

REPORT
OF THE
ASTRONOMER ROYAL
TO THE
BOARD OF VISITORS
OF THE
ROYAL OBSERVATORY, GREENWICH.

Read at the Annual Visitation of the Royal Observatory, 1933 June 3.

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The President of the Royal Society SIR FREDERICK GOWLAND
HOPKINS.

The President of the Royal Astronomical Society PROF. F. J. M. STRATTON.

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Nominated as Fellows of the Royal Astronomical Society.	{	PROF. SYDNEY CHAPMAN. DR. H. KNOX-SHAW. SIR GERALD LENOX-CONYNGHAM. PROF. H. F. NEWALL. MR. J. H. REYNOLDS. PROF. F. J. M. STRATTON.

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REPORT OF THE ASTRONOMER ROYAL

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Read at the Annual Visitation of the Royal Observatory, 1933 June 3.

The Report here presented refers to the year from 1932 May 11 to 1933 May 10, and exhibits the state of the Observatory on the last-named day.

Sir Frank Dyson retired from the office of Astronomer Royal on February 28. The observations referred to in the present Report were thus mostly made under his direction.

I.—New Instruments :—

The 36-inch Reflecting Telescope presented, with its accessories, by Mr. W. Johnston Yapp, which is being constructed by Messrs. Sir Howard Grubb, Parsons and Co., is practically completed. The two smaller quartz mirrors are finished and the 36-inch mirror is in its final stages. The instrument has been erected in the makers' works where tests on the optical and mechanical performance will be carried out.

A slitless spectrograph, to be used in conjunction with the 36-inch reflector, is under construction by Messrs. Adam Hilger, Ltd. Its design is modelled on that of the existing spectrograph attached to the 30-inch reflector. The construction is in an advanced state. The large prism is finished and the mechanical parts have been completed.

The building and dome for the reflector have been completed. The dome is rotated by means of an endless cable driven by an electric motor ; it was tested on November 21 and found to be extremely satisfactory. The building was constructed

by the Civil Engineer-in-Chief's Department of the Admiralty and the dome was constructed and erected by Messrs. Sir Howard Grubb, Parsons and Co.

The buildings for the new transit circle are being erected by the Civil Engineer-in-Chief's Department. The collimator houses have been finished and the foundations of the observing house are complete. Considerable progress is being made with the construction of the instrument by Messrs. Cooke, Troughton and Simms, Ltd.

A micrometer of the long-screw type, for measuring astrographic plates, has been purchased from Messrs. Adam Hilger, Ltd. The errors of the screw and slide have been investigated and are satisfactorily small. The instrument is convenient and accurate in use. It is being employed for the measurement of the photographs of Eros taken during the opposition of 1930-31.

II.—Buildings and Grounds, Movable Property, and Library :—

The exterior of the dome housing the 28-inch equatorial has been repainted as has also been the external woodwork of the South Building. A new entrance to the clock cellar, opening on the North Terrace, has been constructed.

The refrigerating plant, used in connection with the testing of chronometers, has been overhauled. An electrically-driven grinding machine has been installed in the workshop.

The voltage of the electrical supply to the enclosure containing the old Magnetic Observatory has been changed from 110 volts to 220 volts. This change has been made to meet the demands which will be created by the erection of the new reflector and transit circle. Conduit pipes have been run from the main Observatory to the enclosure, to carry the additional electric cables required for use with these instruments.

A new 110-volt transformer to supply current for power purposes in the South Building has been installed.

At Abinger, the engines for generating electrical supply have been overhauled.

The following instruments which are in regular use have been lent to the Royal Observatory :—

The Cookson Floating Zenith Telescope, from the Cambridge Observatory, for a fourth period of seven years from July, 1932.

A 13-foot spectrohelioscope, complete with coelostat, but without grating, from the Mount Wilson Observatory.

A 7-inch prism of 40° angle, from the Joint Permanent Eclipse Committee.

A position micrometer for measuring solar photographs, from the Solar Physics Observatory, Cambridge.

A Schuster-Smith coil magnetometer for measurement of horizontal intensity, from the National Physical Laboratory.

