REPORT

OF THE

ASTRONOMER ROYAL

TO THE

BOARD OF VISITORS

OF THE

ROYAL OBSERVATORY, GREENWICH.

Read at the Annual Visitation of the Royal Observatory, 1931 *June* 6.

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The Report here presented refers to the year from 1930 May 11 to 1931 May 10, and exhibits the state of the Observatory on the last-named day.

A generous offer to present a large telescope to the Observatory was made to me by Mr. William Johnston Yapp on March 13. After careful consideration it was decided that a 36-inch reflector would be the most useful addition to the equipment of the Observatory. To meet the cost of this instrument, with a spectroscope and a new 34-foot dome, Mr. Yapp has given £15,000. This munificent and public-spirited gift has been gratefully accepted by The Lords Commissioners of the Admiralty.

The new telescope will be devoted in the first place to spectroscopic observations of colour temperatures which have been carried on with some difficulty, as the 30-inch reflector is not separately mounted and not available when the 26-inch refractor is in use.

An order for the telescope and dome will be placed with Messrs. Sir Howard Grubb, Parsons & Co.

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

The external painting of the Astrographic, Sheepshanks, Altazimuth, Photoheliograph, and Transit Pavilion domes was completed on July 10, 1930.

The south vertical shutter of the transit circle room, which was in a bad condition, was removed and a new one fixed on July 10.

A considerable amount of redecoration and many small repairs have been carried out by the Works Department during the year.

The painting of the wall of the 28-inch dome after the installation of the motor referred to below, and the staircase to the dome, was completed in March.

The principal rooms in both storeys of the South Building as well as the central rooms and lobbies, and also the Workshop, have been repainted. The lead work on the turrets has been renewed. The painting in this building was completed in April.

The renewal of some of the wood-work and the external painting of the buildings in the courtyard of the Observatory is in progress at the date of this report.

The installation of a motor for turning the dome of the 28-inch Equatorial was completed in January. A three horse-power motor is carried on the dome, the current being supplied by contact pieces rubbing on insulated rails fixed to the walls of the building.

The large wireless aerial, stretching from the Octagon Room to the South Building, was taken down in October as it was found no longer necessary.

At Abinger the positive plates of the main battery were renewed during August and September. New wooden casing has been erected round the water-tower. A cement flooring has been laid in the office where the wooden floor had suffered from dry rot.

A new steel silencer for the oil engines has been substituted for the brick one which was damaged by a small explosion.

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 third period of seven years from July, 1925.

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.

Schuster-Smith Coil Magnetometer for measurement of Horizontal Intensity, from the National Physical Laboratory.

A Coil Magnetometer, designed by Dr. D. W. Dye, F.R.S., for measurement of Vertical Intensity, from the National Physical Laboratory.

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 Science Museum—
Harrison Time machine No. 2, and a number of other instruments of historical interest.

Reference has been made in previous reports to the restoration of Harrison's Time Machines, Nos. 1, 2 and 4. The more complicated machine No. 3, offered peculiar difficulties which have been surmounted by the care and skill of Commander Gould. The Observatory is greatly indebted to him for the trouble and time he has generously given to the repair and preservation of these historic instruments.

The annual examination of the Library has been made. Five books are reported missing and cannot be accounted for at present. These were missing last year. Three of the books missing last year have been found.

II.—Astronomical Observations:—

Transit Circle.—The Sun, Moon, major planets and fundamental stars have been regularly observed.

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

Transits	11,175	Circle Observations ..	11,253
Collimation	276	Nadir point	648
Level	676		

The Sun was observed on 131 days and the Moon on 79 days.

Transits are reduced as far as apparent place to April 25 and Zenith Distances to April 11. Mean places for the Equinox 1925·0 have been determined as far as 1930 December 31. The planetary ledgers are completed to 1930 December 31.

It may be of interest to give the corrections to the Sun's longitude as derived from Newcomb's Tables, which have been used in the *Nautical Almanac* since 1901.

