1883.

VICTORIA.

EIGHTEENTH REPORT

OF THE

BOARD OF VISITORS

TO

THE OBSERVATORY;

TOGETHER WITH THE

Annual Report of the Government Astronomer.

PRESENTED TO BOTH HOUSES OF PARLIAMENT BY HIS EXCELLENCY'S COMMAND.

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EIGHTEENTH REPORT

OF THE

BOARD OF VISITORS TO THE OBSERVATORY.

To His Excellency the Most Honorable the Marquis of Normanby, G.C.M.G., *Governor and Commander-in-Chief of the Colony of Victoria, &c., &c., &c.*

We have the honour to report that we have completed the visitation of the Observatory for this year, and to inform Your Excellency that we found the instruments in perfect order, and the work going on satisfactorily, although the absence on leave of Mr. White, chief assistant, imposes much additional labour on the staff.

The building for the new Transit Circle is well advanced, and it is hoped that the instrument will be mounted in about three months.

The interior of the present room and offices needs colouring, nothing having been done to the walls since the building was erected twenty years ago.

We are glad to find that the arrears of published observations are being overtaken, and that the scope of the meteorological work has been very greatly extended in a practical and very useful direction. A map of the rainfall areas in Victoria is being prepared, from which most valuable information concerning the distribution of the rainfall in all parts of the colony can be obtained.

It will be seen by the report of the Astronomer that, during the year, besides the ordinary work of the Observatory, there have been numerous important observations made of the Great Comet of 1882 and of the transit of Venus.

The longitude of the Observatory has been corrected by the result of a series of telegraphic comparisons between Singapore, Port Darwin, Banjoewangie, and Melbourne, and it is found that the longitude is 1·5 of a second less than as heretofore assumed. The longitude will now be stated as 9h. 39m. 53·37s.

The most important matter which we have to submit for the consideration of Your Excellency's Government is the necessity for providing for the vacancies in the Observatory staff, which cannot long be avoided. In our last Report we referred to the desirability of training young men to fill positions in the Observatory as they become vacant, and we would further suggest that in any future permanent appointments a thoroughly mathematical training shall be considered an essential qualification. This, we feel sure, is absolutely necessary if the position the Observatory now holds among others is to be maintained; for the rapid progress taking place in astronomy and in physical science demands a proportionately higher preliminary training for their satisfactory study and practical investigation.

W. F. STAWELL,
G. V. SMITH,
GEORGE VERDON, F.R.S.,
J. E. BROMBY, D.D., Hon. Sec.,
M. H. IRVING, M.A.,
W. C. KERNOT, M.A.,
F. STANLEY DOBSON, LL.D., M.A.

Melbourne, September 21, 1883.

REPORT OF THE GOVERNMENT ASTRONOMER TO THE BOARD OF VISITORS TO THE OBSERVATORY.

23rd August, 1883.

THE Report which I now submit to the Board of Visitors refers to the year commencing the 1st of July, 1882, and terminating 30th June, 1883.

The last visitation of the Board took place on August 15th, 1882.

During the year which has elapsed no important changes have been made in the Observatory, either as regards the personal establishment, in the work, or directions of research. Nevertheless, unless we rest content to lag behind, the rapid advancement now taking place in all the branches of science with which this Observatory is concerned, renders necessary constant minor changes and improvements in details to keep our work up to the scientific requirements of the time. Such changes or additions that have been made will be referred to further on.

I.—PERSONAL ESTABLISHMENT.

The permanent staff of the Observatory is the same as the date of my last Report, and consists of—

Mr. ELLERY, Director, Government Astronomer;
Mr. WHITE, Chief Assistant;
Mr. MOERLIN, Assistant;
Mr. TURNER, ,,
Mr. GILBERT, ,,
Mr. PRINGLE, ,,
J. BURLEY, Messenger.

On the temporary staff there are Messrs. Kemp, Ingamells, and Hauser; the former has been now several years at the Observatory; the second was employed as telegraph clerk last year, as stated in my former Report; while the latter acts as clerical assistant in connexion with the weather chart and intercolonial weather system. There are also engaged in the establishment, as in former years,

G. SWANSON, Mechanic;
JAS. GRIEVE, Workman.

Mr. Lilly, who had for some years acted as mathematical assistant, left the Observatory in September last. Mr. Pringle was appointed on probation in April, 1882, but, having passed the Matriculation Examination in November, his appointment as a 5th class officer of the civil service was made in December last.

In April last, Mr. White, the chief assistant, obtained a year's leave of absence to visit Europe and to recruit his health, which had been somewhat unsatisfactory of late. He arrived in England in June last, already much benefited by his holiday.

As regards the distribution of the duties among the officers, some minor changes, rendered necessary by increasing duties and also by the temporary absence of the chief assistant, have been made. Mr. Moerlin, assisted by Mr. Kemp, continues in charge of the magnetic and meteorological work, and also undertakes the reductions of the meridional observations in polar distance, and in the absence of Mr. White also takes charge of the reduction of the right ascension observations and clock errors. The meridional observations have always been in charge of Mr. White, assisted by Mr. Gilbert; but in the absence of the former, the transit circle observations are made by Mr. Gilbert, assisted by Mr. Pringle. Mr. Turner, as usual, has been almost exclusively occupied with observation with the great telescope and solar photography. The duties connected with the Library and the receipt and acknowledgment of books are transferred to Mr. Turner and Mr. Pringle.

II.—GROUNDS AND BUILDINGS.

By the kind assistance of the Curator of the Botanical Gardens, I have been able to gradually effect some improvement in the Observatory grounds by laying out, trenching, and planting clumps of trees and shrubberies, and clearing the intermediate portions of undergrowth so as to form rough lawns between the planted portions. Only the part immediately fronting the Observatory has been done up to the present, but I hope from time to time to extend this work to the southern and eastern portion of the grounds.

The greatly increased traffic on the St. Kilda road, coupled with its bad state of repair during the last summer added seriously to the dust nuisance from which the Observatory has suffered more and more each year. To mitigate this as far as possible, I propose planting densely-growing shrubs and trees around the ground as rapidly as means at my command will admit. I trust, however, that when the alterations of the road now in progress are completed that there will be a diminution of this inconvenience.

The extensive repairs to the fencing around the grounds carried out last year has greatly improved its appearance, and will also, I hope, prolong its existence until the hedge of Cape thorn, planted around it about two years ago, has grown sufficiently to form a fence by itself.

The main building is now in excellent repair so far as the exterior is concerned. Some internal renovations, however, are much required, which will probably be effected during the current year.