A coil magnetometer, designed by the late Dr. W. D. Dye, F.R.S., for measurement of vertical intensity, from the National Physical Laboratory.

The following instruments, borrowed for observation of the Solar Eclipse of 1932 August 31, are stored at the Royal Observatory.

16-inch coelostat and two spectroscope slits from the Royal Astronomical Society.

Two 16-inch coelostats, one 12-inch coelostat, a 15-inch concave mirror and a 4-inch concave grating from the Joint Permanent Eclipse Committee.

A 6-inch lens of 45-feet focus, from J. H. Worthington, Esq.

Several other smaller instruments are also on loan to the Royal Observatory.

The following instruments have been lent by the Royal Observatory :—

To the Royal Observatory, Cape of Good Hope—

Transit A : Altazimuth B : Object glass of photoheliograph No. 1 : Clocks, Dent 1916 and Dent 2013.

To the University Observatory, Oxford—

Clock Arnold No. 2.

To the Solar Physics Observatory, Cambridge—

Photoheliograph object glass No. 5.

To the Imperial College of Science and Technology—

6-inch equatorial, Simms No. 2 : Altazimuth A.

To the Meteorological Office—

Three variometers, one recording apparatus, a dip inductor, and an ammeter, for use at Fort Rae, N.W. Canada, during the International Polar Year 1932-33.

To the Science Museum—

Harrison's Time Machines Nos. 2 and 3, and a number of other instruments of historical interest.

The restoration of Harrison's Time Machine No. 1, referred to in last year's Report, has been completed. The machine was returned in going order on February 3 together with a complete set of drawings, prepared by Commander Gould, on which all repaired parts, replacements and modified winding apparatus

(A 313/1170)g

A 3

are distinctly marked for future guidance. In connection with the restoration of the mechanism Messrs. T. and F. Mercer, of St. Albans, very generously, at appreciable cost to themselves, rendered valuable assistance in making and supplying the special set of balance springs required and in carrying out Commander Gould's design for winding the machine.

The annual examination of the Library has been made. Thirteen books are reported missing and cannot be accounted for at present, including four reported last year. One of the books missing last year has since been found.

III.—Astronomical Observations :—

Transit Circle.—The Sun, Moon, planets and fundamental stars have been regularly observed. Progress has been made with the programme commenced in 1931.

The total number of observations made during the year is as follows :—

Transits	12,035	Zenith Distances	11,464
Collimation.. .. .	285	Nadir point	641
Level	664		

The Sun was observed on 128 days and the Moon on 91 days.

Transits are reduced as far as apparent place to April 18 and zenith distances to April 18.

The observations of the Moon continue to show a decrease in the correction to the longitude given by Brown's Tables which were introduced into the Nautical Almanac in 1923.

Year.	Longitude.		Latitude.		No. of observations.	
	Limb.	Mösting A.	Limb.	Mösting A.	Limb.	Mösting A.
1923 ..	+ 6.99	+ 7.47	— 0.36	— 0.43	101	60
1924 ..	+ 7.21	+ 7.14	— 0.62	— 0.39	87	54
1925 ..	+ 6.61	+ 6.71	— 0.67	— 0.55	90	52
1926 ..	+ 6.40	+ 6.55	— 0.48	— 0.72	93	66
1927 ..	+ 6.20	+ 6.24	— 0.50	— 0.71	80	43
1928 ..	+ 5.51	+ 5.88	— 0.73	— 0.46	97	60
1929 ..	+ 5.20	+ 5.89	— 0.58	— 0.60	108	67
1930 ..	+ 5.08	+ 5.40	— 0.73	— 0.63	82	47
1931 ..	+ 4.76	+ 4.87	— 0.82	— 0.71	69	46
1932 ..	+ 4.61	+ 4.56	— 0.81	— 0.77	85	57

The above values are referred to Newcomb's Equinox and adopted colatitude of $38^{\circ} 31' 21''.70$.

The Second Greenwich Catalogue of Stars for 1925, from observations made over the period 1922-30, is now in the hands of the printer.

About 2,100 stars are contained in Part I, comprising fundamental and latitude stars. Part II gives all stars brighter than 8.0 magnitude and some fainter, between the limits of $+32^\circ$ to $+64^\circ$, in all about 10,600 stars.

