ANNUAL REPORT* OF THE KODAIKANAL OBSERVATORY FOR THE YEAR 1948.

1. *General.*—A noteworthy feature of the year was the visit to this observatory of Prof. S. Chapman, Sedleian Professor of Natural Philosophy at the University of Oxford.

The old Magnetic Observatory which was closed down in 1923 was restarted and systematic observations of the magnetic elements were commenced from 1st November 1948.

During the year, a survey party of six scientists representing different branches of science proceeded to the Western Himalayas to explore suitable sites for a combined high-altitude observatory. Dr. R. Ananthakrishnan, Assistant Director of this observatory, joined the party to study the suitability of the sites from the astronomical standpoint.

Exchange of spectroheliograms with foreign observatories continued as in previous years. 281 K-flocculus plates relating to the period October 1947 to September 1948 were supplied to the Solar Physics Observatory, Cambridge and 7 photoheliograms for specified dates to the Royal Observatory, Greenwich. 141 K-flocculus and 174 H-alpha flocculus photographs relating to the period 1942-48 were received from the Meudon Observatory, France. The Mount Wilson Observatory supplied 91 K-Prominence and 78 H-alpha flocculus plates relating to the period January 1947 to June 1948.

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 Instrument Company.

*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.

5. Spectroheliograph made by the Cambridge Scientific Instrument Co. with an 18-inch Cooke siderostat and a 12-inch Cooke photo-visual lens of 21 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.

8. *Spectrograph I.*—With $3\frac{1}{2}$ prisms in Littrow mount and about 14 ft. focus, designed and built in this observatory. This is fed by a 12-inch Foucault siderostat in conjunction with an 8-inch lens.

9. *Spectrograph II.*—10 ft. concave grating in Rowland mounting designed and built in this observatory. A 12-inch polar siderostat designed and constructed in this observatory feeds this spectrograph independently. The polar siderostat is working temporarily with a 7-inch mirror until a mirror of appropriate size becomes available.

10. *Spectrograph III.*—20-ft plane grating spectrograph in Littrow mount using a $6\frac{1}{4}$-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 $3\frac{1}{2}$ prisms can be brought into use in its place.

11. *Spectrograph IV.*—Angularg rating spectrograph with collimator lens of about 7 ft. focus and camera lens of about 14 ft. focus using a $3\frac{1}{4}$-inch Rowland plane grating, designed and built in this observatory.

Sun light can be admitted into spectrographs III and IV 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 up to 16-inch sparks.

17. Large Dubois Electromagnet.

18. Small dividing engine by the Cambridge Scientific Instrumen 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.

With the restarting of the magnetic observatory, the following instruments are also in operation :—

25. Kew Magnetometer No. 3.

26. Kew Magnetometer No. 6, kindly loaned by the Survey of India, Dehra Dun.

27. One Earth Inductor (No. 40, Wild pattern).

28. One Horizontal Force Magnetograph (Watson type).

29. One Vertical Force Magnetograph (Watson type).

30. One Declination Magnetograph (Watson type).

3. *Routine Observations.*—Weather conditions were generally less favourable during 1948 than during the previous year. The average definition of the sun's image before 11 A. M. (I. S. T.) estimated on a scale in which 1 is the worst and 5 the best was 2·8 compared to 2·7 of the previous year. On 83 days the definition was 2 or less while on 26 days it was 4 or more. Observations of the sky conditions described in last year's report were continued. Systematic observations of sky and seeing conditions at 2100 and 03 hrs. every night were commenced from 1st October 1948. Observations with the photoheliograph, the prominence spectroscope, the spectrohelio scope and the spectroheliographs were carried out as usual. Direct photographs of the sun on a scale of 8″ to the sun's diameter were obtained on 305 days as against 304 in 1947. Disk spectroheliograms in the H-alpha and K lines were obtained on 286 and 275 days respectively and K-prominence plates were secured on 274 days. Quarterly statements of chromospheric eruptions were sent to Dr. L. d'Azambuja of the Meudon Observatory and Mr. H.W. Newton of the Royal Observatory, Greenwich.

Observations of the heights of prominences in Hα, D_3 and Hβ were continued with the Prominence Spectroscope. In all, 466 prominences were measured ; the heights of 325 prominences were determined in all the three lines, those of 99 in Hα and D_3 and the heights of the rest in Hαonly.

The heights of 325 prominences measured in Hα, D_3 and Hβ were compared with the corresponding heights obtained from the K-prominence spectroheliograms. The mean heights obtained were 53″. 6 in Ca, 48″.1 in Hα, 43″.1 in D_3 and 38″.9 in Hβ.

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.	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total.
Number of new groups. N.	16	11	10	16	14	14	13	12	11	16	17	17	167
Number of new groups. S.	19	22	14	20	15	13	20	19	16	14	6	17	195
Total.	35	33	24	36	29	27	33	31	27	30	23	34	362
Mean daily No.	7·7	5·6	4·2	9·7	6·9	8·1	7·4	10·0	6·5	6·3	5·6	7·0	7·1

Compared with 1947 the total number of new spot groups shows a decrease of 15·7% ; the mean daily number also shows a decrease of 12·3%. There were two days on which the sun's disc was free from spots. The approximate mean latitude of the sunspot groups for the whole year was 14° as against 17° of the previous year.

