GREENWICH

PHOTO-HELIOGRAPHIC

RESULTS.

1907, 1908.

RESULTS OF MEASURES

MADE AT THE

ROYAL OBSERVATORY, GREENWICH,

UNDER THE DIRECTION OF

SIR W. H. M. CHRISTIE, K.C.B., M.A., D.Sc., F.R.S.
ASTRONOMER ROYAL,

OF

PHOTOGRAPHS OF THE SUN

TAKEN AT

GREENWICH, IN INDIA, AND IN MAURITIUS,

IN THE YEAR

1908.

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GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1908.

MEASURES OF POSITIONS AND AREAS OF SUN SPOTS AND FACULÆ, 1908.

Page.	Column.	Line.	
*38**	1	22	No. of Group, *for* 6473, *read* 6476.
*40**	2	last line	No. of Group, *for* 6487, *read* 6488.

Also in the footnotes:—

Page.	
*2**	Group 6333, *insert* Probably a return of Group 6322.
	Group 6335, *for* Third apparition, *read* Fourth apparition.
	Group 6338, *for* Third apparition, *read* Fourth apparition.
*3**	Group 6340,* *insert* Revival of Group 6321.
	Group 6344, *for* Return of Group 6232*a*, *read* Return of Group 6323*a*.
*8**	Group 6357, *for* Fourth and last, *read* Fifth and last.
*11**	Group 6361, *for* Third and last, *read* Fourth and last.
*13**	Group 6372, *insert* Return of Group 6359.
*19**	Group 6391, *for* coalesing, *read* coalescing.
*23**	Group 6407, *insert* Possibly a return of Group 6392.*
*27**	Group 6423, *for* May 5–9, *read* May 5–8.
*28**	Group 6430, *for* May 9–11, *read* May 9–12.
*30**	Group 6443, *insert* Revival of Group 6426.
*33**	Group 6455, *insert* Revival of Group 6437.
*35**	Group 6466, *for* June 29–July 6, *read* June 28–July 6.
*38**	Group 6476, *for* July 13, *read* July 13–14.
	Group 6478, *for* July 14–23, *read* July 14–25.
	Group 6485, *for* July 17–19, *read* July 17–22; *insert* not seen on July 20 or 21.
*40**	Group 6488, *for* July 22–24, *read* July 22–25.
*42**	Group 6492, *for* August 3–11, *read* August 2–11.
*55**	Group 6532, *for* spot, *read* spots.

LEDGERS OF SUN SPOTS, 1908.

Page.	Group.	
*84**	6361	Head-note. *For* Third and last, *read* Fourth and last.

GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1908.

INTRODUCTION.

§ 1. *Measures of Positions and Areas of Sun Spots and Faculæ on Photographs taken at the Royal Observatory, Greenwich, at Dehra Dûn and at the Kodaikánal Observatory in India, and at the Royal Alfred Observatory, Mauritius, in the year* 1908 ; *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; at the Kodaikánal Observatory, Southern 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,—which was substituted for the Thompson for a few days in 1908 July, when new adjusting screws and blocks were being fitted to the 30-inch mirror, which is carried by the same equatorial,—is an instrument used in the Transit of Venus expedition to New Zealand, which, as now adapted, gives a solar image of nearly 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 & Co. being used, with hydroquinone development.

The photographs from Dehra Dûn, 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; the Kodaikánal photographs were taken under the superintendence of Professor C. Michie Smith, Director of that Observatory; and the Mauritius photographs were

taken under the superintendence of Mr. T. F. Claxton, Director of the Royal Alfred Observatory, Mauritius. At each observatory the instrument employed was a Dallmeyer Photoheliograph giving an image of the Sun about 8 inches in diameter. 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 1908, those finally selected for measurement being supplied by the different observatories as under :—

Greenwich	171
Dehra Dûn	161
Kodaikánal	26
Mauritius	8
Total	366

The measures were made in the manner described in the *Introduction to the Greenwich Photo-Heliographic Results* for 1907, 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 1908 :—

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 1907, and the following table gives the resulting correction for zero of position for the mean of the two wires :—

Thompson Photoheliograph.