Proper motions are given for all stars in the catalogue. For stars in Boss' Preliminary General Catalogue a revision of the proper motion as determined by Boss has been made, and for other stars the proper motions have been independently determined by comparison with other catalogues.

Cookson Zenith Telescope.—During the year, 243 plates were taken for latitude variation, and 4 for determination of scale. The results for 1932 were published in the *Monthly Notices* for 1933, March.

28-inch Equatorial.—During the year, 450 observations of 287 double stars were made. These consist of :—

61 double stars, with separation $< 0''.5$.			
95	„	„	$0''.5$ to $1''.0$.
78	„	„	$1''.0$ to $2''.0$
53	„	„	$> 2''.0$

Thompson Equatorial.—With the 26-inch refractor, 1,424 photographs were taken for stellar parallax. Of these, 339 were rejected mainly on account of poor meteorological conditions. During the year, 1,194 plates were measured and the parallaxes of 40 stars determined. The usual annual publication of results was made in the *Monthly Notices* for November.

The manuscript of "Observations of Stellar Parallax, Vol. II," containing the parallaxes of 250 stars, is in the hands of the printer.

With the 30-inch reflector, in pursuance of the determination of colour temperatures of stars, 112 comparisons of 43 stars have been made with the Standard System. The measurement is nearly up to date.

A volume has been published containing the absolute colour temperatures of 63 stars. The zero of the system was derived by comparison with a Kodak acetylene burner. Although it is considered that the zero thus obtained is not greatly in error yet a degree of uncertainty was introduced by an unexpected variation in the temperature of the acetylene flame. The zero, therefore, is being redetermined by comparison with a set of three 100-volt standard lamps which have been calibrated at the National Physical Laboratory and will be checked at frequent intervals.

(A 313/1170)g

A 4

Astrographic Equatorial.—The preparation of the copy for press of Vol. VI of the Greenwich Astrographic Catalogue was completed. The proofs have been read and the volume published. This volume contains the proper motions of all stars between declination $+72^\circ$ and the North Pole which are in the Bonn Durchmusterung and also of fainter stars whose proper motions exceed $3''$ per century. A list is given of 252 stars in this region of the sky having proper motions exceeding $20''$ per century. With the publication of this volume, the programme of the determination of the proper motions of the stars from declination $+64^\circ$ to the North Pole, commenced in 1923, has been completed and the survey of the Greenwich Astrographic Zones has been brought to a conclusion.

The following plates have been taken with the telescope during the year :—

Eclipse of Moon 1932 September 14	22 plates.
Eros Path Fields (for check)	3 plates.

Two plates of Nova Geminorum 1933, with exposures 15^m and 20^m , were taken on March 23. The nova was not shown on either of the plates.

Observations of Eros.—Good progress has been made with the measurement of the photographs taken in connection with the recent near opposition in 1930–31 of the planet Eros. The plates exposed with the Astrographic Equatorial on the fields covering the track of the planet have all been measured and the work of reducing the measures is proceeding. These photographs were taken for the purpose of obtaining good determinations of the positions of the secondary comparison stars. The plates were measured against a réseau. These measures will give the positions of 2,396 stars on Dr. Schorr's list. The meridian places of the reference stars in the list compiled by Dr. Kopff are being utilised for the deduction of the plate constants.

The plates exposed on Eros itself with the 26-inch refractor are being measured on the long-screw Hilger micrometer recently purchased. 101 of these plates have been measured in right ascension and 68 in declination. The measurement of the Eros plates secured with the Astrographic Equatorial has not yet been commenced.

Photoheliograph.—Photographs of the Sun were obtained on 281 days with either the Dallmeyer 4-inch photoheliograph or the Thompson 9-inch. The number of photographs selected for preservation is 550, including 43 with double images of the Sun for the determination of the zeros of position angle. The zeros of position angle have also been determined regularly by visual observations.

H.M. Astronomer at the Cape has reported that the Sun was photographed there on 336 days in the year 1932, and on 88 days in the first three months of 1933. The Director of the Kodaikanal Observatory has reported that plates were taken there on 342 days in the year 1932 and on 88 days during the first three months of 1933.

