REPORT

OF

THE ASTRONOMER ROYAL

TO THE

BOARD OF VISITORS

OF THE

ROYAL OBSERVATORY, GREENWICH,

Read at the Annual Visitation of the Royal Observatory, 1903 *June* 6.

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The Report here presented refers to the year from 1902 May 11 to 1903 May 10, and exhibits the state of the Observatory on the last-named day.

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

The improved fire and water service of the Observatory was completed shortly after the date of the last Report, by the supply of fire hose for use with the various hydrants, and of a telephonic fire alarm.

[Since the date of this Report the telephonic communication was put out of action by lightning, during the thunderstorm of May 17, and is now being restored.]

The N.E. Lobby on the upper floor of the New Observatory has been fitted up as an additional photographic room for use in conjunction with the S.E. Lobby in the photographic publication of the Astrographic Chart.

A partition has been put up in the Office Room used by the Astronomer Royal and Chief Assistants, to provide a separate room for the former.

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A portion of the boundary fence on the west side has been renewed, a retaining wall being built to support it.

The triennial exterior painting of the Observatory buildings which was commenced in the spring of 1901 was completed last November.

Electric lamps have been fitted up to light the entrance to the new Observatory building, and the passage from the old Observatory to the Altazimuth Pavilion and other buildings.

The principal movable instruments are thus distributed :—

At Greenwich—

Transits B, C, and the transit with axis view.

Altazimuth D.

Equatorials (6-inch).—Cooke No. 2, Simms No. 1, Hodgson, and Corbett. (The telescopes of the two last-named are mounted respectively on the Thompson and 28-inch Equatorials.)

Photoheliographs.—Nos. 2, 3, and 5.

Detached Telescopes (on tripod stands).—Two 4-inch (Simms Nos. 1 and 2), two 4-inch (R.O. Nos. 1 and 2), one $3\frac{1}{2}$-inch (R.O. No. 3).

Two Hilger Chronographs.

A single prism Spectroscope.

On loan—

Transit.—A, at the Cape Observatory. D and E, lent to the Paris Observatory for use in the longitude determination.

Altazimuths.—A, at the Science Schools, South Kensington; B, at the Cape Observatory; E, at the Royal Naval College, Greenwich.

Equatorials.—Lee (6-inch), at Hong Kong Observatory; Simms No. 2 (6-inch), lent to the Science and Art Department.

Photoheliographs.—No. 1, complete, at the Cape Observatory; No. 4, complete, at the Kodaikanal Observatory.

Clocks.—Dent No. 1916, and Dent No. 2013, at the Cape Observatory; Dent No. 2011, at the Kew Observatory; Dent No. 2010, at Devonport; and Arnold 2, at the University Observatory, Oxford.

Anemometer.—Whewell's Anemometer, formerly mounted above the roof of the Octagon Room of the Royal Observatory, lent for exhibition at South Kensington Museum.

Lent to the Royal Observatory by the Royal Astronomical Society :—
4-inch Rapid Rectilinear Lens, for use in the photographic determination of places of stars in the immediate neighbourhood of the Pole.

In the last Report it was stated that the new card catalogue for the Astronomical Library in the West Wing had been completed for all bound volumes, including volumes of separate pamphlets, each pamphlet in the latter case being separately indexed, and that index cards had been made in duplicate, one set being arranged in the order of the books on the shelves, to serve as a subject catalogue, and the other in alphabetical order of the authors' names. The old catalogue for the Astronomical Library, which was divided into twenty different sections, each arranged in alphabetical order of authors' names, has been compared with the new card catalogues. A number of discrepancies have been noted, but the great majority of these refer to unbound pamphlets, and will no doubt be explained when the card catalogue of the latter is also compared with the old catalogues.

The card catalogue of the unbound pamphlets has been completed, and a large number of pamphlets have been selected for binding. The others have been entirely re-arranged, and placed in boxes classified according to subject and size.

The preparation of the card catalogue for the East Library (Magnetic and Meteorological) has been taken in hand.

The annual examination of the library has been made, the books on the shelves being compared with the catalogues. Search is being made for some books which are not in their places on the shelves, and not entered in the lending book. Of the eight books missing last year, four have since been found.

II.—Astronomical Observations :—

Transit Circle.—The Sun, Moon, planets, and fundamental stars have been regularly observed on the meridian as in previous years. The number of observations made from 1902 May 11 to 1903 May 10, is as follows :—

Transits, the separate limbs being counted as one observation	11,734
Determinations of collimation error	298
Determinations of level error	614
Circle observations	9,923
Determinations of nadir point (included in the number of circle observations)	603
Reflexion observations of stars (similarly included)	403

The transits are completely reduced (so as to exhibit Mean R.A. 1903 · 0) to 1903 April 22. Instrumental and clock errors are formed to 1903 May 7.

The circle observations are completely reduced to 1903 April 13.

The progress made in the observation of the reference stars for the astrographic plates, for which more than 10,000 stars are to be observed three times above and twice below pole, has been very satisfactory, the present state of the work being as shown in the following table :—

Limits of N.P.D.	Area in square degrees.	No. of Stars.	Average No. per square degree.	Number of Stars observed.						Total No. of Observations.	Per cent.
				5 times or more.	4 times.	3 times.	Twice.	Once.	Not observed.		
0°–5°	78·5	359	4·6	359	—	—	—	—	—	1,795	100
5°–10°	234·8	1,062	4·5	1,062	—	—	—	—	—	5,310	100
10°–15°	389·4	1,695	4·4	960	253	214	181	78	9	6,894	81
15°–20°	541·1	2,375	4·4	332	307	554	836	311	35	6,533	55
20°–26°	856·0	4,556	5·3	309	513	1,019	2,042	668	5	11,406	50
0°–26°	2099·8	10,047	4·8	3,022	1,073	1,787	3,059	1,057	49	31,938	63½
Corresponding totals reported last year.				1,513	819	2,012	3,889	1,508	255	26,163	52

The observations of these stars were commenced in 1897 and will be completed at the end of 1906. Thus in 6·35 years 63½ per cent. of the observations have been secured, of which 11½ per cent. were contributed in the last year. From a comparison of the observations above and below pole for the stars from N.P.D. 0° to 5°, which have been completely observed, it appears that the probable error of a catalogue place (5 observations) does not exceed ± 0″·23 in R.A. or N.P.D.

The investigation of personal equations is completed for 1902.

The correction for R–D discordance, the error of the assumed colatitude, and the position of the ecliptic have been investigated for 1902.

