

## REPORT\* OF THE KODAIKANAL OBSERVATORY FOR THE YEAR 1938.

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During 1938 there has been a slight decrease in almost all forms of solar activity except the prominence areas which show an 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 continued as part of the programme of the International Astronomical Union. The data of solar activity given in this report are, however, based on Kodaikanal photographs only, as photographs from other observatories will not be available until a considerable time after the end of the year.

Under the auspices of the International Astronomical Union, this observatory supplied 9 original photoheliograms to Greenwich Observatory, 321 original calcium disc spectroheliograms to Cambridge Observatory and 35 positives of photoheliograms, 60 positives of H $\alpha$  disc plates and 6 of K prominence plates to Meudon Observatory.

Daily character figures of solar activity according to H $\alpha$  bright flocculi and H $\alpha$  dark markings for the year 1938 have been communicated to the Observatoire Fédéral, Zürich 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, combined with their own.

2. *Weather conditions.*—Weather conditions were slightly less favourable for solar observations than during the previous year. The mean value of the definition in the north dome before 10 A.M. was only 2.0 on a scale in which 1 is the worst and 5, the best, and the number of days on which the definition was estimated as 4 or above was 10, as against 2.2 and 11 respectively during 1937.

3. *Photoheliograph.*—Photographs of the sun on a scale of 8-inches to the sun's diameter were taken on 328 days using a 6-inch achromatic object glass and a green colour filter.

4. *Spectroheliographs.*—Photographs of the monochromatic image of the sun's disc in K light were obtained on 322 days, prominence plates in K light on 303 days and H $\alpha$  disc plates on 283 days. The total number of spectroheliograms secured during the year was 2578.

5. *Six-inch Cooke Equatorial and Spectroscope.*—Work with this instrument has been 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. A list of these

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\* 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.

eruptions together with times when the sun was under observation was sent quarterly to the Meudon Observatory, Paris, for inclusion in the Bulletin of Character Figures. The displacements observed in the prominences and in  $H\alpha$  dark and bright markings are summarised in the half-yearly bulletins of this observatory.

7. *Research Work*.—In continuation of observations and measurements of Intensity Profiles previously reported, the Director and Mr. C. K. Ananthasubrahmaniam have been engaged on a photometric study of the changes of Magnesium *b* group and other strong Fraunhofer lines from the centre of the sun's disc to the polar and equatorial limb. The 3rd order spectrum of a 20 ft. grating spectrograph was used for this purpose.

Dr. A. K. Das and Mr. E. G. Narayan have been making a statistical study of prominence areas to determine the possible influence of the earth on solar prominences.

Mr. M. Salaruddin and the Director photographed and measured the spark spectrum of Bromine from 2200 to 6500 Å. A new multiplet has been identified and  $^5D$  terms located. Precise measures of intensity have been made by photographic photometry for the lines of the above multiplet under varying degrees of excitation.

Mr. Salaruddin and Dr. A. K. Das have measured the Intensity of Cosmic Radiation at Agra and Kodaikanal and studied the diurnal variation of intensity with sidereal and mean times.

A line-shifter has been designed and mounted on the  $H\alpha$  spectroheliograph so as to record variations in form and details of prominences on the disc and limb of the sun due to Doppler effect.

The 6-inch coelostat used with the 13 ft. prism spectrograph constructed for line contour work, was found to have insufficient light grasp. From the parts received from the Takthasingji Observatory, Poona, a 12-inch siderostat has been built up and mounted. For want of a 12-inch flat, it is at present fitted with a 7-inch mirror. A monochromator for use with the spectrograph has also been constructed and mounted. To test the performance of the instrument Mr. E. G. Narayan and Dr. A. K. Das have photographed the solar spectrum in the  $\nu 3883$  region.

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.

1938.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
New groups . . . . .	29	25	25	20	23	30	32	34	25	24	31	30	328
North . . . . .	15	10	8	11	9	16	19	18	16	14	19	16	171
South . . . . .	14	15	17	9	14	14	13	16	9	10	12	14	157
Mean daily numbers .	5.4	5.7	5.0	5.0	6.2	4.9	8.3	7.1	5.4	5.1	5.6	5.7	5.8

Compared with the previous year, the number of new groups observed showed a decrease of 13 per cent. and the mean daily numbers a decrease of 16 per cent. There were no days on which the sun's disc was free from spots. The approximate mean latitude of the spots was  $15^{\circ}2$  in the northern hemisphere and  $14^{\circ}7$  in the southern. Bright reversals of the  $H\alpha$  line over the sun's disc observed with the spectroscope in the neighbourhood of sunspots.

numbered 872 as against 891 in the previous year. The displacements observed in the neighbourhood of sunspots numbered 65 as against 73 in the previous year. Of these 43 were towards the red, 8 towards the violet and 14 both-ways simultaneously.  $D_3$  was observed as a dark line on 789 occasions as against 826 in 1937.