Photographs have been received from the Royal Observatory, Cape of Good Hope, to 1933 January 23. Seven photographs have been received from the Kodaikanal Observatory to complete the series for 1932.

The measurement of the combined series has been made from 1932 January 28 to 1933 January 1; the Greenwich plates have been measured to 1933 March 11. The reductions of positions and areas of spot groups and their principal components have been completed from 1932 January 2 to December 31 and the reductions of the Greenwich plates carried to 1933 February 5.

Sunspot activity decreased still further during the year, and the minimum of the 11-year cycle may be expected shortly. A few large spots, however, made their appearance. The largest of these had a maximum area of 1,500 millionths of the sun's hemisphere and crossed the sun's central meridian on February 7.5. Another large group of spots, which attained an area of 1,100 millionths, began as a very small spot near the centre of the disc on November 16. The leading spot of this group returned to the central meridian on December 13.0 (when the area of the spot was 500 millionths) and again on January 9.0 and February 5.4. An associated dark flocculus observed with the spectrohelioscope on December 17 had a measured radial velocity of 90 km/sec. inwards to the sun, but generally the spot did not appear to be active spectroscopically.

Photographic prints of solar negatives from 1932 January 1 to December 31 have been supplied to the Solar Physics Observatory, Cambridge. Twenty-six prints for various dates during 1932 were also supplied, for a special research, to Dr. Minnaert at the Physical Laboratory, Utrecht. A duplicate set of solar negatives for the years 1930 and 1931 has been sent to the Science Museum, South Kensington.

Daily spot-numbers, both for the whole disc and for a central zone of the Sun, based on Wolf's method of counting, have been supplied quarterly to Zurich for incorporation in the *Bulletin for Character Figures of Solar Phenomena*, published under the auspices of the International Astronomical Union. Spot-numbers for the central part of the disc have also been supplied retrospectively for the year 1917.

(A 313/1170)g

A 5

Spectrohelioscope.—The sun's disc was examined in $H\alpha$ light with the spectrohelioscope whenever possible. Observations of bright and dark flocculi and of prominences were made on 184 days; on about 30 of these days observations were possible for a few minutes only. A special watch was kept for bright eruptions of $H\alpha$ on the disc and for active dark flocculi associated with sunspots. Eight bright eruptions of minor extent were observed in the vicinity of sunspots, the largest measured radial velocity of the associated dark flocculi being 110 km./sec. outwards from the Sun on October 6. Radial velocities of 164 dark flocculi near sunspots were measured. A summary of the measures made during 1932 has been communicated in a paper to the Royal Astronomical Society.

Eclipse of the Sun.—Two observers, Dr. Jackson and Mr. Davidson, were sent to observe the solar eclipse of 1932 August 31 at Parent on the Canadian National Railway.

In common with most of the other expeditions the results were spoilt by cloud. However, an excellent photograph of the spectrum of the chromosphere was secured with the 6-inch objective prism by Mr. Witchell (who joined the expedition at Parent). Direct photographs of the corona were also obtained with the 6-inch lens of 45-feet focus, kindly lent by Mr. Worthington.

IV.—Magnetic Observations.

Regular magnetic observations have been made at Abinger throughout the year. The variations of declination, horizontal and vertical force have been recorded photographically. In connection with the "Second International Polar Year" the variations have been recorded on a time-scale twelve times as great as the normal scale (that is to say on a scale of 180 mm. to the hour) on four specified days in each month commencing August 1932. Similar records were also taken on the three days August 30 to September 1 which include the day of the total solar eclipse.

Absolute observations of declination, of horizontal force with the Schuster-Smith coil magnetometer, and of vertical force with the Dye coil magnetometer are made every week-day. The measurements both of the horizontal and vertical components of magnetic force are now dependent upon electrical standards, but observations of horizontal force with a unifilar magnetometer and of inclination with an inductor have been taken frequently, for purposes of comparison.

The Observatory is indebted to the National Physical Laboratory for periodical re-measurement of the electrical constants of the potentiometers which are essential accessories to the coil magnetometers.

