M		0·939	172·5	305·5	−71·1			70
			0·924	164·9	292·5	−65·4			49
I.			0·891	97·2	264·8	− 7·7			67
			0·970	94·9	251·8	− 5·5			282
Dec. 29							(0)	(0)	(468)
363·245	H, M		0·902	160·7	310·6	−60·6			51
I.			0·939	176·1	302·1	−72·2			48
			0·897	94·2	250·4	− 5·1			327
Dec. 30							(0)	(0)	(426)
364·231	H, M	2026	0·962	97·1	227·0	− 7·7	44	195	326 *c*
I.			0·787	94·3	249·4	− 5·4			145
Dec. 31							(44)	(195)	(471)

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The Areas of Spots and Faculæ are expressed in millionths of the Sun's visible Hemisphere.

Group 2026, 1887, Dec. 31–1888, Jan. 11. A regular spot.

ROYAL OBSERVATORY, GREENWICH.

LEDGERS

OF

AREAS AND POSITIONS OF SPOT GROUPS

UPON THE SUN'S DISK,

DEDUCED FROM THE MEASUREMENT

OF THE

SOLAR PHOTOGRAPHS,

FOR EACH DAY IN THE YEAR

1887.

AREAS and HELIOGRAPHIC POSITIONS of the SPOT GROUPS on the SUN'S DISK DEDUCED FOR EACH DAY from the MEASUREMENTS of the PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DÛN IN INDIA, and at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the YEAR 1887.

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 Umbræ 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.
	Umbra.	Whole Spot.	Umbra.	Whole Spot.			
Group 1947.							
1887. d					°	°	°
Jan. 19·326	4	10	2	6	213·2	−18·4	+ 25·9
20·463	0	5	0	3	214·3	−17·8	+ 41·9
Means ...	...	...	2	5	213·75	−18·10	...
Group 1948.							
Jan. 20·463	0	54	0	31	147·2	−16·8	−25·2
21·519	12	65	6	34	149·6	−16·8	− 8·9
22·151	13	67	6	34	150·8	−16·5	+ 0·5
23·302	10	34	5	18	151·3	−16·2	+16·3
Means ...	...	...	4	29	149·73	−16·58	...
Group 1949.							
Jan. 24·467	0	75	0	169	42·3	− 3·0	−77·4
25·456	17	205	18	239	41·8	− 3·2	−64·8
26·462	24	211	16	167	41·8	− 3·2	−51·6
27·177	48	241	32	163	41·9	− 3·0	−42·2
28·279	36	226	20	127	42·4	− 2·9	−27·1
29·302	33	326	17	170	41·4	− 3·0	−14·6
30·493	33	396	16	199	42·9	− 3·7	+ 2·6
31·209	85	524	44	270	42·5	− 4·3	+11·7
Group 1949—*continued.*							
1887. d					°	°	°
Feb. 1·328	50	332	28	187	43·5	− 3·8	+27·4
2·432	22	197	15	134	44·1	− 3·6	+42·4
3·350	23	117	21	105	45·6	− 3·4	+56·0
4·203	13	65	17	85	46·1	− 3·5	+67·8
Means ...	...	...	20	168	43·03	− 3·38	...
Group 1950.							
Jan. 25·456	3	31	3	28	49·6	− 1·8	−57·0
26·462	0	5	0	3	50·3	− 1·7	−43·1
27·177	0	4	0	3	50·7	− 1·4	−33·4
Means ...	...	...	1	11	50·20	− 1·63	...
Group 1951.							
Jan. 25·456	6	43	11	83	31·6	− 2·9	−75·0
26·462	8	46	9	48	31·8	− 3·3	−61·6
27·177	13	82	11	66	32·3	− 3·1	−51·8
28·279	16	37	10	24	31·1	− 4·2	−38·4
29·302	7	30	4	16	31·6	− 3·9	−24·4
30·493	3	58	2	30	31·4	− 4·4	− 8·9
31·209	0	43	0	22	31·5	− 4·6	+ 0·7
Means ...	...	...	7	41	31·61	− 3·77	...

AREAS and HELIOGRAPHIC POSITIONS of SPOT GROUPS on the SUN'S DISK—*continued.*

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.			
Group 1952.							
1887. d Feb. 1·328	0	5	0	5	° 76·0	° −19·1	° +59·9
Group 1953.							
Feb. 2·432	0	14	0	18	294·0	−12·6	− 67·7
3·350	4	15	4	13	293·8	−12·0	− 55·8
4·203	1	16	1	11	294·0	−12·2	− 44·3
Means ...	...	...	2	14	293·93	−12·27	...
Group 1954.							
Feb. 3·350	10	55	7	41	306·8	+12·8	− 42·8
4·203	21	87	13	55	307·6	+12·9	− 30·7
5·419	9	42	5	23	309·0	+12·9	− 13·3
6·547	6	35	3	19	310·9	+12·6	+ 3·5
Means ...	...	...	7	35	308·58	+12·80	...
Group 1955.							
Feb. 17·224	7	25	4	12	181·0	−11·9	+ 13·6
18·330	13	112	7	65	181·2	−10·7	+ 29·0
19·207	23	120	16	78	181·4	−10·3	+ 40·6
20·480	0	74	0	72	182·6	− 9·8	+ 58·6
Means ...	...	...	7	57	181·55	−10·68	...
Group 1956.							
Feb. 18·330	3	28	5	46	81·5	+ 9·6	− 70·7
19·207	2	26	2	26	82·2	+ 9·3	− 58·6
20·480	9	21	7	15	82·3	+ 9·4	− 41·7
21·459	5	33	3	19	82·8	+ 9·4	− 28·3
22·166	3	11	2	6	83·4	+ 9·6	− 18·4
Means ...	...	...	4	22	82·44	+ 9·46	...
Group 1957.							
1887. d Feb. 19·207	0	14	0	14	° 80·8	° − 3·1	° −60·0
Group 1958.							
Feb. 19·207	17	68	30	119	69·6	+11·6	−71·2
20·480	14	78	13	72	69·7	+11·4	−54·3
21·459	13	101	9	71	69·9	+11·3	−41·2
22·166	26	118	16	73	69·9	+11·6	−31·9
23·149	26	138	15	78	69·9	+11·8	−18·9
24·274	28	110	15	59	70·5	+11·7	− 3·5
25·458	8	61	5	33	70·2	+11·9	+11·8
26·429	9	42	5	25	70·7	+12·1	+25·2
27·586	0	52	0	38	72·3	+11·2	+41·9
28·447	26	221	23	193	71·6	+10·2	+52·6
Mar. 1·190	16	143	18	170	72·3	+10·1	+63·0
2·230	0	57	0	134	71·7	+ 9·9	+76·2
Means ...	...	...	12	89	70·69	+11·23	...
Group 1959.							
Feb. 21·459	0	47	0	79	37·2	− 8·6	− 73·9
22·166	13	73	15	81	37·8	− 7·9	− 64·0
23·149	16	69	12	52	41·4	− 8·7	− 47·4
24·274	0	71	0	43	38·4	− 8·6	− 35·6
25·458	0	73	0	39	39·7	− 9·2	− 18·7
Means ...	...	...	5	59	38·90	− 8·60	...
Group 1960.							
Feb. 23·149	3	21	2	11	76·7	+ 8·5	− 12·1

