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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
1912.

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GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1912.

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 1912; 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 up to 1912 June 26, after which it was dismantled in order to be used in Brazil in the observation of the total solar eclipse of 1912 October 10, 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 had been occasionally used as well as the Thompson before 1912 June 26, and has been exclusively used since that date—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. or "Fine grain, ordinary" supplied by the Imperial Dry Plate Company, 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

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under the superintendence of Mr John Evershed, Director of that Observatory. The 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 1912, except July 20; those finally selected for measurement being supplied by the different observatories as under :—

Greenwich		235
Cape		102
Kodaikânal		4
Dehra Dûn		24
	Total	365
Days unrepresented		1
	Total	366

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 1912 :—

E. W. Maunder - - - M A. W. Berry - - - AB
 A. H. Smith - - - AS R. J. Pocock - - - RP

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.
1911	December	14. 10 ^{d h}	+ 0. 18	1912	April	6. 9 ^{d h}	+ 0. 18
1912	January	2. 12	+ 0. 19			17. 14	+ 0. 22
		9. 11	+ 0. 25			23. 11	+ 0. 19
		27. 11	+ 0. 20			24. 8	+ 0. 29
	February	7. 11	+ 0. 17		May	8. 12	+ 0. 32
		27. 10	+ 0. 17			9. 8	+ 0. 31
	March	14. 15	+ 0. 32			28. 7	+ 0. 11
		26. 16	+ 0. 27		June	13. 8	+ 0. 5

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 in the year 1912 up to the date, June 27, on which it was dismantled.

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.
1911	December	^{d h} 20. 10	+ 0. 7	1912	June	^{d h} 20. 12	- 0. 10
1912	January	19. 11	+ 0. 3		July	19. 11	+ 0. 12
		30. 10	- 0. 4			30. 11	+ 0. 2
	February	17. 11	+ 0. 7		August	26. 12	+ 0. 16
	March	5. 11	+ 0. 1		September	7. 10	+ 0. 5
		27. 11	+ 0. 9		October	24. 11	+ 0. 3
	April	16. 11	o. 0		November	21. 10	- 0. 8
	May	20. 11	+ 0. 7		December	23. 10	- 0. 10
	June	6. 11	+ 0. 1	1913	January	13. 10	+ 0. 8

A correction of $+0^{\circ}.1$ for zero of position has been applied to all photographs taken with the Cape Photoheliograph up to 1912 October 31. After that date and up to the end of the year 1912 no correction has been applied.

The same method was also employed with the Dallmeyer Photoheliograph at the Royal Observatory, Greenwich, with the modification that the two wires were arranged, not parallel and at right angles to the equator, but nearly at an angle of 45° to it. In the reduction of the measures of the photographs the wires were assumed to be in the zero position when inclined precisely 45° to the equator, and the correction to this zero of position was determined by the measurement of a photograph which had been exposed twice to the Sun's rays, with an interval of about 100 seconds between the two exposures, the instrument being firmly clamped throughout.

The determinations obtained were the following :—

DALLMEYER PHOTOHELIOGRAPH, GREENWICH.

Date, Greenwich Civil Time.			Correction for Zero.	Date, Greenwich Civil Time.			Correction for Zero.
1912	August	^{d h} 14. 11	+ 3. 14	1912	December	^{d h} 2. 12	+ 2. 57
	September	6. 10	+ 3. 8			23. 12	+ 3. 2
		23. 12	+ 3. 20			23. 12	+ 3. 13
		23. 12	+ 2. 58			30. 12	+ 2. 58
	October	21. 11	+ 3. 20			30. 12	+ 2. 55
	November	2. 12	+ 2. 49	1913	January	31. 12	+ 2. 59

On 1912 June 10, a plate was exposed upon Arcturus, the instrument being rigidly clamped, and the star allowed to transit across the field. The measurement of the position of the resulting trail gave a correction of $+3^{\circ} 6'$ for the zero of position of the wires, and this correction of $+3^{\circ} 1'$ was used until 1912 October 30. From 1912 November 2 to the end of the year a correction of $+3^{\circ} 0'$ was used in the reduction of all the photographs taken at Greenwich with the Dallmeyer Photoheliograph.

Transits of the Sun were also taken over the two wires; the times of contact of the first and second limbs of the Sun with the two wires being noted. The ratio of the time taken by the Sun to pass over the NE-SW wire to that taken to pass over the SE-NW wire gives the tangent of the angle made by the Sun's path to the latter wire; the wires being assumed to be exactly at right-angles to each other. From this angle, when corrected for the Sun's motion in declination, the correction for the zero of position of the wires can be inferred.

TRANSITS OF THE SUN. DALLMEYER PHOTOHELIOGRAPH, GREENWICH.

Date.			Correction for Zero.	Date.			Correction for Zero.
1912	July	29	+ 3. 20.9	1912	November	27	+ 3. 0.6
	August	2	+ 3. 25.7		December	2	+ 3. 13.8
		27	+ 3. 26.3			17	+ 2. 59.4
	September	9	+ 3. 28.6			23	+ 2. 55.0
		23	+ 3. 26.2			30	+ 3. 0.3
	November	2	+ 3. 0.8	1913	January	31	+ 3. 5.1

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 1912.

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 1912.0 to be $74^{\circ} 31'.9$, 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 1912.*

§ 3. *Catalogue of Recurrent Groups of Sun Spots compiled from the Ledgers of Groups of Sun Spots for the year 1912.*

§ 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 1912.*

These three sections are similar in all respects to the corresponding sections for 1911.

F. W. DYSON.

*Royal Observatory, Greenwich,
1913 September.*