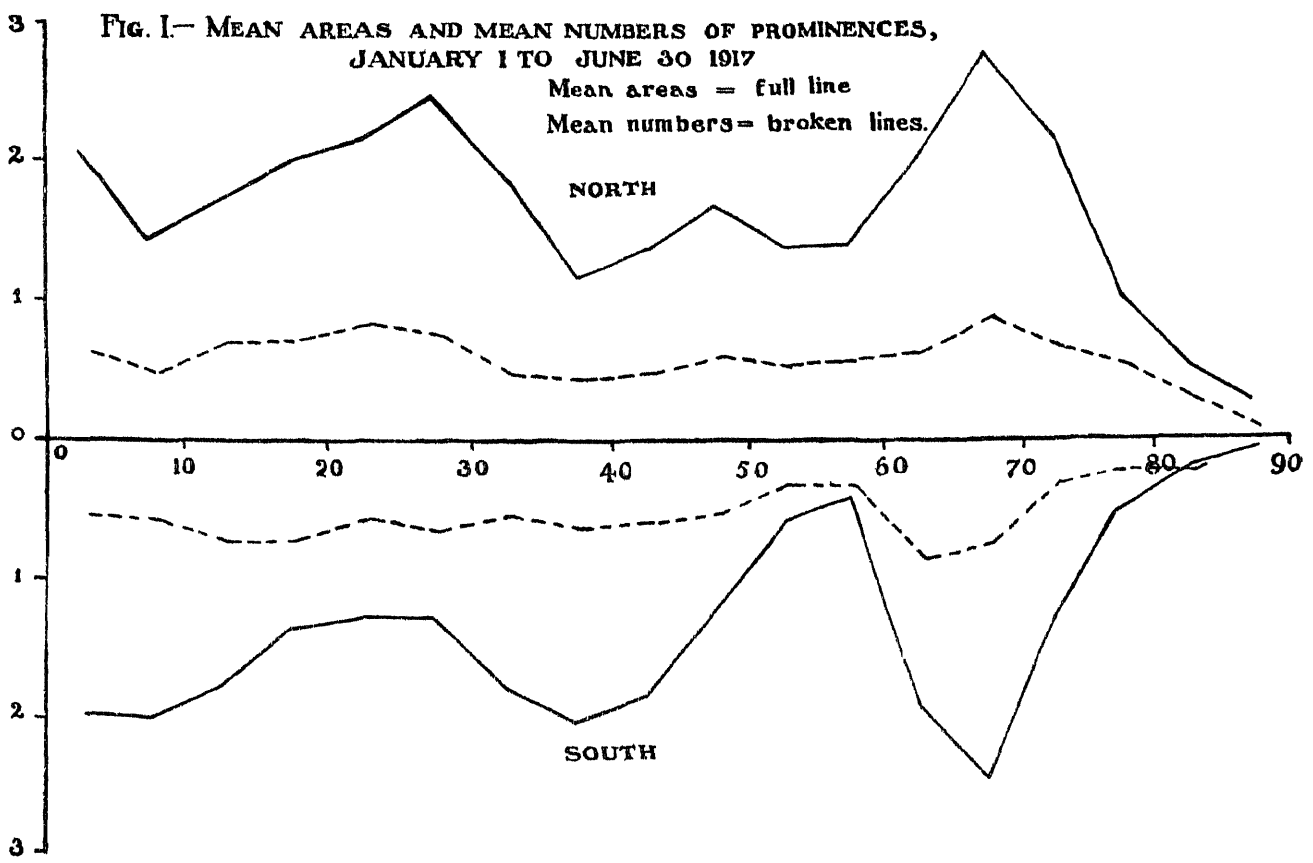
Kodaikanal Observatory.

BULLETIN No. LVII.

SUMMARY OF PROMINENCE OBSERVATIONS FOR THE FIRST HALF OF THE YEAR 1917.

The summary given in this bulletin is based on observations made at Kodaikanal only. Visual observations were practically confined to displacements of the hydrogen lines and to metallic prominences, as the position angles, heights and areas can now be much more satisfactorily determined from the photographs.

