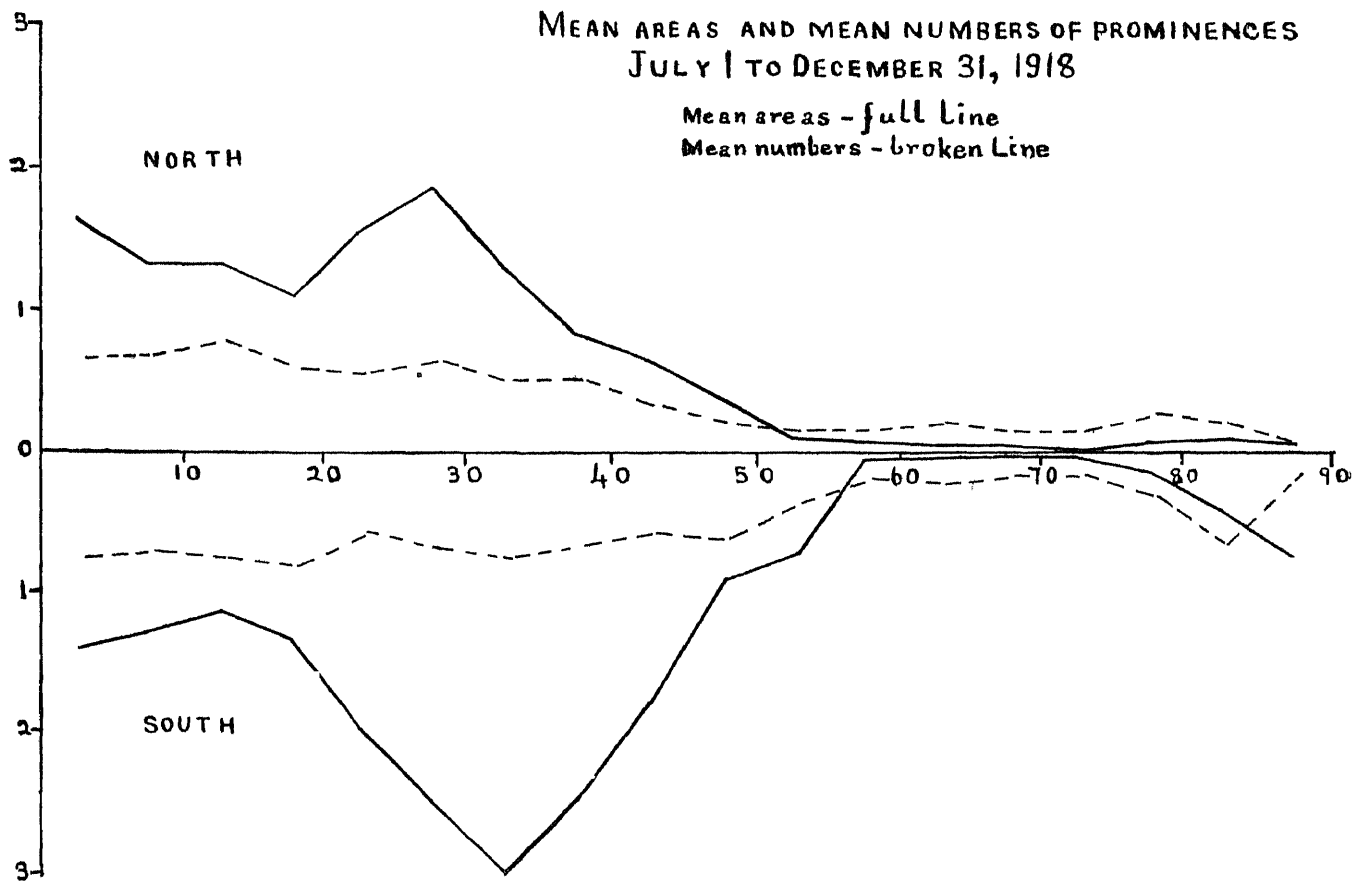
Kodaikanal Observatory.

BULLETIN No. LX.

SUMMARY OF PROMINENCE OBSERVATION FOR THE SECOND HALF OF THE YEAR 1918.