AREAS and HELIOGRAPHIC POSITIONS of SPOT GROUPS on the SUN'S DISK—*continued.*

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.			
Group 1961.							
1887. d					°	°	°
Mar. 10·172	0	24	0	15	283·8	−10·7	+ 32·8
11·474	1	12	1	9	285·5	− 9·0	+ 51·7
Means ...	...	...	1	12	284·65	− 9·85	...
Group 1962.							
Mar. 17·291	7	29	15	72	80·7	+12·5	− 76·4
18·418	9	55	9	59	83·0	+12·4	− 59·2
19·430	12	82	9	62	84·3	+12·4	− 44·6
20·164	26	108	18	71	83·7	+13·1	− 35·6
21·552	10	64	6	35	85·0	+12·8	− 16·0
22·512	10	122	5	66	83·4	+13·5	− 4·9
Means ...	...	...	10	61	83·35	+12·78	...
Group 1963.							
Mar. 19·430	0	13	0	32	51·0	+ 2·3	− 77·9
20·164	12	23	16	32	51·0	+ 2·5	− 68·3
21·552	0	23	0	18	52·4	+ 2·5	− 48·6
22·512	0	21	0	13	53·1	+ 2·4	− 35·2
Means ...	...	...	4	24	51·88	+ 2·43	...
Group 1964.							
Mar. 21·552	0	13	0	24	28·5	+10·0	− 72·5
22·512	0	9	0	10	28·8	+10·2	− 59·5
23·346	0	12	0	10	28·8	+10·7	− 48·4
24·165	0	7	0	5	24·7	+12·1	− 41·8
Means ...	...	...	0	12	27·70	+10·75	...
Group 1965.							
Mar. 25·444	0	28	0	18	10·5	−13·6	− 39·0
26·444	10	80	6	45	11·4	−13·9	− 25·0
27·506	8	29	4	15	10·2	−13·6	− 12·2
Means ...	...	...	3	26	10·70	−13·70	...
Group 1966.							
1887. d					°	°	°
Mar. 30·338	0	18	0	9	347·0	+ 3·0	+ 2·0
Group 1967.							
Mar. 31·186	11	43	6	23	331·0	+13·4	− 2·9
Apr. 1·500	14	49	8	27	331·4	+13·3	+14·9
2·434	3	13	2	8	329·7	+13·0	+25·6
3·196	3	14	2	10	331·2	+13·1	+37·1
4·432	0	4	0	4	332·9	+13·7	+55·1
Means ...	...	...	4	14	331·24	+13·30	...
Group 1968.							
Apr. 12·414	0	13	0	40	94·0	+16·2	− 78·4
13·288	0	16	0	23	93·9	+16·3	− 67·0
Means ...	...	...	0	32	93·95	+16·25	...
Group 1969.							
Apr. 15·514	0	5	0	13	51·8	− 4·6	− 79·7
16·394	0	27	0	34	53·2	− 3·9	− 66·7
17·477	0	0	0	0	...	...	...
18·546	0	0	0	0	...	...	...
19·514	1	24	0	14	53·4	− 3·2	− 25·2
Means ...	...	...	0	12	52·80	− 3·90	...
Group 1970.							
Apr. 18·546	1	25	1	20	42·2	+13·1	− 49·2
19·514	18	221	12	144	43·8	+13·5	− 34·8
20·495	21	278	12	158	44·0	+13·3	− 21·8
21·469	28	225	15	119	45·0	+13·5	− 7·9
22·417	31	198	16	105	45·4	+13·6	+ 5·0
23·432	32	121	18	67	45·0	+13·1	+ 18·1
24·551	15	114	10	72	45·3	+12·9	+ 33·1
25·125	21	70	14	49	45·1	+12·4	+ 40·6
26·417	6	24	6	24	45·2	+12·7	+ 57·8
27·415	0	10	0	16	44·7	+12·6	+ 70·4
Means ...	...	...	10	77	44·57	+13·07	...

AREAS and HELIOGRAPHIC POSITIONS of SPOT GROUPS on the SUN'S DISK—*continued.*

Group 1971.

Date. Greenwich Civil Time.	Projected Area of Umbra.	Projected Area of Whole Spot.	Area for Group. Umbra.	Area for Group. Whole Spot.	Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
1887. d					°	°	°
Apr. 27·415	6	68	9	113	263·3	+ 11·8	− 71·0
28·429	12	97	12	97	262·9	+ 11·9	− 57·9
29·285	39	155	30	119	263·1	+ 12·4	− 46·5
30·471	14	111	9	68	262·5	+ 12·2	− 31·4
May 1·546	0	52	0	29	258·1	+ 12·0	− 21·5
2·126	0	13	0	7	258·6	+ 12·1	− 13·4
Means ...	...	...	10	72	261·42	+ 12·07	...

Group 1972.

Date. Greenwich Civil Time.	Projected Area of Umbra.	Projected Area of Whole Spot.	Area for Group. Umbra.	Area for Group. Whole Spot.	Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
May 2·126	2	29	2	19	231·5	− 5·9	− 40·5
3·577	0	0	0	0	...	...	...
4·292	3	25	1	13	233·4	− 5·7	− 10·1
5·555	16	104	8	53	234·0	− 4·0	+ 7·2
6·101	24	74	12	38	234·8	− 4·4	+ 15·3
7·554	0	97	0	60	235·8	− 5·1	+ 35·5
8·207	13	58	10	41	236·4	− 5·3	+ 44·8
9·450	0	20	0	21	236·9	− 5·4	+ 61·7
10·548	0	19	0	39	237·2	− 4·9	+ 76·5
Means ...	...	...	4	32	235·00	− 5·09	...

Group 1973.

Date. Greenwich Civil Time.	Projected Area of Umbra.	Projected Area of Whole Spot.	Area for Group. Umbra.	Area for Group. Whole Spot.	Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
May 2·126	0	103	0	370	190·9	+ 12·6	− 81·1
3·577	49	451	57	521	190·0	+ 12·0	− 62·9
4·292	87	461	77	413	189·3	+ 12·4	− 54·2
5·555	97	453	62	289	191·3	+ 12·9	− 35·5
6·101	99	487	59	289	190·9	+ 13·1	− 28·6
7·554	102	524	54	277	191·1	+ 13·1	− 9·2
8·207	109	564	57	292	190·9	+ 13·0	− 0·7
9·450	64	503	35	271	191·3	+ 12·7	+ 16·1
10·548	58	433	35	263	191·5	+ 12·5	+ 30·8
11·246	53	320	36	220	191·6	+ 12·9	+ 40·1
12·260	40	242	36	217	192·1	+ 12·8	+ 54·0
13·575	6	99	10	159	191·3	+ 12·2	+ 70·7
14·499	0	35	0	154	191·1	+ 12·3	+ 82·7
Means ...	...	...	40	287	191·02	+ 12·65	...

Group 1974.