	″		″		″
1901 ..	−0·05	1911	+0·93	1921	+1·44
1902 ..	−0·04	1912	+0·97	1922	+1·65
1903 ..	−0·13	1913	+0·83	1923	+1·54
1904 ..	+0·27	1914	+0·88	1924	+1·63
1905 ..	+0·28	1915	+1·30	1925	+1·64
1906 ..	+0·25	1916	+1·56	1926	+1·71
1907 ..	+0·37	1917	+1·45	1927	+1·66
1908 ..	+0·96	1918	+1·49	1928	+1·68
1909 ..	+0·63	1919	+1·55	1929	+1·60
1910 ..	+0·77	1920	+1·47	1930	+1·64

These are all referred to Newcomb's Equinox.

The change in the method of observing may be responsible for the change between 1914 and 1915. The increase in the correction during the first half of the period and its steadiness in the second half is generally supported by the declination observations which give the longitude of the Sun from the true equinox.

The observations of the Moon show a fairly regular decrease in the corrections to Brown's Tables introduced into the *Nautical Almanac* in 1923.

	Longitude.		Latitude.		No. of observations.	
	Limb.	Mösting A.	Limb.	Mösting A.	Limb.	Mösting A.
	"	"	"	"		
1923 ..	+ 6·99	+ 7·47	— 0·56	— 0·63	101	60
1924 ..	+ 7·21	+ 7·14	— 0·82	— 0·59	87	54
1925 ..	+ 6·61	+ 6·71	— 0·87	— 0·75	90	52
1926 ..	+ 6·40	+ 6·55	— 0·68	— 0·92	93	66
1927 ..	+ 6·20	+ 6·24	— 0·70	— 0·91	80	43
1928 ..	+ 5·51	+ 5·88	— 0·93	— 0·66	97	60
1929 ..	+ 5·20	+ 5·89	— 0·78	— 0·80	108	67
1930 ..	+ 5·08	+ 5·40	— 0·93	— 0·83	82	47

The observations for the second Greenwich Catalogue of Stars for 1925 were completed on December 31. It will contain about 10,800 stars between declinations +32° and +64°. Five observations were obtained of 10,300 of the stars and four of the remaining 500. Good progress is being made with the formation of the Catalogue. Precessions and Secular Variations have been calculated. The observations have been collected on the Catalogue sheets to the end of 1929 and those for 1930 are now being entered.

Observations on a new programme were commenced in 1931. The observing catalogue contains all stars down to $7.^{m}5$ in the Draper Catalogue between 0° and +24°, as well as the stars in Boss' Preliminary General Catalogue between declination +64° and the pole. With the fundamental stars there are about 7,500 stars in the Working Catalogue. This is probably the last considerable undertaking of Airy's famous instrument which has been in constant use since 1851.

Cookson Zenith Telescope.—During the year, 238 plates were taken for latitude variation, and 7 for determination of scale. The results for 1930 are published in the *Monthly Notices* for 1931, March.

A new measuring micrometer, of the type used for measuring spectra, has been obtained from Messrs. Adam Hilger. This will greatly increase the speed of measurement,

which has hitherto been made on an old machine, originally constructed for measurement of transit of Venus photographs.

28-*inch Equatorial.*—During the year, 357 observations of 258 double stars were made. These consist of :—

52	double	stars,	with	separation $< 0''\cdot 5$.
76	„	„	„	$0''\cdot 5$ to $1''\cdot 0$
87	„	„	„	$1''\cdot 0$ to $2''\cdot 0$
43	„	„	„	$> 2''\cdot 0$

This number is less than usual, due in part to the fact that the instrument was out of use from 1930 December 5 to 1931 February 2, while the motor for rotating the dome was being installed, but more to the unfavourable meteorological conditions during the year.

The mechanism for rotating the dome is very satisfactory and makes an assistant to the observer unnecessary.

Thompson Equatorial.—With the 26-inch refractor, 1,180 plates have been taken for stellar parallax. Of these, 40 were rejected mainly on account of poor meteorological conditions. In the year 950 plates have been measured and the parallaxes of 34 stars determined. As usual, an annual publication of results was made in the *Monthly Notices* for November, 1930. These observations were to some extent interrupted in December and January by observations of Eros for the determination of the solar parallax. In November and December, 51 photographs of Eros, suitable for measurement, were obtained on ten nights. In January, 59 plates were obtained on nine nights and will be available for comparison with photographs taken in the southern hemisphere.