The distribution of prominences observed and photographed during the half-year ending June 30, 1917, 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 164 observing days being reduced to 148 effective days.



The greatest activity is shown in the belt 65° to 70° both north and south of the equator, the southern maximum having advanced 5° towards the pole compared with the preceding half-year. Besides the marked activity near the equator there is another maximum at 25° to 30° in the northern hemisphere and at 35° to 40° in the southern.

The mean daily areas and daily numbers, corrected for partial observations, are given below .—

	Mean daily areas (square minutes).	Mean daily numbers.
North	2 94	10 32
South	2·42	9·33
Total ..	5 36	19·65

The mean daily areas show a large increase, 46·9 per cent, on the preceding half-year, and mean daily numbers an increase of 6·9 per cent. The above mean daily area is the largest recorded since 1908, although closely approached in 1915.

There has again been an excess of activity in the northern hemisphere, namely 54·9 per cent of areas and 52·5 per cent of numbers. In the region 35° to 45° there is, however, an excess in the south. An excess in the northern hemisphere is also found for metallic prominences, displacements of the hydrogen lines in prominences and for the Hα absorption markings.

The monthly, quarterly and half-yearly frequencies, and the mean heights and extents of prominences are given in the following table. The frequencies are derived from the number of effective days. Compared with the previous half-year there is a large increase in the mean extent of a prominence.

Abstract for the first half of 1917.

Month.	Number of days of observations		Number of prominences.	Mean daily frequency.	Mean height.	Mean extent.
	Total.	Effective				
1917					"	°
January	25	22	416	18·9	38 5	3·37
February .	26	25	525	21·0	37 6	4·25
March	30	28	577	20·6	39 8	3 37
April .. .	30	27	541	20 0	40·4	3·73
May ...	30	29	565	19·5	37 1	3·83
June	23	17	285	16 8	38 1	3·87
First quarter .	81	75	1518	20·2	38 7	3·67
Second quarter	83	73	1391	19·1	38·6	3·80
First half-year	164	148	2909	19·7	38 6	3·73

Distribution east and west of the sun's axis.

Areas show a slight preponderance at the eastern limb, whereas numbers show practically no excess, as is seen below. When 2908 prominences are observed the most probable excess due to chance is ± 0·62 per cent, so that the preponderance of areas observed may very well be due to chance only.

1917 January to June	East.	West.	Percentage east
Number observed	1455	1454	50 02
Total areas in square minutes	4035	3897	50·87

Metallic prominences.

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

TABLE I.—LIST OF METALLIC PROMINENCES OBSERVED AT KODAIKANAL, JANUARY TO JUNE 1917.

