

RESULTS OF MEASURES
MADE AT THE
ROYAL OBSERVATORY, GREENWICH,
UNDER THE DIRECTION OF
F. W. DYSON, M.A., LL.D., F.R.S.,
ASTRONOMER ROYAL,
OF
PHOTOGRAPHS OF THE SUN
TAKEN
AT GREENWICH, AT THE CAPE, AND IN INDIA,
IN THE YEAR
1910.

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ERRATA.

GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1910.

MEASURES OF POSITIONS AND AREAS OF SUN SPOTS AND FACULÆ, 1910.

Page.

- D 2 Footnote. *Insert* Group 6799, 1910 January 1. Some small faint markings, *f* Group 6793.
D 14 Footnote. *Insert* Group 6827*. March 16. A very small spot.
D 16 Footnote. Group 6832. *Insert* Probably a return of Group 6829.

GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1910.

INTRODUCTION.

§ 1. *Measures of Positions and Areas of Sun Spots and Faculae on Photographs taken at the Royal Observatories of Greenwich, and of the Cape, and in India, at Kodaikánal and at Dehra Dún, in the year 1910; with the deduced Heliographic Longitudes and Latitudes.*

The photographs from which these measures were made were taken at the Royal Observatories of Greenwich or of the Cape; at the Kodaikánal Observatory, Southern India, or at Dehra Dún, North-West Provinces, India.

The photographs of the Sun, taken at Greenwich, were taken either with the Thompson or with the Dallmeyer Photoheliograph. The Thompson Photoheliograph, which was in regular use throughout 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 10 centimetres to the solar radius. The Dallmeyer—which has been occasionally used as well as the Thompson—is an instrument used in the Transit of Venus expedition to New Zealand, and, as now adapted, also gives a solar image of about 10 centimetres radius on the photographic plate.

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

The photographs from the Cape Observatory were taken under the superintendence of Mr S. S. Hough, His Majesty's Astronomer at the Cape; and those from Kodaikánal under the superintendence of Mr John Evershed, Director of that Observatory. The

Div INTRODUCTION TO GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1910.

photographs from Dehra Dûn, which have been forwarded by the Solar Physics Committee to fill the gaps in the combined series, were taken under the superintendence of the Deputy Surveyor-General, Trigonometrical Survey of India. At each observatory the instrument employed was a Dallmeyer Photoheliograph giving an image of the Sun about 10 centimetres in radius. The plates and development used have been much the same at each of the four collaborating observatories.

Photographs of the Sun were available for measurement upon each day in 1910, those finally selected for measurement being supplied by the different observatories as under :—

Greenwich	171
Cape	104
Kodaikânal	1
Dehra Dûn	89
Total		365

The measures were made in the manner described in the *Introduction to the Greenwich Photo-Heliographic Results* for 1909, and the results of the measures are printed upon the same plan, the following being the signatures of those persons who measured the photographs for the year 1910 :—

E. W. Maunder - - M C. F. Lait - - - CL
 A. H. Smith - - AS F. A. Saville - - FS

The zero of position-angles for the Thompson Photoheliograph employed at Greenwich has been determined by the same method as in 1909, and the following table gives the resulting correction for zero of position for the mean of the two wires :—

Thompson Photoheliograph, Greenwich.

Date, Greenwich Civil Time.			Correction for Zero.	Date, Greenwich Civil Time.			Correction for Zero.
1909	December	^d 20. ^h 11	- 0. 1	1910	May	^d 28. ^h 12	+ 0. 19
1910	January	10. 13	+ 0. 15			28. 12	+ 0. 28
	February	27. 12	+ 0. 5		June	14. 11	+ 0. 21
		12. 11	- 0. 2			28. 11	+ 0. 26
		21. 10	- 0. 5		July	19. 10	+ 0. 28
	March	25. 10	+ 0. 1		August	3. 10	+ 0. 28
		3. 11	- 0. 13			29. 10	+ 0. 12
		14. 12	+ 0. 3		September	13. 11	+ 0. 26
	April	1. 11	- 0. 23			27. 15	+ 0. 40
		22. 12	+ 0. 1		October	20. 12	+ 0. 29
	May	10. 11	+ 0. 2		November	9. 11	+ 0. 20
					December	22. 10	+ 0. 4
				1911	January	30. 11	+ 0. 25

MEASURES OF PHOTOGRAPHS OF THE SUN.

D v

No correction for zero of position of the wires has been applied to the photographs taken at Greenwich until 1910 May 17, when a new camera was fitted to the Thompson Photoheliograph. After that date a correction of $+0^{\circ}4$ has been applied to the Greenwich photographs up to the end of the year 1910.

