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the Author

THE DOMINION ASTRONOMICAL OBSERVATORY AT
OTTAWA

BY

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THE DOMINION ASTRONOMICAL OBSERVATORY AT
OTTAWA

By OTTO KLOTZ

THE Observatory at Ottawa to-day is an evolution of the astronomical work inaugurated in 1885 in connection with the Railway Belt in British Columbia.

British Columbia entered Confederation, became part of the Dominion of Canada, on July 20, 1871.

One of the conditions upon which British Columbia entered the Dominion was the speedy construction of a trans-continental railway, and in this connection, by the Imperial Order in Council of the 16th May, 1871, British Columbia conveyed in trust of her Crown Lands to the Dominion ". . . not to exceed twenty miles on each side of the said line" (railway). These twenty miles on each side of the railway are known as the Railway Belt, and became Dominion Lands, to be administered by the Department of the Interior, and furthermore, to be correlated with the Dominion Lands survey system of the Northwest, a system based on geographic co-ordinates.

The mountainous character of British Columbia precluded projecting and running standard base-lines and meridians, as had

been done over the wide expanse of prairie from Winnipeg to Calgary and Edmonton. However, another method was available, and that was to establish a number of astronomic stations accurately determined in latitude and longitude along the railway line, and furthermore to make a very accurate azimuth survey of the railway connecting the survey with the astronomic stations. With these data it was thus possible to compute with precision the position on the earth, that is, in latitude and longitude, of every point of the railway, and hence the position it would occupy were the rectangular net of Dominion Lands Survey spread over the Railway Belt, becomes known. The distance involved in this survey was 512 miles, extending from Port Moody, the original Pacific terminus, to the summit of the Rocky Mountains.

In 1885 there was no Vancouver; it subsequently became the terminus. Accordingly in the spring of 1885 (the last spike of the railway was driven at Craigellachie on November 7, 1885), the Surveyor General, E. Deville, issued instructions to two astronomers, T. Drummond and Otto Klotz, to make the astronomic observations, and to W. Ogilvie to make the azimuth survey. It may be noted that the official use of the word astronomer by the Department was for the first time made in the above case.

The beginning was made from the Pacific end of the line, and the writer had charge of the astronomic work. The nearest well-determined point was Seattle, the astronomic position being determined by the U. S. Coast and Geodetic Survey, its longitude being based on Greenwich. Hence Seattle became the initial point for our longitudes, and from it were established Victoria and Kamloops, the latter becoming in turn the basal longitude station, to which were referred Port Moody, Revelstoke, Field and other stations as far east as Winnipeg.

The astronomic equipment consisted of two Troughton and Simms portable transits, Fo. 1, and Fo. 2, each of 2½-inch aperture and 28 inches focal length, previously used on the 49th parallel Boundary Survey of 1872-1874; two sidereal box chronometers by Dent and Frodsham, respectively; two pocket chronometers; one zenith telescope for latitude work, and two standard registers

of the Western Union Telegraph Company, on the tapes of which the clock signals, sent by hand, were recorded. In 1885, besides occupying Seattle, the positions of Victoria, Port Moody and Kamloops were determined, and the azimuth survey carried from Port Moody to Farwell, now Revelstoke. In the following year Revelstoke, Field, Calgary and Winnipeg were occupied.

At Calgary a connection was made with the 5th Initial Meridian, and at Winnipeg subsequently with the Principal Meridian and with longitudes from the east for a comparison with the longitude brought across the continent through the United States and eastward again via Seattle and British Columbia.

The success of these two years of astronomic work in connection with the accurate determination of geographic positions for the Department of the Interior gave astronomic work a permanent footing in the Technical Branch under the Surveyor General, E. Deville, and this led to an extension of its application to a wider field, not only within the vast area of Dominion Lands in the Northwest, but also in other parts of Canada for cartographical and other purposes.

It was essential that the longitude of Winnipeg be well established by connection with the east (Harvard), as it was to serve as a base station. The adopted longitude of Winnipeg rested upon a rather unsatisfactory determination of West Lynne from Dearborn Observatory, Chicago. By linear measure from West Lynne along the 49th parallel, the international boundary line, the longitude of the Principal Meridian was established, and by triangulation from the latter to Winnipeg the longitude of Winnipeg was found.

On February 10, 1887, the Surveyor General, E. Deville, submits to the Deputy Minister a memorandum suggesting the establishment of an observatory at Ottawa in connection with the longitude work in the west. This was approved by the then Minister, the Hon. Thos. White, but nothing was done.