As regards the reduction of observations, the mean hourly ordinates of all the traces have been read off to date. The reduction of absolute observations is complete to 1932 December 31, and with provisional constants to the present time.

The tabulation of results for 1932 is complete, and the copy for press is in the printer's hands.

The mean values of the magnetic elements at Abinger for the year 1932 are given below. The values for 1929 to 1931 are given for comparison.

		Decl. W.	Hor. Force.	Vert. Force.	Inclination.†
1929..	..	12° 35'·8	0·18555	0·42918	66° 37'·2
1930..	..	12° 24'·6	0·18542	0·42924	66° 38'·2
1931..	..	12° 13'·7	0·18544	0·42923	66° 38'·1
1932..	..	12° 2'·6	0·18536	0·42940	66° 39'·1

The weekly report of mean hourly values of declination has been sent regularly to several offices for publication or information—a service maintained in conjunction with Eskdalemuir Observatory.

Two coil magnetometers have been tested during the year, and the coil constants determined. One of these was of the Smith portable type for measurement of horizontal force; the other was for measurement of vertical force by the method used in the Dye instrument. Four portable instruments for measuring changes of the vertical component of the earth's field have also been examined for the determination and certification of their constants. Two inertia cylinders have been standardised against the Greenwich Standard.

It is proposed to investigate the site difference in horizontal force between the pavilion for absolute observations and the new pavilion which was erected last year for standardising instruments. For this purpose a portable coil magnetometer of the Smith pattern has been borrowed from the Ordnance Survey Department.

The Superintendent of the magnetic department made a series of observations of horizontal force at Eskdalemuir Observatory between January 24–30, using the Kew-pattern magnetometer Casella 181 which is in use at Abinger, for the purpose of obtaining a comparison between the standard instruments in use at the two Observatories.

In connection with the Magnetic Survey of the British Isles by the Ordnance Survey Department, Mr. H. L. P. Jolly visited the Abinger Station before the

† These values are deduced from observations with the coil magnetometers, and are not derived from actual observation of the angle of inclination.

commencement of his surveying programme in 1932 for the purpose of comparing his instruments with the Abinger standards.

V.—Meteorological Observations :—

The registration of atmospheric pressure, temperature of the air and of evaporation, the direction, pressure and velocity of the wind, the amount of rainfall, sunshine and cloudiness at night, has been maintained continuously. Estimates of visibility have been made by eye at definite hours.

Registration of the electric potential gradient of the atmosphere, which was suspended during the erection of the building for the Yapp Equatorial Telescope, was recommenced on November 15 on the fresh site mentioned in the last Report.

As stated last year it was also necessary to remove the thermograph and the standard thermometer screen to temporary sites on account of the new buildings. Fresh permanent sites will not be chosen until the new conditions can be studied as a whole from the point of view of meteorological suitability.

The tabulation of results for 1932 is complete and the copy for press is in the printer's hands.

The following details of the weather refer to the period of twelve months ended 1933 April 30 :—

The mean temperature was $50^{\circ}\cdot 5$ which is $1^{\circ}\cdot 0$ above the average of the 75 years 1841–1915. The highest temperature in the shade was $98^{\circ}\cdot 9$ registered on August 19. The temperature also exceeded 90° on the day preceding and the day following August 19. The lowest temperature was $20^{\circ}\cdot 0$ on January 23. Temperatures of freezing point or below were recorded on 42 days. The mean daily horizontal movement of the air was 275 miles, which is 10 miles below the average for 50 years 1867–1916. The greatest daily movement was 560 miles recorded on February 1 ; the least daily movement was 130 miles on December 26. The greatest motion in one hour, 33 miles, was recorded on March 17. The greatest pressure reached was 19·4 lbs. to the square foot, on March 17. The duration of bright sunshine recorded was 1,240 hours, or 27·7 per cent. of the possible total. There were 71 entirely sunless days, of which 40 occurred in the winter months November to January. There were 28 entirely cloudless nights, that is nights on which an unbroken trace of Polaris was obtained by the Night-Sky Camera. The total rainfall was 24·77 inches, that is 0·53 inches more than the average for 75 years 1841–1915, and measurable rain fell on 165 days. The wettest month was October with 5·37 inches. The driest month was June with 0·27 inch.