The apparent correction for discordance between the nadir observations and stars observed by reflexion for 1902 was found to be — 0″·20, which is rather smaller than the results of the last ten years 1892–1901, for which the mean value of this discordance is — 0″·30, ranging in different years from — 0″·25 to — 0″·41. Since 1897 January 1, a correction of — 0″·25 has been applied to the observations of the nadir in forming the zenith point on days when no reflexion observations of stars were obtained.

Observations of level and nadir have been made, when practicable, three or more times on the same day. The following table shows the mean values of the diurnal changes of the level and nadir, observations within three hours of noon, 6 p.m., and midnight respectively being grouped together:—

—	Diurnal Change of Level.			Diurnal Change of Nadir.		
	Noon.	6 p.m.	Midnight.	Noon.	6 p.m.	Midnight.
1898 -	+ 0″·25	0″·00	+ 0″·18	+ 0″·17	0″·00	+ 0″·17
1899 -	+ 0·30	0·00	+ 0·18	+ 0·17	0·00	+ 0·17
1900 -	+ 0·39	0·00	+ 0·23	+ 0·14	0·00	+ 0·04
1901 -	+ 0·28	0·00	+ 0·26	+ 0·17	0·00	+ 0·09
1902 -	+ 0·22	0·00	+ 0·20	+ 0·20	0·00	+ 0·17

As a result of the change in the method of adopting the azimuth error introduced in 1900, the small discordance which existed in the Second Ten Year Catalogue between the right ascensions observed above and below pole, appears to have been practically eliminated, as is shown in the following table:—

—	0°—5°		5°—10°		10°—15°		15°—20°		20°—25°	
	Mean excess of R.A. above pole × sin N.P.D.	No. of Stars.	Mean excess of R.A. above pole × sin N.P.D.	No. of Stars.	Mean excess of R.A. above pole × sin N.P.D.	No. of Stars.	Mean excess of R.A. above pole × sin N.P.D.	No. of Stars.	Mean excess of R.A. above pole × sin N.P.D.	No. of Stars.
1887–1896 - -	s. +·013		s. −·014		s. −·023		s. −·021		s. −·020	
1900 - -	−·013	134	−·002	135	−·001	43	−·021	47	+·019	37
1901 - - -	−·012	156	−·002	247	−·005	37	−·008	51	−·027	33
1902 - -	−·002	9	−·007	248	+·004	165	+·004	42		

The correction for the R–D discordance found for 1902 is $+ 0''\cdot048 + 0''\cdot263$ sin Z.D., a value agreeing well with the results of recent years.

The colatitude of the transit-circle as found from observations of about 522 stars in 1902 is 38° 31′ 21″·74, differing by $- 0''\cdot16$ from the adopted value. The consistency with which a value of the colatitude about $0''\cdot15$ less than that found for the 10 years 1887–1896 has been obtained in the last few years is remarkable. The following table gives the values of the corrections to the adopted value found by circumpolar observations, and by observations of the sun since 1897, using Bessel's Refractions:—

CORRECTIONS to adopted COLATITUDE, 38° 31′ 21″·90.

—	Circumpolar Observations.	Observations of Sun.	—	Circumpolar Observations.	Observations of Sun.
1897 - -	−0″·17	+0″·04	1900 - -	−0″·10	−0″·08
1898 - -	−0·15	0·00	1901 - -	−0·14	−0·17
1899 - -	−0·14	0·00	1902 - -	−0·16	−0·12

The correction to the tabular obliquity of the ecliptic from solar observations in 1902 is $+0''\cdot14$. The discordance between the results from summer and winter solstices is $-0''\cdot24$, indicating that the mean of the observed distances from the pole to the ecliptic is too large by $+0''\cdot12$. The apparent correction from observations of the Sun to the right ascensions of clock stars is $+0^s\cdot023$.

Observations of the Sun from 1887–1896 indicated a correction to equinox of $+^s\cdot047$, and the last six years have given $+^s\cdot065$, $+^s\cdot085$, $+^s\cdot045$, $+^s\cdot021$, $+^s\cdot024$, and $+^s\cdot023$, these quantities being subject to correction for latitude variation, which will render them much more accordant. In view of these results and of the somewhat arbitrary nature of the equinox correction due to the personality of the observers in observations of the Sun's limbs, a correction of $+^s\cdot054$ has been applied to the right ascensions of the Second Ten Year Catalogue in forming the clock star list for 1903 to refer them to the equinox of Prof. Newcomb's "Catalogue of Fundamental Stars for 1900," which is sensibly the same as that resulting from observations of the Sun since 1886.

The mean error of the Moon's tabular place (computed from Hansen's lunar tables with Newcomb's corrections) is $-0^s\cdot157$ in R.A. and $-0''\cdot39$ in N.P.D., deduced from 97 observations. These are equivalent to a mean error of $-2''\cdot35$ in longitude and $-0''\cdot03$ in ecliptic north polar distance.

In connection with the delimitation of the boundary between Yola and Lake Chad, by observations of the Moon for longitude, a discussion has been made of the errors of the Moon's tabular R.A. from recent Greenwich observations since 1892, after correcting the parallactic inequality of Hansen's tables.

The re-reduction of Groombridge's observations is completed as far as the derivation of the mean right ascension and north polar distance for the year of observation. Ledgers have been formed, and the precessions and secular variations are now being computed. For all stars in Newcomb's Fundamental Catalogue and all stars observed by Bradley these are already computed and the mean positions for $1810\cdot0$ determined. The re-reduction has been largely based on Newcomb's Fundamental Catalogue, which contains 337 stars observed by Groombridge, the right ascensions of this catalogue being used for clock error and error of position of the pole, and the north polar distances for the polar point correction.

A comparison has been made between the new Groombridge results and Auwers' Bradley (as reduced to 1810 by Dr. Kobold), for which 674 stars were available.

The following table exhibits the differences between these catalogues, in order of N.P.D., an equinox correction of $-0^{s}\cdot04$ being first applied to the right ascensions given by Dr. Kobold:—

Limits of N.P.D.	Groombridge—Bradley.				Limits of N.P.D.	Groombridge—Bradley.			
	R.A. × sin N.P.D.	No. of Stars.	N.P.D.	No. of Stars.		R.A. × sin N.P.D.	No. of Stars.	N.P.D.	No. of Stars.
	s		"			s		"	
0°–5°	−0·02	14	+0 09	12	30°–35°	−0·01	78	+0·03	96
5°–10°	−0·07	19	+0·30	16	35°–40°	−0·01	62	−0·12	75
10°–15°	−0·05	28	−0·02	43	40°–45°	0·00	101	−0·18	101
15°–20°	−0·03	33	−0·03	47	45°–50°	+0·01	101	−0·18	101
20°–25°	−0·01	43	+0·03	60	50°–52°	0·00	52	−0·73	54
25°–30°	−0·01	54	+0·02	69					

Altazimuth.—The clamping of the instrument in Z.D. has been improved by strengthening the attachments to the uprights of the reversing apparatus and connecting these rigidly with the cast-iron supports of the instrument. It is now quite satisfactory. The reduction of the span of the micrometer slides referred to in the last report has given very satisfactory results, as only one wire of the 27 vertical and 21 horizontal wires has broken during the year.

