ANNUAL REPORT* OF THE KODAIKANAL OBSERVATORY FOR THE YEAR 1947.

1. *General.*

A note-worthy feature of the year was the visit to this observatory of Sir Harold Spencer Jones, Astronomer Royal, England and Professor Harlow Shapley, Director, Harvard College Observatory, U. S. A. Questions relating to the post-war development of the observatory were discussed with them.

Exchange of spectroheliograms with foreign observatories continued as in the previous year and efforts were made to make up the arrears which had accumulated during the years of war. 972 K flocculus plates for the period April 1944—September 1947 were supplied to the Solar Physics Observatory, Cambridge, 150 Hα flocculus and 30 K flocculus plates for the period January 1943—December 1944 to the Meudon Observatory, France and 25 photoheliograms for the period 1943—1946 to the Royal Observatory, Greenwich. The Mount Wilson Observatory supplied 180 Hα flocculus, 156 K prominence and 21 Hα prominence plates for the period January 1945—May 1947. 38 K flocculus and 61 Hα flocculus positives on film for the year 1941 were received from the Meudon Observatory, France.

2. *Instruments.*

The equipment of this observatory consists at present of the following principal instruments :—

1. Six-inch Cooke Equatorial with a grating spectroscope attached for observing prominences.
2. Six-inch Lerebour and Secretan Equatorial remounted by Grubb for direct solar photography. A six-inch astrographic camera is also mounted on the same equatorial.
3. Six-inch stellar telescope by T. Cooke and Sons, York.
4. Six-inch transit instrument and barrel chronograph made by the Cambridge Scientific Instruments Company
5. Spectroheliograph made by the Cambridge Scientific Instruments Co., with an 18-inch Cooke siderostat and a 12-inch Cooke photo-visual lens of 20 ft. focal length, used for photographs in the K line.
6. An auxiliary spectroheliograph using a 6-inch Anderson grating designed and built in this observatory is attached to the above for taking spectroheliograms in the Hα line.
7. Hale spectrohelioscope together with a 5-inch coelostat kindly loaned by the Mount Wilson Observatory.

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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 the administrative details will be incorporated in the annual report of the India Meteorological Department.

8. *Spectrograph I.*—With 3½ prisms in Littrow mount and about 14 ft. focus, designed and built in this observatory. This is fed by a 12-inch siderostat in conjunction with an 8-inch lens.

9. *Spectrograph II.*—10 ft. concave grating in Rowland mounting designed and built in this observatory. Sunlight can be admitted into this spectrograph by the 12-inch siderostat and 8-inch lens using auxiliary reflectors.

10. *Spectrograph III.*—20-foot plane grating spectrograph in Littrow mount using a 6¼-inch Michelson grating, designed and built in this observatory. The spectrograph is so constructed that the grating can be quickly moved aside by turning a handle and a system of 3½ prisms can be brought into use in its place.

11. *Spectrograph IV.*—Angular grating spectrograph with collimator lens of about 7 ft. focus and camera lens of about 14 ft. focus using a 3¼-inch Rowland plane grating, designed and built in this observatory.

Sun light can be admitted into spectrographs III and IV either by the 18-inch siderostat or by a coelostat built for 12-inch mirrors but working temporarily with smaller mirrors until mirrors of appropriate size become available.

12. Hilger E 315 quartz spectrograph.

13. 20″ Reflecting telescope by Grubb received from the Takhtasinghji Observatory at Poona in 1912. The instrument has not yet been mounted.

14. Cambridge photoelectric microphotometer.

15. Three Hilger comparators for measuring spectrograms.

16. Large induction coil capable of giving upto 16-inch sparks.

17. Large Dubois Electromagnet.

18. Small dividing engine by the Cambridge Scientific Instruments Co., Ltd.

19. Four mean time clocks : (*i*) Kulberg M 6326 (*ii*) Shelton (*iii*) Arnold and Dent (*iv*) W. Ottway and Co.

20. One sidereal clock by T. Cooke & Sons, York.

21. Two chronometers : (*i*) Kulberg No. 6244 (*ii*) Frodsham No. 3476.

22. Two tape chronographs by Fuess.

23. Milne-Shaw seismograph (E-W component only.)

24. A complete set of meteorological instruments.

3. *Routine Observations* :–

Weather conditions were generally more favourable for observations than during the previous year. The definition of the solar image before 11 A.M. (I. S. T.) estimated on a scale in which 1 is the worst and 5 the best was 2 or less

on 78 days and 4 or more on 67 days. The mean value of the definition was 2·7. Systematic observations of the general sky conditions and of the definition of the sun's image at 08, 09, 10, 11, 12, 14 and 16 hrs. I. S. T. every day were begun during the year in order to study the suitability of Kodaikanal for coronagraph work. Observations with the photoheliograph, the prominence spectroscope, the spectrohelioscope and the spectroheliograph were continued as usual. Direct photograhps of the sun on a scale of 8″ to the sun's diameter were obtained on 304 days as against 292 days in 1946. Spectroheliograms in the Hα and K lines were obtained on 292 and 282 days respectively, while K prominence plates were secured on 274 days. Quarterly statements of chromospheric eruptions were sent to Dr. L. d'Azambuja of the Meudon Observatory, France and to Mr. H. W. Newton of the Royal Observatory, Greenwich.