Date. Greenwich Civil Time.	Projected Area of Umbra.	Projected Area of Whole Spot.	Area for Group. Umbra.	Area for Group. Whole Spot.	Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
1887. d					°	°	°
May 8·207	22	91	11	46	191·7	− 11·1	+ 0·1
9·450	21	158	11	84	192·3	− 10·7	+ 17·1
10·548	15	64	10	39	192·8	− 10·2	+ 32·1
11·246	1	51	0	34	193·0	− 10·1	+ 41·5
Means ...	...	...	8	51	192·45	− 10·53	...

Group 1975.

Date. Greenwich Civil Time.	Projected Area of Umbra.	Projected Area of Whole Spot.	Area for Group. Umbra.	Area for Group. Whole Spot.	Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
May 9·450	0	24	0	17	131·5	− 3·2	− 43·7
10·548	0	63	0	36	131·8	− 3·2	− 28·9
11·246	5	56	3	30	132·3	− 2·6	− 19·2
Means ...	...	...	1	28	131·87	− 3·00	...

Group 1976.

Date. Greenwich Civil Time.	Projected Area of Umbra.	Projected Area of Whole Spot.	Area for Group. Umbra.	Area for Group. Whole Spot.	Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
May 9·450	0	12	0	22	102·1	+ 7·6	− 73·1
10·548	0	18	0	18	101·7	+ 7·8	− 59·0
11·246	6	16	5	13	102·5	+ 8·2	− 49·0
Means ...	...	...	2	18	102·10	+ 7·87	...

Group 1977.

Date. Greenwich Civil Time.	Projected Area of Umbra.	Projected Area of Whole Spot.	Area for Group. Umbra.	Area for Group. Whole Spot.	Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
May 11·246	0	8	0	29	68·9	− 2·2	−82·6
12·260	1	8	1	11	69·4	− 1·8	−68·7
13·575	0	27	0	21	70·0	− 0·4	−50·6
14·499	0	16	0	10	70·0	+ 1·5	−38·4
Means ...	...	...	1	18	69·58	− 0·73	...

AREAS and HELIOGRAPHIC POSITIONS of SPOT GROUPS on the SUN'S DISK—*continued.*

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.			
Group 1978.							
1887. d					°	°	°
May 14·499	0	61	0	36	77·1	− 8·8	− 31·3
15·548	5	147	2	77	78·3	− 9·4	− 16·2
16·526	67	473	35	241	78·7	− 9·4	− 2·9
17·118	123	653	62	331	79·6	− 9·2	+ 5·8
18·148	191	905	104	490	80·5	− 9·4	+ 20·3
19·274	203	1116	128	701	81·7	− 9·2	+ 36·4
20·524	71	679	61	588	83·1	− 9·1	+ 54·4
21·432	41	464	54	599	83·8	− 9·0	+ 67·1
Means ...	...	...	56	383	80·35	− 9·19	...
Group 1979.							
May 16·526	3	24	3	25	20·2	− 7·8	− 61·4
17·118	15	29	12	25	20·4	− 8·0	− 53·4
Means ...	...	...	8	25	20·3	− 7·90	...
Group 1980.							
May 17·118	0	30	0	15	69·7	+ 2·0	− 4·1
Group 1981.							
May 26·406	0	9	0	11	17·8	+ 0·6	+ 66·9
Group 1982.							
May 28·161	10	41	5	21	300·3	+ 6·3	+ 12·6
29·123	22	113	12	63	300·1	+ 6·2	+ 25·1
30·265	19	65	12	43	300·8	+ 6·3	+ 40·9
31·407	0	21	0	19	300·8	+ 7·1	+ 56·1
Means ...	...	...	7	37	300·50	+ 6·48	...

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.			
Group 1983.							
1887. d					°	°	°
May 28·161	26	43	14	23	281·7	+20·1	− 6·0
29·123	18	54	10	30	282·4	+19·7	+ 7·4
30·265	6	16	3	10	283·1	+19·6	+ 23·2
Means ...	...	...	9	21	282·40	+19·80	...
Group 1984.							
May 30·265	0	7	0	10	193·4	+11·4	−66·5
Group 1985.							
May 31·407	0	19	0	10	246·5	− 8·2	+ 1·8
Group 1986.							
June 1·571	0	53	0	55	168·5	−11·1	−60·9
2·373	25	142	20	115	167·5	−10·9	−51·2
3·214	37	336	24	219	168·7	−10·5	−38·9
4·404	10	99	5	54	170·5	−10·2	−21·3
5·204	4	38	2	20	170·7	− 9·5	−10·6
Means ...	...	...	10	93	169·18	− 9·44	...
Group 1987.							
June 6·487	14	561	18	787	95·5	−10·0	− 68·8
7·321	178	641	171	614	95·0	− 9·4	− 58·2
8·502	169	840	115	583	95·0	− 9·2	− 42·6
9·438	189	989	112	589	94·8	− 9·0	− 30·3
10·417	201	1119	107	596	95·0	− 8·9	− 17·2
11·434	216	1077	109	548	94·9	− 8·6	− 3·8
12·517	227	1076	117	557	95·2	− 8·4	+ 10·7
13·440	194	932	107	513	94·9	− 8·2	+ 22·7
14·425	188	809	118	507	94·9	− 8·1	+ 35·7
15·447	130	623	100	483	95·0	− 8·0	+ 49·3
16·412	87	400	95	437	95·0	− 7·7	+ 62·2
17·417	32	143	67	296	95·1	− 7·6	+ 75·6
18·106	0	59	0	311	94·9	− 7·5	+ 84·4
Means ...	...	...	95	525	95·01	− 8·51	...