The instrument has been used in the meridian in four positions during the year, the positions being changed regularly after two months, so that they will recur at different seasons of the year in a cycle of two years. Observations have been made during the year of the Sun, Moon, planets, and fundamental stars, including all those in the lists of the *Nautical Almanac*, *American Ephemeris*, *Connaissance des Temps*, and *Berliner Jahrbuch*. The observation of the reference stars for Sir D. Gill's heliometer observations of major planets is now completed. Extra meridian observations of the Moon have been regularly made whenever practicable during the first and last quarters of each lunation.

The following observations have been made during the year:—

	No. of Observations.
Collimation error	287
Level error	523

	No. of Observations.
Azimuth error	162
Nadir	502
Reflexion observations of stars	124
R.A. of Sun, planets, and stars (in meridian)	1,233
N.P.D. of Sun, planets, and stars (in meridian)	941
R.A. of Moon (in meridian)	25
N.P.D. of Moon (in meridian)	26
Azimuth and Zenith distance of stars (extra meridian)	257
Azimuth and Zenith distance of Moon (extra meridian)	39

Twelve determinations of flexure have been made during the year in the four positions of the instrument.

The altazimuth observations are completely reduced to the end of 1902, the zenith distance reductions being completed to 1903 March 28, and the transits as far as the application of collimation error to 1903 April 27.

The R–D discordance has been investigated as far as 1903 February 28, a separate determination being made for each position of the instrument.

The observations of the Moon obtained in 1902 have been compared with those given by the transit-circle, and very satisfactory accordance is shown between the two instruments, the extra-meridian observations of the altazimuth being quite comparable in accuracy with the meridian observations, whether with the transit-circle or altazimuth. It is satisfactory to find that the new altazimuth has thus fulfilled the anticipations which were entertained when it was designed for extra-meridian as well as for meridian observations.

Reflex Zenith Tube.—Observations with this instrument (by reflexion from a surface of mercury) have been made continuously throughout the year. It is found that stars down to 7·0 magnitude can be observed, and the definition is good over a field of nearly 1° from the centre, so that it is practicable to observe stars satisfactorily more than 50′ north or south of the zenith. A working catalogue containing all stars down to the mag. 7·0, which transit within about 50′ of the zenith of Greenwich, has been prepared, and stars have been selected for observation from this list. During the year 311 double observations and 49 single observations have been obtained,

the number of different stars observed being 59. The following table of some of the stars which have been observed shows that a continuous series of observations with sufficient overlap is being secured of stars distributed over the 24 hours of right ascension, from which a good determination of the variation of latitude and of the constant of aberration may be anticipated :—

Star.	Mag.	R.A.	Z.D. South.	No. of Obs.	Extent of Observations from 1902 May 17, to 1903 May 10.
		h. m.	′		
Groombr. 58 - -	6·0	0·19	— 1·0	8	Oct. 29—Jan. 15.
Piazzi II., 220 -	5·7	2·54	— 29·9	12	Nov. 12—Feb. 13.
9 Aurigae - -	5·2	4·59	0·0	10	Nov. 17—Mar. 7.
Groombr. 1272 -	6·0	7· 6	— 6·6	12	Jan. 15—Mar. 26.
Lalande 14549 -	6·5	7·26	— 2·7	13	Jan. 15—Mar. 28.
27 Lyncis - -	5·1	8· 1	— 18·2	17	Jan. 28—Mar. 28.
Bradley 1306 -	6·5	9·14	— 11·1	10	Feb. 28—April 22.
Groombr. 1542 -	6·7	9·18	— 30·3	11	Feb. 18.—April 22.
θ Ursæ. Maj. - -	3·0	9·26	— 38·6	20	Feb. 16—May 4.
Groombr. 1721 -	6·3	10·54	— 32·1	5	April 9—May 4.
5 Canum. Ven. -	5·2	12·19	— 36·7	5	April 9—(being continued).
7 Canum. Ven. -	6·5	12·25	— 34·9	4	April 9— „
ι Boötis - - -	4·5	14·12	— 19·7	2	May 7— „
θ Boötis - -	4·0	14·21	— 49·2	2	May 7— „
β Draconis - -	3·0	17·28	— 52·7	11	May 17—Feb. 17.
γ Draconis - -	2·2	17·54	— 1·4	33	Throughout the year.
ι^2 Cygni - - -	3·9	19·27	— 2·8	11	June 23—Dec. 2.
π^1 Cygni - -	5·1	21·38	+ 43·2	10	Aug. 6—Dec. 18.
β Lacertae - -	4·7	22·19	— 16·7	15	Sept. 3—Dec. 18.
9 Lacertae - -	5·5	22·23	+ 25·2	16	Sept. 3—Dec. 18.

The above table commences with the observations made on 1902 May 17, immediately after the date of the last report. It should further be borne in mind

that the number of observations would have been greater had it not been for the necessity of determining the scale value and errors of the screws, 78 transits of stars over the 30 wires having been made during the year with the wires turned through 90°.

A large number of measures have also been made of the distances apart of the 30 wires in terms of the micrometer screws; different parts of the two screws have been compared with one another; and the value of definite intervals of the two screws determined by comparison with the observations of transits of stars. The screws are found to be in excellent condition, and the small amount of wear shown has been accurately determined.

The reduction of the observations to give zenith distance has been completed to 1902 December 31, and the results at this stage seem very satisfactory.

Clocks and Chronographs.—For convenience in working the circuits required for registration of the seconds from the Sidereal Standard for the various instruments in different parts of the Observatory, a new distributing relay has been placed in the basement of the Altazimuth Pavilion which works four circuits, one of these being in connection with the relay in the Old Observatory building, which is used for local distribution to the instruments in that part of the Observatory.

Owing to the damage caused by rats gnawing the gutta-percha covering of the telegraphic wires in the Observatory and the consequent interruptions of the circuits, iron pipes have been laid down under the floors of the buildings, in which the wires are now carried.

The Sidereal Standard Clock, the clock "Dent 2017" used with the Astrographic Equatorial, and "Graham 2" used in the Longitude Pavilion, have been cleaned and repaired during the year.