Date		Hour I S T		Base	Latitude		Limb	Height	Lines
					North.	South			
1917		H	M	°	°	°		"	
January	17	10	26	1		11 5	E	65	4924·1, 5016, 5018 6, b_1, b_2, b_3, b_4, 5197 8, 5276·2, 5283 7, 5316·8, 5328·2, 5371·8, 5397·2, 5404 3, 5405 9, 5429 9, 5434 7, 5447·1, 5455·7, 5535 0, D_1, D_2, 6677—all very bright
	23	8	30		15		E	90	b_1, b_2, b_3, b_4, 5316 8
	25	8	49	13	14 5		E	270	b_1, b_2 bright at base from +8° to +21°
	28	8	44	11		22·5	W	20	6677, D_1, D_2, 5316·8, 5197·8, b_1, b_2, b_3, b_4, 5018·6, 5016 (slightly), 4924·1.
February	16	9	13	67		17·5	W	150	D_1, D_2, b_1, b_2, b_3, b_4, 6677, 7065, 5316 8, 4924·1, 5016.
	18	8	50			17	W	80	b_1, b_2, b_3, b_4, 5316·8.
	22	8	41	5	30		E	45	D_1, D_2, b_1, b_2, b_3, b_4.
	26	9	0	1	28 5		E	15	D_1, D_2, b_1, b_2, b_3, b_4, 5316 8
March	2	9	3			20	E	120	D_1, D_2, b_1, b_2, b_3, b_4, 6677, 7065, 5161·8.
	8	8	50		27		W	20	6677, D_1, D_2, 5316 8, 5234·8, 5197 6, b_1, b_2, b_3, b_4, 5018 6, 5016, 4924 1.
	9	8	50		20		E	15	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8, 5766.
	11	8	50	5	27 5		W	50	7065, 6677, D_1, D_2, 5383 6, 5316·8, 5276 2, 5234 8, 5197·6, b_1, b_2, b_3, b_4, 5018·6, 5016, 4924·1—all very bright.
	15	8	48	4		11	W	60	D_1, D_2, b_1, b_2, b_3, b_4.
	19	8	53	14	13		E	180	D_1, D_2, b_1, b_2, b_3, b_4, 6677.
	20	9	4	3	25·5		E	65	D_1, D_2, b_1, b_2, b_3, b_4.
	27	8	43	6	20		E	20	D_1, D_2, b_1, b_2, b_3, b_4.
	27	8	48			23	W	30	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197 8, 5276·2, 5316·8, D_1, D_2.
April	4	8	57	2	29		W	30	D_1, D_2 slightly bright.
	5	8	45	2	13		W	90	7065, 6677, D_1, D_2, 5316·8, 5284 3, 5276·2, 5234·8, 5197·8, b_1, b_2, b_3, b_4, 5018 6, 5016, 4924·1—all very bright.
	16	8	57	5	25·5		E	120	Whole prominence visible in D_1, D_2, b_1, b_2, b_3.
	22	8	32	4		16	W	90	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276 2, 5284 3, 5316·8, D_1, D_2, 6677
May	4	9	5	5	22·5		W	20	D_1, D_2, b_1, b_2, b_3.
	8	8	45	4		24	W	60	4924·1, 5016, 5018 6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276·2, 5284 2, 5316 8, D_1, D_2, 6677, 7065
	9	8	37	7	18·5		E	40	D_1, D_2, b_1, b_2, b_3.
	12	9	5	25	22·5		E	115	D_1, D_2, b_1, b_2, b_3, 6677, 7065.
	22	8	35	3		25·5	E	30	6677, D_1, D_2, b_1, b_2, b_3, b_4, 5316·8.
	24	8	59	2		5	E	25	6677, D_1, D_2, b_1, b_2, b_3, b_4, 5316·8
	26	8	44			23	E	15	6677, D_1, D_2, 5316·8, b_1, b_2, b_3, b_4, 5018·6, 5016, 4924·1.
	26	8	55	2		15	W	90	6677, D_1, D_2, 5535 05, 5363 0, 5316 8, 5283 2, 5276·2, 5234·8, 5197 5, b_1, b_2, b_3, b_4, 5018 6, 5016, 4924·1
	28	9	5		10		W	20	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8, 6677.
June	3	8	59	7	17·5		W	65	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8, 4924·1, 5234 8, 5016, 6677.
	22	8	53		22		W	10	D_1, D_2, b_1, b_2, b_3, b_4.

The total was 32 against 25 in the preceding half-year. Their distribution north and south, and extreme and mean latitudes are given below. They were equally divided between the eastern and western limbs.

	Number	Mean latitude	Extreme latitudes.
North	19	21° 1	30,° 10°
South	13	17·7	25 5, 5

Displacements of the hydrogen lines.

Particulars of the displacements observed are given in Table II.

TABLE II.—DISPLACEMENTS OF THE HYDROGEN LINES.