The distribution of prominences observed and photographed during the half-year ending December 31st, 1918, is represented in the accompanying diagram. The full line gives the mean daily areas and the broken line the mean daily numbers for each zone of 5° of latitude. The ordinates represent tenths of a square minute of arc for the full line and numbers for the broken line The means are corrected for incomplete or imperfect observations, the total of 151 days being reduced to 122 effective days.



The outstanding feature in the prominence distribution in latitude is the sudden fall in the activity of the polar regions. The northern high latitude region ceased to produce prominences of any size after July, but the southern polar regions displayed a feeble activity up to the end of the year. This phase of the prominence cycle is a fairly definite one and seems to occur when the high latitude zones of activity, progressively

advancing in latitude, finally reach and envelop the poles. The southern zone of prominences was a little behind the northern in advancing towards the pole, its final dissolution therefore occurred later. The disappearance of the polar prominences occurred previously in the years 1895 and 1907, indicating periods of 12 years and 11 years respectively.

The mean daily areas and daily numbers corrected for imperfect records are given below :—

	Mean daily areas (square minutes)	Mean daily numbers.
North	1·24	6·90
South	1·99	9·04
Total ...	3·23	15·94

The fall in activity here shown when compared with the corresponding figures for the previous half year is mainly the result of the dissolution of the polar prominences, but there is also a general reduction in all latitudes of the northern hemisphere. In the south the activity has increased between latitude 25° and 40°, and there results a marked preponderence of the south over the north.

Prominences generally attained a maximum development in the northern hemisphere early in 1917, whilst the southern maximum occurred during the first half of 1918 This delayed action of the south has caused a reversal of the relative activity of north and south which took place between the years 1917 and 1918 The mean brightness of the southern prominences in the second half of 1918 was slightly greater than that of the northern prominences.

The monthly, quarterly and half-yearly frequencies and the mean height and extent of the prominences are given in the following table. The frequencies are derived from the number of effective days :—

TABLE I.—ABSTRACT FOR THE SECOND HALF OF 1918.

Month	Number of days of observation		Number of prominences.	Mean daily frequencies	Mean height.	Mean extent.
	Total.	Effective				
1918.					"	°
July	29	23	396	17·2	32·2	3·42
August	26	19	276	14·5	35·4	3·84
September	29	24	352	14·7	34·2	3·22
October	29	25	389	15·6	33·9	3·31
November	15	12	228	19·0	27·3	2·27
December	23	19	321	16·9	28·0	2·39
Third quarter	84	66	1024	15·5	33·8	3·46
Fourth quarter	67	56	938	16·8	30·3	2·74
Second half-year	151	122	1962	16·1	32·1	3·12

The mean height and the mean extent of the prominences have diminished compared with the first six months of the year

Distribution east and west of the sun's axis.

The distribution east and west of the sun's axis of both prominence numbers and areas is given in the following table :—

1918 July to December	East.	West	Percentage east.
Number observed	943	1015	48·06
Total areas in square minutes	211·0	184·2	53·38

The distribution has reverted to an eastern excess in the case of the areas.

Metallic prominences.

The following metallic prominences were recorded in the half year .—

TABLE II.—LIST OF METALLIC PROMINENCES OBSERVED AT KODAIKANAL, JULY TO DECEMBER 1918.