Date, Greenwich Civil Time.		d h	Correction for Zero. ° ′	Date, Greenwich Civil Time.		d h	Correction for Zero. ° ′
1907	December	9. 13	+ 0. 3	1908	August	29. 11	− 0. 5
1908	February	12. 11	− 0. 10		September	12. 10	− 0. 9
	March	6. 12	+ 0. 6			14. 15	+ 0. 12
		17. 13	− 0. 5			26. 10	− 0. 5
	April	9. 15	+ 0. 18			29. 15	+ 0. 11
	May	9. 12	+ 0. 12		October	3. 12	− 0. 2
		23. 13	+ 0. 7			6. 11	− 0. 2
	June	5. 15	+ 0. 1			30. 10	+ 0. 2
		29. 16	+ 0. 5		November	9. 12	− 0. 1
	July	14. 10	+ 0. 2			20. 12	− 0. 2
		31. 10	− 0. 5		December	8. 12	− 0. 1
	August	6. 15	− 0. 1			10. 13	− 0. 13
		7. 10	0. 0			28. 11	+ 0. 8
		17. 12	− 0. 2	1909	January	7. 11	+ 0. 6

The Director of the Kodaikánal Observatory has reported, for each of the photographs that he has supplied, the amount of the correction for zero of position of wires that it is necessary to apply.

The photoheliograph at Dehra Dûn was brought into satisfactory adjustment by 1908 February 21, and, as a precaution against any future disturbance passing without record, the practice was adopted of stopping the driving-clock after the exposure of the plate had been made, and making a second exposure about two minutes later, thus affording a means for determining the true west point of the plate.

In the case of five photographs taken at Dehra Dûn, before the photoheliograph was brought into adjustment, and for which the error of position of the wires is not known, the measures of the areas have been used, and, for the identification of the spots and faculæ, a correction for zero of position has been estimated from a comparison with the photographs taken on the days immediately preceding and following. The heliographic longitudes and latitudes thus deduced for these five photographs are only approximate and have been placed in brackets.

Photographs taken at Mauritius in the year 1908 were only selected for measurement from those taken in the months of January and February, and for these the same correction for zero of position was adopted as during the latter part of the year 1907, viz., $-5^{\circ}\cdot4$.

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* 1907. The inclination of the Sun's axis to the ecliptic is assumed to be 82° 45′, the longitude of the ascending node for 1908·0 to be 74° 28′·6, 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* 1908.

§ 3. *Catalogue of Recurrent Groups of Sun Spots compiled from the Ledgers of Groups of Sun Spots for the year* 1908.

§ 4. *Total 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* 1908.

These three sections correspond in all respects to the corresponding sections for 1907.

W. H. M. CHRISTIE.

Royal Observatory, Greenwich,
1910 *September.*

ROYAL OBSERVATORY, GREENWICH.

MEASURES OF POSITIONS AND AREAS

OF

SUN SPOTS AND FACULÆ

ON

PHOTOGRAPHS

TAKEN WITH THE

PHOTOHELIOGRAPHS

AT GREENWICH, IN INDIA, AND IN MAURITIUS,

WITH THE DEDUCED

HELIOGRAPHIC LONGITUDES AND LATITUDES.

1908.

MEASURES of POSITIONS and AREAS of SUN SPOTS and FACULÆ on PHOTOGRAPHS taken at the ROYAL OBSERVATORY, GREENWICH, at KODAIKÁNAL and at DEHRA DÛN in INDIA, and at the ROYAL ALFRED OBSERVATORY, MAURITIUS, in the Year 1908.

NOTE.—The Greenwich Civil Time at which the Photograph was taken is expressed by the Day of the Year and decimals of a day, reckoning from Midnight, January 1^{d} 0^{h}. 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 K. that it was taken at Kodaikánal; the letter D. that it was taken at Dehra Dûn; the letter M. that it 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.