Date.	Hour I.S.T.	Latitude.		Limb	Displacement.			Remarks.
		North	South.		Red	Violet.	Both ways	
1917.	H. M.	°	°		Å	Å	Å	
January 4	8 55		26·5	E	Slight			No prominence.
4	8 59		45 0	E			Slight	Do.
4	8 30	41 5		W	1			Near base
5	10 41	20		W	Slight			At top
6	8 53		52	E	Do.			
6	8 29	9 5		W		1		
6	8 23	64		W	Slight			
12	10 48	17 5		W	0 5			
14	8 28	23		W	Slight			
16	8 30	48 5		W		Slight		About the middle of the prominence.
17	10 26		11·5	E	Slight			
18	10 28	32·5		E	Do			
18	9 38		85	—	1			On upper half
19	8 52	26		W		Slight		
19	8 52	28		W	Slight			
20	8 45		82	W	Do.			
20	8 35		77	W		Slight		
20	8 32		49·5	W	Slight			
21	8 38	11		E	Do.			
23	8 30	15		E	0·5	Slight		2 A to red a little to the south of it.
23	8 19	17		W		Do.		
23	8 18	35		W		2		
24	8 29	16		E	1·5	1·5		
25	8 43		1	E		Slight		
25	9 5	78		W	Slight			
26	8 36	13·5		E		1		At several places.
27	8 48	40		E	Slight			At base.
27	9 20	40		E		Slight		Do.
27	8 55		20	E	Slight			
28	8 20		83·5	W	Do			
28	8 40		43·5	W		Slight		
28	8 44		20	W			0 5	
29	9 2	2		E	Slight			
29	9 7	2		E		0·5		
29	8 41	64		W	Slight			Over the whole prominence.
29	8 39	78		W	Do.			
30	8 53	29		E	Do.			
February 2	15 20	13		E			Slight	No prominence.
3	11 11		15	E			0·5	Do.
3	11 11		16	E		0 5		Do.
4	8 41	12		E	0 5			
4	8 47		23	E	Slight			
4	8 20	68		W	Do.			Near base.
5	9 15	26		E		0 5		Over the whole prominence
5	9 4	Equator		E	Slight			
7	8 50	33		W	0 5			At top.
7	8 46	55		W	0·5			At top of the lower prominence.
11	8 29	76·5		E	0·5			No prominence.

Date	Hour I S.T.	Latitude. North.	Latitude. South	Limb.	Displacement. Red	Displacement. Violet.	Displacement. Both ways.	Remarks.
1917.	H. M.	°	°		Å	Å	Å	
February 11	8 58		29	E	0·5			At top
11	8 31	73·5		W	Slight			
12	8 43	83 5		—	0 5			No prominence
12	8 35	66 5		E	Slight			
12	9 11	1		W			Slight	
12	8 53	16		W			Do.	
13	11 45	60·5		W	Slight 1·0			
14	9 9	44		E	0·5			
14	9 15		30	E		Slight		At top
14	8 57		9	W	0 5			
14	8 44	52		W	Slight			At top.
14	8 38	73		W	1			Do
16	8 50	83		—		Slight		
16	8 45	72		E	0·5			
16	9 1		10 5	W	Slight			C displaced 0 5 A both ways at −13°.5 West near base. Higher up, C was displaced to red by different amounts—maximum being 6 A at 9h 4m Displacement 0·5 A both ways at base and 0·5 A to violet higher up at 10h 20m. At 9h 4m there was a faint patch of light at more than 7 A. A similar patch—probably a ghost was seen on the other side also. At −19° West C was displaced at several points to red, the greatest amount being 3 A at 9h 15m.
16	8 59	31		W	Slight			
16	8 55	64·5		W		Slight		At several places
18	8 35	7		E		0 5		
18	8 50		17	W		0·5		
22	8 35	12·5		E		Slight		At top.
22	8 32		15	E	Slight			
22	8 30		41·5	E	Do.			
25	8 51		81·5	E	Do			
25	8 41		38	W		Slight		
25	8 36	27		W	Slight			
27	9 6	64		E		Slight		
27	8 15		3	E	Slight			
27	8 43		16	E	Do.			At top.
27	8 51		23	W		0·5		
27	8 55		13·5	W	0·5	Slight		
28	9 0		16	W		2		At base.
March 1	9 14		12	E	1	0·5		Over jets.
1	9 17		18·5	E	1			Not seen at 9h 25m.
1	9 0		23	W		2		
2	8 52		20	E	1			At base.
2	9 3		20	E		1 5		At top.
3	9 1	49 5		W			Slight	
4	8 40	41 5		E		Slight		Near base.
4	8 41	30		E	0·5			At top
5	8 53	22		E		1		
6	8 48	28		W	0·5			At top. Not seen at 9h 2m.
9	8 50	20		E	Slight			At base.
10	9 5	81 5		E	Do.			Do.
10	8 48		3	E	0 5			
10	8 46		20	E	Slight			
10	9 0		54 5	W	0 5			At top. Prominence and displacement disappeared at 9h 15m.
11	8 50	27·5		W	0·5			At top.
12	9 2		11	E	Slight			
13	8 51	13		E		Slight		
13	8 49		15·5	E	0·5			
15	8 53		19 5	W		0·5		At top.
15	8 48		11	W	Slight			Do.
15	8 46	15		W			Slight	
16	9 0		28	E	1·5			
17	8 34		30	W		Slight		At top.