5. *Prominences.*—The mean daily areas and numbers of prominences as derived from the spectroheliograms taken at Kodaikanal during the year are :

Areas (in sqr. minutes).

	North.	South.	Total.
January—June	2·07	1·75	3·82
July—December	2·08	2·09	4·17

Numbers.

	North.	South.	Total.
January—June	6·46	5·80	12·26
July—December	6·30	6·04	12·34

As compared with the previous year's values, the prominence area showed a general decrease while the numbers remained practically unchanged. In the northern hemisphere, the decrease in area was 9%, while it was 31% in the southern hemisphere. The distribution of areas in latitude showed pronounced maxima in the zones 75°-80°N and 70°-75° S, with secondary maxima at 25°-30° in both hemispheres. In the distribution of numbers, the principal peaks of activity were in the zone 70°-75° in both the hemispheres, with secondary peaks at 20°-25°. The zone of maximum activity indicated a poleward drift in both the hemispheres as compared to last year.

19 metallic prominences were observed during the year with the prominence spectroscope. 10 of these were in the northern hemisphere and 9 in the southern hemisphere ; 11 were seen on the west limb and the rest on the east limb.

Doppler displacements of the Hα line in prominences were observed on 135 occasions with the prominence spectroscope. On 44 of these occasions, the displacements were towards red, in 42 cases towards violet and in the remaining in both the directions.

Observations made with the spectrohelioscope in Hα line showed Doppler displacements in prominences and dark markings on 76 occasions, of which 19 were seen towards red, 25 towards violet and the rest both ways.

The mean daily area of Hα absorption markings (without applying foreshortening correction) was 3382 millionths of the sun's visible hemisphere, representing a decrease of 27% as compared with the figure for the previous year. The latitudinal distribution in area showed maximum activity in the zones 20°-30°N and 10°-35°S with peaks at 25°-30°N and 30°-35°S.

6. *Solar Flares.*—In connection with a scheme sponsored by Dr. L. d' Azambuja, President, Commission No. 11, I. A. U., of collecting information about exceptionally intense solar flares from solar observatories all over the world and broadcasting the information for the benefit of geophysicists, arrangements were made for sending cablegrams to the Meudon Observatory whenever such flares were observed at Kodaikanal. During 1948 one such cablegram was sent concerning an exceptionally intense flare observed on 19th March 1948.

7. *The Brilliant Comet of November 1948.*—One of the brightest comets since the last appearance of Halley's comet in 1910, was observed during November 1948. The comet was a brilliant object in the southeastern sky in the early morning hours when it was first observed, and steadily receded from the sun in a westsouthwesterly direction. Systematic visual and photographic observations of the comet were made at this observatory commencing from 11th November 1948 till 14th December 1948 with several interruptions caused by bad weather. On 12th November 1948 the brightness of the nucleus of the comet was estimated at about 1·5 stellar magnitude and its tail extended to 28°. On 7th December 1948 when it was last photographed, the nucleus was very faint (about magnitude 5) and the tail had dwindled to less than 5°. By 14th December 1948 the comet had become a telescopic object.

8. *Research Work.*—Measurements made on a number of spectrograms of the H and K lines obtained under good atmospheric conditions with a 14-foot Littrow prism spectrograph (mean dispersion 0·45 Å/mm in this region) at various points of the solar disc showed that while the widths of H_3, H_2, K_3 and K_2 increase progressively from centre to limb, their ratios K_3/K_2, H_3/H_2, K_3/H_3 and K_2/H_2 remain practically constant all over the disc. The mean values of the width ratios obtained from these measurements were $K_3/K_2=H_3/H_2=0{\cdot}68$ and $K_3/H_3=K_2/H_2=1{\cdot}1$.

A statistical study of the Hα dark markings over a whole solar cycle (1933—1943) showed that the length to height ratio is most frequently 2 : 1. A parallel study of all clearly arch-type prominences photographed in the K line during the period 1908—1940 at Kodaikanal also showed that the ratio $\frac{\text{base}}{\text{height}}$ is most frequently 2 : 1. From these results it may be inferred that the fundamental shape of quiescent prominences is the semicircular arch, all other forms being probably variants of the fundamental type. Incidentally, this inference lends support to the theory of formation of prominences proposed by A. K. Das some years ago.

9. *Time.*—The standard clocks of the observatory were rated by comparison with Greenwich time signals.

10. *Seismology.*—The Milne-Shaw seismograph of this observatory recorded 162 earthquakes during the year. The details of the records are given in the Quarterly Seismological Bulletins published by the India Meteorological Department.

11. *Library.*—19 new books and 777 periodicals were added to the library during the year.

12. *Publication.*—Printed copies of the Annual Reports for the years 1942—1946 were received from the press. The Annual Report for 1947 was sent for printing.

The following note was sent for publication :—

"The Comet of November 1948"—*Science and Culture*, Calcutta.

A. K. DAS,
Director,
Kodaikanal Observatory.

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