With the 30-inch reflector the determination of the absolute colour temperatures of the stars in the Greenwich standard system has been continued. A considerable amount of experimental work has been carried out under laboratory conditions, and as a result, the use of the carbon arc as an intermediary has been abandoned.

The stars are now compared directly with a Kodak standard acetylene burner, which provides a convenient standard at a colour temperature of 2,360° K. We are indebted to Prof. Brame, of the Royal Naval College, for the construction of apparatus used in purifying the acetylene. In comparing the stars with this source, a colour filter is inserted in the beam from the burner, and the transmissions of this filter at the wave lengths used in the measurements are determined in the laboratory.

This method has been found to work well and a series of comparisons has been begun. Each plate consists of a photograph of the spectra of a star near the zenith, of two stars at low altitudes (for the elimination of atmospheric absorption), and of the acetylene flame through the filter.

Observations of this nature have been made on six nights, and are being continued. From the results so far obtained, the colour temperature of a star of type Ao appears to be in the neighbourhood of 13,000° or 14,000°.

The self-recording microphotometer obtained from the Cambridge Scientific Instrument Company has been brought into use and a number of spectra measured. This instrument will be of great use when the colour temperatures of the stars of later type are under investigation. For the different stages of the comparison of the Ao type stars and the acetylene flame, the visual photometer is found more suitable.

Astrographic Equatorial.—During the year, 78 photographs have been taken and 68 measured for the determination of proper motions of stars. The work is now completed to dec. +78°, with the exception of three plates, and a number of plates have been measured in higher declinations. To complete the work, 74 fields have to be photographed and 104 fields compared with earlier photographs.

Beginning on October 9, 220 plates of Eros were obtained on 45 nights. On 22 nights, 151 plates were taken East and West of the meridian, and can be utilized for determination of the solar parallax by the diurnal method. All the plates are useful for the determination of the mass of the Moon. A few plates of the planet were taken with a wire grating for the determination of effective wave length.

For the better determination of the positions of the comparison stars, 113 plates of 71 fields were taken subsequently, 90 with the telescope West of the pier, and 23 with the telescope East, thus securing a reversal of the object glass. These plates completely cover the track of Eros from dec. +28° to dec. −5°, as well as fields in higher declination where Eros had been photographed at Greenwich.

Some years ago a number of photographs were taken with the 26-inch refractor to determine the magnitudes of stars in Kapteyn's Selected Areas. This work was not completed, but 40 areas were photographed two or three times each. It has been decided to publish the results already obtained and copy for press has been prepared. The plates reach the magnitude $14\cdot^{m}0$ or fainter. In addition, the magnitudes of 395 stars within 1° of the pole are included.

Heliographic Observations.—Photographs of the Sun were obtained on 260 days with either the Dallmeyer 4-inch photoheliograph or the Thompson 9-inch. The number

of photographs selected for preservation is 507, including 26 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 343 days in the year 1930, and on 88 days in the first three months of 1931. The Director of the Kodaikanal Observatory has reported that plates were taken there on 330 days in the year 1930, and on 84 days during the first three months of 1931.

Photographs have been received from the Royal Observatory, Cape of Good Hope, to 1931 January 23. Photographs have been received from the Kodaikanal Observatory to supplement the series for 1930. Three photographs have been kindly lent by the Ebro Observatory, Tortosa, to make the record complete.

The measurement of the combined series has been made from 1929 October 11 to 1931 January 2. The reductions of positions and areas of spot groups and their principal components have been completed from 1929 July 11 to 1930 June 21.

Sunspot activity has diminished considerably, but large spots crossed the Sun's central meridian on October 11, February 20, and March 15.

Observations in Hα light were made of the Sun's disc with the Spectrohelioscope on 142 days during the year, but only on half of these days were observing conditions sufficiently good for an examination of the whole disc. A summary of measures of radial velocities made during 1930 of bright and dark Hα flocculi has been communicated to the Royal Astronomical Society. A considerable solar eruption was observed on August 12 and another on November 25, the maximum radial velocities observed for the dark absorption markings being respectively on the two occasions 115 km./sec. inwards and 450 km./sec. outwards from the sun. Accounts of these eruptions have also been published in the *Monthly Notices*.