Date		Hour I S T		Latitude. North	Latitude. South.	Limb	Displacement Red	Displacement Violet	Displacement Both ways.	Remarks
1917.		H	M	°	°		Å	Å	Å	
March	18	9	40	12 5		W		Slight		
	18	9	33	83		W		0 5		
	19	8	53	13		E		1		At top
	20	8	59	27		E	Slight			
	20	9	4	25 5		E	0 5			At base.
	20	8	55	7 5		W	Slight			
	20	8	49	70		W	Do.			At top
	23	9	0 to 9 6	16 5		E	1·5	2·5		At different places.
	24	9	30	39 5		E	Slight	Slight		To red at top, to violet at base
	27	8	35		30	E		Do.		At top
	27	8	32		68	E	Slight			
	27	8	48		23	W			Slight	
	29	8	59	10		E	Slight			At base
	29	9	0	6		E		Slight		
	29	8	43	58 5		W		Do		
	29	8	40	80 5		W	Slight			
	30	8	45	21		E		0 5		
	30	8	48		26	E	Slight			
	30	8	40		30	W		Slight		At base
April	4	8	50	68		W	Slight			
	4	8	48	83		W	Do.			
	7	8	28	27		E		Slight		At base
	8	8	16		76·5	E	Slight			
	8	8	15		82	W	Do.			
	9	8	30	15		W	0·5			
	10	8	59	16		E	Slight			
	10	8	59	13		E	0 5			
	10	8	59	11		E		1		
	12	8	39		10	E			Slight	
	12	8	39		13·5	E			Do	
	12	8	47		83·5	E	Slight			No prominence
	12	8	25		22	W	Do.			
	13	8	40	7		E	0 5			
	13	8	51		26	E			Slight	
	15	9	47		13	E	Slight			
	16	8	57	25·5		E		0·5 to 2		Over the whole prominence except near base, amount varying from 0·5 A to 2 A.
	16	8	48	83 5		W			Slight	
	18	8	28	28		E	Slight	Slight		To red at top, to violet at base.
	19	8	42	26·5		E	Do.			At base.
	20	8	33	26		E		0 5		Do.
	20	8	41	18		W	Slight			
	21	8	14	31		E		Slight		
	23	8	45		11	E			Slight	
	23	8	33	10		W		Slight		No prominence
	23	8	33	15		W		0·5		
	24	8	32	11		W		0·5		At base.
	25	8	18	83·5		E	Slight			No prominence.
	25	8	42		14	E	Do.			
	25	8	29		30	W	Do			
	25	8	24	38·5		W	0·5			At top.
	25	8	21	62·5		W	Slight			No prominence.
	25	8	19	80		W	Do			Do
	25	8	19	83·5		W	Do.			Do.
	26	8	40		27	E	1			
	26	8	12		77	E		0·5		
	26	9	0		25	W		1·5		
	28	9	45		60·5	E		Slight		
May	2	9	3		81	W		1		
	4	9	5	22·5		W			3	
	5	9	25	26·5		E		4		
	5	9	35		71	E		2		On the floating mass.
	5	9	14	33		W		Slight		
	7	9	5	23		E	Slight			

