REPORT* OF THE KODAIKANAL OBSERVATORY FOR THE YEAR 1941.

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

During the year 1941 there has been a further decrease of solar activity both in prominence areas and numbers.

Sixty-three spectroheliograms for those days when Kodaikanal photographs were incomplete or wanting during 1939 and 1940 were obtained from the observatories at Mount Wilson, Cambridge and Ewhurst. As usual this observatory supplied to the Solar Physics Observatory, Cambridge, original calcium disc spectroheliograms for 302 days.

Daily character figures of solar activity according to H α bright flocculi and H α absorption markings were communicated to H. W. Newton, Esqr., Greenwich Observatory, London, for transmission to Prof. Brunner, Zurich for inclusion in the quarterly bulletin on solar activity. 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. *Observing Conditions.*—Observing 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 2·3 on a scale in which 1 is the worst and 5 the best ; the number of days on which definition was estimated as 4 or above was only 3 as against 9 during the previous year.

3. *Photoheliograph.*—Photographs on a scale of 8 inches to the sun's diameter were taken on 322 days using a 6-inch achromatic object glass and a green colour screen.

4. *Spectroheliographs.*—Photographs of the monochromatic images of the sun's disc in K light were obtained on 302 days, prominence plates in K light on 289 days and H α disc plates on 262 days. The total number of spectroheliograms taken during the year was 1951.

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. The details of the observations of chromospheric eruptions and the displacements of H α line in the prominences and in dark and bright markings are summarised in the bulletins of the observatory. A quarterly list of chromospheric eruptions together with the times when the sun was under observation was also communicated for inclusion in the Bulletin on Solar Activity.

*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.

7. *Research Work.*—The Director has improved the Direct-Reading Spectrophotometer built last year by replacing the single-tube amplifier by a balanced circuit. The instrument has been used for measuring the profiles of some of the strong Fraunhofer lines in the solar spectrum. Preliminary observations also made with this instrument on the intensity of radiation from sunspots relative to the surrounding photosphere have shown that the character of the radiation from a sunspot is independent of its position on the disc.

A study of photographs made of the band spectrum of OD in the 3000 A region revealed a new ($2 \rightarrow 2$) band and coincidences (considerably in excess of the numbers possible by mere chance) between the rotational lines of the OD bands and the Fraunhofer lines were obtained. But the atomic lines of heavy hydrogen do not fit well with the solar absorption lines. Further work on this question is in progress.

The Assistant Director continued the theoretical study of the motion of gases in the sun's atmosphere and undertook experimental work on Zeeman-effect. The occurrence of highly stripped atoms of Iron, Nickel Cobalt, etc., in the corona has been investigated on the basis of the results of the dynamical study of the solar envelope and the conclusions so far reached indicate a probable cause ; a paper on the subject will shortly be communicated for publication. An intermittent vacuum arc with rotating electrodes capable of functioning in a space of 3 mm. between the poles of a powerful electromagnet has been constructed for photographing Zeeman patterns.

A study of the structure of the H and K lines over sunspots and at various points on the sun's disc is in progress. Photographs of spot spectra so far obtained with a large prism spectrograph (dispersion about 0·4 A per mm. in the H and K region) indicate that, contrary to what is generally believed to be the case, the H_3 and K_3 components are not absent over the umbra.

Statistical studies on the distribution of the heights of prominences in latitude and on periodicities in prominence areas are in progress.

Mr. C. K. Ananthasubrahmanyam, Assistant, obtained the M.Sc., degree of the Madras University with a thesis entitled " On the photometric study of the Mg. b group and Identification of OD bands in 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.