Date.		Hour I S T	Base	Latitude		Limb.	Height	Lines
				North	South.			
1918.		H. M	°	°	°		"	
July	10	8 50	5	7·5		W	20	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197 7, 5234·8, 5316·8, D_1, D_2, 6677.
	11	8 56	6	7		E	35	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5231·6, 5276·2, 5284·2, 5316·8, 5362·0, 5535·0, D_1, D_2, 6677 and 7065.
	11	8 36	8	14		W	30	D_1, D_2, b_1, b_2, b_3, b_4, 5316 8
	13	8 34	12		37	E	100	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8.
	13	8 54	7	15·5		W	30	D_1, D_2, 5316 8, b_1, b_2, b_3, b_4, 4924 1,6677 slightly bright
	14	8 49		13		W	30	D_1, D_2, 5316·8, b_1, b_2, b_3, b_4, 5016, 6677 and 7065.
	18	9 23	5		17·5	W	60	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8, 4924·1, 5016, 5018·6, 6677, 7065 All very bright.
	28	8 30	10	11		E	25	D_1, D_2, b_1, b_2, b_3, b_4, 5316 8, 6677, 7065, 5016, 5197·7.
August	8	9 22	23	4·5		W	120	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8, 6677
	24	8 46	1	13 5		W	75	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276·2, 5284·2, 5316·8, 5363·0, 5425·4, 5527·0, 5535·06 D_1, D_2, 6677, 7065.
September	7	8 45		Equator		E	110	D_1, D_2, b_1, b_2, b_3, b_4 bright over the whole height of the prominence.
	21	8 30		15		W	60	4924·1, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276·2, 5316·8, D_1, D_2, 6677 slightly bright.
October	10	9 5	9	27·5		W	55	D_1, D_2, b_1, b_2, b_3.
	23	8 56			14	W		D_1, D_2, b_1, b_2, b_3, b_4, 5316 8, 5018·6, 4924·1, 6677.
November	13	10 41	36		19	E	90	6677, D_1, D_2, b_1, b_2, b_3, b_4.
	26	12 18	9	10·5		W	65	6677, D_1, D_2, b_1, b_2, b_3, b_4, 5316·8, 5018·6, 4924·1, 5197·7, 5234·8, 5284·2, 5276·0.
December	8	8 50			10	W	20	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8
	13	9 36		12		E	30	D_1, D_2 slightly bright.
	13	9 22			20	W	20	D_1, D_2 b_1, b_2, b_3, b_4, 4924·1, 5316·8. Not seen at 9^h 45^m.
	20	8 40			8	W	15	D_1, D_2, b_1, b_2, b_3, b_4, 4924·1, 5316·8.
	24	8 44			26·5	E	20	D_1, D_2, b_1, b_2, b_3, b_4.
	26	9 45		12		W	15	D_1, D_2, b_1, b_2, b_3, b_4, 5316 8
	28	8 55			31	W	50	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8.
	28	8 45			10	W	20	4922·5, 4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276·2, 5284·2, 5316·8, 5363·0, 5424·3, 5535·06, D_1, D_2, 6677, 7065.
	29	8 35	9		28 5	W	60	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8. Whole prominence seen in b_1, b_2, b_3, b_4.
	30	9 45	5		6·5	W	60	4922·3, 4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276·2, 5284·2, 5316·8, 5363 0, D_1, D_2, 6677, 7065. All lines very bright.
		8 35	17	24·5		W	75	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276·2, 5316·8, 5363·0, 5535·06, D_1, D_2, 6677, 7065. The lines bright over the whole base of the prominence and particularly at the southern end.
	31	8 37			24	W	30	4924 1, 5018·6, 5197·7, b_1, b_2, b_3, b_4, D_1, D_2, 5316·8.
		8 40	3		8·5	W	75	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8.
		8 40		4		W		D_1, D_2, b_1, b_2, b_3, b_4, 5316·8.

The metallic prominences recorded above were distributed as follows :—

—	Number	Mean latitude	Extreme latitudes.
		°	° °
North	15	12·8	4, 27·5
South	14	18 6	6 5, 37
Equator	1	..	.

Only seven were recorded on the eastern limb against twenty-three on the western limb.

Displacements of the hydrogen lines.

Particulars of the displacements observed in the prominences or chromosphere are given in table III.

TABLE III.

Date.		Hour I.S.T.	Latitude North.	Latitude South.	Limb	Displacement. Red.	Displacement. Violet.	Displacement. Both ways	Remarks.
1918.		H. M.	°	°		A	A.	A	
July	2	11 40	13		W		Slight		
	4	8 50		68	E	Slight			
	7	8 50		62	E	1			
	7	8 30	15		W	2			
	7	8 26	67·5		W		Slight		
	8	8 38	77·5		W		1		No prominence.
	9	8 47	4		W			Slight	
	9	8 46	14		W			Do.	
	9	8 43	35		W		0 5		At base.
	9	8 25	79		W	Slight			
	10	8 36		40	E	Do.			
	10	8 50	7·5		W			Slight	
	11	8 33	73		E		1·5		No prominence.
	11	8 56	3		E	2			
	11	10 20	Equator		E	Slight	0 5		
	11	8 36	16		W	Do.			
	11	9 17	12		W	2	0·5		
	13	8 34		37	E		Slight		At base.
	13	8 54	15·5		W		Do.		At top.
	14	8 55	15		E		Do.		Do.
	15	8 48	10		E		2		Do
	16	8 50	14·5		W			0 5	
	17	8 40	24		E	2·5			Whole prominence bodily shifted to red of the line.
	17	8 30		12	E		Slight		
	18	9 23		17 5	W	2	1		
	18	9 6	40		W		Slight		
	21	8 15		11·5	E	Slight			
	22	8 34		18·5	E	0·5			
	25	9 5	29		E	Slight			
	28	8 30	7		W	1 5			
	30	9 17	15		W		0·5		
August	4	9 1		41 5	W		Slight		
	6	8 59	2 to 6		W	0 5			At several places.
	6	8 59	10		W		0·5		
	6	8 54	12		W	Slight			
	6	8 53	16		W	1	2		
	6	8 52	20		W		1·5		
	6	8 52	25		W	1	1		
	6	8 50	41		W	0 5			
	7	8 48	20		E		1·5		
	8	9 11		23·5	E		2		At top.
	8	9 11		23·5	E		0·5		At base.
	8	9 22	4·5		W			Slight	
	12	8 38		16	W	1			
	16	10 8		29·5	E	1 5			At base.
	21	10 20		3·5	E	Slight			