Date.		Hour I.S.T.	Latitude.		Limb	Displacement.			Remarks.
			North.	South.		Red.	Violet	Both ways.	
1917		H. M	°	°		Å	Å	Å	
May	8	8 45		24	W	Slight			
	9	8 50		31	W	Do.			
	9	8 37	20		W			0 5	
	10	8 5	16·5		W	Slight			
	11	8 48	10		W	Do.			
	11	8 42		15	W	Do.			Over the whole prominence
	12	9 5	18		E	4	8		Displacements disappeared at 9h 9m.
	13	8 37		74	E	Slight			
	15	9 10	37		E	1			
	15	8 48	39		W			Slight	No prominence.
	16	8 47		9	W		Slight		
	19	8 47		9	W		Do.		
	19	8 43	47 5		W		Do.		
	19	8 42	51		W	Slight			
	20	8 44	23		E	Do.			Over upper half.
	20	8 40		46	E		Slight		
	22	8 35		25	E	1			
	24	8 57	10		E		2		At top.
	24	8 59	1		E			Slight	
	27	9 31		15	W			Do.	
	27	9 30	7		W		Slight		
	28	9 5	10		E		1·5		
June	2	8 40	27·5		E		Slight		At top.
	2	8 36		50	E			Slight	
	3	8 59	17 5		W	2			
	8	11 50	26		E		1		
	9	15 35	6		E	1	2		At the north end of the prominence.
	11	10 2	39		E	1	1		Do.
	11	10 10		20	E			Slight	At the south end.
	13	9 8		35	W	Slight			
	16	8 50	22·5		E		Slight		
	21	8 40	32·5		E	0·5			
	22	8 58		17	W	0·5			
	22	8 53	22		W	1			
	22	8 43	75		W		Slight		At base.
	24	8 48	63·5		E		Do.		No prominence.
	29	9 0		15	W		0 5		
	30	8 16		5	E		Slight		
	30	8 19		15	E		1		Slightly changing
	30	8 23		68	W	Slight			No prominence.
	30	8 6		6	W		Slight		At the south end of the prominence.

The total number observed was 207, against 179 in the preceding half-year. There were 122 in the northern hemisphere and 84 in the southern, 1 being on the equator ; 108 or 52 per cent were on the eastern limb, 96 on the western and 3 on the central meridian. One hundred and seventeen were to the red, 79 to the violet and 21 both ways simultaneously.

Between 0° and 30° there were displacements observed in 129 prominences, between 31° and 60° in 36, between 61° and 90° in 42.

Reversals and displacements of the C line on the disc.

Two hundred and forty-four reversals of the C line on the disc, 22 dark markings of the D_3 line, and 73 displacements were recorded, each of which is an increase on the previous half-year. Their distribution east and west of the central meridian together with the most probable excess due to chance is given below .—

	East.	West.	Percentage east.	Most probable excess.
Reversals of C near spots	126	118	51·6	± 2 2%
Darkenings of D_3	13	9	59·1	± 7·4%
Displacements of C	39	34	53·4	± 4·7%

There was a large preponderance of displacements towards the red, 46 being to the red, 20 to the violet and 7 both ways simultaneously.

Prominences projected on the disc as absorption markings.

The grating spectroheliograph for photographing the absorption markings in Hα light was in regular use during the half-year Photographs were obtained on 138 days counted as 125 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	1556	10 14
South	1131	8·22
Total .	2687	18 36

Compared with the previous half-year there is an increase of 55 6 per cent in areas and of 42 9 per cent in numbers This increase is evident in the region from 0° to 50° both north and south of the equator, whilst the activity in the polar regions has entirely disappeared in the northern hemisphere, but remained unchanged in the southern

The distribution of the absorption markings in latitude is shown in the accompanying diagram ; the only remarkable feature is the disappearance of the usually marked activity round the north pole although evident in prominences