In March, 1887, W. F. King and the writer officially visited Boston, Cambridge, New York and Washington, with the object of inspecting, subsequently to purchase, a transit for the proposed

permanent observatory at Ottawa; a portable transit for field work, as W. Ogilvie had taken one of our portable transits used in 1885 and 1886 on his exploratory trip down the Yukon; a sidereal clock; two box chronometers and a standard barometer. When C. Carpmal, director of the Meteorological and Magnetic Observatory, heard of the above errand and the proposed erection of a permanent astronomic observatory at Ottawa, there was a tempest in a teapot for a short time. In May, 1887, a temporary observatory was built in the garden of W. F. King, in which the Russell alt-azimuth to be used by King the coming season was tested. In this year W. F. King, Chief Inspector of Surveys, became associated with the writer in astronomic work in the west, when Wapella, Port Arthur and Kalmar were occupied, besides Winnipeg, by King as reference stations in longitude.

Proceeding to the west together, King and the writer visited en route the observatories at Ann Arbor, Mich.; at Madison, Wis., and at Northfield, Minn. At Winnipeg we connected by triangulation the 1872 longitude point, flag-pole at Fort Garry, with the temporary observatory of 1886, north of the C.P.R. and on the east side of Main Street.

In July, 1887, a new transit was ordered from Cooke and Sons, England.

In October, 1887, Deville wrote to King at Winnipeg, "that the observatory building (Ottawa) is in a worse muddle than ever," and suggested connecting Winnipeg with Cambridge (Harvard), with Ottawa intermediate. King at latter, Klotz at other two stations.

October 18, 1887, King wrote from Kamloops to Deville about the astronomic work and expressed desirability of a permanent observatory at Ottawa.

October 25, 1887, the Minister (Hon. T. White) informed Klotz, re erection of observatory at Ottawa, "My colleagues opposed it, so I dropped it for the present in order to gain my point eventually."

October 30, 1887, Klotz to Surveyor General, again urging

the erection of an observatory at Ottawa—"an efficient transit room to start with."

November 9, 1887, Klotz to Surveyor General, sending photograph of Brashear's 8½-inch reflector, cost \$300, which the former was prepared to buy himself for observation of occultations in conjunction with Ogilvie's observations on the Yukon, near the 141st meridian. The Department bought the reflector.

It may be noted that at this time both the Surveyor General, E. Deville, and the Chief Inspector of Surveys, W. F. King, were permanent officers of the Department, were in the Inside Service, while the writer was on day pay and not resident in Ottawa, although Ottawa was his official headquarters.

On February 22, 1888, the writer submitted a long letter to the Surveyor General on the subject of the erection at Ottawa of an astronomic observatory. The letter was signed jointly by W. F. King and the writer. It was approved by the Surveyor General and forwarded to the Deputy, who submitted it for favorable consideration to the Minister.

On February 27, 1888, five days after the above letter, the Surveyor General submitted a long memorandum on the same subject—advocating a permanent observatory at Ottawa—to the Deputy; the latter asked the former to obtain the concurrence of King and Klotz, which was gladly given, Klotz, however, writing that he considered the estimate of cost too low. The Deputy (A. M. Burgess) was throughout favorable to the proposition.

Due to the untimely death of the Minister, the Hon. Thos. White, April 21, 1888, the Deputy wrote to the Surveyor General that "our late Minister had not taken any action upon this before his death," and asked Deville to keep the subject in mind when the new Minister of the Interior would be appointed.

Early in 1888, the new Cooke & Sons transit, 3-inch aperture, 34-inch focal length, was received, and was mounted by the writer at the new observatory (Princess Street) at Winnipeg, May 31, 1888; also a sidereal clock with electric attachments, which was set up in the basement of the Clarendon Hotel, Winnipeg. The Brashear equatorial also was set up at Winnipeg. During this

year Edmonton and Onion Lake (110° meridian) were occupied and connected in longitude with Winnipeg.

About this time the Alaska boundary question occupied the attention of the Department of the Interior more and more, and the astronomic work was temporarily suspended, but the observatory scheme was kept alive. A good deal of correspondence took place between the Department of the Interior and those of the Public Works and Railways and Canals about a site for the temporary observatory, either along the Canal Basin or on a Government lot on Cliff Street.