AREAS and HELIOGRAPHIC POSITIONS of SPOT GROUPS on the SUN'S DISK—*continued.*

Date. Greenwich Civil Time.	Projected Area of Umbra.	Projected Area of Whole Spot.	Area for Group. Umbra.	Area for Group. Whole Spot.	Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
Group 1988.							
1887. d					°	°	°
June 9·438	2	47	4	91	49·8	+ 0·7	− 75·3
10·417	7	40	7	44	49·6	+ 1·2	− 62·6
11·434	12	63	9	48	49·3	+ 1·5	− 49·4
12·517	13	57	8	35	50·3	+ 0·8	− 34·2
13·440	7	25	4	13	50·6	+ 0·9	− 21·6
14·425	0	7	0	3	51·8	+ 1·0	− 7·4
Means ...	...	...	5	39	50·23	+ 1·02	...
Group 1989.							
June 17·417	9	62	5	31	25·7	+ 0·3	+ 6·2
18·106	20	85	11	44	26·4	+ 0·3	+ 15·9
19·501	31	298	19	183	26·2	+ 0·3	+ 34·2
20·420	8	112	6	82	26·4	+ 0·6	+ 46·6
21·263	4	45	4	40	24·2	+ 1·2	+ 55·5
Means ...	...	...	9	76	25·78	+ 0·54	...
Group 1990.							
June 18·106	0	7	0	16	293·3	− 5·8	− 77·2
19·501	0	13	0	12	293·8	− 5·4	− 58·2
20·420	7	86	6	64	292·4	− 5·4	− 47·4
21·263	10	89	6	57	291·7	− 5·8	− 37·0
22·416	3	66	2	36	291·8	− 5·5	− 21·6
23·476	0	69	0	35	290·4	− 5·9	− 8·9
24·143	3	32	2	15	290·3	− 6·4	− 0·2
25·196	1	8	0	4	290·2	− 5·5	+ 13·6
Means ...	...	...	2	30	291·74	− 5·71	...
Group 1991.							
June 27·449	29	197	42	292	177·3	−10·8	−69·4
28·513	42	266	38	240	177·7	−11·4	−55·0
29·492	54	319	38	220	178·0	−11·7	−41·7
30·273	64	281	39	171	178·5	−11·6	−31·0
July 1·413	61	348	33	187	178·7	−11·7	−15·6
2·528	67	411	35	211	178·6	−11·4	− 1·0
3·551	67	368	36	194	179·1	−11·8	+13·0
4·434	57	276	33	159	179·8	−11·7	+25·5
5·577	42	227	29	157	180·4	−11·7	+41·2
6·558	34	175	30	158	180·7	−11·7	+54·4
7·404	16	98	20	126	181·0	−11·8	+65·9
8·458	0	35	0	105	180·7	−11·9	+79·5
Means ...	...	...	31	185	179·21	−11·60	...
Group 1992.							
1887. d					°	°	°
July 2·528	8	49	31	200	97·2	− 7·5	−82·4
3·551	21	137	30	196	97·2	− 7·5	−68·9
4·434	43	252	41	241	96·6	− 7·3	−57·7
5·577	59	344	40	235	96·8	− 7·2	−42·4
6·558	61	367	36	217	96·5	− 7·3	−29·8
7·404	79	391	42	209	96·9	− 7·1	−18·2
8·458	58	403	30	206	96·8	− 7·3	− 4·4
9·471	64	364	33	187	96·9	− 7·2	+ 9·2
10·492	65	334	36	184	96·9	− 7·3	+22·8
11·582	46	267	29	172	97·4	− 7·2	+37·7
12·492	39	235	31	188	97·8	− 7·3	+50·1
13·429	25	158	28	176	97·8	− 7·0	+62·5
14·418	14	84	30	186	98·5	− 7·4	+76·2
Means ...	...	...	34	200	97·18	− 7·28	...
Group 1993.							
July 5·577	8	124	4	68	140·1	−19·0	+ 0·9
6·558	77	384	44	217	141·4	−19·8	+15·1
7·404	75	449	46	276	142·0	−19·5	+26·9
8·458	48	281	35	206	142·7	−19·1	+41·5
9·471	32	163	31	160	143·5	−18·4	+55·8
10·492	13	86	20	135	143·2	−18·4	+69·1
11·582	0	13	0	77	143·2	−18·4	+83·5
Means ...	...	...	26	163	142·30	−18·94	...
Group 1994.							
July 5·577	0	42	0	138	57·5	+ 6·9	−81·7
6·558	19	193	33	338	52·6	+ 7·1	−73·3
7·404	40	379	43	415	52·2	+ 7·2	−63·1
8·458	76	489	57	372	52·1	+ 7·6	−49·1
9·471	99	532	60	329	51·9	+ 7·5	−35·8
10·492	109	475	59	255	52·0	+ 7·7	−22·1
11·582	106	556	53	280	53·0	+ 7·5	− 6·7
12·492	101	491	51	249	54·0	+ 7·3	+ 6·3
13·429	85	480	45	255	54·7	+ 7·2	+19·4
14·418	87	403	52	241	54·8	+ 7·0	+32·5
15·459	62	296	45	215	55·0	+ 6·9	+46·6
16·460	37	200	35	193	54·4	+ 7·0	+59·1
17·458	16	74	26	120	54·5	+ 6·6	+72·5
18·465	0	15	0	50	50·9	+ 8·4	+82·2
Means ...	...	...	40	246	53·54	+ 7·28	...

AREAS and HELIOGRAPHIC POSITIONS of SPOT GROUPS on the SUN'S DISK—*continued.*

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.			
Group 1995.							
1887. d					°	°	°
July 23·418	23	96	12	50	255·5	− 9·2	− 7·6
24·455	10	87	5	45	254·9	− 9·9	+ 5·5
25·089	36	140	20	75	255·0	− 9·8	+13·9
26·531	51	381	34	254	260·3	−10·0	+38·3
27·403	70	636	62	531	261·4	−10·2	+50·9
28·437	70	513	92	640	261·3	−10·2	+64·6
29·206	21	364	58	813	262·4	−10·3	+75·8
Means ...	...	...	40	344	258·69	− 9·94	...
Group 1996.							
July 24·455	0	13	0	18	182·0	−13·4	−67·4
25·089	4	18	4	19	182·0	−13·0	−59·1
26·531	4	20	3	14	182·4	−13·2	−39·6
27·403	4	18	2	11	182·5	−13·3	−28·0
28·437	0	14	0	8	181·9	−12·8	−14·8
Means ...	...	...	2	14	182·16	−13·14	...
Group 1997.							
July 30·544	0	23	0	30	102·9	−11·2	−65·9
31·458	3	40	3	35	104·0	−10·7	−52·8
Aug. 1·530	5	39	3	26	104·4	−10·9	−38·2
2·588	6	38	3	21	106·2	−10·7	−22·5
3·406	4	48	2	26	106·5	−10·6	−11·3
4·402	11	26	6	14	106·5	−10·4	+ 1·9
5·406	3	20	1	11	106·7	−10·9	+15·4
6·487	0	15	0	9	106·5	−10·3	+29·4
7·206	0	6	0	4	106·0	−10·4	+38·5
Means ...	...	...	2	20	105·52	−10·68	...
Group 1998.							
July 30·544	0	39	0	64	97·6	− 7·9	−71·2
31·458	8	77	9	79	97·5	− 7·7	−59·3
Aug. 1·530	15	105	11	76	97·2	− 7·7	−45·4
2·588	19	130	11	79	97·5	− 7·7	−31·2
Group 1998—*continued.*							
1887. d					°	°	°
Aug. 3·406	21	138	12	76	97·6	− 7·3	−20·2
4·402	15	144	8	75	97·6	− 7·3	− 7·0
5·406	26	153	14	79	97·6	− 7·6	+ 6·3
6·487	17	131	10	72	97·8	− 7·4	+20·7
7·206	18	119	11	71	97·5	− 7·5	+30·0
8·538	6	33	5	26	97·6	− 7·1	+47·6
9·573	5	24	6	26	97·3	− 7·2	+60·9
Means ...	...	...	9	66	97·53	− 7·49	...
Group 1999.							
July 31·458	13	161	19	247	86·5	− 5·4	− 70·3
Aug. 1·530	31	295	28	272	86·5	− 4·9	− 56·1
2·588	43	423	29	288	86·8	− 4·6	− 41·9
3·406	36	412	22	245	87·3	− 4·6	− 30·5
4·402	27	385	16	203	88·0	− 4·7	− 16·6
5·406	54	575	28	295	90·3	− 4·8	− 1·0
6·487	73	630	39	332	90·9	− 4·9	+ 13·8
7·206	89	636	49	354	90·9	− 5·3	+ 23·4
8·538	53	433	37	297	91·6	− 5·0	+ 41·6
9·573	17	263	16	243	92·5	− 4·7	+ 56·1
10·512	0	115	0	167	92·8	− 4·4	+ 69·0
Means ...	...	...	26	268	89·46	− 4·85	...
Group 2000.							
July 31·458	3	49	5	70	86·6	+ 11·3	− 70·2
Aug. 1·530	6	130	5	115	86·6	+ 11·1	− 56·0
2·588	10	90	6	61	86·8	+ 11·4	− 41·9
3·406	13	65	7	38	86·7	+ 11·6	− 31·1
4·402	2	23	1	12	87·0	+ 11·7	− 17·6
5·406	1	14	1	7	87·3	+ 11·9	− 4·0
Means ...	...	...	4	51	86·83	+ 11·50	...