Date		Hour I.S.T	Latitude North.	Latitude South.	Limb.	Displacement. Red.	Displacement. Violet.	Displacement. Both ways	Remarks.
1918		H. M	°	°		A	A	A	
August	24	8 36	66		E			Slight	No prominence.
	26	8 30	3		W			2	
	26	8 40	7		W	Slight			At top.
	30	8 45		34·5	E	Do.			
September	2	8 40	7		W	Do.			
	3	8 36	19		W	0·5			
	4	9 45		16	E		Slight		
	7	8 49		23	E		Do.		
	7	8 31	34·5		W		Do.		
	8	8 45		7	E	Slight			
	10	8 48	6		W	Do.			
	19	9 22	53·5		W		Slight		
	21	8 33		19	W		Do		
	21	8 32		12	W	Slight			At top.
	23	8 37	71·5		E		Slight		Do.
October	2	8 43		19·5	E	4	Do		
	3	9 39	48		W			Slight	
	4	9 5	9		E		3		
	4	9 10		68	E	1			
	4	8 49	35·5		W		Slight		
	4	7 58	57		W	2			
	5	9 5	9		W			2	Not seen at 9h 14m.
	5	9 0	17		W		5		
	5	9 13	17		W	1			
	6	8 55	57·5		W		0·5		
	7	8 54		32	W		2		At top.
	7	8 56		16	W		0·5		
	10	9 5	24		W	5	1·5		
	11	10 25		42	E	4			
	11	10 25		40	E		Slight		
	20	8 28	45·5		W	0·5			
	21	9 10		20	W	0·5	3		
	23	9 5	27		E			Slight	
	23	8 56		14	W			1	
	24	8 36	61·5		E	Slight			
	25	8 33	23		W			1	To red.
								0·5	To violet.
	26	8 52	85		E	Slight			
	26	9 14	78		E	0·5			Not seen at 9h 15m.
	26	9 22	31		E			Slight	
	26	9 9		34	W	Slight			Over the streamer.
	27	8 44		27	E	1·5	0·5		
	27	8 29	1		W	1·5			
	27	8 29	6		W	Slight			
	27	8 26	27		W	Do.	Slight		To red at top ; to violet at base
	28	9 4	6		E			Slight	
	28	8 54	16		W		0·5		
	28	8 54	12		W	1			
	28	8 54	9		W		2		
	28	8 54	6		W	1			
	28	8 50	31		W	0·5			
	29	8 56	8·5		W	1			
	29	8 56	16		W	1			
	30	8 43	62·5		E	Slight			
	30	8 44	62·5		E		1		
	30	8 40		77	W	1			
	30	8 33	1		W		Slight		
	31	12 0	20		W	1			
November	8	9 20		45	E			Slight	
	8	9 25		86·5	—		Slight		
	9	8 56	22		E		0·5		
	9	9 0		16	E			Slight	
	9	9 1		43·5	E		1		At top.
	9	8 47		27	W	0·5			
	9	8 40	67		W			Slight	
	10	8 45	15		E	2	Slight		