VI.—Printing and distribution of Greenwich Publications :—

A small volume, Observations of Colour Temperatures of Stars, has been distributed.

The distribution of the volume of Greenwich Observations for 1931 and its separate parts, together with Volume VI of the Greenwich Astrographic Catalogue, is proceeding.

The MSS. of Volume II of Observations of Stellar Parallax, of the Second Greenwich Catalogue of Stars for 1925, and of part of the Volume of Greenwich Observations for 1932 have been forwarded to H.M. Stationery Office.

VII.—Chronometers :—

The number of chronometers and watches belonging to the Admiralty now at the Observatory is 2,976. Of this total, 173 chronometers, 173 chronometer watches, 327 hack watches and 36 pocket watches are being rated. Five are in regular use in the Observatory. The remainder, consisting of 425 chronometers, 1,028 chronometer watches, 231 hack watches and 578 pocket watches are kept in storage.

In addition to Admiralty chronometers there are 45 chronometers and 18 watches deposited at the Observatory for various reasons.

During the year ended 1933 April 30, a total of 1,463 chronometers and watches has been received and 1,554 issued. The number sent for repair was 724, viz. : 665 for the Admiralty, 47 for the Indian, 1 for the New Zealand, and 3 for the Canadian Governments, and 8 for the Royal Air Force.

During the year 5 chronometers, 23 chronometer watches, and 72 pocket watches have been sold out of surplus stock, and 10 chronometers have been transferred to the Naval Ordnance Department.

VIII.—Time Service :—

The time determinations were made by means of the reversible transit instrument B, fitted with impersonal micrometer, until April 5. A similar instrument, transit D, was substituted and used subsequent to April 7. The pivots of transit B have been re-ground. When possible, observations are made at intervals of not more than 5 days. In the year 1932 May 11–1933 May 10, observations have been made on 81 nights.

The Clock Shortt No. 11 was used as standard sidereal clock until June 1 when No. 3 was substituted and used until November 22 when it was replaced by No. 11.

The service of rhythmic time signals at 10^h and 18^h transmitted through the Post Office wireless station at Rugby, and also the daily time signals to the General Post Office and the British Broadcasting Corporation, have been transmitted regularly. The Free Pendulum Clock, Shortt No. 16, controls the mean time clocks used for the Post Office and Broadcast signals, in addition to the rhythmic signal transmitter.

At the request of the Director of the Bureau International de l'Heure a signal of ten seconds duration is now transmitted immediately following the Rugby series at 10^h and 18^h. The purpose of these signals is the determination of time-lags in receiving and recording sets.

The corrections to the transmitted times of the rhythmic signals for adjustment to the final time determinations are published and distributed periodically by the Hydrographer of the Navy in "*Notices to Mariners*."

The Time Ball did not drop at 13^h on September 27 owing to failure of the clock signal contact.

The performance of the time balls at the Admiralty Signal stations and also the Westminster Clock is shown by the following table of the errors of the return signals.

Error of Return Signal.	Portsmouth.	Portland.	Devonport.	Westminster.
Not greater than 0 ^s .2	205	199	217	114
0 ^s .3 to 0 ^s .5	1	4	4	83
0 ^s .6 to 1 ^s .0	0	1	3	97
Greater than 1 ^s .0	0	1	9	9

The clocks at the Admiralty stations are corrected daily by the 10^h signal, but the Westminster Clock is not so corrected.

Wireless time signals are received regularly from the Eiffel Tower, Nauen, Bordeaux and Annapolis. These are registered automatically, and the corrections found for the Nauen, Bordeaux and Annapolis signals are published monthly for distribution in "*Notices to Mariners*," together with the corrections to the Rugby signals.

The following table gives the monthly means of the differences from Greenwich shown by the various time signals, using the final clock errors derived from

observations made with the small reversible transit instrument B at Greenwich, and the corrections for final time determinations published by Paris, Hamburg and Washington Observatories.

The Annapolis signals have been corrected for lag of land line to Washington and by 0^s.02 for time of travel.