The new transit circle room is now in course of erection ; it is already in an advanced stage, and expected to be finished in October. The instrument itself has not yet been received from the makers, but as the contract time for its completion expired in April last, it may be expected to arrive very shortly. The new transit room has been placed on the east side of the main building, the northern wall of both buildings being in one line, but separated by a quadrangle of about 25 feet. Across the south end of this quadrangle will be a passage parallel with the north wall of the east transit room and leading from a door near the south-east corner of the old transit room into nearly the centre of the west wall of the new one. The internal dimensions are :— From north to south 36 feet, east to west 20 feet, height at meridian opening $20\frac{1}{4}$ feet. It is constructed of brick with stucco, similar to the rest of the building. The roof is of corrugated iron and wood. There are three roof shutters, also made of corrugated iron, fixed on a light iron frame-work, and they run on and off the opening on light iron rails. The inclination of the roof is such that when the shutters are released they run gently off the opening by their own weight, while the closing is effected by means of wire ropes with counterpoises on the west wall of the room. The north and south openings, 2 feet 5 inches wide in the clear, are closed by double shutters opening outwards. The piers are very massive, those for the circle being blocks of blue-stone (basalt), weighing over 5 tons each. All the piers rest on a foundation of heavy blocks of basalt and cement concrete, on a subsoil of hard sandstone cement. From the excellent natural foundation, the massiveness of the piers, and the care taken in construction, I have every reason to hope the mounting of the new transit circle will be as stable as that of the old one, which is all that could be desired in that respect.

The great telescope building, as well as the south equatorial and photo-heliograph house, magnetograph house, and minor buildings are in good condition. The want of a verandah around the latter is, however, severely felt during the summer months, and provision has been made on the Estimates for the current year for this addition.

The dome of the north equatorial has given trouble for some time past ; it is frequently difficult to move without undue force. The principle on which its running mechanism was first designed was bad, and it has always been unsatisfactory. It is now absolutely necessary to alter it. A completely new arrangement has been designed, and is in course of construction. The floor of the room itself has been raised nearly three feet, obviating the necessity of the high steps formerly used. This is found to be an immense improvement as regards convenience and comfort in observing.

III.—Instruments, Apparatus, etc.

Astronomical Instruments.—The principal astronomical instruments are in a satisfactory condition. The transit circle, although showing some signs of wear, especially in its pivots, continues to furnish excellent and trustworthy results, but every year forces upon us the necessity of greater optical scope for our meridian work ; it is therefore gratifying to know we may reasonably expect to have our new circle erected within the next three or four months.

The great telescope continues in good condition, and although the inevitable loss of reflective power increases a little year by year, it does not yet affect the work on which it is engaged to any sensible degree. Indeed some photographs of faint objects obtained lately are clear evidence of the immense light-gathering power it still possesses, and of the trivial loss occasioned so far by the slight tarnish apparent.

The south equatorial (8-inch) is in capital order. Since my last report some additions and improvements have been made to it, partly to make it more convenient for general use, and especially for the parallax observations of Sappho and Victoria completed in October last. These additions consist in a new driving clock with Grubb's electric control pendulum (referred to in my last Report), which works most satisfactorily; a new epicyclical slow motion, as well as a new clamp and tangent slow motion, to get rid of a little looseness or "lost time" in the old form, and two new micrometers with dark field illumination. To secure truly central rays for illumination of the micrometer field in the parallax observations referred to, an arrangement was made, by help of a very small prism cemented on to the outside of the object glass and a simple train of lens and mirrors, to get light from the declination circle lamp down the optical axis of the telescope. This gave excellent and symmetrical illumination of the micrometer wires.

Some months ago I tried the incandescent electric lamp for the illumination of this instrument with such good results that I have now arranged three of the small Swan's lamps (about 2 to 3 candle power each) for the complete lighting up of the instrument. One lamp is for illuminating the declination circle under the microscopes, one for the setting declination circle, and one for illuminating the field of the telescope. A small handle near the eye-piece enables the observer to turn the current on to either lamp at pleasure. The current for the lamps is obtained from four carbon zinc elements in bichromate fluid. By a convenient arrangement the elements of the 4-cell battery can be immersed or withdrawn from the battery fluid by a handle or cord within convenient reach of the observer's hand, so that the amount of light can be regulated from the merest glow to a light far more intense than is required. By using rather small elements and cells

containing a large quantity of fluid, the current can be kept practically constant for a long time, and with a little care the batteries will do about 30 to 50 hours' work without replenishing with fluid.

The photo-heliograph, chronographs, clocks, and all minor astronomical instruments are in good working condition. There is one point, however, in connexion with the electric contact in the transit clock that may be referred to. The contact springs were mounted on ebonite as the insulating material. It had been noted for years that certain changes in the clock rate occurred which could not be accounted for as due to change of temperature or atmospheric pressure. It occurred to me that some alteration of the ebonite, which we know takes place under changes not only of temperature but of moisture also, must be the cause of this, and I got the springs remounted on slate as the insulator. The result was very marked and satisfactory, and points to slate as an excellent substance for this and similar purposes.

One or two new instruments have been made in our workshop during the past year, notably two new micrometers for the south equatorial already referred to and described in Appendix A., and an apparatus for the determination of absolute *personal equation* described in the Appendix B.

Magnetic and Meteorological Instruments.—No addition or any change of importance has been made in the instruments of this branch of the Observatory. They are in good working order, and in the same position as at the date of the last visitation.

An important change has, however, been made in the photographic process for the self-registering instruments by the adoption of a special photographic paper known as Morgan and Kidd's argentic-bromide paper, instead of the old Talbot type paper used hitherto. This is a very great improvement. The paper is obtained already prepared from the makers in England at a cost but slightly, if at all, exceeding the cost of materials in the Talbot type process hitherto followed in this work. The time saved, equal to six hours per week, and the much better and more certain results secured, would, however, amply compensate for even a considerable increase in cost. The photographic work used to take up at least 13 hours a week ; by this change it is reduced to 7. The same paper is now being used at Greenwich and Kew for similar purposes.

The Hagemann vacuum and the modified Robinson anemometer continue to work well ; the former especially proves a most valuable and easily managed instrument. I am getting one of a somewhat simpler form than ours made for the Meteorological Observatory at Hobart.

IV.—The Library.

This has been materially increased during the year, principally by the donations enumerated in Appendix C, but also by books purchased—chiefly serials.

New shelving has been fitted up in the east transit room, which has enabled me to give accessible place to a great number of books hitherto packed away.

V.—Publication.

I am glad to report that we are gradually overtaking arrears of work in this direction.

The astronomical results and annual catalogues from 1876 to 1880, forming volume VI., are now in the hands of the printer, and about a third of the whole has been already set up and revised. The second general ten-year catalogue is also well advanced, but its completion has been delayed owing to pressure of work and to the failing health of the chief assistant, Mr. White, who had charge of the computations connected therewith.

The monthly record of meteorology and terrestrial magnetism has been issued up to January, 1883, and is ready for the printer up to the end of June, 1883. The volumes of the yearly results of the magnetic and meteorological observations have been published to 1876 only, but the years '77, '78, '79 are ready for the press, and all the tabulations are finished to the end of 1882. The weather chart is published daily as hitherto, and an isobaric chart and weather forecast compiled every afternoon, which forms the basis of the weather chart published in the *Argus* the next day.

VI.—The Work of the Observatory.

There has been no important departure from the lines of our ordinary work hitherto followed during the past year. As usual the meridian observations have claimed our first attention, and are always regarded as of the most importance in the astronomical work. As regards extra meridional observations, the revision of Sir John Herschel's nebulæ has been steadily gone on with, while such work as cometic and planetary observation, observation for solar parallax, and other occasional observations have been carefully attended to from time to time as requirement or opportunity arose.