Date		Hour I.S.T		Latitude		Limb	Displacement			Remarks
				North	South		Red	Violet	Both ways	
1918.		H	M	°	°		A	A	A	
November	10	8	58		11	E	3*		1·5	* At top.
	10	9	0		20	E	1	0 5		To red at base; to violet at top.
	10	9	4		61	E		0·5		
	10	8	39	11		W	Slight			
	13	8	15		4	E			6	Between 4° and 6°, the amount of displacement to violet varied from 1 A to 6 A at 10h 30m C was displaced 6 A both ways at several places 10h 35m Maximum amount 8 A to violet, very faint at 10h 41m
	14	10	6	12		W	Do.			
	16	8	58	11		E		Slight		At top
	16	8	45	15		W			Slight	
	19	12	32	69		E	Slight			
	26	12	18	6		W	0 5			
	26	12	35	6		W		3·5		D_3 was also displaced 3 5 A
	26	12	40	6		W		1		
	26	12	10	33·5		W	2	5		Violet displacement at top only.
	28	15	46		4	W		2		Over upper part of prominence (140″).
December	5	8	52	18		E		Slight		
	9	9	28		14	W		Do.		At base
	10	9	3		18	W			Slight	
	10	9	2		12	W		Slight		
	13	8	41		71	W		Do.		
	13	9	22		20	W	Slight	1 5		To violet at base, to red at top.
	19	10	22		11	E			Slight	
	19	9	36		11	W	Slight			
	20	9	00	86 5		E	Do.			At base.
	20	8	45	5		W		Slight		
	21	9	39	72		E	Slight			
	21	9	48		25	E	2			
	21	9	34		44	W			0·5	
	21	9	33		32·5	W		Slight		
	21	9	31		2	W	1			
	22	8	56	76		E	0·5			
	22	9	15	3		E	1·5			
	22	10	22		22	E	0·5			
	22	8	59	51		W	1			
	22	8	57	81		W	Slight			
	23	9	40	73		E	0·5			
	23	9	31		8	E	1			Ghosts at about 9 A from C on both sides at northern end of prominence where it was fairly bright. Lat. + 14° E.
	23	9	45	38 5		W	1·5			
	24	8	52	51		E	2			No prominence.
	24	8	47	Equator		E	Slight	0 5		To red at base, to violet at top.
	25	8	52	10		E	Do.			
	26	9	38	87		E	Do.			
	26	9	55		68	W		1 5		No prominence
	26	9	46	7		W		Slight		
	26	9	45	12		W		0·5		
	26	9	42	79·5		W		0 5		No prominence.
	28	8	50		9	W	2			At top.
	29	8	22		45	E		2		Prominence extended at top to - 31° E. The amount of the displacement varied from 0·5 at -- 45° E to 2 A at 31° E.
	29	8	35		33	W		Slight		At top
	29	8	39	26		W		Do.		
	30	8	25	83·5		E		1·5		
	30	9	42		6·5	W	6			At tops of streaks Not seen at 9h 45m
	30	8	35	16		W			Slight	
	31	8	37		24	W	0·5			At top.
	31	8	40	4		W			0·5	

The total number of displacements was 165, of these 2 were on the equator, and the rest were distributed as follows :—

Latitude			North.	South.
1° to 30°	..	...	66	38
31° to 60°	.	...	16	14
61° to 90°	...	...	21	8
	Total	...	103	60
East limb	...	...	66	
West limb	...	...	98	
Pole	...	...	1	

There were 84 displacements towards red, 72 towards violet and 25 both ways simultaneously.

Reversals and displacements on the disc.

170 bright reversals of the Hα line, 9 dark reversals of the D_3 line and 50 displacements of the Hα line were recorded. They were distributed as follows :—

	North	South.	East.	West
Bright reversals of Hα	92	78	88	82
Dark reversals of D_3	5	4	6	3
Displacements of Hα	26	24	23	27

These figures and the number of displacements at the limb indicate a general reduction of solar activity amounting to about 40 per cent compared with the first 6 months of the year.

Of the 50 displacements of the Hα line 29 were towards red, 10 towards violet and 11 both ways simultaneously.

