

# 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

1911.

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GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1911.

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20 38 Col 3 fm Blank a 6764a

# ERRATA.

## GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1911.

### MEASURES OF POSITIONS AND AREAS OF SUN SPOTS AND FACULÆ, 1911.

Page.	Column.	Line.	
D 26	2	2	Heliographic Longitude, <i>for</i> $289^{\circ}5$ , <i>read</i> $289^{\circ}7$ .
		3	" " <i>for</i> $255^{\circ}5$ , <i>read</i> $255^{\circ}7$ .
		4	" " <i>for</i> $(223^{\circ}4)$ , <i>read</i> $(223^{\circ}6)$ .

### LEDGERS OF SUN SPOTS, 1911.

Page.	Group.	Date.	
D 29	6926	42.594	Longitude from Central Meridian, <i>for</i> $+65^{\circ}2$ , <i>read</i> $+64^{\circ}9$ .
	6931	Means	Mean Longitude of Group, System II., <i>insert</i> $104^{\circ}10$ .

# GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1911.

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## 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 1911; 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. No photographs taken with the Dallmeyer Photoheliograph in the year 1911 were used for measurement.

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 photographs from Dehra Dún, which have been forwarded by the Solar Physics Committee to fill the gaps in the combined series, were taken under the superintendence

D iv INTRODUCTION TO GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1911.

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 1911, except January 1; those finally selected for measurement being supplied by the different observatories as under:—

Greenwich . . . . .	225
Cape . . . . .	117
Kodaikānal . . . . .	4
Dehra Dūn . . . . .	18
Total	364
Days unrepresented . . . . .	1
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 1911:—

E. W. Maunder - - - M      C. F. Lait - - - CL  
 A. H. Smith - - - AS      A. W. Berry - - - AB

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.
1910	December	22. 10	+ 0. 4	1911	August	4. 8	+ 0. 15
1911	January	30. 11	+ 0. 25			24. 8	+ 0. 3
	February	15. 12	+ 0. 10			29. 7	+ 0. 17
	March	1. 11	+ 0. 17		September	12. 9	+ 0. 13
		20. 12	+ 0. 27			26. 9	+ 0. 11
	April	5. 11	+ 0. 20		October	10. 10	+ 0. 19
		26. 15	+ 0. 21			25. 10	+ 0. 20
	May	10. 11	+ 0. 21		November	7. 11	+ 0. 17
		25. 11	+ 0. 16			21. 10	+ 0. 26
	June	8. 8	+ 0. 7		December	4. 11	+ 0. 28
		20. 9	+ 0. 15			14. 10	+ 0. 18
	July	5. 15	+ 0. 31	1912	January	2. 11	+ 0. 19
		19. 8	+ 0. 14				

MEASURES OF PHOTOGRAPHS OF THE SUN.

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A correction of  $+0^{\circ}.3$  has been applied to the photographs taken at Greenwich with the Thompson Photoheliograph throughout the year 1911.

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	December	17. 10 <sup>d h</sup>	— 0. 9 <sup>o ' /</sup>	1911	August	3. 9 <sup>d h</sup>	+ 0. 10 <sup>o ' /</sup>
1911	February	17. 10	— 0. 2			22. 11	+ 0. 4
		28. 11	— 0. 13			31. 12	+ 0. 10
	March	17. 11	+ 0. 8		October	3. 11	+ 0. 8
	May	6. 11	+ 0. 6			23. 10	— 0. 1
		12. 13	+ 0. 2		November	9. 10	— 0. 1
	June	3. 11	+ 0. 1		December	20. 10	+ 0. 7
		27. 10	+ 0. 8	1912	January	19. 11	+ 0. 3
	July	7. 11	+ 0. 6				

A correction of  $-0^{\circ}.1$  for zero of position has been applied to all photographs taken with the Cape Photoheliograph up to 1911 March 16. After that date a correction of  $+0^{\circ}.1$  has been applied up to the end of the year.

In the use of the photoheliographs at Kodaikánal and at Dehra Dún 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 Dún 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 Dún during the year 1911.

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 1911.0 to be  $74^{\circ} 31'.1$ , 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 1911.*

This section is similar to the corresponding section for 1909, except that the Mean Heliographic Longitude of the group is given as computed upon two different systems. In System I. the longitude is computed as in former years; the daily sidereal motion due to the Sun's rotation being assumed to be  $851' \cdot 07$  for all spots, whatever their latitude, corresponding to Carrington's assumed mean rotation period of  $25 \cdot 38$  days. In System II. the daily sidereal motion is assumed to vary with the latitude in accordance with the formula

$$866' \cdot 6 - 128' \sin^2 l.$$

In both systems the longitude of the centre of the Sun's disc is adopted as  $301^\circ \cdot 09$  for 1911 January  $1^{\text{d}} \cdot 0$ ; the longitudes given under System I. are uniform with those given in preceding volumes of the *Greenwich Photo-Heliographic Results*.

§ 3. *Catalogue of Recurrent Groups of Sun Spots compiled from the Ledgers of Groups of Sun Spots for the year 1911.*

§ 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 1911.*

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

F. W. DYSON.

*Royal Observatory, Greenwich,  
1912 September.*