The meteorological work is increasing every year, more particularly in the direction of gathering statistics, in the intercolonial weather telegram system, and in placing meteorological information before the public. The magnetic work has been continued as in former years without change except so far as refers to the photographic method of registration already referred to. The following is a brief synopsis of the principle work of the year.

Transit Circle Observations.—These have been for the most part confined to the ordinary observations of standard stars for the determination of clock and azimuth errors, the determination

of places of stars that have been observed with comets, and of other stars whose positions are required for correcting catalogues for geodetic purposes or for some special astronomical requirement. The number of observations with the transit circle of the several kinds are as follows :—

Right Ascension Observations	1714
Polar Distance ditto	430
Observations for Instrumental Errors, viz. :—	
Collimation	159
Level	159
Nadir	157
For Runs of Microscopes	26
For Flexure of Telescope...	7

All of which are finally reduced to the end of June, 1883.

Great Telescope Observations.—The great telescope has not been kept so closely at its special work—the revision of the southern nebulæ—as might be wished. This is accounted for by the fact that a considerable number of nights were occupied with the great comet, and many others in experimenting in celestial photography with the new gelatine plates.

The principal work was the revision of 20 of the nebulæ and clusters of Herschel's catalogue which have been all sketched, viz. :—4235, 4239, 3797, 3990, 3996, 3811, 3823, 3874, 3864, 3866, 3966, 4024, 4075, 4120, 4144, 4121, 4132, 4179, 4183, 4258. Some of Herschel's nebulæ were looked for, but could not be found—in some instances probably owing to an unfavourable state of the sky.

The photographic work comprised 22 negatives of the moon with gelatine plates. The extreme sensitiveness of these plates made it necessary to reduce the aperture from 48 to 24 inches, and then the exposure had to be as instantaneous as possible.

Several attempts to photograph the nebulæ and comets were made with these plates, with more or less success. Photographs of the nebula of Orion, after an exposure of one, two, three, and four minutes were got ; the one exposed for four minutes gave promise of very satisfactory results in this direction, but several attempts on the nebula η Argus failed, even although exposed 30 to 40 minutes ; this, I think, may be accounted for by supposing the light of this nebula to be deficient in the more refrangible rays as compared with Orion, &c. Photographs of groups of stars and of the planets were also obtained.

The great obstacle to obtaining photographs of faint objects is the difficulty of keeping such a large telescope steady during a period necessary for the exposure of the plate, so that, when a sufficient exposure has been obtained, the stars are all considerably enlarged from the vibrations and small movements of the telescope in the interval. A certain amount of scientific interest attaches to these experiments, but the results do not yet promise to be of such value as to warrant diverting the telescope from the revision of the nebulæ for the purpose. I propose, therefore, to keep the telescope more exclusively to the nebulæ in the coming summer and autumn.

During the year observations of some kind were obtained on 79 nights ; 57 nights were taken up with visitors. On the remaining 229 nights cloudy weather, full moonlight, or some other cause interfered with the work.

Sun Photographs.—170 pictures were obtained with the photo-heliograph during the year. Most of these were on the ordinary wet collodion plates, but some were taken on gelatine plates with a much reduced aperture.

Special and Occasional Observations.—Under this head I class cometic and other extra meridional observations, observations of the planets Sappho and Victoria for solar parallax, the transit of Venus of December 6th, 1882, and the Port Darwin expedition for determination of longitude of Australian Observatories.

In my last report I referred to a series of measures of difference of declination between the planetoids Sappho and Victoria, and selected fixed stars lying near their path, which had been commenced a little before the last visitation. This work was begun in July and finished in October, in accordance with a scheme arranged by Mr. Gill, the Astronomer Royal at the Cape of Good Hope. It was an undertaking of a somewhat arduous nature, requiring the utmost care and precision to furnish results fitted for the solution of the problem for which they were required, namely, the parallax of the sun. Considerable difficulties presented themselves in the prosecution of the work. First, the weather was not by any means propitious. The planetoids and the comparison stars were all faint objects, requiring a very clear sky for their satisfactory observation, and a great number of nights, although moderately clear, were hazy. There was often a doubt too as to which of several stars visible in the neighbourhood were the actual comparison stars selected.

However, a very fine series of measures were obtained on about 30 out of the 90 nights selected for the work. It was arranged at the outset that Mr. Gill should undertake all the subsequent calculations, and a copy of the observations was sent to him after the completion of the work, but up to the present I have not heard of the results.

Perhaps the most interesting astronomical event of the year was the apparition of the great comet in September, 1882, which continued sufficiently visible for measures of position up to the 26th April, 1883. From its first appearance to the last observation with the great telescope we had it under sight for 250 days. An extensive series of measures were got, as well as some photographs and spectroscopic measures.

The most important work of this kind was the observation of the transit of Venus in December last. At the date of the last visitation of the Board neither the number of observing

stations which were to be established in connexion with this Observatory, nor their exact position, were quite decided upon. It was, however, shortly afterwards arranged to establish a station at Hobart, and another at Sale, in Gippsland. After selecting the sites and arranging the equipment, I despatched Mr. White, the chief assistant, to Hobart, and Mr. Moerlin to Sale, in time to get their observatories and instruments into position and order before the day of transit. The outcome was fine weather and thorough success at Hobart, where Mr. White secured excellent observations; cloudy weather at Sale, for not even a glimpse of the sun could be got by Mr. Moerlin; and a satisfactory series of observations here by both Mr. Gilbert and myself, besides a number of photographs of the various phases obtained by Mr. Turner with the photo-heliograph. The results of the Victorian parties' observations were, according to arrangement, transmitted to the British Committee, to whose care the computation of the results of all the British observations have been entrusted.

The determination of the longitude of Australian observations from Greenwich by telegraph has also been accomplished this year, and a large portion of the work has fallen on this Observatory. Ever since the last transit of Venus in 1874 the question of Australian and New Zealand longitudes, and their accurate determination by telegraph, has been under the consideration of English, American, and Australian astronomers; and correspondence on the point passed between the American Hydrographic Officer and myself, and the President of the Royal Society of London, Mr. Todd, and myself. The despatch of a British observing party to Queensland to observe the transit of Venus offered an opportunity for carrying the project into effect. If Australia would undertake the necessary observations at Port Darwin, it was arranged that one of the Queensland party should, after the transit, proceed to Singapore and exchange signals with the observer at Port Darwin. It was subsequently arranged between Mr. Todd, Mr. Russell, and myself, and agreed to by our respective Governments, that each colony interested should contribute towards the cost of sending an Australian observer to Port Darwin, to co-operate with the observer at Singapore. Consequently I selected a gentleman engaged in the Lands and Survey Office, and who had already spent several months in practical work at the Observatory, as an observer for Port Darwin, while Captain Darwin, R.E., undertook the Singapore work. The longitude determination from Greenwich to Singapore had already been accomplished in six steps, viz.:—Greenwich—Mokattam, Mokattam—Suez, Suez—Aden, Aden—Bombay, Bombay—Madras, Madras—Singapore.

After careful practice, during which he had an opportunity of personally arranging the methods of proceeding and codes of signals with Captain Darwin, Mr. Baracchi was despatched to Port Darwin, *vid* Sydney, on December 9th, arriving at Port Darwin on December 29th, 1882.