In accordance with arrangements mentioned in the Report of last year, a duplicate series of solar negatives for the years 1922 to 1929 has been sent from Greenwich to the Science Museum, South Kensington.

Photographic prints of solar negatives for each day from 1929 January 1 to 1929 December 31 have been supplied to the Solar Physics Observatory, Cambridge.

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 Zürich for incorporation in the *Bulletin for Character Figures of Solar Phenomena*, published under the auspices of the International Astronomical Union.

III.—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. Absolute observations of declination, of horizontal force with the *Schuster-Smith* coil magnetometer, of vertical force with the *Dye* coil magnetometer and of dip with the earth-inductor are made every week-day, while observations of horizontal force with the unifilar magnetometer have been taken when possible, for purposes of comparison, on one of the piers in the testing hut. Since 1929 January 1, the records of vertical force have been based upon observations with the *Dye* coil-magnetometer, and the measurements both of the horizontal and vertical components of magnetic force are now dependent upon electrical standards.

The Observatory is indebted to the National Physical Laboratory for periodical remeasurement 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 1930 December 31, and with provisional constants to the present time.

The tabulation of results for 1930 and the preparation of copy for press are nearly complete.

The mean values of the magnetic elements at Abinger for the year 1930 are given below. The values for 1926 to 1929 are given for comparison.

	Decl. W.	Hor. Force.	Vert. Force.	Dip.
1926	13° 10′·4	0·18581	0·42947	66° 36′·3
1927	12° 58′·4	0·18575	0·42932	66° 36′·2
1928	12° 47′·0	0·18564	0·42941	66° 37′·3
1929	12° 35′·8	0·18555	0·42918†	66° 37′·2†
1930	12° 24′·6	0·18542	0·42924†	66° 38′·2†

The weekly report of mean hourly values of declination has been regularly sent to several offices for publication or information—a service taken over from Kew Observatory at the beginning of 1925 and now maintained in conjunction with Eskdalemuir Observatory.

Observations of the magnetic elements at Greenwich have been made on several occasions during the short period in the early hours of the morning when there is no

† These results are based upon observations with a Coil-magnetometer.

interference from electric trains, with a view to comparison with the simultaneous values recorded at Abinger and obtaining the difference at the two sites.

The instrument used for measures of horizontal force was the portable coil-magnetometer now being employed in the magnetic survey of the British Isles, kindly lent to the Observatory by the Director of the Ordnance Survey Department.

The results are tabulated below, together with those obtained from the original twelve-months' comparison made in 1925. It should be noted that the comparison of H.F. at the two stations in 1925 depended upon unifilar magnetometers independently standardised at widely different dates, whereas the recent comparison is based upon coil-magnetometers one of which was standardised by means of the other.

Difference Abinger *minus* Greenwich.

Date.	Declination West.	Horizontal Force.	Inclination.
1930 July–August, 7 nights	+13′·3	+171γ	−16′·1
1931 March, 3 nights	+13′·8	+171γ	−16′·2
1925 comparison	+12′·8	+183γ	−16′·2

The somewhat discordant results in Declination are surprising, and comparison of the values of this element will be continued from time to time.

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 commencement and after the conclusion of his surveying programme in 1930, for the purpose of comparing his instruments with the Abinger standards.

Five Coil-magnetometers of the Standard Schuster-Smith type, and one of the portable type have been tested, and certificates of the determination of the constant of the coils have been issued.

Two Kew pattern unifilar magnetometers and one Dip Circle have also been tested and certificates of their constants issued.

IV.—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 continuously maintained, as well as estimates of visibility made by eye at definite hours.

Registration of the electric potential gradient of the atmosphere with a radium collector and a Kelvin-White quadrant electrometer has been continuously maintained. Improve-

ments in insulation were effected on November 4, since which date there have been few failures due to leakage of charge.