1932.	Paris 9½ ^h Rhythmic.	Nauen 12 ^h Rhythmic.	Annapolis 17 ^h .	Bordeaux 20 ^h Rhythmic.
	S.	S.	S.	S.
January	— .034	— .016	— .006	— .036
February	— .009	— .020	— .006	— .007
March	— .012	+ .023	+ .017	— .011
April	+ .022	+ .024	+ .025	+ .026
May	+ .014	+ .003	+ .021	+ .021
June	+ .010	+ .013	+ .030	+ .012
July	+ .031	+ .054	+ .047	+ .035
August	+ .057	+ .050	+ .085	+ .062
September	+ .023	+ .041	+ .060	+ .024
October	+ .021	+ .016	+ .059	+ .025
November	— .001	+ .017	+ .065	+ .004
December	— .025	+ .033	+ .069	— .013
Mean	+ .008	+ .020	+ .039	+ .012
Number of comparisons	303	301	343	351

The sign + means late on Greenwich. The reference point for all comparisons is the commencement of the signals. The Nauen times have been referred to the Eichelberger system of star places.

IX.—Personal Establishment :—

The permanent staff at the present time is constituted as follows :—

Chief Assistants.—Mr. Greaves, *One vacancy*.

Assistants.—Mr. Bowyer, Mr. Davidson, Mr. Furner, Mr. Witchell.

Junior Assistants (Higher Grade).—Mr. Acton, Mr. Cullen, Mr. Melotte, Mr. Stevens.

Junior Assistants.—Mr. Barton, Mr. Chamberlain, Mr. Finch, Mr. Jeffries, Mr. Martin, Mr. Newton, Mr. Rickerby, Mr. Rickett, Mr. Symms and Mr. Wells.

Clerical Assistant.—Mr. Edney.

20 Computers, including 6 ladies, are employed at the Observatory.

Dr. Jackson resigned on March 1st the post of Chief Assistant, which he had held since 1914 October 8, in consequence of his appointment as His Majesty's Astronomer at the Cape. Dr. Jackson had associated himself particularly with the meridian and double-star observations and had made a detailed study of the performance of the free-pendulum clocks. He was in charge of three expeditions from the Observatory, to observe a total eclipse of the sun. The vacancy caused by Dr. Jackson's resignation has not yet been filled.

The present arrangement of the staff under the general superintendence of the Chief Assistants is as follows :—

Branch.	Established Staff.	Unestablished Staff.
<i>Transit Circle, Altazimuth and Zenith Telescope.</i>	Mr. Furner, Mr. Cullen, Mr. Acton, Mr. Symms.	Mr. Slator, Mr. Blackwell, Mr. Malyon, Mr. Diston, Mr. Larkin, Mr. Grimwood, Mr. Stockwell.
<i>Time Signals and Chronometers</i>	Mr. Bowyer, Mr. Rickett ...	Mr. Harris, Mr. Shortland, Mr. Rudd.
<i>Thompson Equatorial ...</i>	Mr. Davidson, Mr. Martin ...	Miss Jeffries, Miss French.
<i>28-inch Equatorial ...</i>	Mr. Furner ...	—
<i>Astrographic Equatorial ...</i>	Mr. Melotte, Mr. Jeffries, Mr. Finch.	Miss Bonnett, Miss Cumberledge.
<i>Photoheliograph and Spectro-helioscope.</i>	Mr. Newton, Mr. Barton ...	Mr. Carter, Mr. Howes.
<i>Small Transit ...</i>	Mr. Finch ...	
<i>Magnetic and Meteorological ...</i>	Mr. Witchell, Mr. Stevens, Mr. Wells, Mr. Rickerby.	Miss Clack, Mr. Dennis, Mr. Deeks.
<i>Secretariat and Library ...</i>	Mr. Edney, Mr. Chamberlain ...	Miss Brickman.

The staff of workmen now employed consists of a foreman of works, two joiners, a mechanic, a boy assistant mechanic, a gate porter, two messengers, a night watchman, a gardener, three labourers and a charwoman. There is also a mechanic at Abinger who has charge of the engines and acts as caretaker.