Mr. Todd had so well arranged matters by telegraph with his officers at Port Darwin that Mr. Baracchi had little difficulty, with the help of a sailor he took from Melbourne with him, in getting his observatory and instruments into position and setting to work. It was unfortunately the wet season at Port Darwin, and very great delay was caused by the prevalent cloudy skies. However, by the end of February a satisfactory series of signals had been exchanged between Mr. Baracchi and Captain Darwin at Singapore, as well as with Captain Helb at Banjoewangie (Java); and also with the Adelaide and Melbourne Observatories. He dismounted his instrument and left Port Darwin on March 6th, reaching Melbourne on April 1st; having most successfully and satisfactorily accomplished the task entrusted to him.

The results of this work have been all computed and are complete, with the exception of copies of observations made at Singapore, which are daily expected from Captain Darwin; these, however, are only required to verify the same information sent by cable to Mr. Baracchi at the time, and are not likely to affect the results already arrived at.

	H.	M.	S.	
Hitherto adopted longitude of Melbourne ...	9	39	54·8	E.
Longitude by Telegraph	9	39	53·37	E.

The latter, subject perhaps to some very small correction, will be adopted as the true longitude of Melbourne. I might mention that the several colonies which agreed to share in the cost of this work are New South Wales, South Australia, New Zealand, Tasmania, and Victoria.

During the time the British transit of Venus observing party was in New Zealand, longitude signals were exchanged between Burnham in New Zealand and Sydney, the signals being also repeated on to Melbourne; but owing to the prevalence of cloudy weather either at Sydney or Burnham on the few nights selected, the results are not considered satisfactory by Mr. Russell, more especially as on one night when it was fine both at Burnham and Melbourne a series of signals, which had just been commenced, were lost through some blunder or mistake on the part of a telegraph operator in Melbourne. It is therefore probable a new undertaking of the kind will be necessary before the true difference of longitude between New Zealand and Australian observatories can be considered satisfactorily determined. In the course of this work signals were exchanged between the Melbourne and Sydney clocks, but the result differed slightly from former determinations, and it is therefore intended to carry out a very careful series of signals between Adelaide, Sydney, and Melbourne during the coming spring or summer.

Meteorology and Terrestrial Magnetism.—This branch of our work has been carried on as usual. Determinations of the absolute force of terrestrial magnetism have been made by Mr. Moerlin regularly every month, and continuous photographic registration of the variations in these forces are obtained with the magnetographs. Besides the magnetographs, continuous registration by photography is obtained of the movements of the barometer, and the *wet and dry bulb thermometers.* The photographic manipulation in connexion with this work is, as already stated, very much facilitated by the adoption of the new gelatine argentic-bromide paper. The photographic curves from these instruments occupy about 900 sheets in the year, the manipulation itself of which

involves a very considerable amount of labour. This, however, has been much dimished, as already stated, by the adoption of the argentic-bromide paper. The sheets are all filed away in order, so as to be easily referred to for any date that may be required.

The amenographs, both Robinson's and Hagemann's, as well as the spring ombrograph, have furnished unbroken records of the velocity and direction of the wind, of the force of every gust of wind, and of the times, duration, intensity, and amount of rainfall. These very valuable records are also filed away so as to be accessible at any moment.

The *sunshine recorder* has also supplied a faithful register of the hours of sunshine.

As regards the ordinary meteorological work at the Observatory, I have continued our four daily eye observations of all the instruments, state of weather, &c., which form the basis of the meteorological record.

The five coast stations (second-class)—Portland, Cape Otway, Wilson's Promontory, Lakes' Entrance, and Gabo Island—have continued in operation and supplied unbroken records. Of three other second-class stations—viz., Echuca, Ballarat, and Sandhurst—the two former only furnish complete returns. At Sandhurst the instruments have been for many years at the Lands Office. The site, however, has become so closed in by buildings, that it is unfit for a meteorological station; moreover, owing to departmental changes, difficulties have arisen in obtaining regular observing. Under these circumstances I have for some time past endeavoured to make more suitable arrangements. Last month I obtained the co-operation of the Council and Director of the School of Mines, and have arranged to place the instruments in the grounds of the Mechanics' Institute and School of Mines, under the supervision of the Director. I hope by this means to re-establish complete registration, which had for so many years been most assiduously and carefully carried out by the several district surveyors, until the position became so unfit as to detract seriously from the value of the records. .

I have considerably extended our system of rain-gauges over the colony, and we now receive monthly returns from 154 observers, most of whom are volunteers, to whose charge Government gauges have been entrusted. There are also many private observers, who furnish us with monthly registers obtained with their own gauges. There is no lack of volunteers for this service, but as I desire to establish gauges in the more thinly-populated districts rather than multiply them in the more settled parts of the country, I am compelled to decline the generously proffered services of a good many who are very ready to help in this work.

The records of the Hobson's Bay tide gauge have been obtained without interruption during the year.

Time-ball, Distribution of Time, &c.—The time-ball at Williamstown has given its signal properly on 275 out of 296 times. The failures—21—were, for the most part, owing to interruption on the telegraph lines. The time-ball at Geelong has also been dropped regularly and correctly.

The Clock Control System continues in operation, but unfortunately the great increase in telephone wires in town has multiplied the interruptions from contact of wires very considerably.

The Post Office Clock has been going exceedingly well excepting on three occasions, viz., February 16th, April 9th, and June 11th. On the first occasion it was accidentally stopped, on the second the escape wheel broke, and on the third its rate altered suddenly and largely without any discoverable cause. Except on these occasions its error has never exceeded twelve seconds.

As regards work done gratuitously for the public, I may mention rating or adjusting 30 chronometers and 10 watches; testing 65 aneroid and mercurial barometers; selecting and testing numerous surveying, meteorological, astronomical, and nautical instruments, for mariners, explorers, and others. The largest tax on the staff in this direction, however, which increases every year, is in furnishing meteorological and physical data, copies of records, answering questions upon these and astronomical subjects to numerous applicants in this and the neighbouring colonies or from other countries.

VII.—Intercolonial Weather Telegraphy.

The intercolonial weather system is now moderately complete; it embraces all the settled portions of Australia and New Zealand, and several important stations in Tasmania. The latter colony has only been waiting for a supply of meteorological instruments, which has just arrived, to give most complete and substantial co-operation in the undertaking.

Western Australia has added another reporting station to our list—namely, Weld—which most materially adds to our knowledge of the meteorological conditions ruling every morning in the great Australian Bight.

To improve the weather system the chief requirements now are greater promptitude in the despatch of the telegrams and the establishment of a few more inland stations, especially in the North-Eastern portion of Australia.

VIII.—General.

Last November I received a letter from Dr. Krueger, of Kiel, informing me it was proposed that the Kiel Observatory should be constituted "a central bureau for astronomical telegraphy," and that numerous national observatories—those of Great Britain among the number—had already agreed to the proposition. I was requested to allow the Melbourne Observatory to become the central office for the Australian colonies. I at once agreed to the proposal.