The transit-circle chronograph has also been cleaned and repaired, some parts which were worn considerably being replaced.

[Since the date of this report the Mean Solar Clock Dent 2012 was injured during a thunderstorm (May 17), the contact springs being broken and the platinum

points fused. It is now being repaired. Several galvanometers in use for the time signal service were also destroyed.]

Equatorials.—During the year ending 1903 May 10, 7 disappearances and 1 re-appearance of stars occulted by the Moon have been observed by one or more observers.

The 28-inch Refractor.—This instrument has been used throughout the year for micrometric measurements of double stars. The total number of double stars measured during the year is 381; of these 192 have components less than 1″·0 apart, and 105 less than 0″·5. The close pairs whose distance apart is less than 1″·0 have been measured on the average on $2\frac{1}{2}$ nights each, and the wider pairs on the average on three nights. The wider pairs consist of bright stars with a faint companion, and of stars of special interest.

The following list includes the most difficult and interesting stars measured during the year :—

	Distance.	Magnitudes.		Distance.	Magnitudes.
Capella -	< 0″·1	1 and 1	OΣ 269 -	0″·3	6·5 and 7·0
κ Pegasi -	0·1	3·9 „ 5·0	β 720 -	0·4	6·0 „ 6·5
ε Hydrae AB	0·1	3·5 „ 6·0	42 Comæ -	0·4	6·0 „ 6·0
δ Equulei	0·2	4·1 „ 4·1	β 581 -	0·5	8·5 „ 8·6
β 1099 -	0·2	6·0 „ 6·5	De. 15 -	0·5	8·2 „ 8·6
β 1266 -	0·2	7·2 „ 7·5	Σ 2525 -	0·5	7·4 „ 7·6
β 524 -	0·2	6·0 „ 7·0	β 733 -	0·7	6·0 „ 11·0
Σ 2367 -	0·2	7·2 „ 7·6	β 1025 -	0·8	8·0 „ 10·3
β 883 -	0·3	7·0 „ 7·0	ζ Herculis	0·9	3·0 „ 6·5
Σ 2107 -	0·3	6·5 „ 8·0	β 648 -	1·0	6·0 „ 9·2
β 612 -	0·3	6·3 „ 6·5	β 701 -	1·0	7·5 „ 10·2
68 Comæ -	0·3	6·5 „ 8·0	β 1251 -	1·4	6·0 „ 11·5
ζ Boötis -	0·3	3·5 „ 3·9	70 Ophiuchi	1·5	4·1 „ 6·1
γ^2 Andromedæ -	0·3	5·0 „ 6·2	Procyon -	5·5	1·0 „ 13·0

Series of measures have been obtained of κ Pegasi (8 nights), δ Equulei (11 nights), 70 Ophiuchi (9 nights), and ζ Herculis (10 nights). Capella has been examined at every favourable opportunity, and observations of the position angle of

the elongated image have been secured on 8 days. The weather during the past year has been generally unfavourable for the observations of this and other very difficult objects. The results of the observations for 1902 have been communicated to the Royal Astronomical Society, and will be published in the Monthly Notices, 1903 May.

Thompson Equatorial.—An extensive renewal of the papier mâché covering of the 30-foot dome (originally erected in 1884) has been found to be necessary, a large number of the papier mâché boards having in course of years become damaged by the weather. The necessary repairs have been deferred till the summer, so as to cause as little interference as possible with the use of the Thompson Equatorial, the dome having in the meanwhile been made weathertight.

The occulting shutter used for photographing the satellite of Neptune and other faint companions of a bright object has, by a device of Mr. Davidson's, been made to work automatically by means of a small electro-magnet brought into action at each revolution of the spindle of the driving clock, once in 20 seconds.

The following photographs have been taken during the year with the 26-inch refractor :—

Neptune and Satellite, 91 photographs; 66 on 36 nights selected and measured.
Comet *b* 1902, 4 photographs; 2 on 2 nights selected and measured.
Eros, 4 photographs; 1 on 1 night selected but not yet measured.
Nova Geminorum, 5 photographs.
Pole, 1 photograph.

With the 30-inch reflector the following photographs have been obtained :—

Comet *b* 1902, 43 photographs; 26 on 24 nights selected and measured.
Eros, 8 photographs; 3 on 3 nights selected but not yet measured.
Comet *d* 1902, 42 photographs; 37 on 30 nights selected but not yet measured.
Comet *a* 1903, 20 photographs; 16 on 13 nights selected but not yet measured.
Comet *b* 1902, 5 photographs of about 60^m exposure, showing the tails, seven in number.

The total number of photographs taken was 223, of which 151 have been selected for measurement, and of these 94 have been measured.

When 6 photographs of Comet *a* 1903 taken with the Astrographic Equatorial are added to these, there are 63 photographs, principally of comets, awaiting measurement.

A new micrometer for measurement of photographs of Eros and of other photographs where especial accuracy is required, was obtained from Messrs. Troughton and Simms at the beginning of 1903. It is in general construction like the astrographic micrometer, the microscope moving on a horizontal slide, and the photographic plate moving in a perpendicular direction. The object glass of the microscope has a focal length of 3 inches, and it is so mounted that a magnification of 1 or 2 in the body of the microscope can be used. A glass diaphragm in the focus of the microscope is carried on cross slides with micrometer screws. The value of 1 revolution of the screw is $\frac{1}{75}$th of an inch, and the glass diaphragm differs from that in use with the astrographic micrometer by having pairs of lines $\frac{1}{3}$ rev. of the screw apart, the distance from the centre of one pair to that of the next being 1 rev. With a magnification 2 in the body of the microscope the scale of photographs taken with the Astrographic Equatorial is such that 1 rev. of the screw equals 10″, and the scale is the same for photographs taken with the 26-inch refractor when a magnification of 1 in the microscope is used. The micrometer screws have been examined and found to be sensibly uniform, and the values of 1 revolution have been accurately determined. A careful investigation has been made of the division errors of the glass diaphragm, and an examination made of the optical distortion of the microscope object glass. It is found that the latter, though sensible, is not large enough to affect the measures owing to a compensation introduced by the measures being all referred to two réseau lines 5′ apart. This micrometer has been used to determine the errors of the glass diaphragms in use on the astrographic micrometer, the diaphragms being removed from their micrometer and fixed on a glass plate and measured in the same way as a photographic plate.

The measures of the photographs of Eros for the determination of the Solar parallax will be commenced now that these preliminary investigations are finished.