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 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).
1908.				°	°	°			
0·139	FS, AS		0·917	280·6	70·6	+ 8·5			129
		6334	0·778	262·6	56·0	− 7·7	0	7	192*sp*
		6329	0·390	333·7	15·5	+17·5	0	2	
		6329	0·404	337·0	14·7	+18·8	6	19	
		6331	0·234	327·6	12·3	+ 8·4	0	6	
		6331	0·250	330·1	12·3	+ 9·5	0	6	
		6329*	0·434	0·8	4·7	+22·7	0	3	
		6329*	0·393	2·3	4·1	+20·0	0	11	
		6329*	0·420	2·5	4·0	+21·7	3	19	
		6331†	0·255	27·7	358·2	+10·0	1	4	
K.		6333	0·878	93·7	303·8	− 4·7	0	29	
		6333	0·880	95·6	303·5	− 6·4	31	192	508*c*
		6333	0·913	95·8	299·2	− 6·6	5	26	
		6333	0·923	94·8	297·8	− 5·6	9	56	
			0·743	136·4	326·6	−34·8			96
			0·689	108·8	322·8	−15·0			75
			0·741	122·1	321·3	−25·3			390
			0·855	106·3	307·0	−15·4			113
			0·917	115·3	299·9	−24·3			92
			0·961	79·2	292·2	+ 9·5			150
Jan. 1				(+2·6)	(5·1)	(−3·0)	(55)	(380)	(1745)
1·430	FS, CL		0·830	241·7	41·6	−25·0			147
			0·692	245·0	29·6	−19·3			130
		6334*	0·957	262·8	61·2	− 7·8	0	15	223*f*
		6342*	0·117	125·1	342·6	− 7·0	0	7	
		6333	0·699	96·0	303·9	− 6·5	21	161	
		6333	0·750	95·6	299·6	− 6·3	0	89	777*c*
G.		6335*a*	0·955	75·1	276·9	+13·2	19	113	738*c*
		6336	0·959	79·9	275·6	+ 8·8	8	49	
		6337	0·985	80·6	268·9	+ 8·7	0	90	
			0·793	69·6	298·3	+14·0			65
			0·865	86·4	288·6	+ 1·5			225
			0·929	67·2	282·7	+19·8			364
Jan. 2				(+1·9)	(348·1)	(−3·2)	(48)	(524)	(2669)
1908.				°	°	°			
2·450	FS, AS		0·992	262·6	57·6	− 7·8			217
			0·774	249·3	24·1	−18·0			367
			0·699	302·6	13·2	+19·5			258
		6333	0·514	97·3	304·0	− 6·6	12	100	
		6333	0·558	97·6	301·0	− 7·0	0	29	144*c*
		6333	0·589	97·6	298·8	− 7·1	5	46	
		6333	0·589	93·6	298·7	− 4·8	0	6	
		6335*a*	0·871	72·3	276·3	+13·7	12	87	64*n*
		6336	0·874	78·0	275·0	+ 8·8	7	44	98*s*
G.		6337	0·928	80·0	267·6	+ 8·0	6	57	119*s*
		6339	0·959	81·2	262·1	+ 7·4	0	63	235*f*
		6338	0·964	77·2	261·4	+11·4	50	269	266*c*
		6340	0·987	77·0	255·1	+12·3	0	31	
			0·806	75·4	282·6	+ 9·7			435
			0·880	63·6	277·2	+21·2			593
			0·875	85·8	274·1	+ 2·1			146
			0·932	73·8	267·8	+13·8			556
Jan. 3				(+1·4)	(334·7)	(−3·3)	(92)	(732)	(3498)
3·472	FS, CL		0·802	282·5	13·2	+ 7·9			119
			0·828	297·2	12·7	+20·1			207
			0·738	305·0	1·9	+22·4			109
		6341	0·894	249·6	23·9	−19·7	0	21	245*nf*
		6341	0·875	247·9	21·2	−20·9	0	24	
		6342	0·278	263·2	337·2	− 5·2	0	17	
		6342	0·235	258·0	334·5	− 6·2	3	15	
G.		6333	0·306	100·6	303·7	− 6·5	7	120	
		6333	0·345	101·8	301·4	− 7·3	6	24	
		6333	0·370	93·7	299·6	− 4·6	0	7	
		6333	0·382	101·1	299·1	− 7·4	2	65	
		6335*a*	0·743	68·1	276·2	+13·7	10	76	124*p*
		6336	0·745	74·9	274·7	+ 8·8	0	20	94*s*
		6337	0·818	77·9	267·6	+ 7·9	4	33	59*f*

Group 6329, 1907 December 25–1908 January 1. A large regular spot, *a*.
Group 6331, 1907 December 27–1908 January 1. A small spot, *a*, usually with some small companions.
Group 6333, 1907 December 30–1908 January 8. A number of spots, mostly small, in an irregular and very changeful stream. Probably a return of Group 6322.
Group 6329*, 1907 December 31–1908 January 1. Some small spots, *f* Group 6329.
Group 6331†, 1907 December 31–1908 January 1. A very small spot, *f* Group 6331.
Group 6334, 1907 December 31–1908 January 1. Some very small spots.
Group 6342*, 1908 January 2. A very small spot, *p* the place of Group 6342.
Group 6334*, 1908 January 2. A small spot, *f* the place of Group 6334.
Group 6335, January 2–10. Return of Group 6318. ~~Third~~ Fourth apparition. A regular spot, *a*.
Group 6336, January 2–6. A small regular spot, *s* Group 6335 and *p* Group 6337.
Group 6337, January 2–7. A spot rapidly diminishing.
Group 6338, January 3–14. Return of Group 6319. ~~Third~~ Fourth apparition. A large regular spot, *a*, followed by a long scattered train.
Group 6339, January 3–12. An irregular stream, *s* Group 6338.
Group 6340, January 3–5. A small faint spot.
Group 6341, January 4–5. A few small faint spots in an irregular cluster.
Group 6342, January 4–9. A number of spots, mostly small, in a straight stream. The group steadily increases in size.