AREAS and HELIOGRAPHIC POSITIONS of SPOT GROUPS on the SUN'S DISK—*continued.*

Date. Greenwich Civil Time.	Projected Area of Umbra.	Projected Area of Whole Spot.	Area for Group. Umbra.	Area for Group. Whole Spot.	Mean Longitude of Group.	Mean Latitude of Group.	Longitude from Central Meridian.
Group 2001.							
1887. d					°	°	°
Aug. 13·573	4	109	6	193	271·6	− 9·5	−71·9
14·536	12	121	12	123	272·3	− 9·6	−58·4
15·535	16	135	11	100	273·1	− 9·6	−44·3
16·338	29	142	18	88	274·6	− 9·8	−32·2
17·243	25	144	14	80	275·6	−10·0	−19·2
18·661	18	107	9	56	277·1	− 9·4	+ 1·0
19·586	7	53	4	28	278·0	− 9·7	+14·1
20·554	7	29	4	17	278·8	−10·2	+27·6
21·183	0	13	0	8	279·2	−10·6	+36·3
Means ...	...	...	9	77	275·59	− 9·82	...
Group 2002.							
Aug. 13·573	0	25	0	81	261·4	+ 9·3	− 82·1
14·536	9	50	13	69	261·5	+ 9·3	− 69·2
15·535	15	89	13	80	261·4	+ 9·4	− 56·0
16·338	20	125	14	87	261·8	+ 9·4	− 45·0
17·243	29	135	17	80	262·0	+ 9·8	− 32·8
18·661	31	166	16	85	262·0	+ 9·9	− 14·1
19·586	11	80	6	40	262·2	+ 10·0	− 1·7
20·554	10	41	5	20	261·8	+ 10·0	+ 10·6
21·183	7	24	4	13	262·0	+ 10·0	+ 19·1
22·452	7	25	4	15	261·5	+ 10·4	+ 35·4
Means ...	...	...	9	57	261·76	+ 9·75	...
Group 2003.							
Aug. 16·338	0	10	0	7	262·6	− 16·9	− 44·2
Group 2004.							
Aug. 20·554	0	12	0	24	178·5	− 15·0	− 72·7
21·183	0	19	0	24	178·7	− 14·9	− 64·2
22·452	0	15	0	12	177·9	− 15·0	− 48·2
Means ...	...	...	0	20	178·37	− 14·97	...
Group 2005.							
1887. d					°	°	°
Aug. 27·569	0	25	0	32	225·9	+ 4·4	+ 67·4
28·231	0	30	0	66	227·2	+ 4·6	+ 77·5
Means ...	...	...	0	49	226·55	+ 4·50	...
Group 2006.							
Sept. 3·451	6	97	3	52	85·8	− 5·9	+ 18·2
4·464	0	37	0	22	84·1	− 6·5	+ 29·9
Means ...	...	...	2	37	84·95	− 6·20	...
Group 2007.							
Sept. 13·459	0	12	0	10	246·0	− 6·9	− 49·4
14·436	3	23	2	15	245·8	− 6·6	− 36·6
15·481	0	12	0	6	246·4	− 6·3	− 22·2
Means ...	...	...	1	10	246·07	− 6·60	...
Group 2008.							
Sept. 14·436	1	38	1	31	230·3	+ 5·4	− 52·1
15·481	60	402	38	250	232·3	+ 4·6	− 36·3
16·538	107	582	58	316	233·0	+ 4·6	− 21·8
17·185	110	822	56	425	232·3	+ 4·9	− 13·9
18·193	159	942	80	508	233·1	+ 4·7	+ 0·2
19·275	129	844	67	437	232·1	+ 5·1	+ 13·5
20·453	96	685	56	397	233·0	+ 5·2	+ 29·9
21·290	85	532	59	360	234·0	+ 4·7	+ 41·9
22·491	42	312	41	296	234·9	+ 4·8	+ 58·7
23·304	33	235	47	341	235·8	+ 4·6	+ 70·3
24·085	7	85	13	173	231·4	+ 5·4	+ 76·3
Means ...	...	...	47	321	232·93	+ 4·91	...
Group 2009.							
Sept. 24·085	8	22	6	14	190·0	−15·1	+ 34·9

AREAS and HELIOGRAPHIC POSITIONS of SPOT GROUPS on the SUN'S DISK—*continued.*

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.			
Group 2010.							
1887. d					°	°	°
Oct. 2·237	17	82	12	54	86·2	− 5·0	+ 38·7
3·163	21	103	17	86	87·0	− 5·0	+ 51·7
4·140	11	53	14	64	86·7	− 5·1	+ 64·3
Means ...	...	...	14	68	86·63	− 5·03	...
Group 2011.							
Oct. 4·140	8	43	5	25	45·0	−11·0	+ 22·6
5·143	0	7	0	5	45·4	−10·8	+ 36·2
6·276	2	15	1	13	46·0	−12·4	+ 51·7
Means ...	...	...	2	14	45·47	−11·40	...
Group 2012.							
Oct. 18·147	4	29	4	32	134·5	− 1·9	− 63·1
19·175	22	203	17	156	135·0	− 1·6	− 49·1
20·200	39	295	24	185	134·0	− 1·1	− 36·6
21·466	51	578	28	311	134·2	− 0·5	− 19·7
22·427	24	524	12	267	135·2	− 0·3	− 5·9
23·532	28	265	14	136	136·0	+ 0·3	+ 9·4
24·463	14	183	8	101	137·0	+ 0·4	+ 22·6
25·435	12	68	7	42	137·5	+ 0·4	+ 36·0
26·428	10	30	7	24	138·6	+ 0·2	+ 49·9
27·283	2	13	2	13	137·4	− 0·1	+ 60·2
Means ...	...	...	12	127	135·94	− 0·42	...
Group 2013.							
Oct. 19·175	0	4	0	2	149·4	− 9·0	−34·7
20·200	0	36	2	21	147·7	−10·0	−22·9
Means ...	...	...	1	12	148·55	− 9·50	...