The object of this scheme is that all important astronomical intelligence, discoveries, &c., may be at once communicated to the central bureau at Kiel, which communicates the news

by telegraph to the various secondary centres, so as to disseminate it among astronomers as rapidly as possible. About six weeks ago I received an official intimation that the Eastern Extension Company had granted the privilege of free transmission of 12 astronomical telegrams each way per year on their cables and lines, and the Superintendent of Telegraphs in Adelaide has intimated that all such telegrams shall pass free over the South Australian lines also. A code by which such messages may be greatly shortened has been devised in America and adopted by the Central Bureau. Any astronomical discovery or intelligence of importance transmitted to this Observatory from any part of Australia or New Zealand will be codified and sent to Kiel, from whence astronomers in other parts of the world will be notified. On the other hand any similar intelligence reaching Kiel from other parts of the world will be telegraphed to Melbourne, from whence the intelligence will be transmitted to all Australian and New Zealand astronomers.

I am sending a few photographs, &c., to the Calcutta Exhibition. They comprise three enlargements of photographs of the moon, 16 inches diameter ; ages, 9 days, 10 days, and 15½ days respectively. Also a bird's-eye view of the Observatory and grounds from the tower of Government House, and some pictures of the great telescope. Some months ago a desire was expressed in Parliament that a map should be issued every year from the Observatory, showing the distribution of rainfall over the colony. After much consideration as to the best method of doing this, and several conferences with the Surveyor-General, who not only takes great interest in the question, but also possesses a most complete knowledge of the topography and physical characters of the colony, a plan has been adopted to show the areas over which a definite rainfall has occurred, by a *tint* or *tone*. There are seven tints showing the areas over which the annual fall has been—10, 15, 20, 25, 30, 35, 40 inches respectively. The map shows the rainfall not only of Victoria but also of a large part of New South Wales and South Australia, including all Riverina. I expect to issue the map in a week or two.

This method of indicating that important factor in Australian climate and Australian prosperity will, I hope, be found useful, for the distribution, when the mode of indicating is understood, is seen at a glance ; and as I hope shortly to get another map prepared, showing average annual distribution as far as our records will permit, it will become interesting to watch from year to year the movement of the several areas over the southern portion of Australia, and will afford a ready means to determine, after a time, whether there is any rough law which shall account for dry or wet cycles over comparatively small areas, such as Gippsland, the Western district, the Northern districts, &c.

While on this subject, I wish to call attention to the importance, in view of future schemes for conservation of water and its distribution, of instituting some accurate but simple system of gauging our rivers and principal streams in connexion with the system of collecting rainfall statistics, and thereby obtaining some knowledge of the loss, retention, or delivery of rainfall in our several gathering grounds and basins. In some areas where the rainfall would indicate a full flow of the chief streams, this does not occur, and great loss evidently occurs through soakage into lower strata. Such knowledge in connexion with that of the rainfall would be of greatest importance in selecting streams from which to obtain supplies.

As regards the work for the current year, I do not propose to make any great change.

So soon as the new transit circle is erected and properly adjusted, it will be employed upon the revision of a rather large catalogue of stars at the request of the Astronomische Gesellschaft, besides our own special work. The great telescope I propose shall be devoted as exclusively as possible to the continuation of the revision of Sir John Herschel's nebulæ. I hope also to make some change by which a photograph of the sun shall be obtained on every *possible occasion*, for by existing arrangements several opportunities, especially on Sundays, are lost. To this end the adoption of the dry instead of the wet plate method will help considerably. The present position of the photo-heliograph is inconvenient, as it is too far away from either of our photographic rooms, and I intend moving it on the earliest opportunity, and shall then probably utilize the dome it now occupies for a four or five inch equatorial, which is often required for students and amateurs.

The continual and increasing progress to which science in all its departments is subject, is ever changing and improving the modes and means of observation and inquiry, and every year brings about some necessary change in a scientific establishment of this kind, so that although it may now appear as if but little departure from our present arrangements is required, it will be as hitherto my chief desire and duty not only at once to avail myself of any progress, improvements, or discovery that may arise, but also as far as possible improve for ourselves the methods and appliances of research, so that our Observatory may honourably maintain the position it now holds among others of the world.

ROB. L. J. ELLERY,

Government Astronomer.

August 23rd, 1883.

APPENDICES

TO THE

REPORT OF THE GOVERNMENT ASTRONOMER TO THE BOARD OF VISITORS.

APPENDIX A.

NEW "DARK FIELD" MICROMETER.

This micrometer is of a somewhat novel form. As far as the micrometer box, parallel wire frames, screws, &c., are concerned, it resembles the ordinary parallel wire micrometer of the German form. The principal frame which carries the measuring web is actuated by a screw with 100 threads to the inch, and is "kept to its work" by a pair of fine spiral springs, one on each side of the screw. The smaller frame carries five webs, three parallel to the screws, and two at right angles to it ; the latter are known as the bisecting webs. This frame is used for adjusting to zero only, and is therefore movable over a very small range, by means of a short screw of 100 threads to the inch, also opposed by a strong spiral spring. Two bisecting wires are used to avoid too great a range of the measuring screw. The whole micrometer box is movable at right angles to the optical axis of the telescope by means of a well made slide, actuated by a screw with 60 threads to the inch, opposed by a strong spiral spring. The eye-piece is made to slide across the field of view on the micrometer box, by means of a quick four-threaded screw. The measuring screw has an epicyclical count wheel-head, as well as the divided head proper, so that whole and parts of revolutions of the screw are read at once. The slide for the eye-piece, as well as that for the whole micrometer box, are moved by two milled screw-heads (the eye-piece one being much the smallest), situated at the end of the box opposite the micrometer screw-heads, and are very convenient for manipulation.

This instrument can be used as an ordinary micrometer with a bright field, by using the light from the central reflector in the telescope. It is in the arrangement for dark field illumination that the principal novelty exists. The micrometer box, with sliding stage, is attached to a piece of tube 4 inches long, terminating in the adapting screw for attaching to the telescope. At right angles to this tube, and about $2\frac{1}{2}$ inches from the micrometer box, is fixed another short tube somewhat smaller, to carry one of Swan's $2\frac{1}{2}$ candle power incandescent lamps. The light from this lamp rendered parallel by means of a lens falls on diagonal mirrors of silvered glass, and is thence reflected towards the micrometer box, filling an annular space between the outer tube and a smaller short one to prevent stray light entering the field of view. The light then passes through four square apertures at the base of the micrometer slide, two being parallel with the slides, and two at right angles to them. The holes communicate with small rectangular boxes which conduct the light to four small thin glass mirrors adjusted to reflect the light exactly in the plane of the wires, illuminating both systems symmetrically on both sides.

There is a small arrangement of shutters for closing the square apertures in the base of the micrometer, and either pair can be closed at will, so that only one system of wires are illuminated if desirable when observing extremely faint objects, or both pairs can be closed if it is desired to use central illumination and a bright field.

As reading the micrometer heads while observing is often very troublesome, requiring a hand-lamp illumination, and with many observers a lens also, I have obtained a beam of light from the electric lamp for this purpose. In the central stopping of the lamp lens the central half-inch is cleared away, permitting a beam to pass across the optical axis into a small tube fixed exactly opposite to the lamp tube. At the end of this is a prism which reflects the beam of parallel rays upon one side of the micrometer heads to a reflective surface, which illumines the reading part of the heads, so that with a small reading lens fixed to the micrometer, a most comfortable and convenient method of obtaining the micrometer readings is supplied.