Astrographic Equatorial.—The photography for the Greenwich Zone (Dec. + 64° to the Pole) being completed, only a few photographs have been taken to replace some which appeared to be inferior to the general standard. Altogether 116 photographs were taken during the year; these include 16 plates for the Astrographic Chart, 21 for the Catalogue, 48 of Nova Persei, 11 of *Comet b* 1902, 6 of *Comet a* 1903, and 8 for the adjustments of the instrument. Positives on glass have been made of 72 chart plates during the year. Altogether 1,359 plates have been copied, a number of the 1,140 fields being duplicated.

Since the last report 63,200 measures of pairs of images (6^m and 3^m), as well as the diameters of the 6^m images, have been made. The number of plates measured in the twelve months is 88. This completes the measurement from Dec. 64° to Dec. 80°, with the exception of the part from $20^h\ 40^m - 24^h$ in Zone 79°. In all 928 plates out of 1,149, and 1,764 square degrees out of 2,087, have been measured, amounting to about 84½ per cent. of the whole work of measurement.

The total numbers of stars measured, including $20^h\ 40^m$ — 24^h of Zone 79°, measured since the date of the report, with the corresponding numbers in the *Bonn Durchmusterung*, and in the catalogues of the *Astronomische Gesellschaft*, are—

Limits of Declination.	Number of Stars measured.	Number in B.D.	Number in A.G.C.	A.G.C.
64°–65°	8,954	1,932	1,200	Helsingfors.
65°–70°	49,014	8,159	3,700	Christiania.
70°–75°	49,900	5,872	—	Dorpat.
75°–80°	42,300	4,451	3,777	Kazan.
Totals 64°–80°	150,168	20,412		

It is to be noted that the numbers in the second column of the above table refer to separate stars, measured in duplicate in the great majority of cases.

Plate constants have been computed for 192 plates, whose centres are at declinations 70°, 71°, and 72°, the Standard co-ordinates of the Reference Stars being deduced from the Greenwich observations, 1897–1901, in order that they may be included in the Introduction to the Volume I. of the measures which comprises the Zones between Dec. 64° and 72°. This Introduction is nearly ready for the printers.

As the Greenwich Meridian Observations of the Reference Stars are completed within 10° of the Pole, the computation of Standard co-ordinates has been commenced, starting from the Pole, so that as soon as the measures of the plates are completed, the determination of plate constants can be proceeded with. All the Standard co-ordinates from the Pole to 85° Dec. are completed.

In addition to the determination of the errors of the glass diaphragms of the measuring micrometers, referred to in connection with the new micrometer for measuring the Eros plates, the errors of the two réseaux Nos. 80 and 81 have been determined, and a redetermination made of the errors of No. 34.

The counting of the Chart plates has been continued during the year, Zone 69° being counted from 17^h-24^h, and Zone 64° completely. The counting is thus completed between Dec. 64° and Dec. 70°. A paper on the Statistics of the Stars between 65° and 70° N. Dec. was communicated to the Royal Astronomical Society in 1903 January, and printed in the Monthly Notices. Zone 64° being at the limit of the Greenwich Zone, is only counted on one plate; in the other zones both overlapping plates are counted, and the table below gives the total number of stars shown, as well as the number shown in duplicate:—

Limits of Declination.	No. of Square Degrees.	Number in B.D.		Number shown on Photographs.					
		$9^m{\cdot}0$ and brighter.	Total Number.	Exposure 20^s		Exposures 3^m and 6^m		Exposure 40^m	
64°–65°	155	743	1,932	1,890		8,954		45,281	
65°–66°	149	762	2,005	2,476	1,473	9,239	7,109	47,080	39,401
66°–67°	144	632	1,744	2,155	1,294	9,505	7,213	45,333	38,631
67°–68°	138	624	1,577	1,849	1,201	9,586	7,236	44,489	39,188
68°–69°	132	529	1,470	2,103	1,277	9,939	8,106	45,627	41,036
69°–70°	126	347	1,363	2,435	1,418	10,745	8,598	46,897	41,520
Totals -	689	3,094	8,159	11,018	6,663	49,014	38,262	229,426	199,776
Number per square degree (Dec. 64°–65°).	—	4·8	12·5	12·2		57·8		292·1	
Number per square degree (Dec. 65°–70°).	—	4·5	11·8	16·0	9·7	71·1	55·5	330·0	290·0
Ratios - - (Dec. 64°–65°).	—	1	2·6	2·5		12·0		60·9	
Ratios - - (Dec. 65°–70°).	—	1	2·6	3·6	2·2	15·8	12·4	74·0	64·4

In accordance with the recommendation of the International Committee, it has been arranged to reproduce and distribute to a limited number of Observatories and Institutions the Greenwich portion of the Astrographic Chart, the original negatives being enlarged to twice the scale. A method of direct photographic reproduction has been adopted, prints being made by contact on bromide card (15in. by 12in.) from an enlarged positive on glass. It is found that practically no stars are lost in the reproduction, and there is little liability to false stars beyond those which may exist in the original negative, and these can readily be detected by reference to the overlapping plate. It is proposed to limit the reproduction to 50 sets, though additional sets can be subsequently made if required. Provision for this work has been

made by the Admiralty, and it is hoped that it will be completed in about five years. Preparations have been made to begin at once, the N.E. Lobby having been fitted up for making and washing the prints, the S.E. Lobby being used for developing them; and as soon as some zinc washing tanks, which have been ordered, are delivered, the work will be commenced.

For the photographic determination of the places of the close circumpolar stars used for azimuth error, nine successful photographs of the Pole have been taken with the 4-inch rapid rectilinear lens belonging to the Royal Astronomical Society, and four with the lens belonging to the Royal Observatory. It has not been found possible as yet to measure any of these photographs, as the investigation of the new micrometer is only just completed.

III. Spectroscopic and Heliographic Observations :—

The spectroscope, mounted on the 30-inch reflector of the Thompson equatorial was in use from May 10 to September 16, and again from November 1 to December 4, the equatorial being required for other purposes during the rest of the year. 39 spectra of some of the brighter stars have been photographed. A large number of measures of lines on 15 of these photographs have been made and reduced to exhibit apparent motions in the line of sight. There would appear still to be displacements of the lines as the telescope is moved during long exposure, though these have been considerably reduced in amount by the improvements mentioned in the last Report. It is to be remarked that both the mirrors of the 30-inch reflector require re-silvering, and that until this is done the spectroscope cannot be used with advantage, owing to the loss of light in the reflector.