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.			
Group 2014.							
1887. d					°	°	°
Oct. 20·200	0	6	0	8	106·0	− 3·1	− 64·6
21·466	2	10	2	7	106·9	− 3·0	− 47·0
22·427	0	12	0	7	107·5	− 2·8	− 33·6
23·532	0	7	0	4	108·8	− 2·4	− 17·8
24·463	0	18	0	9	105·7	− 2·3	− 8·7
25·435	0	12	0	6	108·8	− 2·2	+ 7·3
26·428	0	5	0	3	111·0	− 2·4	+ 22·3
27·283	0	18	0	11	107·9	− 2·7	+ 30·7
28·210	0	20	0	14	108·5	− 2·0	+ 43·6
29·428	0	2	0	2	110·3	− 2·1	+ 61·4
Means ...	...	...	0	7	108·14	− 2·50	...
Group 2015.							
Oct. 24·463	0	9	0	5	128·9	−12·3	+ 14·5
25·435	0	22	0	13	129·8	−12·3	+ 28·3
26·428	8	24	6	17	130·1	−11·7	+ 41·4
27·283	2	11	2	10	130·6	−11·3	+ 53·4
Means ...	...	...	2	11	129·85	−11·90	...
Group 2016.							
Oct. 31·449	3	32	2	22	65·5	+ 2·0	+ 43·2
Nov. 1·157	0	4	0	3	66·9	+ 1·6	+ 53·9
Means ...	...	...	1	13	66·2	+ 1·80	...
Group 2017.							
Nov. 5·409	3	40	11	130	236·2	− 7·4	−80·6
6·475	16	107	21	143	235·8	− 7·9	−67·1
7·191	23	140	22	134	236·0	− 8·1	−57·4
8·162	30	159	22	116	235·8	− 8·2	−44·8
9·304	34	190	20	112	235·8	− 8·1	−29·7

AREAS and HELIOGRAPHIC POSITIONS of SPOT GROUPS on the SUN'S DISK—*continued.*

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.			
Group 2017—*continued.*							
1887. d					°	°	°
Nov. 10·296	34	181	18	96	236·2	− 8·0	−16·2
11·572	24	141	13	72	236·1	− 8·0	+ 0·4
12·227	24	125	12	65	236·6	− 7·9	+ 9·6
13·172	17	79	9	44	237·1	− 8·0	+22·5
14·186	10	48	6	30	237·5	− 7·9	+36·3
15·168	2	16	2	13	237·8	− 8·2	+49·6
16·186	0	7	0	8	237·9	− 8·2	+63·1
Means ...	...	...	13	80	236·57	− 7·99	...
Group 2018.							
Nov. 7·191	1	12	0	7	269·8	+ 5·5	−23·6
8·162	0	3	0	2	271·5	+ 6·9	− 9·1
Means ...	...	...	0	5	270·65	+ 6·20	...
Group 2019.							
Nov. 11·572	0	4	0	9	160·2	− 17·7	− 75·5
12·227	0	12	0	16	160·9	− 18·1	− 66·1
13·172	3	27	3	25	161·1	− 18·0	− 53·5
14·186	6	40	4	27	161·9	− 18·1	− 39·3
15·168	0	43	0	26	162·2	− 18·1	− 26·0
16·186	3	28	2	15	162·8	− 18·1	− 12·0
17·449	21	54	12	29	163·8	− 17·4	+ 5·8
18·318	5	20	3	11	163·6	− 17·7	+ 16·9
19·448	0	13	0	8	162·8	− 18·1	+ 31·1
20·214	1	6	1	5	163·4	− 17·8	+ 41·7
Means ...	...	...	3	17	162·27	− 17·91	...
Group 2020.							
Nov. 11·572	0	21	0	80	154·5	− 17·7	− 81·2
12·227	7	47	14	90	154·0	− 18·1	− 73·0
13·172	16	101	18	111	154·1	− 18·3	− 60·5
14·186	28	105	22	83	154·1	− 18·3	− 47·1
15·168	5	66	3	43	153·9	− 18·7	− 34·3
16·186	3	26	2	15	153·7	− 18·9	− 21·1
Means ...	...	...	10	70	154·05	− 18·33	...

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.			
Group 2021.							
1887. d					°	°	°
Dec. 3·518	15	150	48	489	225·3	− 8·0	− 81·0
4·189	66	414	136	850	221·7	− 7·9	− 75·8
5·436	96	842	89	808	222·8	− 7·6	− 58·2
6·198	141	1084	107	833	222·1	− 7·6	− 48·9
7·503	116	1285	70	763	222·8	− 7·2	− 31·1
8·211	178	1225	97	670	222·1	− 7·5	− 22·4
9·427	49	1091	25	557	222·9	− 6·9	− 5·5
10·181	158	1152	79	581	223·7	− 7·4	+ 5·2
11·189	95	896	51	476	224·2	− 7·9	+ 18·9
12·207	71	677	43	412	224·9	− 8·0	+ 33·0
13·177	68	504	50	369	225·4	− 8·2	+ 46·2
14·427	43	294	48	324	225·4	− 8·0	+ 62·8
15·191	28	175	47	295	225·3	− 7·9	+ 72·7
Means ...	...	...	68	571	223·74	− 7·62	...
Group 2022.							
Dec. 9·427	10	100	6	57	203·6	−14·4	− 24·8
10·181	55	244	30	129	204·4	−14·5	− 14·1
11·189	45	203	24	104	205·3	−14·6	0·0
12·207	20	161	11	86	204·9	−14·4	+ 13·0
13·177	2	32	1	18	207·0	−14·5	+ 27·8
Means ...	...	...	14	79	205·04	−14·48	...
Group 2023.							
Dec. 12·207	3	12	2	9	239·1	− 6·9	+ 47·2
Group 2024.							
Dec. 14·427	15	112	40	307	83·1	− 7·5	− 79·5
15·191	113	575	202	1030	78·8	− 7·4	− 73·8
16·551	126	1036	108	919	79·4	− 7·6	− 55·3
17·474	164	1275	113	876	80·0	− 7·8	− 42·5
18·473	162	1209	94	701	80·7	− 7·9	− 28·6
19·288	256	1458	135	773	80·5	− 8·0	− 18·0

AREAS and HELIOGRAPHIC POSITIONS of SPOT GROUPS on the SUN'S DISK—*continued.*

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.			
Group 2024—*continued.*							
1887. d					°	°	°
20·207	242	1418	123	722	80·3	− 7·9	− 6·1
21·282	241	1553	123	797	82·0	− 8·1	+ 9·6
22·214	191	1336	104	726	82·1	− 8·0	+ 22·0
23·301	122	1133	78	716	82·4	− 8·2	+ 36·7
24·210	123	852	94	651	82·5	− 8·5	+ 48·8
25·214	76	608	83	666	83·3	− 8·6	+ 62·8
26·483	10	135	27	368	83·6	− 8·2	+ 79·8
Means ...	...	...	102	712	81·44	− 7·98	...

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.			
Group 2025.							
1887. d					°	°	°
Dec. 21·282	21	87	11	47	53·1	−12·8	−19·3
22·214	14	138	7	70	53·5	−12·8	− 6·6
23·301	26	134	14	69	53·8	−13·3	+ 8·1
24·210	17	120	9	65	53·6	−13·3	+19·9
25·214	12	46	7	29	53·6	−12·9	+33·1
26·483	2	24	1	19	54·7	−13·6	+50·9
27·262	2	10	2	24	55·2	−13·7	+61·6
Means ...	...	...	7	46	53·93	−13·20	...

ROYAL OBSERVATORY, GREENWICH.

TOTAL PROJECTED AREAS OF SUN SPOTS

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

1887.

TOTAL PROJECTED AREAS OF UMBRÆ, WHOLE SPOTS, AND FACULÆ UPON THE SUN'S DISK FOR EACH DAY IN THE YEAR 1887.