The same method was employed with the Dallmeyer Photoheliograph, at the Royal Observatory, Cape of Good Hope, and the following determinations obtained :—

Dallmeyer Photoheliograph, Cape of Good Hope.

Date, Greenwich Civil Time.			Correction for Zero.	Date, Greenwich Civil Time.			Correction for Zero.
1910	March	^d 4	+ 0.18	1910	August	^d 1	+ 0.15
		^h 8				^d 11	
		19.	+ 0.21			15.	+ 0.24
	April	6.	+ 0.14		September	2.	+ 0.18
		18.	+ 0.16			14.	+ 0.12
		29.	+ 0.9		October	20.	+ 0.7
	May	13.	+ 0.20		November	3.	+ 0.23
		31.	+ 0.20			9.	+ 0.6
	June	14.	+ 0.30		December	7.	- 0.9
		28.	+ 0.20			8.	- 0.8
	July	20.	+ 0.20			17.	- 0.9

A correction of $+0^{\circ}3$ for zero of position has been applied to all photographs taken with the Cape Photoheliograph up to 1910 August 16, when the position of the wire frame was altered. After that date a correction of $+0^{\circ}2$ has been applied up to 1910 November 10; no correction from 1910 November 10 to 1910 December 6, and a correction of $-0^{\circ}1$ for the rest of the year.

In the use of the photoheliographs at Kodaikánal and at Dehra Dûn the position-circle has 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. At Dehra Dûn the practice has also been adopted of stopping the driving-clock after the exposure of the plate has been made, and making a second exposure about two minutes later, thus affording a further means for determining the true west point of the plate. No correction for zero of position of the wires has been applied for the reduction of the photographs taken at Kodaikánal and Dehra Dûn during the year 1910.

The method of reduction of the measures of the photographs is the same as that described in the *Introduction to the Greenwich Photo-Heliographic Results* for 1909. The inclination of the Sun's axis to the ecliptic is assumed to be $82^{\circ}45'$, the longitude of the ascending node for 1910.0 to be $74^{\circ}30'2$, and the period of the

Sun's sidereal rotation to be 25·38 days; the meridian which passed through the ascending node 1854 January 1, Greenwich Mean Noon, being taken as the zero meridian.

- § 2. *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 1910.*
- § 3. *Catalogue of Recurrent Groups of Sun Spots compiled from the Ledgers of Groups of Sun Spots for the year 1910.*
- § 4. *Total Areas of Sun Spots and Faculae for each day, and Mean Areas and Mean Heliographic Latitude of Sun Spots and Faculae for each Rotation of the Sun, and for the year 1910.*

These three sections are similar in all respects to the corresponding sections for 1909.

F. W. DYSON.

*Royal Observatory, Greenwich,
1911 September.*

ROYAL OBSERVATORY, GREENWICH.

MEASURES OF POSITIONS AND AREAS
OF
SUN SPOTS AND FACULÆ
ON
PHOTOGRAPHS
TAKEN WITH THE
PHOTOHELIOGRAPHS
AT GREENWICH, AT THE CAPE, AND IN INDIA,
WITH THE DEDUCED
HELIOGRAPHIC LONGITUDES AND LATITUDES.

1910.

MEASURES of POSITIONS and AREAS of SUN SPOTS and FACULÆ ON PHOTOGRAPHS taken at the ROYAL OBSERVATORIES of GREENWICH and of the CAPE, and in INDIA, at KODAIKĀNAL and at DEHRA DŪN, in the Year 1910.

NOTE.—The Greenwich Civil Time at which the Photograph was taken is expressed by the Day of the Year and decimals of a day, reckoning from Midnight, January 1st. For convenience of reference, the Month and Day of the Month (Civil Reckoning) are added.

The letter G. signifies that the photograph was taken at Greenwich; the letter C. that it was taken at the Cape; the letter K. that it was taken at Kodaikānal; the letter D. that it was taken at Dehra Dūn; 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.

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.