In the year ending 1903 May 10, photographs of the Sun have been taken on 204 days, with the Thompson photoheliograph. Of these, 440, taken on 202 days, have been selected for preservation, besides 18 with double images of the Sun for the determination of zero of position angles. Supplementary photographs have been received from India and Mauritius to 1902 December 31.

For the year 1902, Greenwich photographs have been selected for measurement on 177 days, and photographs from India and Mauritius (filling up gaps in the series) on 172 days, making a total of 349 days out of 365 on which photographs are at present available.

Shortly after the date of the last report a long period of almost complete solar quiescence set in; from 1902 June 5 to September 17 inclusive, a period of 105 days, the mean daily spotted area being less than a single unit (one millionth of the Sun's visible hemisphere). An active period set in on September 18 and lasted until November 28, 72 days, the mean daily area being 164 millionths. The rest of the year 1902 was very quiet, the remaining 34 days showing a mean daily area of only 3. In the present year the Sun has been much more active, and has been free from spots on only 14 days since January 1, as compared with about 100 in the same period of last year. The first of a fine series of spot-groups appeared on the east limb on 1903 March 21, and a succession of new groups has followed almost without intermission up to the date of this Report. There can be no doubt, therefore, that the solar activity is very decidedly upon the increase.

All the photographs for 1902 have been measured in duplicate, and the reductions completed, except the taking out the mean areas and latitudes for each rotation and for the year. The copy for press of the daily results is ready for the printer.

Tables and diagrams showing the distribution of sun spots in latitude and the areas of sun spots and faculæ compared with magnetic diurnal ranges for the 29 years 1874 to 1902 have been prepared and will be published in the *Monthly Notices* R.A.S. for May.

IV. Magnetic Observations :—

The variations of magnetic declination, horizontal force and vertical force, and of earth currents, have been registered photographically, and accompanying eye observations of absolute declination, horizontal force and dip have been made as in former years.

The regular determinations of magnetic declination, horizontal force and dip have been made with the new declinometer, the Gibson deflexion instrument, and the Airy dip circle mounted in the Magnetic Pavilion.

The magnetic reductions for 1902 are completed to the following stages :—

The eye observations of the declination, and horizontal and vertical force magnets, are completely reduced. The time-scales for the magnetic registers are complete, the base line values, deduced from eye observations, are entered on the sheets,

and the hourly ordinates of the photographic curves are completely read and reduced. The temperature of the magnet basement at every hour has been read from the Richard thermograph sheets, and the daily and hourly means have been taken. The declination, dip and deflexion observations made in the Magnetic Pavilion are completely reduced.

The principal results for the magnetic elements for 1902 are as follows :—

Mean declination - - -	16° 22′·8 West.
Mean horizontal force - -	4·0134 (in British units). 1·8505 (in Metric units).
Mean dip (with 3-inch needles) -	67° 3′ 25″.

These results depend on observations made in the Magnetic Pavilion and are free from any disturbing effect of iron.

The magnetic disturbances in 1902 have been small and few in number. There were no days of great magnetic disturbance and 3 of lesser disturbance. Traces of the photographic curves for these days will be published in the annual volume, as usual. The calculation of diurnal inequalities from five typical quiet days in each month, selected in concert with M. Moureaux and Dr. Chree, has been continued.

V.—Meteorological Observations :—

The meteorological instruments are all in good order. The registration of atmospheric pressure, temperature of the air and of evaporation, pressure and velocity of the wind, rainfall, sunshine, and atmospheric electricity has been continuously maintained.

The meteorological reductions are in the following state :—The observations o barometer, thermometers, anemometers, rain-gauges, and sunshine recorder (corrected, where necessary, for instrumental error) are reduced up to the present time. On the photographic sheets all time-scales are laid down, and the hourly ordinates are read out and completely reduced to the end of 1902 for the dry and wet bulb thermometers, and to 1902 June for the barometer. The table of principal changes of the wind is complete for 1902.

The mean temperature for the year 1902 was 49°·1, or 0°·4 below the average for the 50 years 1841–90.

During the twelve months ending 1903 April 30, the highest temperature in the shade (recorded on the open stand in the Magnetic Pavilion enclosure) was 86°·1, on July 14. The highest temperature recorded in the Stevenson screen in the Magnetic Pavilion enclosure was 83°·1, and in the Observatory Grounds 85°·3, on the same day.

The lowest temperature of the air recorded in the year was 23°·6, on January 16. During the winter there were only 32 days on which the temperature fell below 32°·0, being 24 days below the average number.

The mean daily horizontal movement of the air in the year ending 1903 April 30, was 303 miles, which is 22 miles above the average of the preceding 35 years. The greatest recorded movement was 748 miles, on February 24, and the least 88 miles, on January 21. The greatest recorded pressure of the wind was 37 lbs. on the square foot, on February 24, and the greatest hourly velocity 48 miles, on February 27.

During the year 1902 Osler's anemometer showed an excess of 39 revolutions of the vane in the positive direction N., E., S., W., N., excluding the turnings which are evidently accidental.

The number of hours of bright sunshine recorded during the 12 months ending 1903 April 30, by the Campbell-Stokes instrument, was 1,335 out of 4,457 hours during which the Sun was above the horizon, so that the mean proportion of sunshine for the year was 0·300, constant sunshine being represented by 1.

The rainfall for the year ending 1903 April 30 was 23·68 inches, being 0·86 inch less than the average of 50 years. The number of rainy days was 172. The rainfall has been less than the average for each of the eight years from 1895 to 1902 inclusive, the total deficiency for the eight years ending 1902 December 31 amounting to 28·91 inches. For the four months 1903 January–April there has been an excess of 0·95 inch.

VI.—Printing and Distribution of Greenwich Publications :—

The printing of the volume for 1900 is complete, with the exception of the Introduction, which is in type.

As regards the volume for 1901, the transit-circle observations and results derived from them are printed, with the exception of part of the planetary results;

the transits, meridian zenith distances, and extra meridian observations made with the altazimuth are printed, and copy for press of the star-ledgers, catalogue and planetary results is prepared; proofs of the equatorial observations have been received; the heliographic results are printed; the magnetic and meteorological results are printed with the exception of the Introduction.

The printing of the Volume for 1902 has been commenced.

The printing of the measures for the Astrographic Catalogue is completed for the Zones 64° to 72° Dec., forming Vol. I. of the work, to which is to be added the Introduction, containing plate-constants, discussions of personality and probable errors, &c., which is now nearly ready for the printer.

Owing to the heavy work entailed by the recent Paris-Greenwich longitude determinations, the printing of the Montreal longitude determination, 1892, has been delayed, but will now be proceeded with, as well as the printing of the recent Paris longitude determination.