On June 30, 1890, by order-in-council a new office was created—Chief Astronomer—and W. F. King, Chief Inspector of Surveys, was appointed thereto at a salary of \$1,800 per annum.

It is important to note that during these years, and for some years subsequently, there was no thought of an observatory with dome nor of engaging in astrophysical work; this was a later evolution, on the advent of the Hon. Clifford Sifton as Minister of the Interior, who wanted a creditable astronomic outfit and building, representing the National Observatory of Canada.

The Surveyor General, the Chief Astronomer and the writer were at the time more concerned about a permanent observatory at Ottawa, as the initial place of reference for longitude work throughout Canada, with the installation of transits, and later a meridian circle for fundamental work. It was hoped ultimately to expand the astronomic work of latitude and longitude that had been carried on for some years to include a trigonometrical or geodetic survey, towards which the writer had labored and written for many years.

In 1890, W. Ogilvie made an exploratory survey from Lake Timiskaming to and along part of James Bay. The meridian from the head of the lake forms the boundary line between Ontario and Quebec. To determine its longitude, it was by survey connected with Mattawa, and the difference of longitude between Mattawa and Ottawa was determined by the Surveyor General and the Chief Astronomer, although the accurate longitude of Ottawa had not been established.

In 1892 the astronomic work was in so far resumed that the Department took part (by the writer) in a fresh trans-Atlantic longitude determination connecting Greenwich with Montreal via Waterville in Ireland, and Canso, N.S., the termini of the Commercial Cable.

The Chief Astronomer was appointed in 1892 H. M. Boundary Commissioner, so that his and the writer's time was occupied with the Alaskan Boundary survey during the following three years.

In 1896 the astronomic work was resumed by King and Klotz. Port Stanley on Lake Erie for international boundary purposes was established, and Winnipeg connected with Ottawa, while Ottawa was connected with Montreal by Professor McLeod and the Chief Astronomer.

The year 1896 saw a change of government, and the Hon. Clifford Sifton became Minister of the Interior, and the writer became a permanent official and entered the Inside Service with the official title of Astronomer.

On the 23rd April, 1897, the Chief Astronomer asked the writer to draw up specifications for a new transit to be ordered from Cooke & Sons, and shortly afterwards the instrument was ordered. It was received early in 1898, as well as a break-circuit chronometer, No. 48419, from E. Dent & Co., London.

On 15th April, 1898, the writer recommended the purchase of another and better chronograph from Warner and Swasey.

On June 7, 1898, the Chief Astronomer submitted a memorandum to the Minister, the Hon. Clifford Sifton, on the subject of an adequate observatory—with 10-inch refractor, a star spectroscope, a sidereal and a mean time clock, a chronograph and pendulum apparatus at a total cost of \$7,800. The chronograph was authorized to be purchased from Warner and Swasey for \$400, and was obtained.

On June 23, 1898, the Chief Astronomer wrote the Deputy, J. A. Smart, that he did not expect immediate action by the Minister to his memorandum of the 7th inst., save on the chrono-

graph, but simply directed the attention of the Minister and Government to the subject as worthy of consideration.

In June, 1898, the writer, en route to Russia, took the chronometer, 48419, to Dent, London, for electric alterations.

On November 4, 1898, the writer prepared a list of the 85 observatories in the United States and of 252 observatories in other countries, giving their equipment, with special reference to the dimensions of their equatorials. This list was included in the memorandum November 7, 1898, to the Minister by the Chief Astronomer, in which details and reasons were given for a proposed national observatory and its equipment. The cost of the building, \$7,000, had also been furnished by the writer. The total cost submitted—without cost of site—was \$16,075. The equatorial recommended was of 10-inch aperture.

On November 10, 1898, the Minister requested the Chief Astronomer to let him know what other observatories there were in Canada and the nature of their work.

On November 15, 1898, the Chief Astronomer replied that there were only two, one at Toronto and the other at McGill, and that their work did not interfere with that contemplated at Ottawa.

In a letter, 26th May, 1899, the Public Works Department informed the Chief Astronomer that the sum of \$16,000 for the instruments and building had been placed in the Supplementary Estimates for next year.

On the 19th August, 1899, the Chief Astronomer wrote to the Minister of the Interior that steps should be taken to begin the construction of the observatory, pointing out, however, that the architect had deferred the preparation of the plans until the site was chosen, as "the site of the building must determine its architectural character." The sites suggested by the Chief Astronomer were: "the knoll on Parliament Hill, just behind the Western Block; another is the site of the summer-house west of the Library; and the third is in Major's Hill Park, on the Mackenzie Avenue side and about half-way between Rideau and St. Patrick Streets." The preference was for the "knoll."