In the line immediately below the results for each day are given in brackets:—1. The Position Angle of the Sun's Axis (from the North point); 2. The Heliographic Longitude and Latitude of the Centre of the Disc; 3. The total areas for each day of Spots and Faculæ.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ. Area for each Group (and for Day).	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULÆ. Area for each Group (and for Day).						
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).							Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).							
1910. 0.182	FS, CL		0.932	258.0	145.0	-12.3			210	1910. 0.182	FS, CL		0.830	94.6	20.3	-5.5			161						
			0.795	242.8	126.4	-23.3			183				0.898	73.5	14.3	+13.3				120					
			0.729	268.1	123.0	-3.5			163							(+2.3)	(76.3)	(-3.1)	(242)	(1133)	(1428)				
			6791	0.746	287.8	122.5	+11.0	0	7			154c	1.188	AS, CL		0.906	247.6	127.0	-21.6				137		
			6791	0.726	285.9	121.1	+9.3	0	3									0.879	267.7	124.4	-3.6			199	
			6791a	0.695	286.7	118.5	+9.2	36	153										0.722	250.5	107.9	-16.2			145
			6797	0.399	301.4	96.4	+9.1	2	8									6791a	0.837	283.4	118.4	+9.3	32	154	250c
			6797	0.412	305.3	96.2	+10.9	2	6									6791	0.819	283.2	116.6	+8.9	0	12	
			6797	0.376	302.2	95.0	+8.6	2	10									6801	0.550	256.5	95.8	-10.1	0	5	
			6793	0.240	220.1	85.4	-13.6	0	4									6801	0.553	254.1	95.7	-11.4	1	13	
			6793	0.218	223.8	85.1	-12.1	0	5									6797	0.570	290.2	95.6	+8.6	0	7	
			6793a	0.260	212.3	84.6	-15.7	106	418									6793a	0.418	238.8	84.7	-15.4	88	387	
			6798	0.187	227.4	84.3	-10.3	2	10									6793	0.377	233.3	81.3	-16.0	2	17	
			6793	0.273	204.9	83.2	-17.4	3	12									6796a	0.145	29.2	59.0	+4.1	33	159	
			6793	0.241	203.4	82.0	-15.8	18	77									6796	0.201	43.0	55.1	+5.2	2	13	
			6793	0.213	206.6	81.9	-14.0	0	6									6796	0.215	51.3	53.4	+4.6	0	3	
			6793	0.246	198.2	80.9	-16.5	0	15									6796	0.234	46.6	53.2	+6.1	2	6	
			6793	0.255	193.3	79.8	-17.4	0	11									6796	0.234	62.0	51.1	+3.2	15	67	
			6793	0.207	188.5	78.1	-14.9	0	26									6796	0.274	51.9	50.5	+6.6	2	9	
			6799	0.250	178.0	75.8	-17.5	0	3									6800	0.147	115.8	55.4	-6.9	7	23	
	6799	0.221	164.8	72.9	-15.4	0	11				6800				0.194	101.2	52.0	-5.3	7	19					
	6796a	0.331	68.3	58.4	+4.1	41	186				6800				0.748	107.4	15.5	-15.1			104				
	6796	0.367	70.9	56.0	+4.0	0	5				6800				0.878	54.4	8.6	+28.8			132				
	6796	0.411	75.0	53.0	+3.3	2	6						(+1.8)	(63.0)	(-3.2)	(191)	(894)	(967)							
	6796	0.444	76.4	50.8	+3.2	20	80						0.908	265.1	114.3	-5.8			239						
	6796	0.467	69.6	50.3	+6.6	2	27						0.777	254.0	99.3	-14.4			185						
	6796	0.460	75.3	49.9	+3.9	1	7						6791a	0.944	281.4	118.6	+9.6	35	147	367f					
	6796	0.501	73.3	47.6	+5.5	0	2						6791	0.934	282.2	116.9	+10.2	0	21						
	6800	0.372	98.1	54.7	-5.9	0	13						6798	0.620	257.3	86.9	-10.4	0	7						
	6800	0.386	100.7	53.9	-7.0	0	5						6793a	0.604	248.5	84.6	-15.4	80	359						
	6800	0.411	96.3	52.2	-5.4	7	15																		
	6800	0.433	97.8	50.8	-6.2	0	2																		
		0.705	61.8	35.9	+17.1			253																	
		0.818	114.2	23.2	-21.4			184																	

- Group 6791, 1909 December 23-1910 January 4. A large regular spot, *a*, usually with one or more small attendants.
- Group 6793, 1909 December 25-1910 January 6. A very large regular spot, *a*, with occasionally a few small attendants. Probably not a return of Group 6781, but a new formation.
- Group 6796, 1909 December 28-1910 January 8. A large regular spot, *a*, followed by a fine but unstable train of small spots.
- Group 6797, 1909 December 29-1910 January 2. A few small unstable spots.
- Group 6798, 1909 December 31-1910 January 3. Some small faint unstable spots, *n* of Group 6793. The group is not seen on January 2.
- Group 6800, 1910 January 1-5. A few small spots in a short stream.
- Group 6801, January 2. A small spot with a very small faint companion.

Group 6799, 1910 January 1. Some small faint markings, f Group 6793.