VII.—Chronometers, Time Signals, Longitude Operations, &c.:—

The number of Government marine chronometers and deck-watches now being tested at the Observatory is 479, viz., 285 box chronometers, 41 pocket chronometers, and 153 deck-watches. In addition to these, 9 chronometers and 2 deck-watches are being tested after repair for the Indian Government.

In the year ending 1903 May 10, the average daily number of chronometers and deck-watches being rated was 571; the total number received was 1,337, the total number issued 1,288, and the number sent for repair 625. These include 22 box chronometers, 3 deck-watches and 1 pocket chronometer for the Indian Government. At the present time there are 12 box chronometers on trial for purchase for the Indian Government.

For the annual trial of chronometers, which lasted 29 weeks, with a range of temperature from 43° to 105°, 47 chronometers were sent in, 16 being rejected in the course of the trial on account of the difference between one week's rate and the next having exceeded 12 seconds. Out of the remaining 31 chronometers 18 were purchased for the Navy and 2 for the Transvaal Government. With the exception of the first 3 chronometers, the performance was decidedly below the average of

recent years. Thus the average trial number of the first 10 chronometers was 21·1, as against 17·1, 18·5, 17·9, and 16·6 in the previous four years, and the average for the first 20 was 26·3, as against 21·5 and 21·0 in the last two years. As the trial numbers of several chronometers would be considerably reduced if a correction for progressive change of rate were made, it is not unlikely that the larger trial numbers found this year may be partly accounted for by the chronometers not being sufficiently seasoned.

For the annual trial of deck watches, lasting 16 weeks and including trials in the oven and in positions, 147 watches were entered, and of these 41 were purchased for the Navy. Among the watches sent for trial were 44 with centre seconds dials, of which 12 were purchased. There were 76 "Karrusel" watches in the trial, of which 20 were purchased. The performance of the deck-watches does not reach the high standard of last year, but fairly maintains the average of the previous seven years.

As the Admiralty desire to purchase a small number of pocket chronometers to gradually replace those at present in use on Surveying Vessels, pocket chronometers will be included in the annual trial of chronometers this year, and notice of this with a specification of the conditions has been issued to the makers. The next competitive trial of chronometers (box and pocket) will commence on July 4, and of deck-watches on October 24.

The Greenwich time-ball was not raised on two days during the year, owing to the violence of the wind. On May 13, through inadvertence, the ball was not raised at 13^h; on September 14 the ball did not rest properly on the clips, and failed to remain up; on December 15 the ball dropped about 2 feet, when the check rope jammed between the piston and cylinder and prevented further drop; on April 4 the clips failed to release the piston; and on April 20 there was a failure in the electric connections. On these days the ball was raised again at 14^h and dropped correctly.

The Greenwich time signal at 13^h failed on April 20 owing to the interruption of the electric connections referred to above. The error of the time signal was inappreciable except on September 7 (Sunday), when it was $8^s·0$ early, and October 7, when it was $0^s·7$ early.

The automatic drop of the Deal time-ball failed on 6 days owing to interruptions of the telegraphic connections, and on April 20, when no signal went out from

Greenwich. On 6 days the ball was not raised owing to the violence of the wind. On September 7 the ball was dropped 8^s too soon owing to the error of the Greenwich signal, and on January 16 it was dropped 7^s too soon (by a telegraph signal); it was raised again at 14^h and dropped by hand.

The return signal from Devonport failed on 38 days (of which 11 were Sundays) and could not be observed on 9 days owing to interruptions by telegraph signals. The apparent error of the clock signal (after daily correction of the clock by aid of a time signal from Greenwich, on the plan described in the Report for 1885) did not exceed $0^s \cdot 2$ on 88 per cent of the 316 days of observation, did not exceed $0^s \cdot 5$ on 97 per cent., and never exceeded $1^s \cdot 0$.

The return signal from the Portsmouth clock failed on 78 days (of which 41 were Sundays), and could not be observed on 5 days owing to interruption by telegraph signals. The apparent error of the clock (corrected in the same manner as the Devonport clock) did not exceed $0^s \cdot 2$ on 85 per cent of the 280 day of observation, did not exceed $0^s \cdot 5$ or 97 per cent., and never exceeded $1^s \cdot 0$.

The automatic signals from the Westminster clock have been received throughout the year except on 11 days, when the signal failed, and during the month of January while the clock was being repaired. The apparent error of the clock was not greater than $0^s \cdot 5$ on 21 per cent. of the days of observation, not greater than $1^s \cdot 0$ on 39 per cent., not greater than $2^s \cdot 0$ on 68 per cent., not greater than $3^s \cdot 0$ on 90 per cent., not greater than $4^s \cdot 0$ on 96 per cent., and exceeded 4^s on 8 occasions. It is understood that the performance of the clock has been affected by bricklayers' work in the weight shaft in connection with electric lighting last October, and that the cleaning of the clock which was thus rendered necessary had to be deferred till the Parliamentary recess.

Longitude Operations.—The second stage of the re-determination of the Paris-Greenwich longitude was completed in the Autumn of 1902. As in the first stage carried out in the Spring and referred to in the last Report, observations were made simultaneously by two French and two English observers at adjacent stations. The observations of both the French and English observers were made in three groups of three, six, and three full nights (or their equivalents in half nights), the observers with their instruments being interchanged between the first and second and again between the second and third parts. In the determination made in the Autumn the stands were also interchanged with the instruments. The following table gives a

summary of the number of nights of observation of the English observers, Mr. Dyson and Mr. Hollis:—

Date.	Observer at		No. of Nights on which Signals were exchanged.	No. of Nights on which Clock Error was determined.		
	Paris.	Greenwich.		Paris.	Greenwich.	Simultaneously.
1902.						
I. March 17–30 -	D.	H.	13	5	9	4
II. April 6–24 -	H.	D.	19	10	11	6
III. April 27–May 3 -	D.	H.	7	3	5	3
I. Sept 21–26 -	H.	D.	6	4	6	4
II. Sept. 29–Oct. 22 -	D.	H.	24	11	13	8
III. Oct. 25–Nov. 4 -	H.	D.	11	8	8	5

The reduction of the observations made by the English observers is completed with the exception of slight corrections which may have to be made in a very few instances to the assumed right ascensions of the stars.