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

*Areas.*

	North.	South.	Total.
1938 January to June . . . . .	4.91	2.93	7.84 square minutes.
July to December . . . . .	4.21	4.33	8.54 „ „

*Numbers.*

	North.	South.	Total.
1938 January to June . . . . .	8.35	6.65	15.00
July to December . . . . .	7.61	7.00	14.61

Prominence areas show an increase of 12 per cent. whereas the numbers show a decrease of 6 per cent. when compared with the previous year. The northern hemisphere shows a slight preponderance of activity over the southern. The distribution of areas and numbers in latitude showed a tendency to increase in low latitudes up to  $40^\circ$  and to decrease in zones of high latitudes. During the second half of the year the high latitude peak became unimportant so that the activity was confined mainly to within  $60^\circ$  of the equator in both the hemispheres.

Forty-eight metallic prominences were observed during 1938 as against 60 in the previous year. Of these 20 were observed in the northern hemisphere and 28 in the southern hemisphere and all these were between latitudes  $4^\circ$  and  $36^\circ$ . Displacements of the  $H\alpha$  line in the chromosphere and prominences observed during the year with the spectroscope numbered 323 as against 369 in 1937. Of these 176 were towards the red, 124 towards the violet and 23 bothways simultaneously. The largest displacements noticed were 6 Å to red and 8 Å to violet.

The displacements observed in prominences with the spectroheliograph numbered 187 as against 259 in the previous year. Of these 97 were in the northern hemisphere and 90 in the southern, and 100 were on the east limb and 87 on the west limb. Displacements to the red numbered 99 and those to violet numbered 88. The largest displacement in prominences observed in 1938 was 4.0 Å to violet.

Eruptive prominences on the limb were photographed on January 25, April 6, May 6, December 24 and December 30. The greatest height recorded was 13' on May 6, S. E. limb. The prominence of December 24 rose in latitude N  $20^\circ$  on the west limb and poured into a centre of attraction in latitude S  $64^\circ$ . There was no sunspot area in the neighbourhood. A striking feature of the prominence was its spiral structure.

The mean daily areas of prominences projected on the disc as hydrogen absorption markings amounted to 10161 millionths of the sun's visible

hemisphere as against 9490 millionths in the previous year, showing an increase of 7 per cent. Their distribution in latitude is similar to that of calcium prominences except that the activity in the zones  $20^{\circ}$ — $25^{\circ}$  in the northern hemisphere and  $15^{\circ}$ — $20^{\circ}$  in the southern hemisphere is more pronounced in the case of the  $H\alpha$  absorption markings.

10. *Time*.—The 16-hour time signal issued by the Alipore Observatory, Calcutta, was received accurately on most days and all failures were reported to the Postmaster-General, Madras. In addition wireless time signals were received from Colombo and Rugby from the 15th July 1938, the wireless set of the office having been rectified.

11. *Seismology*.—The Milne-Shaw seismograph recorded 255 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 1937 and the following bulletins and articles were published during the year.

1. Bulletin No. 113. Summary of Prominence Observations for the second half of the year 1936.
2. Bulletin No. 114. Summary of Prominence Observations for the first half of the year 1937.
3. An account of the work done in this observatory during the last 25 years—Jubilee volume Indian Science Congress Association published in 1938.
4. "Progress of Meteorology in India" by Dr. A. K. Das—Progress of Science in India during the past 25 years pages 732-741 published by the Indian Science Congress Association 1938.

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KODAIKANAL ;

*The 15th February 1939.*

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\* The error of the standard clock of this observatory is usually determined by reference to the 16-hour signal distributed from the Alipore Observatory, Calcutta. The reception of the signal at Kodaikanal is rendered possible by the courtesy of the Telegraph Department which permits the telegraph line to be joined through to this observatory.