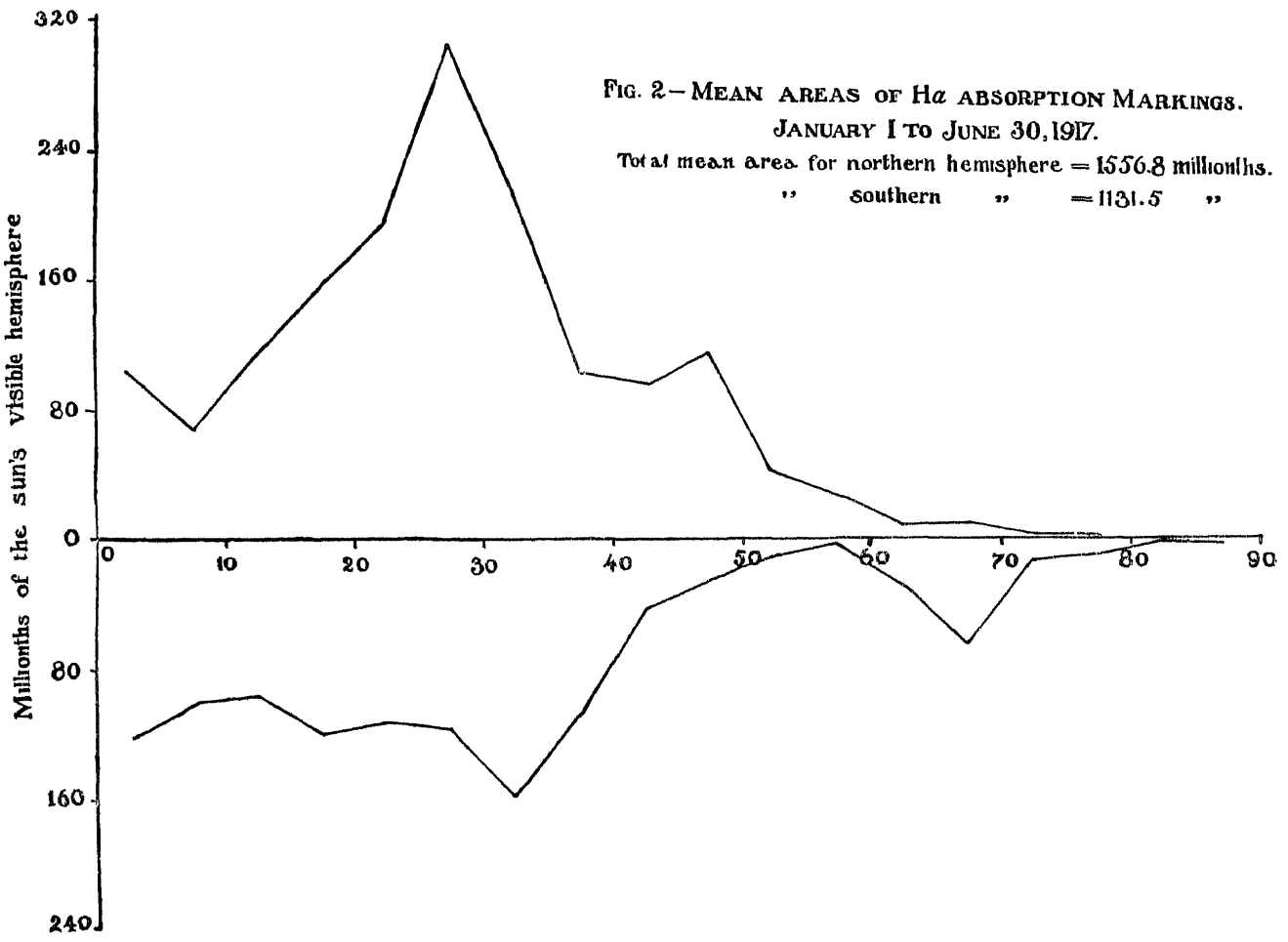


FIG. 2—MEAN AREAS OF Hα ABSORPTION MARKINGS.
JANUARY 1 TO JUNE 30, 1917.
Total mean area for northern hemisphere = 1556.8 millionths.
" southern " = 1131.5 "

The distribution relative to the central meridian of the sun shows the usual excess on the eastern side, there being 52·9 per cent of areas in the eastern and 53·4 per cent of numbers. The most probable excess due to chance is 0·70 per cent on either side, whilst the chances of excesses of 2·9 per cent and of 3·4 per cent on either side are respectively 48 times and 206 times less likely than equality on both sides.

KODAIKANAL OBSERVATORY,
3rd August 1917.

T. ROYDS,
Assistant Director.

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