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.		
		Umbræ.	Whole Spots.	Faculæ.
	d			
Jan.	1·	...	...	...
	2·2	48	246	507
	3·2	24	152	291
	4·2	19	94	226
	5·5	19	51	292
	6·2	12	58	431
	7·2	8	22	358
	8·2	6	15	350
	9·2	0	0	0
	10·	...	...	...
	11·3	0	0	0
	12·2	0	0	0
	13·2	0	0	0
	14·2	0	0	406
	15·2	0	0	420
	16·2	0	0	193
	17·5	0	0	196
	18·3	0	0	112
	19·3	4	10	136
	20·5	0	58	0
	21·5	12	65	0
	22·2	13	67	197
	23·3	10	34	452
	24·5	0	75	84
	25·5	25	279	211
	26·5	32	262	148
	27·2	61	327	869
	28·3	52	263	378
	29·3	40	355	347
	30·5	36	454	147
	31·2	85	567	183
Feb.	1·3	50	337	239
	2·4	22	211	193
	3·4	37	187	699
	4·2	36	168	807
	5·4	9	42	163
	6·5	6	35	0
	7·2	0	0	128
	8·2	0	0	100
	9·2	0	0	0
	10·2	0	0	115
	11·5	0	0	105
	12·4	0	0	132
	13·2	0	0	185
	14·2	0	0	97
	15·3	0	0	187
	16·5	0	0	181
	17·2	7	25	134
	18·3	17	140	379
	19·2	42	228	515
	20·5	24	174	950
	21·5	18	180	513
	22·2	42	201	869

Greenwich Civil Time.		Projected Area.		
		Umbræ.	Whole Spots.	Faculæ.
	d			
Feb.	23·1	46	228	575
	24·3	28	180	228
	25·5	8	135	0
	26·4	9	42	99
	27·6	0	52	0
	28·4	26	221	584
Mar.	1·2	16	143	438
	2·2	0	57	485
	3·4	0	0	497
	4·1	0	0	453
	5·1	0	0	211
	6·0	0	0	0
	7·2	0	0	137
	8·4	0	0	143
	9·2	0	0	60
	10·2	0	24	136
	11·5	1	12	130
	12·5	0	0	0
	13·5	0	0	0
	14·2	0	0	191
	15·3	0	0	0
	16·3	0	0	152
	17·3	7	29	352
	18·4	9	55	422
	19·4	12	95	484
	20·2	38	131	651
	21·6	10	100	387
	22·5	10	152	336
	23·3	0	12	131
	24·2	0	7	104
	25·4	0	28	70
	26·4	10	80	641
	27·5	8	29	444
	28·4	0	0	192
	29·4	0	0	401
	30·3	0	18	532
	31·2	11	43	448
April	1·5	14	49	346
	2·4	3	13	63
	3·2	3	14	0
	4·4	0	4	120
	5·2	0	0	119
	6·	...	...	...
	7·2	0	0	0
	8·5	0	0	26
	9·5	0	0	91
	10·1	0	0	92
	11·1	0	0	0
	12·4	0	13	65
	13·3	0	16	287
	14·4	0	0	264
	15·5	0	5	146

Greenwich Civil Time.		Projected Area.		
		Umbræ.	Whole Spots.	Faculæ.
	d			
April	16·4	0	27	199
	17·5	0	0	184
	18·5	1	25	53
	19·5	18	245	88
	20·5	21	278	103
	21·5	28	225	0
	22·4	31	198	236
	23·4	32	121	159
	24·6	15	114	0
	25·1	21	70	284
	26·4	6	24	391
	27·4	6	78	402
	28·4	12	97	121
	29·3	39	155	762
	30·5	14	111	326
May	1·5	0	52	247
	2·1	2	145	105
	3·6	49	451	361
	4·3	89	485	468
	5·6	113	557	0
	6·1	124	561	0
	7·6	102	621	99
	8·2	144	714	242
	9·5	86	717	472
	10·5	73	596	460
	11·2	65	452	1528
	12·3	41	250	721
	13·6	6	126	650
	14·5	0	112	217
	15·5	5	147	0
	16·5	70	497	254
	17·1	138	712	243
	18·1	191	911	143
	19·3	203	1116	190
	20·5	71	679	458
	21·4	41	464	218
	22·	...	...	...
	23·5	0	0	104
	24·2	0	0	0
	25·3	0	0	212
	26·4	0	9	408
	27·1	0	0	703
	28·2	36	84	497
	29·1	40	167	0
	30·3	25	89	398
	31·4	0	40	723
June	1·6	0	53	333
	2·4	25	142	412
	3·2	37	336	158
	4·4	10	99	391
	5·2	4	38	367
	6·5	14	561	414

Greenwich Civil Time.		Projected Area.		
		Umbræ.	Whole Spots.	Faculæ.
	d			
June	7·3	178	641	802
	8·5	169	840	477
	9·4	191	1036	384
	10·4	208	1160	564
	11·4	228	1140	564
	12·5	240	1133	78
	13·4	202	957	0
	14·4	188	816	0
	15·4	130	623	84
	16·4	87	400	293
	17·4	41	205	376
	18·1	20	151	671
	19·5	31	310	190
	20·4	15	198	125
	21·3	15	135	218
	22·4	3	66	115
	23·5	0	69	0
	24·1	3	32	51
	25·2	1	8	0
	26·2	0	0	82
	27·4	29	197	484
	28·5	42	266	422
	29·5	54	319	340
	30·3	64	281	96
July	1·4	61	348	113
	2·5	75	460	65
	3·6	88	504	242
	4·4	100	528	458
	5·6	110	738	449
	6·6	190	1118	629
	7·4	210	1316	772
	8·5	182	1207	942
	9·5	194	1059	142
	10·5	187	895	81
	11·6	152	836	56
	12·5	140	727	231
	13·4	110	637	310
	14·4	101	487	586
	15·5	62	296	126
	16·5	37	200	227
	17·5	16	74	86
	18·5	0	15	108
	19·4	0	0	0
	20·4	0	0	0
	21·5	0	0	0
	22·4	0	0	0
	23·4	23	96	0
	24·5	10	100	209
	25·1	40	158	563
	26·5	56	402	0
	27·4	74	654	424
	28·4	70	527	442
	29·2	21	364	203