1941.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Total.
New groups	15	14	16	12	17	16	16	19	16	12	12	9	174
North	6	7	11	6	5	9	10	12	10	8	9	4	97
South	9	7	5	6	12	7	6	7	6	4	3	5	77
Mean daily numbers	3·3	3·4	3·4	2·1	2·6	3·8	4·1	3·6	3·0	3·0	3·0	2·8	3·2

The number of new groups showed a decrease of 27 per cent. and the mean daily numbers a decrease of 26 per cent. compared with the previous year. There were two days on which the sun's disc was free from spots. The approximate mean latitude of spots was 10°·6 in the northern hemisphere and 8°·3 in the southern. Bright reversals of Hα line on the sun's disc were observed with the spectroscope in the neighbourhood of sunspots on 364 occasions as against 744 in the previous year. The displacements observed in the neighbourhood of sunspots numbered 7 as against 44 during 1940. Of these 5 were towards red and 2 towards red and violet simultaneously. D_3 was observed as a dark line on 276 occasions as against 676 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.
1941	January to June	2·49	1·58	4·07 square minutes.
	July to December	1·94	1·59	3·53 ,,

Numbers.

		North.	South.	Total.
1941	January to June	7·27	5·88	13·15
	July to December	6·96	5·39	12·35

There has been a decrease of 19 per cent. in areas and 11 per cent. in numbers when compared with the figures for the previous year. Both areas and numbers show a preponderance in the northern hemisphere. The distribution of areas in latitude shows maximum activity between 20° and 35° in the northern hemisphere and 15° and 30° in the southern. The distribution of numbers is nearly uniform from the equator to latitude 50°.

Twenty-six metallic prominences were observed during the year as against 33 during 1940. Of these 11 were in the northern hemisphere and 15 in the southern ; all of them were observed from the equator to latitude 35°. Displacements of the hydrogen C line in the chromosphere and prominences observed during the year with the spectroscope numbered 54 as against 204 in 1940. Of these 26 were towards the red and the same number to violet and 2 bothways simultaneously.

The displacements observed in prominences with the spectrohelioscope were 65 as against 124 in the previous year. Of these 32 were in the northern hemisphere and 33 in the southern while 42 were on the east limb and 23 on the west. The largest displacement observed during the year was 5·6 A to red in a dark marking.

An eruptive prominence was photographed on the west limb of the sun on February 28th ; it reached a maximum height of 10′ and covered an area of nearly 11 square minutes.

The foreshortening correction that was being applied hitherto to the areas of hydrogen absorption markings situated at different longitudes on the sun's disc was given up from the beginning of the year. The routine statistics are being prepared from the actual measures of the areas. The

mean daily area of hydrogen absorption markings (without foreshortening correction) was 3,117 millionths of the sun's visible hemisphere as against *4,480 (without foreshortening correction) in 1940 showing a decrease of 30 per cent. The distribution of areas in latitude is nearly similar to that of the prominences. The largest hydrogen absorption marking of the year (photographed on the 10th December) covered an area of about 4,225 millionths of the sun's visible hemisphere.

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 Post-Master General, Madras.

11. *Seismology.*—The Milne-Shaw seismograph recorded 201 earthquakes during the year. The details of records are incorporated in the Quarterly Seismological Bulletins published by the India Meteorological Department.

12. *Publications.*—The Annual Report for the year 1940 and the Kodaikanal Observatory Bulletin No. 119 "Summary of Prominence Observations for the year 1940" were published during the year. The following notes and articles were either published or communicated for publication in scientific journals :—

1. "A new (2 2) band in the spectrum of the OD molecule" by A. L. Narayan, Cur. Sc., Vol. 10, p. 75.
2. "On the Presence of Highly Stripped Atoms in the Solar Corona" by A. K. Das, Sc. & Cult., Vol. VII, 1941-42, pp. 357-58.
3. "Study of the Profiles of the Fraunhofer Lines in the Solar Spectrum", Part I, Mg. b. group by Y. Paramasiva Rao and C. K. Ananthasubrahmanyam, Ind. Jour. Physics (in press).

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Kodaikanal Observatory.

KODAIKANAL ;
The 16th February 1942.

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*The mean daily area after applying foreshortening correction was given as 7,912 millionths of the Sun's visible hemisphere in the report for the year 1940.

†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.

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