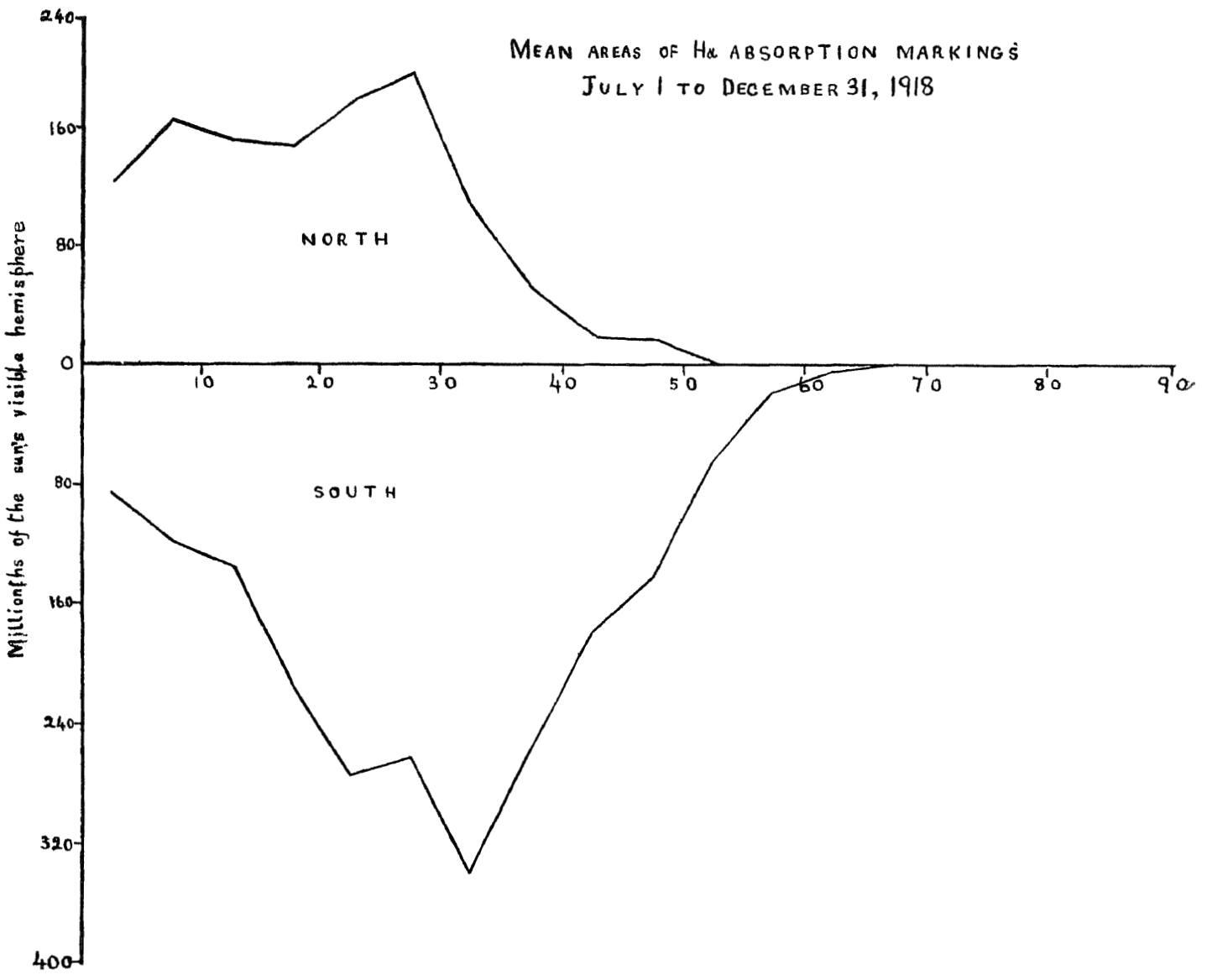
Prominences projected on the disc as absorption markings.

Photographs of the sun's disc in Hα light were obtained on 115 days counted as 98 effective days. The mean daily areas in millionths of the sun's visible hemisphere corrected for foreshortening, and the mean daily numbers are given below :—

	Areas	Numbers.
North	1158	8·7
South	2075	13·2
Total	3233	21·9

The numbers and areas show an increase in the southern hemisphere but they have diminished on the whole since the previous half year about 19 per cent.

The distribution of the absorption markings in latitude is shown in the accompanying diagram.



The curve is very similar to that of the prominences at the limb showing a maximum activity in the zones 25°—30° north and 30°—35° south.

Both areas and numbers show an excess on the eastern hemisphere, the percentage east being for areas 52·94, and for numbers 53·90. The most probable excess due to chance is 0·73 per cent on either side.

KODAIKANAL OBSERVATORY,
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