The following details of the weather refer to the period of twelve months ended 1931 April 30 :—

The mean temperature was 50°·0 or 0°·5 above the average of the 75 years 1841–1915. The highest temperature in the shade was 92°·2 registered on August 28 and 29, and the temperature exceeded 80° on twelve days, including the two days on which it also exceeded 90°. The lowest temperature was 21°·0 on March 10. Temperatures of freezing point or below were recorded on 55 days. The mean daily horizontal movement of the air was 289 miles, which is 5 miles above the average for 50 years, 1867–1916. The greatest daily movement was 713 miles, recorded on January 17, the least, 43 miles, on December 5. The greatest motion in one hour, 42 miles, was recorded on November 22 and 23. The greatest pressure reached was 18·0 lbs. to the square foot, on September 20. The duration of bright sunshine recorded was 1,320 hours or 29·6 per cent. of the possible total. There were 75 entirely sunless days in the period, of which 21 occurred in December. The total rainfall was 27·94 inches, that is, 3·70 inches greater than the average for 75 years 1841–1915, and measurable rain fell on 188 days. The wettest month was November with 4·41 inches. The driest month was March with 0·33 inch. During a heavy rainstorm on June 18, the quite exceptional fall of 2·66 inches in a little more than two hours was registered, 2·4 inches of which fell in about 45 minutes.

V.—Printing and distribution of Greenwich Publications :—

The volume for 1928 and its separate parts have been distributed and the printing of the volume for 1929 is complete. The printing of a small volume of Photographic Magnitudes of Stars brighter than $14^{m}\cdot0$ in Kapteyn's Selected Areas is also completed.

VI.—Chronometers :—

The number of chronometers and watches belonging to the Admiralty now at the Observatory is 2,975. Of this total, 285 chronometers, 257 chronometer watches, 229 hack watches and 60 pocket watches are being rated. The remainder, consisting of 310 chronometers, 978 chronometer watches, 222 hack watches and 629 pocket watches are kept in storage.

In addition to Admiralty chronometers there are 42 chronometers and 20 watches deposited at the Observatory for various reasons.

During the year ended 1931 April 30, a total of 1,604 chronometers and watches have been received and 1,686 issued. The number sent for repair was 944, viz. : 914 for

the Admiralty, 18 for the Indian, and 2 for the Canadian Governments, and 10 for the Royal Air Force.

During the year 32 chronometers, 34 chronometer watches, 1 hack watch and 4 pocket watches have been sold out of surplus stock.

VII.—Time Service :—

The Time determinations have been made throughout the year by means of the reversible transit instrument " B " fitted with impersonal micrometer. When possible, observations are made at intervals of not more than 5 days. In the year 1930 May 11–1931 May 10, observations have been made on 63 nights.

The Clock Shortt No. 3 was used as Standard Sidereal Clock throughout the year. No. 11 has been kept going as reserve standard, and compared regularly with No. 3. The progressive increase of losing rate in clock No. 11 shows no diminution.

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.

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 was not raised on account of high wind on two occasions, viz.: September 20 and October 8.

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 $0^s{\cdot}2$	239	217	210	101
$0^s{\cdot}3$ to $0^s{\cdot}5$	1	0	9	86
$0^s{\cdot}6$ to $1^s{\cdot}0$	2	0	9	96
Greater than $1^s{\cdot}0$	0	0	4	23

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 $0^s \cdot 02$ for time of travel.

1930.	Paris $9\frac{1}{2}^h$ Rhythmic.	Nauen 12^h Rhythmic.	Annapolis 17^h.	Bordeaux 20^h Rhythmic.
	s.	s.	s.	s.
January	+·004	+·107	−·021	+·008
February	+·046	+·106	+·021	+·054
March	−·021	+·045	+·004	+·001
April	−·004	+·040	+·023	+·011
May	+·005	+·015	+·064	+·023
June	+·006	+·017	+·043	+·014
July	+·013	+·013	+·074	+·034
August	+·027	+·024	+·070	+·051
September	+·027	+·030	+·046	+·041
October	+·042	+·079	+·071	+·052
November	+·007	+·029	+·046	+·026
December	+·069	+·022	+·026	+·087
Mean	+·016	+·044	+·039	+·033
Number of comparisons ...	303	302	327	332

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.

