REPORT OF THE KODAIKANAL OBSERVATORY FOR THE YEAR 1932.

This report is concerned with the astronomical and seismological 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.

2. *Preliminary.*—There has been a large decline in solar activity during the year 1932. The mean daily number of spots shows a decrease of 41 per cent, the mean areas of calcium prominences show a decrease of 47 per cent and the mean areas of hydrogen prominences a decrease of 38 per cent. The daily numbers of prominences decreased by 27 per cent and the areas of Hα absorption markings decreased by 37 per cent.

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.

Daily character figures of solar activity as regards Hα bright flocculi and Hα dark markings for the year 1931 as well as for the period 1918–1922 were communicated to the Observatoire Fèdèral, Zurich, under the auspices of the International Astronomical Union. The character figures for K bright flocculi from Kodaikanal plates are communicated by the Cambridge Observatory combined with their own. Eighteen original photoheliograms were supplied to the Greenwich Observatory, 335 original calcium disc spectroheliograms to Cambridge Observatory and 35 spectroheliograms (copies) to Meudon Observatory.

3. *Weather conditions.*—Weather conditions obtaining in the morning 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 2·4 on a scale in which 1 is the worst and 5 the best, whilst the number of days on which the definition was estimated as 4 or above was 27 as against 13 in the previous year.

4. *Photoheliograph.*—Photographs of the sun on a scale of 8 inches to the sun's diameter were taken on 342 days using a 6-inch achromatic object glass and a green colour screen.

5. *Spectroheliographs.*—Monochromatic images of the sun's disc in K light were obtained on 335 days, prominence plates in K light on 309 days, Hα disc plates on 291 days and Hα prominence plates on 264 days. The total number of spectroheliograms obtained during the year was 2,779.

6. *Six-inch Cooke Equatorial and Spectroscope.*—Work with this instrument has been continued on the same lines as formerly for the

visual observations of solar phenomena which cannot be readily photographed.

7. Eight staff meetings were held during the year.

8. The Leonid Showers were looked for on the nights of the 16th and 17th but were not seen.

9. *Research work.*—The forms and motions of prominences in calcium and hydrogen have been compared by the Director for the years 1929 to 1931 and are found to be essentially identical in the two elements. These facts constitute observational evidence against the theory of radiation pressure as the force supporting prominences and driving eruptive prominences away from the sun, unless it can be shown that the pressure (which can only be appreciable on atoms of ionised calcium) is in some way communicated to other atoms. It was also shown that the calculation of radiation pressure on calcium atoms must take into account the radiation in the bright wings of the line rather than the continuous radiation from the sun.

With a view to examining the measure of agreement between the theoretical intensities of spectral lines in a multiplet and those observed in the laboratory and in the sun, Dr. A. L. Narayan has photographed some multiplets of nickel in emission and absorption for photometric study. It is found that the more intense lines are relatively much stronger in absorption in the sun than in emission in the laboratory.

Using a specially constructed vacuum arc lamp containing a thallium amalgam, Dr. Narayan has measured the wavelengths of the resonance lines of Tl with an interferometer, and their variations of intensities and complexity with current have been studied.

Mr. P. R. Chidambara Ayyar has shown that two-days spots exhibit a minimum frequency between 30° and 50° longitude from the central meridian as in the case of one-day spots.

Mr. Chidambara Ayyar has also measured the intensity of absorption across the width of $H\alpha$ absorption markings by micro-photometric traces of spectroheliograms. He finds that the maximum of absorption is symmetrical near the centre of the sun and moves towards the limb side of the marking in other positions.

Mr. Md. Salaruddin has measured the change of areas of $H\alpha$ absorption markings as they cross the sun's disc. In order to explain the observed variation, he finds it necessary to assume that the average cross-section of the mass of gas producing absorption is triangular with the height about two times the base.

Mr. A. S. Rao, Research student, has investigated the spectrum of arsenic under different conditions of excitation and analysed it. He deduces an I.P. for the neutral atom of 10·5 V which is 0·9 V higher than Russell's estimate. The I.P. for As II is found to be 20·1 V. It would appear that the majority of persistent lines which are likely to appear in the sun's spectrum lie in inaccessible regions.

Mr. G. V. Krishnaswami, Reader in Mathematics, Annamalai University, has been engaged in correlating metallic prominences with disc phenomena as revealed in spectroheliograms.

Mr. C. P. S. Menon, Research Fellow of the Madras University, has investigated how far collisions can account for the presence of $H\alpha$ at the same height in the chromosphere and in prominences as Ca^+. He has also begun a photometric study of the the B band in the solar spectrum.

Summary of Sunspot and Prominence Observations.

