

## REPORT\* OF THE KODAIKANAL OBSERVATORY FOR THE YEAR 1940

The data of solar activity given in this report are based on Kodaikanal observations only.

During 1940 there has been on the whole a decrease in solar activity, although prominence areas have remained nearly steady and the prominence numbers show a slight increase over the previous year.

The collection of spectroheliograms from other observatories for those days on which complete records could not be obtained at Kodaikanal, was not possible during the year on account of the war in Europe; but this observatory supplied 320 original calcium disc spectroheliograms to the Cambridge Solar Physics Observatory.

Daily character figures of solar activity according to  $H\alpha$  bright Flocculi and  $H\alpha$  dark markings were communicated to the International Astronomical Union for inclusion in the Bulletin of Character Figures. Daily character figures as derived from calcium flocculi from Kodaikanal photographs are communicated for publication by the Solar Physics Observatory, Cambridge.

2. *Observing Conditions.*—Observing conditions were slightly more favourable for solar observations than during the previous year. The mean value of the definition in the north dome before 10 A.M. was 2.3 on a scale in which 1 is the worst and 5 the best, as against 1.8 during 1939, but the number of days in which definition was estimated as 4 or above was only 9 as against 17 during the previous year.

3. *Photoheliograph.*—Photographs of the sun on a scale of 8 inches to the sun's diameter were taken on 337 days using a 6-inch achromatic object glass and a green colour screen.

4. *Spectroheliographs.*—Photographs of the monochromatic image of the sun's disc in K light were obtained on 314 days, prominence plates in K light on 302 days and  $H\alpha$  disc plates on 273 days. The total number of spectroheliograms taken during the year was 2185.

5. *Six-inch Cooke Equatorial and Spectroscope.*—Work with this instrument was continued on the same lines as in previous years for the visual observations of solar phenomena, which cannot be readily photographed.

6. *Spectrohelioscope.*—Observations with the Hale spectrohelioscope were made on all days of favourable weather except Sundays and holidays, special attention being given to bright chromospheric eruptions. These eruptions together with the displacements observed in the prominences and in  $H\alpha$  dark and bright markings are summarised in the bulletins of this observatory. A quarterly list of these eruptions was also communicated for inclusion in the Bulletin of Character Figures.

7. *Instruments and Research Work.*—The second siderostat installed some time ago was provided with a 12-inch aluminised mirror manufactured by Grubb.

The Assistant Director constructed a Rowland mount for the 10-foot concave grating of this observatory.

---

\* This report deals chiefly with the astronomical work of the Kodaikanal Observatory. The Meteorological data will be published in the 'India Weather Review' and administrative details will be incorporated in the annual report of the India Meteorological Department.

A photoelectric recording photometer for the direct measurement of intensities has been designed by the Director employing a two-tube bridge-type balanced d. c. amplifier for the purpose. Profiles of the  $H\beta$ ,  $M_g$ ,  $b_1$ ,  $b_2$ ,  $b_3$  lines have been obtained at the centre and limb of the sun by Mr. C. K. Ananthasubrahmaniam.

The Director is engaged in the study of the (0, 0) band  $\lambda$  3065 of O D and its identification in the solar spectrum.

8. *Sunspots*.—The following table gives the monthly numbers of new groups observed at Kodaikanal and their distribution between the northern and southern hemispheres. The mean daily numbers are also given.

1940.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
New groups . . . . .	15	19	21	25	16	18	23	22	21	18	21	21	240
North . . . . .	6	7	9	13	7	7	11	10	9	9	12	13	113
South . . . . .	9	12	12	12	9	11	12	12	12	9	9	8	127
Mean daily numbers . . . . .	2.9	4.6	5.5	4.7	3.3	4.2	4.4	5.5	4.0	3.6	4.5	5.0	4.3

Compared with the previous year, the number of new groups observed showed a decrease of 27 per cent, and the mean daily numbers a decrease of 26 per cent. There were no days on which the sun's disc was free from spots. The approximate mean latitude of spots was  $12^\circ.0$  in the northern hemisphere and  $10^\circ.8$  in the southern. Bright reversals of the  $H\alpha$  line on the sun's disc were observed with the spectroscope in the neighbourhood of sunspots on 744 occasions as against 963 in the previous year. The displacements observed in the neighbourhood of sunspots numbered 44 as against 64 during 1939. Of these 29 were towards the red, 11 towards the violet and 4 bothways simultaneously.  $D_3$  was observed as a dark line on 676 occasions as against 720 during the previous year.