X.—General Remarks :—

The Observatory was visited by the Maharajah and Maharani of Porbandar on August 18 and by Princess Katherine of Greece on September 30.

Mr. J. A. Madeira, of Coimbra Observatory, continued his studies of different branches of the work at Greenwich until August.

Mr. S. Kawasaki, of the International Latitude Observatory, Mizusawa, Japan, worked at the Observatory from July to October.

Dr. de Graaf Hunter, late Director of the Geodetic Survey of India, studied in May, 1933, the methods used for determining time and longitude with the portable transit instrument.

The copies of the Standard Yard and Pound, kept at the Royal Observatory, were removed on November 10 by the Standards Department of the Board of Trade for comparison.

The magnetic station at Abinger is being used to an increasing extent by the manufacturers of magnetometers and other magnetic instruments for the testing and certification of such instruments. Assistance has been given to manufacturers by testing of instruments of new design required for geophysical purposes.

The work of the Greenwich Observatory on the Astrographic Zones from declination $+64^\circ$ to the North Pole, assigned to it as its share in the international plan for the mapping of the heavens, has been brought to a completion with the publication of Vol. 6 of the Astrographic Catalogue. The work at Greenwich on these Zones has extended over about 40 years. The two volumes, 5 and 6, together contain the proper-motions of about 16,500 stars in the Bonn Durchmusterung and of about 13,500 fainter stars. The stars selected for stellar parallax observations at Greenwich with few exceptions are in this same area of the sky. The general data available as to stellar positions, magnitudes, proper motions and parallaxes are thus more complete for this than for any other region of the sky.

In addition to Vol. 6 of the Astrographic Catalogue, published during the year and referred to above, two other volumes of importance have been sent to the printer. The Second Greenwich Catalogue of Stars for 1925 contains the positions of all stars from dec. $+32^\circ$ to $+64^\circ$, to a magnitude limit of $8^m.0$, based on observations with the transit-circle during the years 1922 to 1930. With the

18 REPORT OF THE ASTRONOMER ROYAL TO THE BOARD OF VISITORS, 1933 JUNE 3.

completion of the observations of the present working list, which was commenced in 1931 and includes stars in the region from the equator to dec. $+24^\circ$, to a magnitude limit of $7^m.5$ but with the addition of many fainter stars, the observation at Greenwich since 1897 of all the stars in the northern sky down to the limit of $7^m.5$ or fainter will be completed. Observations of the region from the Pole to dec. $+64^\circ$, from 1897 to 1905, were published in 1909 as the Second Nine Year Catalogue; those of the region from dec. $+24^\circ$ to dec. $+32^\circ$, extending from 1906 to 1914, were published in 1920 as the Catalogue of Stars for 1910. The proper motions of many of these stars have been determined from meridian observations and published in the catalogues. The present programme of observation will be the last fundamental programme with the Airy transit circle with which, since the year 1851, some 600,000 star transits have been observed.

The second volume of Determinations of Stellar Parallaxes, containing details of observations of 250 stars, completes the determination at Greenwich of the parallaxes of 500 stars. This work is somewhat handicapped by the limited space in the dome preventing the employment of a dewcap of sufficient length to be effective to prevent dewing of the objective in the winter months. Considerable loss of observation is thereby entailed. Proposals for avoiding such loss of observation are under consideration.

With the completion of the work on Harrison's Time Machine No. 1, referred to previously, Lieutenant-Commander Gould has completed his work on Harrison's four timekeepers. For the machines Nos. 1 and 3, Commander Gould made full-sized drawings of all parts. These drawings, together with his notes and work-books, he has presented to the Observatory. If at any subsequent time it should become necessary to give further attention to the machines, the work will thereby be much facilitated. The Observatory is deeply indebted to Commander Gould for the great amount of time which he has voluntarily expended in the intricate task of restoring these historical time-pieces and for the care with which the restoration has been carried out, with the result that the machines can now be seen in going order and practically as they were left by Harrison. As an outcome of the work on these machines, it has been possible for Commander Gould to place on record many of Harrison's principles and designs, of which little was hitherto known.

H. SPENCER JONES.

Royal Observatory, Greenwich.

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