TOTAL PROJECTED AREAS OF UMBRÆ, WHOLE 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.			Umbræ.	Whole Spots.	Faculæ.			Umbræ.	Whole Spots.	Faculæ.			Umbræ.	Whole Spots.	Faculæ.
	d					d					d					d			
July	30·5	0	62	365	Sept.	6·1	0	0	802	Oct.	15·4	0	0	0	Nov.	23·0	0	0	0
	31·5	28	327	531		7·4	0	0	113		16·5	0	0	0		24·2	0	0	0
						8·5	0	0	37		17·5	0	0	56		25·3	0	0	0
Aug.	1·5	56	568	568		9·6	0	0	205		18·1	4	29	168		26·2	0	0	364
	2·6	78	680	138		10·5	0	0	256		19·2	22	207	666		27·2	0	0	277
	3·4	73	663	326		11·5	0	0	247		20·2	42	337	761		28·2	0	0	363
	4·4	56	577	180		12·6	0	0	285		21·5	53	588	261		29·2	0	0	228
	5·4	84	761	123		13·5	0	12	45		22·4	24	536	0		30·3	0	0	98
	6·5	90	777	0		14·4	4	60	141		23·5	28	272	0					
	7·2	107	761	0		15·5	60	413	0		24·5	14	209	0	Dec.	1·2	0	0	0
	8·5	59	466	0		16·5	107	582	0		25·4	12	102	0		2·2	0	0	226
	9·6	22	287	545		17·2	110	822	0		26·4	18	60	0		3·5	15	150	132
	10·5	0	115	330		18·2	159	942	318		27·3	5	43	544		4·2	66	414	706
	11·6	0	0	428		19·3	129	844	360		28·2	0	20	342		5·4	96	842	305
	12·6	0	0	233		20·5	96	685	0		29·4	0	2	253		6·2	141	1084	678
	13·6	4	134	279		21·3	85	532	272		30·5	0	0	279		7·5	116	1285	0
	14·5	22	171	707		22·5	42	312	786		31·4	3	32	90		8·2	178	1225	0
	15·5	30	225	389		23·3	33	235	1146							9·4	59	1192	0
	16·3	48	277	642		24·1	15	107	880	Nov.	1·2	0	4	189		10·2	213	1395	216
	17·2	54	279	0		25·3	0	0	416		2·4	0	0	111		11·2	140	1099	0
	18·7	49	273	0		26·3	0	0	163		3·2	0	0	200		12·2	94	850	200
	19·6	18	133	139		27·4	0	0	0		4·4	0	0	43		13·2	70	536	236
	20·6	18	82	155		28·6	0	0	0		5·4	3	40	114		14·4	58	406	221
	21·2	7	56	11		29·4	0	0	104		6·5	16	107	256		15·2	141	750	934
	22·5	7	40	182		30·4	0	0	300		7·2	24	152	479		16·6	126	1036	304
	23·5	0	0	395							8·2	30	162	274		17·5	164	1275	0
	24·5	0	0	399	Oct.	1·5	0	0	430		9·3	34	190	0		18·5	162	1209	0
	25·1	0	0	513		2·2	17	82	475		10·3	34	181	70		19·3	256	1458	80
	26·4	0	0	345		3·2	21	103	654		11·6	24	166	47		20·2	242	1418	21
	27·6	0	25	354		4·1	19	96	458		12·2	31	184	371		21·3	262	1640	119
	28·2	0	30	350		5·1	0	7	190		13·2	37	207	195		22·2	205	1474	204
	29·4	0	0	518		6·3	2	15	419		14·2	43	193	203		23·3	149	1267	27
	30·4	0	0	164		7·3	0	0	326		15·2	7	125	576		24·2	140	972	373
	31·4	0	0	0		8·1	0	0	141		16·2	6	61	907		25·2	88	655	717
						9·2	0	0	266		17·4	21	54	109		26·5	11	160	382
Sept.	1·4	0	0	0		10·3	0	0	420		18·3	5	20	173		27·3	2	10	383
	2·3	0	0	0		11·4	0	0	127		19·4	0	13	0		28·3	0	0	214
	3·5	6	97	0		12·5	0	0	0		20·2	1	6	0		29·2	0	0	287
	4·5	0	37	0		13·2	0	0	0		21·2	0	0	272		30·2	0	0	368
	5·7	0	0	369		14·3	0	0	0		22·2	0	0	196		31·2	24	108	357

MEAN AREAS of UMBRÆ, WHOLE SPOTS, and FACULÆ upon the SUN'S DISK, as measured on PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DÛN, INDIA, and in MAURITIUS, for each ROTATION of the SUN, from 1886 December 9 to 1887 December 26.

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 (as in former years) in millionths of the Sun's visible hemisphere.

The rotations adopted in the following table (which is in continuation of those for the years 1873–1884, 1885, and 1886 printed in the Greenwich Observations for 1884, 1885, and 1886) 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.		
					Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
			d							
444	1886	December	9·89	27	49	341	254	32	232	324
445	1887	January	6·22	26	18	131	216	11	90	275
446		February	2·56	27	14	89	303	11	72	357
447		March	1·89	27	4	30	252	3	28	304
448		March	29·20	27	7	55	159	4	35	188
449		April	25·47	26	65	417	349	43	309	376
450		May	22·70	27	77	397	349	52	290	402
451		June	18·90	27	82	483	264	60	352	304
452		July	16·10	27	37	320	223	29	255	265
453		August	12·32	28	9	65	246	6	54	302
454		September	8·57	27	47	216	301	21	141	351
455		October	6·84	27	8	91	197	5	53	228
456		November	2·14	28	11	66	208	9	56	247
457		November	29·45	27	118	879	229	86	644	251

MEAN AREAS of UMBRÆ, WHOLE SPOTS, and FACULÆ upon the SUN'S DISK, as measured on PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DÛN, INDIA, and in MAURITIUS, for the YEAR 1887.

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.		
		Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ
1887	361	37	243	256	26	179	301

MEAN HELIOGRAPHIC LATITUDE of the SPOTS upon the SUN'S DISK, as measured on PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DÛN, INDIA, and in MAURITIUS, for each ROTATION of the SUN, from 1886 December 9 to 1887 December 26.

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.		
	d			°		°	°	°
444	1886 Dec. 9·89	27	67	18·12	165	9·84	− 1·78	12·23
445	1887 Jan. 6·22	26	0	...	90	4·37	− 4·37	4·37
446	Feb. 2·56	27	44	11·09	28	7·81	+ 3·72	9·81
447	Mar. 1·89	27	24	10·53	4	12·92	+ 7·32	10·86
448	Mar. 29·20	27	33	13·44	2	4·31	+ 12·28	12·84
449	Apr. 25·47	26	165	12·50	144	8·69	+ 2·65	10·73
450	May 22·70	27	19	5·05	271	8·72	− 7·83	8·48
451	June 18·90	27	123	6·93	228	10·76	− 4·56	9·42
452	July 16·10	27	25	8·90	231	7·48	− 5·90	7·62
453	Aug. 12·32	28	24	8·69	30	9·82	− 1·58	9·32
454	Sept. 8·57	27	131	4·88	10	6·23	+ 4·11	4·97
455	Oct. 6·84	27	12	0·55	42	1·75	− 1·25	1·49
456	Nov. 2·14	28	1	5·73	56	11·65	− 11·55	11·62
457	Nov. 29·45	27	0	...	644	8·05	− 8·05	8·05

MEAN HELIOGRAPHIC LATITUDE of SPOTS upon the SUN'S DISK, as measured on the PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at DEHRA DÛN, INDIA, and in MAURITIUS, for the YEAR 1887.

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.		
			°		°	°	°
1887	361	44	+ 8·75	134	− 8·34	− 4·09	8·44

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 :—

$$-0^\circ\cdot05 \times \frac{\text{Mean Area N.} - \text{Mean Area S.}}{\text{Mean Area N.} + \text{Mean Area S.}}$$

These corrections have been applied in computing the Mean Heliographic Latitudes and Mean Distance from the Equator given in the above Tables for 1887, and in the corresponding Tables for 1886.