The intensity of the light can be modified by increasing or diminishing the electric current with a simple rheostat of German silver wire, controlled by the same small milled-head screw that is used for diminishing the ordinary lamp light for central illumination.

APPENDIX B.

PERSONAL EQUATION APPARATUS.

The apparatus is intended for the determination of the difference between the time of the actual occurrence of a visible phenomenon and the time at which an observer would record the occurrence, either by aid of a chronograph or by a simple eye-and-ear observation. This difference is called the personal equation of the individual. There have been several forms of apparatus constructed for this purpose, and I devised one twenty-two years ago, but all were open to certain objections which I have tried to overcome in the present form.

On the end of a tube, like a short telescope, is fixed a sliding frame carrying a piece of glass three inches long by two inches broad. On the centre of this glass is the negative image of a small star, that is, the plate is nearly opaque, and the star appears as a minute transparent point.

This slide and plate is made to travel to and fro across the end of the tube by means of a quick threaded screw actuated by a train of wheels driven by a weight on a lever, so that by putting the weight on one end of the lever the plate travels one way, and by putting the weight on the other end of the lever it moves back again. The rate of movement is governed by an adjustable fly, so as to represent any motion between that of an equatorial or close circumpolar star.

The screw working the slide has an arm projecting at right angles to it with a minute roller on its end. At each revolution of the screw this roller forces two delicate springs instantaneously into contact as it passes. At the other, or eye-end of the tube, is a sort of double micrometer and eye-piece. The whole micrometer-box moves in a slide at right angles to the tube by means of a screw, and in the box are two sliding frames each carrying a verticle spider web ; a third web, parallel to and in the same plane with the others, is fixed to the micrometer-box. The micrometer is furnished with an ordinary positive eye-piece. Between the webs and the star slide is fixed a small achromatic lens of about 1½-inch focus, which projects a somewhat diminished image of the photographic star on to the plane of the webs, when it appears with the eye-piece like a small star or rather minute planet.

If now the star be placed near the centre of the field, and the plate screw left so that the contact arm keeps the springs in contact, it can be made to coincide exactly with the centre wire by means of the micrometer slide screw. If the plate screw is now turned through one revolution till the arm again closes the springs, the corresponding wire frame can be moved by its screw so that the star is exactly bisected by its web, and by the same process the third web is placed in position, so that the springs will be brought into contact every time the star moves across each of the wires.

The mode of observing is thus :—The instrument is set up at a convenient height for observing, and the light from either a mirror, window, or lamp, directed on to the star plate. The contact-springs are connected with a chronograph, as is also an observing key placed convenient for the observer. The driving weight is now placed on one side the lever, and the star moves across the field, automatically registering on the chronograph the instant it transits each of the three wires, the observer also recording with his key the instant he estimates the transit to occur. The two records side by side on the chronograph-paper show how much early or late the observer is with respect to the actual transit.

A large number of determinations can be made conveniently in a very short space of time, and trials already made with it show it to be thoroughly satisfactory. If any slight error should occur in the coincidence of the bisection of the star by the wires with the electric contacts, it is eliminated by taking the transits right and left.

APPENDIX C.

BOOKS, ETC., PRESENTED TO THE OBSERVATORY.

Title and Author of Book.	By whom Presented.	
Report to the Astronomer Royal of the Board of Visitors of the Royal Observatory, Greenwich, for 1882	Greenwich Observatory ...	England.
Greenwich Astronomical Results, 1880	Ditto	"
Greenwich Astronomical, Magnetical, and Meteorological Observations for 1880	Ditto	"
Greenwich Magnetical and Meteorological Results, 1880	Ditto	"
Greenwich Spectroscopic and Photographic Results, 1881	Ditto	"
Daily Weather Reports of the Meteorological Office; January to July, July to December, 1881	Meteorological Office, London ...	"
Hourly Readings from the Self-Recording Instruments at the Seven Observatories connected with the Meteorological Office, December 1880	Ditto	"
Hourly Readings. Parts 1, 2, and 3, 1881	Ditto	"
Remarks Explanatory and Charts of the Ocean Districts adjacent to the Cape of Good Hope	Ditto	"
Observations at Meteorological Stations of the 2nd Order for the Year 1879	Ditto	"
Report on Storm of October 13-14, 1881	Ditto	"
Report on Gales of Ocean District of Cape of Good Hope. By H. Toynbee	Ditto	"
Contributions to the Meteorology of the Arctic Regions. Part III....	Ditto	"
Quarterly Weather Report, 1879. Appendices and Plates	Ditto	"
Report of the Meteorological Council of the Royal Society for the Year ending 31st March, 1882	Ditto	"
Quarterly Journal of the Meteorological Society. Vol. VIII., No. 42, 43, 44	Meteorological Society	"
General Meteorological Register for the Year 1882	Kew Observatory	"
Monthly Notices of the Royal Astronomical Society. Vol. XLII., No. 7 to Vol. XLIII., No. 5	Royal Astronomical Society ...	"
The Selenographical Journal for 1882	Selenographical Society ...	"
Nautical Almanac for 1886	Nautical Almanac Office ...	"
Tide Table for the Port of Hong Kong for the Year 1883. By E. Roberts, F.R.A.S.	Ditto	"
Tide Tables for the Indian Ports for 1883. By Major Rogers, R.E., and E. Roberts, F.R.A.S.	Ditto	"
Report of the Committee on Solar Physics, appointed by the Lords of the Committee of the Council on Education. London, 1882	Solar Physics Committee ...	"
Report of the Fifty-first Meeting of the British Association for the Advancement of Science	British Association for the Advancement of Science	"
On the Rate at which Barometric Changes Traverse the British Isles. By G. M. Whipple	G. M. Whipple	"
Discussion of the Observations of γ Draconis made with the Greenwich Reflex Tube during the Years 1857-1875. By A. M. Downing, M.A.	A. M. Downing, M.A.	"
Results of Meteorological and Magnetical Observations at Stonyhurst College Observatory, 1881	Stonyhurst Observatory ...	"
Report of the Meteorological Commission of the Cape of Good Hope...	Meteorological Commission ...	Cape of Good Hope
Notes on the Physical Appearance of Jupiter during Season 1880-81. By Dr. Otto Bœddicker	Lord Rosse's Observatory ...	Ireland.
Notes on the Physical Appearance of Comets *b* and *c*, 1881, as observed at Birr Castle, Parsonstown, Ireland. By the Earl of Rosse and Dr. Otto Bœddicker	Ditto	"
Notes on the Physical Appearance of the Planet Mars during Opposition in 1881. By Dr. Otto Bœddicker	Ditto	"
Astronomical Observations and Researches made at Dunsink. Part 4.	Dunsink Observatory	"
Journal of the Scottish Meteorological Society	Scottish Meteorological Society...	Scotland.
Indian Meteorological Memoirs. By H. F. Blandford, F.R.S. Vol. I., Part VI.; Vol. II., Part I.	Indian Meteorological Department	India.
Meteorological Observations recorded at Six Stations in India in the Year 1881; Corrected and Reduced	Ditto	"
Indian Daily Meteorological Observations; April 1882 to April 1883	Ditto	"
Registers of Original Observations in 1882; Reduced and Corrected; January 1883	Ditto	"
Report on the Meteorology of India in 1880. By H. F. Blandford, F.R.S.	Ditto	"
Report on the Administration of the Meteorological Department of the Government of India, 1881-2	Ditto	"
Brief Sketch of the Meteorology of the Bombay Presidency in 1881. By A. N. Pearson	Bombay Meteorological Department	"
Administration Report of the Meteorological Reporter to the Government of Madras for the Year 1881-2	Madras Meteorological Department	"
Results of Meteorological Observations, 1881	Vizagapatam Observatory ...	"
Catalogue of 100 Stars, Mag. 1-5, for 1880 and 1890	Victorian Institute of Surveyors	Victoria.
Sydney Weather Reports and Weather Maps; July 1882 to June 1883	Sydney Observatory	New South Wales.
Annual Report of the Department of Mines for the Year 1881 ...	Mining Department	"
Journal and Proceedings of the Royal Society of New South Wales, 1881. Vol. XV.	Royal Society of New South Wales	"
New South Wales in 1881	Ditto	"
Results of Meteorological Observations made at Windsor. By J. Tebbutt	J. Tebbutt	"
Meteorological Observations, Adelaide, 1880	Adelaide Observatory	South Australia.
Statistics of the Colony of Tasmania for 1881	Government Statist	Tasmania.
Census, 1881	Ditto	"
Papers, Proceedings, and Report of the Royal Society of Tasmania, 1881	Royal Society of Tasmania ...	"
Meteorological Report for 1881	Lands Department	Western Australia.
Report of the Meteorological Service of the Dominion of Canada for 1880. By C. Carpmael	Meteorological Department ...	Canada.