4. *Sunspots.*

The number of new sunspot groups observed during the different months of the year, their distribution in the two hemispheres and the mean daily numbers are given in the following table :—

Month.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Total.
New groups No. of North . .	14	17	9	12	18	26	18	12	13	22	18	13	192
New groups South . .	18	14	18	22	25	17	14	21	14	20	22	22	227
Total .	32	31	27	34	43	43	32	33	27	42	40	35	419
Mean daily No. . .	7·9	6·4	7·0	7·8	10·7	8·2	6·6	8·7	8·4	9·1	8·5	6·8	8·1

Compared with 1946 there was an increase of 44% in the total number of new sunspot groups observed during the year ; the mean daily number showed an increase of 42%. There was not a single day on which the sun's disc was free from spots. The approximate mean latitude of the sunspot groups for the whole year was 17° as against 20° in the previous year. About 12% of the total number of spot groups appeared in latitudes higher than 25°.

The outstanding feature of the sunspot activity during the year was the appearance of a giant sunspot group in April which surpassed in area the great sunspot group of February 1946. The April spot group attained a record area of 4900 millionths of the sun's visible hemisphere as measured on the Kodaikanal photoheliogram for 1947 April 6. It however showed very little activity compared with its predecessors in February and July of the previous year.

5. *Prominences.* :—

The mean daily areas and numbers of prominences as derived from the photographs taken at Kodaikanal on 274 days during the year were as follows :—

	Areas.			Numbers.		
	N.	S.	Total	N.	S.	Total
Jan—June	2·29	2·71	5·00 Sq. min.	6·28	5·92	12·20
July—Dec.	2·17	2·53	4·70 ,,	5·81	5·75	11·56

Compared with the previous year, both the areas and numbers showed an increase in both the hemispheres, the percentage increase in the northern and southern hemispheres being 9% and 17% for the areas and 24% and 33% respectively for the numbers. The latitudinal distribution of areas and numbers showed maximum activity in the zone 60°—65° in both the hemispheres indicating a pole-ward drift of the zones of maximum in both the hemispheres. The prominence areas also showed two secondary maxima at 30°—35° N and 35°—40° S.

29 metallic prominences were observed during the year with the prominence spectroscope, 14 in the northern and 15 in the southern hemisphere. Of these, 18 appeared on the west limb of the sun.

Doppler displacements of the Hα line in prominences were observed on 148 occasions with the prominence spectroscope. In 38 cases the shifts were towards the red side, in 67 cases towards the violet side, while the rest showed displacements in both directions. The following table gives particulars of prominences which showed the largest displacements :—

Date.	Co-ordinates of prominence.	Doppler displacement observed.
1947 May 13 . .	W limb—16° ·5 N	6·0 A towards red.
1947 May 16 . .	E limb—22° ·5 N	Do.
1947 Aug. 8 . .	W limb—43° S	6·0 A° towards violet.

Observations with the spectrohelioscope in Hα line showed Doppler displacements in prominences in 35 cases, 10 of which were towards the red, 11 towards the violet and the remaining in both directions.

The mean daily area of hydrogen absorption markings (without applying fore-shortening correction) computed from Hα spectroheliograms was 7357 millionths of the sun's visible hemisphere representing an increase of 50% over the previous year's mean value. The latitudinal distribution showed a principal maximum in the zone 25°—30° in both the hemispheres, with secondary maxima at 55°—60° N and 65°—70° S.

6. *Research Work*:-

A programme of experimental study of the motion of matter in and around sunspots was commenced with the H and K lines using a Littrow prism spectrograph giving a dispersion of 0·45 A°/mm in this region. Plates obtained under good sky conditions were measured to obtain quantitative data regarding the width and structure of the lines. For studying the magnetic field of sunspots simultaneously with the motion of matter in sunspots, the spectra of a number of major spot groups were photographed in the green and red regions using a 20-ft. grating spectrograph. To study the variation of the effective temperature of the solardisk along a radius with the help of the CH bands, spectrograms of the CH bands in a carbon arc in an atmosphere of hydrogen were obtained simultaneously with the solar CH bands. During the year systematic observations of the heights of prominences in Hα, D3 and Hβ. were made visually with the prominence spectrescope and the values obtained were compared with the heights of the same prominences in K line from the spectroheliograms. On the average the visual observations gave smaller values for the heights. The mean heights in Hα and D3 were nearly the same, while the value for Hβ was about 25% less.

7. *Time* :-

The standard clocks of the observatory were rated by comparison with Greenwich time signals.

8. *Seismology* :—

The Milne-Shaw seismograph of this observatory recorded 131 earthquakes during the year. The details of the records are given in the Quarterly Seismological Bulletins published by the India Meteorological Department.

9. *Library*.

21 new books and 802 periodicals were added to the library during the year.

10. *Publications* :—

Annual Reports for the years 1942-46 which could not be printed during the war period were sent to the press. The following notes were published during the year :—

1. " An Unusual Dark Marking ", by
N. R. Rao, C. V. Subrahmanyam and N. D. Babu,
Observatory, Aug. 1947.

2. " Sunspot Activity During the Current Cycle "—A Review, by R. Ananthakrishnan, K. Sethumadhavan and A. K. Das. Journal of Scientific and Industrial Research Vol. VI, No. 9, Sept. 1947.

A. K. DAS,
Director,
Kodaikanal Observatory.

KODAIKANAL :
The 15th May 1948.

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