9. *Prominences*.—The mean daily areas and numbers of calcium prominences as derived from Kodaikanal photographs are as follows :—

*Areas.*

		North.	South.	Total.
1940	January to June . . . . .	2.48	2.55	5.03 square minutes.
	July to December . . . . .	2.40	2.60	5.00 " "
<i>Numbers.</i>				
		North.	South.	Total.
1940	January to June . . . . .	7.43	6.87	14.30
	July to December . . . . .	7.47	7.07	14.54

Compared with the previous year, there has been practically no change in prominence areas, but the numbers show an increase of 7 per cent. The areas and numbers are equally distributed in the northern and southern hemispheres. The distribution of areas in latitude shows that there are two zones of maximum activity in the northern hemisphere at latitudes  $15^\circ$  and  $35^\circ$  and one in the southern hemisphere near latitude  $20^\circ$ . The distribution of numbers is nearly uniform from the equator to latitude  $55^\circ$ .

Thirty-three metallic prominences were observed during 1940 as against 59 in the previous year. Of these, 15 were in the northern hemisphere and 18 in the southern and all of them were observed from the equator to latitude  $33^\circ$ . Displacements of the hydrogen line in the chromosphere and prominences observed during the year with the spectroscope numbered 204 as against 451 in 1939. Of these 112 were towards the red, 85 towards the violet and 7 both ways simultaneously. The largest displacement noticed was  $9 \text{ \AA}$  to violet.

The displacements observed in prominences with the spectroheliometer numbered 124 as against 282 in the previous year. Of these 49 were in the northern hemisphere and 75 in the southern and 57 were on the east limb and 67 on the west limb. Displacements to the red numbered 67 and those to the violet 57. The largest displacement in the prominences observed during the year was  $6.4 \text{ \AA}$  to violet.

Eruptive prominences on the limb were photographed on February 26, March 8, and May 29. The prominence of March 8 rose to a height of about  $10'$  and that of May 29 showed maximum displacements of  $6.4 \text{ \AA}$  to violet and  $2.8 \text{ \AA}$  to red.

The mean daily areas of prominences projected on the disc as hydrogen absorption markings was 7912 millionths of the sun's visible hemisphere as against 9735 in 1939, showing a decrease of about 19 per cent. In the first half of the year its distribution in latitude is similar to that of prominences at the limb with the peaks very much pronounced. But in the second half of the year its distribution, especially in the northern hemisphere, is irregular with a marked peak near latitude  $15^\circ$ .

A very large absorption marking, the largest for a number of years, was photographed during the first week of April. It extended almost from the east to the west limb on April 5th and 6th and its area was about 14400 millionths of the sun's visible hemisphere. The marking disappeared on April 8th.

10. *Time*.—The error of the standard clock of this observatory was determined, as in former years, by reference to the 16-hour signal\* distributed from Alipore Observatory, Calcutta. The signal was received accurately on most days and all failures were reported to the Postmaster-General, Madras.

11. *Seismology*.—The Milne-Shaw seismograph recorded 182 earthquakes during the year. For details of records reference may be made to Quarterly Seismological Bulletins published by the India Meteorological Department.

12. *Publications*.—The Annual Report for the year 1939 and the following bulletins and articles were published during the year :—

1. Bulletin No. 117. Summary of prominence observations for the second half of the year 1938.
2. Bulletin No. 118. Summary of prominence observations for the year 1939.
3. "The recent unusual solar activity" by M. Salaruddin and B. G. Narayan, *The Observatory*, January 1940. A fuller account of the same work appeared in the *Indian Journal of Physics*, Vol. 13. pp. 451-54, December 1939.

---

\* The reception of the signal is rendered possible by the courtesy of the Telegraph Department which permits the telegraph line to be joined through to this observatory.

4. "Sunspots and magnetic storms during the last week of March 1940" by M. Salaruddin and C. K. Ananthasubrahmaniam, *Science and Culture*, Vol. 5, pp. 775-76, 1940.
5. "Measurements of cosmic rays at Agra and Kodaikanal" by A. K. Das and M. Salaruddin, *Indian Journal of Physics*, Vol. 14, pp. 191-205, 1940.
6. "A precision direct-reading spectrophotometer" by A. L. Narayan and C. K. Ananthasubrahmaniam, *Indian Journal of Physics* 1940 (in press).
7. "An apparent influence of the earth on solar prominences" by A. K. Das and B. G. Narayan, *Indian Journal of Physics*, Vol. 14, pp. 311-323, 1940.
8. "The motion of gases in the sun's atmosphere Part. I. On the mechanism of formation of solar dark markings" by A. K. Das, *Indian Journal of Physics*, 1940 (in press).
9. "The motion of gases in the sun's atmosphere, Part II. On the westward tilt of prominences" by A. K. Das and B. G. Narayan *Indian Journal of Physics*, 1940 (in press).
10. "The motion of gases in the sun's atmosphere, Part III. On the stratification of the solar envelope" by A. K. Das, *Indian Journal of Physics*, 1940 (in press).

KODAIKANAL ;  
*The 24th January 1941.*

}

A. L. NARAYAN,  
*Director, Kodaikanal Observatory.*