APPENDIX C—*continued.*

Title and Author of Book.	By whom Presented.	
Monthly Weather Review of the Meteorological Department of the Dominion of Canada; April 1882 to January 1883	Meteorological Department ...	Canada.
Geological and Natural History: Survey of Canada for 1879-80. Report of Progress. 2 vols.	Ditto	"
Report on Tornadoes of May 29 and 30, 1879. By Sergeant J. P. Finley	Chief Signal Officer	United States.
Annual Report for 1879	Ditto	"
Reduction of Air-pressure to Sea-level at Elevated Stations West of the Mississippi. By Henry Hazen, A.M.	Ditto	"
Chronological List of Auroras from 1870 to 1879. By 1st-Lieutenant A. W. Greeley	Ditto	"
Information Relative to the Construction and Maintenance of Time-balls. By Winslow Upton	Ditto	"
Isothermal Lines of the United States. By 1st-Lieutenant A. W. Greeley	Ditto	"
Report on Solar Eclipse of July 1878. By Professor Cleveland Abbé	Ditto	"
Report on Character of 600 Tornadoes. By Sergeant J. P. Finley. 2 copies	Ditto	"
Annual Report of the Chief Signal Officer of the United States Army to the Secretary of War, 1882	Ditto	"
Monograph of the Central Parts of the Nebula of Orion. By Professor E. S. Holden	Washington Naval Observatory...	"
Astronomical and Meteorological Observations made during 1877 ...	Ditto	"
International Bureau of Exchanges. Correspondence relating to establishment of	Smithsonian Institute	"
Smithsonian Report for 1880	Ditto	"
Reports of Astronomical Observatories	Ditto	"
List of Foreign Correspondents of the Smithsonian Institute... ...	Ditto	"
Astronomical Papers of the American Nautical Almanac Office. Vol. I., Part VI. Transit of Mercury	American Nautical Almanac Office	"
Annual Report of Board of Directors, Chicago Astronomical Society, and Report of Director of Dearborn Observatory for 1882	Dearborn Observatory, Chicago University	"
Celestial Charts, 1 to 20. By Prof. C. H. F. Peters	Litchfield Observatory, Hamilton College	"
12th Annual Report of the Director of the Astronomical Observatory of Harvard College	Harvard College Observatory ...	"
Annals of the Harvard College Observatory. Part I. Micrometric Measurements	Ditto ...	
A Plan for Securing Observations of Variable Stars...	Ditto	"
Account of Work at Harvard College Observatory for 1877-82 ...	Ditto	"
Observations of the Transit of Venus, December '82...	Ditto	"
37th Annual Report of the Observatory, January '83	Ditto	"
First Circular of Instructions for Observers of Variable Stars ...	Ditto	"
Circular relating "Astronomical Photography"	Ditto	"
On the Telegraphic Transmission of Astronomical Data, with Codes, &c. By J. Ritchie, junior		
Report for the Year 1881-2 of the Director of the Observatory in Yale College. By H. A. Newton	Yale College Observatory ...	"
Reports from Consuls of the United States on the Commerce, Manufactures, &c., of their Consular Districts. No. 14. December 1881	Department of State	"
Bulletin of American Geographical Society, 1882. No. 1, 1883 ...	American Geographical Society...	"
Contributions to Meteorology. Results of Examination of United States' Observations. By Elias Loomis	Elias Loomis	"
Contributions to Meteorology. 18th paper. By Elias Loomis ...	Ditto	"
The Wedge Photometer. By Edward C. Pickering	Edward C. Pickering	"
Instructions for Observing Transit of Venus	Hon. Secretary of Navy ...	"
On the Transit of Venus. By William Harkness		
Sidereal Messenger	W. V. Payne	"
Viáge á Europa en Commission Astronómica. By Angel Anguiano ...	Chapultepec Observatory ...	Mexico.
Annuaria del Observatorio de Chapultepec. Para el Año de 1883 ...	Ditto	"
Anales del Ministerio de Fomento de la República Mexicana. Vol. VI.	Central Meteorological Observatory	"
Boletin del Ministerio de Fomento, Mexico; January 1882 to February 1883	Ditto	"
Revista Cientifica Mexicana: for the Year 1882, Nos. 17-23... ...	Ditto	"
Revista Mensual Climatologica, 1882 Nos. 13-15	Ditto	"
Guatemala Meteorological Observations for the Year 1882	Guatemala Meteorological Observatory	Guatemala.
Resultados del Observatorio Nacional Argentina en Cordoba. By Dr. B. A. Gould. Vol. II.	Cordova Observatory	Argentine Confederation.
Anales de la Officina Meteorológica Argentina. Tome III. By Dr. B. A. Gould	Ditto	"
Bulletin Astronomique et Météorologique de L'Observatoire Imperial de Rio Janeiro, December 1881, and for the Year 1882	Imperial Observatory, Rio Janeiro	Brazil.
L'Astronomie par Camille Flammarion (November). Two copies ...	Camille Flammarion	France.
Sur la Comète Périodique de d'Anest 1883. By G. Leveau	G. Leveau	"
Procés-Verbaux des Séances de 1882	Comité International des Poids et Mesures	"
Annales du Bureau Central Météorologique de France, annéé 1877; No. 283, 1879; No. 1,384, 1880	Central Meteorological Department	"
De la Réfraction Cométaire. By Gustave Gellerier (memoirs de la Société de Physique et D'Historie Naturelle de Genève)	Gustave Gellerier	Switzerland.
Ditto ditto. Tome XXVIII, No. 5	Ditto	"
Etude sur la Réfraction Cométaire. By M. Wilhelm Meyer (Memoirs de la Société de Physique et D'Histoire Naturelle de Gènve. Tome XXVIII, No. 4)	Wilhelm Meyer	"
Anales del Institut y Observatorio Marina de San Fernando. Sec. 2, 1879. Meteorological.	San Fernando Observatory, Madrid	Spain.
Ditto ditto. Section 2, 1881		
Bulletin de la Société Royal de Géographie d'Anvers. Tome VII. Nos. 3 to 7	Société de Géographie d'Anvers...	Belgium.
Osservazióni Meteorologishe Orarie-durante l'anno, 1880. By Celso Fornoni	Royal Observatory, Milan ...	Italy.
Operazioni esequito nel' anno 1879, per determinare differenzia di Longitudini fra di Observatoria Astronomici del Campidoglio in Roma e di Brera in Milano	Ditto	"
Sull' Umidita Atmospherica nel' Clima di Milano. By G. N. Schiaparelli	Ditto	"