10. *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 of spots are also given :—

1932.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
New groups ...	12	5	9	5	6	8	4	3	4	7	4	3	70
North	9	3	5	2	4	5	...	...	2	5	2	3	40
South	3	2	4	3	2	3	4	3	2	2	1	...	29
Equator	...	...	...	...	...	...	...	...	...	...	1	...	1
Mean daily numbers.	1·5	0·8	1·2	0·7	1·6	1·5	0·9	0·6	0·2	1·0	0·5	0·9	1·0

Compared with the previous year, the number of new groups observed has decreased by 39 per cent, and the mean daily numbers showed a decline of 41 per cent. During the year the sun was free from spots on 122 days as against 52 during the previous year. The northern hemisphere has continued to be more active than the southern. The approximate mean latitude of spots was 9°·1 in the northern hemisphere and 7°·2 in the southern hemisphere. Bright reversals of the H^{α} line in the neighbourhood of sunspots numbered 133 as compared with 300 in the previous year. Displacements of the H^{α} line on the disc totalled 9, as against 37 in the year 1931. Of these displacements, 8 were towards the red and 1 was towards the violet. D_3 was observed as a dark line on 123 occasions as against 282 in the previous year.

11. *Prominences.*—The mean daily areas of calcium prominences in square minutes of arc, as derived from the Kodaikanal spectroheliograms are as follows :—

	North.	South.	Total.
1932—January to June	1·35	1·32	2·67
July to December	0·98	0·77	1·75

Except for a peak between latitudes 40°—50° in the southern hemisphere in the first half of the year, the prominence activity up to latitudes 50° is fairly uniform ; the disappearance of the peak in the second half of the year accounts for the defect of areas in the southern hemisphere. The mean daily numbers of calcium prominences were 10·9 and 8·7 respectively in the first and second halves of the year.

As against 25 prominences exhibiting metallic lines observed during 1931, only two were observed during the first half of 1932 and none during the second half. One was at a latitude 16°·5 N and the other at latitude 12°·5 S. Displacements of the hydrogen line in the chromosphere and prominences observed during the year numbered 105 as against 245 in the previous year. Of the displacements 59 were towards the red, 45 towards the violet and 1 both ways simultaneously.

The mean daily areas of prominences projected on the disc as absorption markings in hydrogen light were 1,338 millionths of the sun's visible hemisphere. Their latitude distribution is very similar to that of prominences at the limb, except that in the southern hemisphere the activity in the second half of the year is practically confined to the belt 40°—50°, which is not the case for prominences at the limb.

The mean daily areas of hydrogen prominences in square minutes of arc are as follows :—

	North.	South.	Total.
1932—January to June	0·49	0·52	1·01
July to December	0·36	0·26	0·62

The distribution in latitude is generally similar to that of calcium prominences.

12. *Time.*—The error of the standard clock 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 time signals from the source to be joined through to this observatory. The signal is received with accuracy on most days and all failures are at once reported to the Postmaster-General, Madras. In addition, wireless time signals were also regularly received from Colombo, Calcutta and Rugby.

13. *Equipment.*—The Milne-Shaw seismograph was installed and regular records have been obtained from the 15th January.

A Cambridge recording microphotometer and accessories were received from England.

The Riefler clock of the Madras Observatory has been installed at Kodaikanal.

A Negretti and Zambra microbarograph was supplied to the Observatory from Poona and was set up.

An amplifying valve by Stohrer and Son was received by Home Indent.

14. *Seismology.*—The Milne-Shaw seismograph recorded 141 earthquakes during the year. For details of the records, reference may be made to the "India Weather Review."

15. *Publications.*—Summary of Prominence Observations for the first half of 1931, Kodaikanal Observatory Bulletin No. 94.

Prominences and Radiation Pressure, by T. Royds, Kodaikanal Observatory Bulletin No. 95.

The Variations in Areas of Hydrogen Absorption Markings with Longitude, by Md. Salaruddin, Kodaikanal Observatory Bulletin No. 96.

Two Longitudinal Zones of Apparent Inhibition of Sunspots on the Solar Disc, by P. R. Chidambara Ayyar, Kodaikanal Observatory Bulletin No. 97.

Summary of Prominence Observations for the second half of 1931, Kodaikanal Observatory Bulletin No. 98.

In addition the following papers were published by the members of the staff and research workers of the Observatory :—

The General Spectrum of the Night Sky Radiation, by K. R. Ramanathan, Indian Journal of Physics, 1932.

Two Longitudinal Zones of Apparent Inhibition of Sunspots on the Solar Disc (second paper), by P. R. Chidambara Ayyar, M.N.R.A.S., December 1932.

The Structure of H^{a} absorption markings on the Sun, by P. R. Chidambara Ayyar, Current Science, Bangalore.

Further Investigations of the Arc Spectrum of Arsenic, by A. S. Rao, Proc. Roy. Soc., London.

A Note on the First Spark Spectrum of Arsenic, by A. S. Rao, Current Science, Bangalore.

A Note on the Nuclear Spin Moment of the Thallium Atom, by A. S. Rao and A. L. Narayan, Current Science, Bangalore.

A Thesis on the Investigations of the Arc and Spark Spectra of Arsenic, by A. S. Rao. Thesis submitted to the Madras University.

A Note on the Nuclear Spin of Arsenic, by A. S. Rao, Current Science, Bangalore.

The Resonance Spectrum of Hydrogen, by K. R. Rao, Nature.

KODAIKANAL,
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