The determination made in the Spring gave for the difference of longitude between Cassini's meridian and that of the Greenwich transit-circle $9^m\ 20^s{\cdot}974$, and for the difference of personal equation $D - H = 0^s{\cdot}041$. The determination made in the Autumn gave $9^m\ 20^s{\cdot}909$ and the difference of personal equation $D - H = 0^s{\cdot}049$. In the first series, if the level determination had been based entirely on observations of the striding levels, the result would have been $9\ 20^s{\cdot}982$, and if entirely on the observations of nadirs $9^m\ 20^s{\cdot}969$. In the second series the difference between the results from "striding levels" and "nadirs" was only $0^s{\cdot}002$. In the first series the probable error of the difference of longitude determined from one full night's observations was $\pm\,^s{\cdot}040$ and in the second series only $\pm\,^s{\cdot}018$, giving for the probable error of the determination made in the Spring $\pm\,^s{\cdot}0113$, and for that made in the Autumn $\pm\,^s{\cdot}0047$. It is to be noted that in each series there was a double interchange of observers, so that the probable error includes any change of personal equation between the first and third parts, and this would appear to account to some extent for the larger probable error found for the first series.

The International Geodetic Association considering it desirable that a re-determination of the difference of longitude Potsdam-Greenwich should be made with their lately adopted Repsold registering micrometer, the longitude pavilion was placed at their disposal, and the Post Office authorities have given all the telegraphic facilities desired. Prof. Albrecht and Herr Obst installed their instruments in the last week in April, and the observations are now in progress.

Arrangements have been made for Major Burrard and Captain Lenox-Conyngham, of the Indian Survey, to swing "Von Sterneck" pendulums at the Royal Observatory soon after Visitation Day.

VIII.—Personal Establishment:—

To our great regret, Mr. George Bischlager, who was appointed an Established Computer on 1902 June 4, died on 1903 April 17, after a short illness.

Mr. Rendell resigned his appointment as Established Computer on 1903 March 18, to become First Assistant in the Natal Observatory.

Mr. Melotte was appointed an Established Computer on 1902 November 1, and has since his appointment been attached to the clerical branch.

Mr. Stevens has been appointed since the date of this Report (May 14) as an additional Established Computer to assist with the photographic reproduction of the Astrographic Chart.

The permanent staff at the present time is thus constituted, the names in each class being arranged in alphabetical order:—

Chief Assistants—Mr. Cowell, Mr. Dyson.

Assistants—Mr. Hollis, Mr. Lewis, Mr. Maunder, Mr. Nash, Mr. Thackeray.

Second-Class Assistants—Mr. Bryant, Mr. Crommelin.

Clerical Assistant—Mr. Outhwaite.

Established Computers—Mr. Bowyer, Mr. Davidson, Mr. Edney, Mr. Furner, Mr. Melotte, Mr. Stevens, Mr. Storey, Mr. Witchell, and two vacancies.

The two Second-Class Assistants will be replaced by Higher Grade Established Computers as vacancies occur.

Mr. Dyson and Mr. Cowell have the general superintendence of all the work of the Observatory. Mr. Maunder is charged with the heliographic photography and reductions, and in addition has this year been engaged on the preparation of the Library Catalogue. Mr. Lewis has charge of the time-signals and chronometers, and of the 28-inch equatorial. Mr. Thackeray superintends the miscellaneous astronomical computations, and has this year been largely engaged in the re-reduction of Groombridge's observations. Mr. Hollis has charge of the photographic mapping of the heavens, the measurement of the plates, and the computations for the Astrographic Catalogue, and also of the longitude computations, which this year have been very heavy. Mr. Crommelin has charge of the altazimuth and of the reduction of the observations made with it and with the Sheepshanks equatorial. Mr. Bryant has charge of the transit-circle and reflex zenith tube, and of the reduction of the observations made with those instruments. Mr. Nash superintends the work of the magnetic and meteorological Branch. Mr. Outhwaite acts as responsible accountant officer, has charge of the library, records, manuscripts and stores, and conducts the official and general correspondence.

As regards the Established Computers, Mr. Davidson assists Mr. Dyson, and has charge of the Thompson Equatorial; Mr. Bowyer assists Mr. Lewis; Mr. Storey assists Mr. Thackeray; Mr. Stevens assists Mr. Hollis; Mr. Furner assists Mr. Crommelin; Mr. Witchell assists Mr. Bryant, in particular taking charge of the reflex zenith tube; Mr. Edney assists Mr. Nash; and Mr. Melotte assists Mr. Outhwaite as a provisional arrangement.

The number of Supernumerary Computers usually employed in the Observatory is 24; of these 9 are attached to the Astronomical Branch, 3 to the Chronometer Branch, 6 to the Astrographic, Thompson equatorial, and longitude reductions, 4 to the Magnetic and Meteorological Branch, 1 to the Heliographic Branch, and 1 to the Clerical Branch.

A foreman of works, with 2 carpenters and 2 labourers; a foreman mechanic, with 2 assistants; a gate-porter, 2 messengers, a watchman, a gardener, a labourer, and a charwoman, are also attached to the Observatory.

The whole number of persons regularly employed at the Observatory is 59.

At the end of November Mr. J. Simmons, who had been connected with the Observatory for nearly 40 years, resigned his post of Foreman of Works on account of ill-health, and I regret to say died very shortly afterwards.

IX.—General Remarks:—

The work of the Observatory continues to grow in various directions, as is evidenced by this Report, and it is only through the zeal and energy with which the Assistants and Computers have worked that the pressure during the past year has been so well met. In particular, there has been a considerable development in the meridian work consequent on the adoption of an extensive programme of observation with the reflex zenith tube for determination of variation of latitude, a question of primary importance as affecting meridian observations. It is, however, in the photographic branch, under Mr. Hollis, that the pressure has been felt most severely in the past year, accentuated by the circumstance that the Paris longitude determination entailed much additional work, both for observations and reductions. Investigations of the screw and scale errors of the new micrometer for measurement of photographs have also involved much labour in measures and reductions, but the way is now cleared for the systematic measurement of the photographs of Eros for determination of the solar parallax. Under these circumstances it has been found very difficult to keep up the measurements of the numerous photographs of comets taken with the Thompson Equatorial during the past year.

The need for improved tables of the Moon has been emphasized during the past year by the discussion of the results of Greenwich observations in the last ten years, which was taken up primarily in connection with the delimitation of an Anglo-German boundary, and which may perhaps be advantageously extended with a view to its use in the formation of improved tables of the Moon. In the same connection Prof. Newcomb, who has devoted so much attention to the subject, has urged that a fresh comparison should be made between theory and the Greenwich meridian observations from 1750 to the present time. It is a question for consideration whether it would be practicable to carry out this work at the Royal Observatory in such a form as would facilitate the preparation of improved tables and materially advance the lunar theory.

W. H. M. CHRISTIE.

Royal Observatory, Greenwich.
1903 May 29.