APPENDIX C—*continued.*

Title and Author of Book.	By whom Presented.	
Osservazioni di Stelle Cadenti fatte nelle Stazione Italiane durantigli anni 1868, 1869, 1870	Royal Observatory, Milan ...	Italy.
Osservazioni della declinazione Magnetica di Napoli. By Faustino Brioschi	Royal Astronomical Observatory Naples	"
Bollettino Mensule Publicato per cura dell' Osservatorio Central in Montcalieri. Serie II., Vol. II. Nos. 1 to 11	Montcalieri Observatory, Turin...	"
Bollettino dell' Osservatorio della Regia Università di Torino, Anno XVI.	Turin University Observatory ...	"
Effemeridi del Sole, della Luna e dei Principali Pianeti per l'anno 1883	Ditto	"
Sulla Refrazione, Iterpretazione Mathematica dell' Spotesi concui Domenico Cassini	Ditto	"
Rendiconti di Reale Institute Lombardo di Scienze e Lettere. Serie II. Vols. XIII. and XIV.	Lombardy Institute of Science and Literature	"
Il Telescopio di Melbourne. By P. D'Amora Fenente di Vascello ...	P. D'Amora	"
Measures of Principal Double Stars of Short Period. By G. O. Schiaparelli	G. O. Schiaparelli	
Meteorological Observations, Syracuse, Nos. 5 to 12	Meteorological Observatory, Syracuse	Sicily.
Zeitschrift der österreichischen Gesellschaft der Meteorologie. Vol. XVII, to April 1883	Vienna Meteorological Observatory	Austria.
Jahrbücher der K.K. Central Anstalt für Meteorologie und Erdmagnetismus. XVIII. Band. Official copy. Jahrgang 1881 and Jahrgang 1879	Ditto	"
Circular der Akademie der Wissenschaft in Wien, No. 49	Akademie der Wissenschaft in Wien	"
Bahmbestimmung des Kometen 1874, III. (Coggia.) By Dr. J. V. Hepperger	Vienna University Observatory...	"
Beobachtungen angestellt am Astrophysicalischen Observatorium in Ogyalla. By Dr. Nicolous von Konkoly	Ogyalla Observatory	Hungary.
Circular zum Berliner Astronomischen Jahrbuch Nos. 184 to 205 ...	Berlin Observatory	Germany.
Vierteljahrsschrift der Astronomischen Gesellschaft, 17 Jahrgang 2te Heft	Astronomische Gesellschaft ...	"
Veranderlichen Sterne zwischen Decl: + 80 und 2° in 1883	Ditto	"
Neue Reduction der Bradleyschen Beobachtungen aus den jahren 1750 Bis 1762. (II Band.) By A. Auwers	Ditto	"
Verzeichniss der Fundamentalsterne für Zonen Beobachtungen zwischen 2° und 23° Südlichen Declination. By A. Auwers	Ditto	"
Preussiche Statistik von Königlichen Statistischen Bureau in Berlin. Jahre 1881	Prussian Statistical Bureau ...	"
Publicationem der K. Universitäts. Sternwarte zu Leipzig. Heft I.	Leipzig Observatory	"
Moon Charts	Göttingen Observatory ...	"
Bestimmung der masse der Planeten Jupiter. By Dr. Wilhelm Schwor	Strasbourg Observatory ...	"
Meteorologische und Magnetische	Munich Observatory	"
Beobachtungen der K. Sternwarte bei München, Jahrgang 1882 ...		
Verzeichniss von 5563 Teleskopischen Sternen—V., VII., IX., XL., XII., und XIII., Supplementband zu den Annalen der münchener Sternwarte		
Schriften der Universität zu Kiel 1880-81. Band XXVII., and Pamphlets, Address, and Inaugural Dissertations	Kiel University	"
Annalen der Physik und Chemie 1882, No. 6, to 1883, No. 5	... ...	"
Beiblätter do do 1882, No. 5, to 1883, No. 3		
Transit of Venus. By Dr. Carl Friesach	Dr. Carl Friesach	"
Grosse Entfernung und Masse der Sonne. By August Tischner ...	August Tischner	"
Syzygien Tafeln für den Mond. By Th. von Oppolzer	Th. von Oppolzer	"
Central-Zeitung für Optik und Mekanik, Leipzig, 15 April 1883 ...	Dr. Oscar Schneider	"
Norwegian North Atlantic Expedition, Vols. IV., V., VI., VII., VIII., and IX.	Meteorological Institute, Christiana	Norway.
Geodällische Arbeiten. Heft I., II., III.	Norwegischen Comission der Europaischen Gradmessung	"
Vandstands Observationer. Heft I.	Ditto	"
Bulletin de L'Observatoire Météorologique de L'Université D'Upsal. Vol. XIII., 1881. By Dr. Hildabrandson	University Observatory, Upsal	Sweden.
Bestämming uf Upsal Observatoriums Polhöjd	Ditto	"
Ueber den einfluss der Diffraction an Fernhören auf Lientscheiben. By H. Struve	L'Acedemie Imperial des Sciences de St. Petersburg	Russia.
Untersuchungen über das Zweite Spectrum des Wasserstoffs. By Dr. B. Hasselberg	Ditto	"
Das Magnetische Ungewitter (Vol. XXX., No. 3). By Dr. H. Wild	St. Petersburg Observatory ...	"
Annalen des Physikalischen Central-Observatoriums, Jahrgang 1880. Theil I. and II. By Dr. Wild	Ditto	"
Jahres Bericht dem Comité der Nicolae-Haupt Sternwarte	Central Astronomical Observatory	"
Mittheilungen der International Polar-Comission, 3rd and 4th parts ...	International Polar Commission	
Annales de L'Observatoire de Moscou. Vol. VIII. 1st and 2nd parts	Moscow Observatory	"
Observations de Pulkova. Observations faites du cercle verticle ...	Pulkowa Observatory	"
Meteorologische Beobachtungen des Tiflis Observatory	Tiflis Observatory	"
Transactions of the Seismological Society of Japan. Vols. IV. and V.	Seismological Society of Japan ...	Japan.
Observations Meteorologica del Atteneo Municipal de Manila; Duraute, año de 1880, 1881, 1882	Manila Observatory	Manila.
Ditto ditto Oct., Nov., Dec. 1879		

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