VIII.—Personal Establishment :—

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

Chief Assistants.—Mr. Greaves, Dr. Jackson.

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.

21 Computers, including 5 ladies, are employed at the Observatory.

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

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

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.

IX.—General Remarks :—

The Observatory was honoured by a visit from Their Imperial Highnesses Prince and Princess Takamatsu on June 30.

Lieut.-Commanders F.C. Woodhouse and A. Jones, R.N., made a series of observations in September to examine the performance of a new 45° prismatic astrolabe constructed for the Hydrographic Department. Using the standard sidereal clock their observations gave the known latitude and longitude of the station with great accuracy.

Dr. Lundmark, Director of the Lund Observatory, was at Greenwich from December 12 to January 15, examining the Franklin-Adams Charts.

Mr. A de Sitter, of Leiden, took part in the general work of the Observatory from December 2 to February 17.

Mr. Slouka, of the Czech University Observatory, Prague, was here for three weeks in July and August, studying stellar parallax.

Mr. Behari Lal Gulatee of the Survey of India, worked at Abinger in June and July.

During the winter the Observatory took part in the international enterprise for the determination of the Solar Parallax and Mass of the Moon, by observations of the planet Eros. Reference stars had been observed in previous years at the transit circle and alta-zimuth, and this winter a few additional stars were observed. Work with the Astrographic telescope was continuous from October 9 to January 31. With the Thompson refractor the work was confined to the interval November 22 to January 31, when the planet was nearer. The longer series with the Astrographic telescope is of value for determination of the orbit of the planet and the Mass of the Moon, while the observations in December and January with both instruments are better suited for the Solar Parallax. After the planet had moved too far South for observation, photographs were taken with the Astrographic telescope of the region through which the planet had passed, in order to determine accurate positions of a series of stars near its path required as comparison stars for instruments of smaller field.

In last year's report reference was made to the completion of the determination of the relative colour temperatures of a number of stars to be used as standards. This year an attempt has been made to make the colour temperatures absolute by comparison with a terrestrial standard. Except for a few observations by Prof. H. H. Plaskett, the only absolute determination hitherto made is by Dr. Wilsing from observations between 1905 and 1912. Comparisons have been made with the positive crater of the carbon arc, whose temperature has been determined with reference to a calibrated gas-filled lamp. On a suggestion from Mr. Buckley, of the National Physical Laboratory, the lamp was replaced by a Kodak standard acetylene burner. The flame of this burner has a well-determined colour temperature and does not require frequent calibration. By the interposition of suitable filters the colour of the flame can be made a close approximation to that of an Ao star, and the carbon arc as an intermediary is no longer required.

Last year the Board of Visitors passed a resolution drawing attention to the need for a new transit circle, as the present instrument is nearly worn out. The object glass, which

is badly stained, is too thin to bear further repolishing, and many divisions of the circle are nearly obliterated as the result of constant cleaning. This famous instrument has been in regular use for eighty years. Twenty-five years ago Newcomb wrote: " With all its shortcomings, the Airy transit circle has proved to be the most serviceable meridian instrument ever constructed. The result is that the Greenwich observations during the past half-century afford the broadest basis we now possess for the determination of those stars of which accurate positions are most required." The Lords Commissioners of the Admiralty have agreed to the purchase of a new instrument, the cost to be spread over three years, and part provision has been made in this year's estimates. It is proposed to have a reversible instrument generally similar to that at the Cape, with an objective of 7 inches aperture and 8 feet focal length. It will have a motor-driven micrometer. The new instrument will be erected in a building in which provision is made for free circulation of air. Discussion is proceeding with Messrs. Cooke, Troughton & Simms with reference to the details.

The provision of a new transit circle by the Admiralty, and the generous gift by Mr. W. J. Yapp of a large reflecting telescope, are additions of the greatest value to the equipment of the Observatory. The one will enable the traditional work of the Observatory to be maintained on a high level, and the other will allow modern developments of astronomy to be pursued under the most favourable conditions.

F. W. DYSON,

Royal Observatory, Greenwich.
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