On August 23, 1899, the writer interviewed the Minister

(Mr. Sifton) on several official matters, the most important of which was the proposed site on Parliament Hill for the observatory. An emphatic protest was entered against the contemplated site as unsuitable and wholly inadequate for the national observatory of Canada. Cogent and unanswerable reasons were advanced against the site. The Minister gave a sympathetic hearing.

On January 10, 1900, the Chief Astronomer submitted to the Deputy a memorandum stating that the plans were in preparation, but were for a much more expensive building than contemplated, and hence a larger and more expensive instrument was required to lessen the disproportion in cost. About the site—Parliament Hill—the Chief Astronomer said "it would be difficult to get another so suitable astronomically and so convenient for office purposes" (as it is essential that the Chief Astronomer's office should be in the building). A decision by the Minister was requested.

On January 13, 1900, an officer of the Chief Architect's office brought an architecturally elaborate and colored plan of the proposed observatory to King (and me) for him to make suggestions, but only with reference to the interior, as the Chief Architect desired no change in the exterior. This plan was essentially for an architectural monument. By this plan the equatorial would be about 48 ft. above the ground floor, and nearly 60 ft. from the basement for a 10 or 12-inch glass.

On January 17, 1900, the writer called on the Deputy re observatory. The Deputy had the plan, and said, "It looks pretty, but I told the Minister if a \$50,000 or \$60,000 building was to be put up, provision must be made in the estimates for instruments fitting such a building; if the Government wants to spend \$50,000 or \$60,000 on a building, I don't care." "For my part," I added, "if that sum of money is to be spent, I prefer to have a suitable site bought and have a less ornamental, yet fully as—yes, more so—useful, building erected." I explained the scope our work must necessarily eventually take, and that the proposed 100-foot "knoll" was wholly unsuitable. The Deputy said, "I guess you are right." "I know I am right," was my reply.

On the 24th January, 1900, the Chief Astronomer asked the Deputy to put \$8,000 in the estimates for a 12-inch equatorial. On February 19, 1900, the Chief Architect sent to the Chief Astronomer a sketch of the proposed observatory.

In the latter part of February the Chief Astronomer visited Cleveland and Allegheny re instruments.

On March 5, 1900, Warner & Swasey, of Cleveland, submitted an estimate of 12-inch telescope and many accessories for \$9,085. On April 18, 1900, an astronomic clock for \$550 was ordered from the E. Howard Watch & Clock Co., Boston, and subsequently placed (for uniform temperature) in the basement of the Supreme Court building.

What equipment we had in our old wooden observatory on Cliff Street, is found from the following list, made on the removal of the instruments on the night of the big fire in Hull and Ottawa, April 26, 1900: 2 switchboards, 1 watch chronometer; 1 old chronometer, No. 81; 1 new Dent chronometer; striding level in case; old and new Cooke transits; galvanometer; relays; chronograph; Siemens switchboard, and instrument lamps.

During this year, 1900, astronomic work was resumed and Rose Point, Owen Sound, Chalk River, Vancouver, Rayside and Wilno were occupied, and connected in longitude with Ottawa. On Nov. 6, 1900, a complete magnetic field outfit, for the contemplated magnetic survey of Canada under the direction of the Chief Astronomer, was ordered for 1,400 marks from Tesdorpf, Stuttgart.

On February 14, 1901, the Deputy informed the Chief Astronomer, with reference to the observatory, that the Minister was inclined to think that "it is very doubtful if anything will be done this year." However, later an item of \$15,000 appeared in the estimates.

March 11, 1901, Chief Astronomer to J. A. Brashear, saying, "Sorry; observatory scheme fallen through for the present."

May 22, 1901, J. C. Grant to Minister, offering 7 acres along the Rideau—Salisbury Avenue—at \$3,000 an acre for observatory site. It may be stated that the Chief Astronomer and the

writer had examined various vacant lands in Ottawa for a site, and the two that were considered suitable were: the preceding overlooking the Rideau, and the other beyond the T. C. Keefer property at Rockcliffe on the high land and overlooking the Ottawa; but the Minister was disinclined to purchase land.

On May 28, 1901, the Chief Astronomer asked the writer to make a rough plan of the Observatory, which he did. (It is preserved in the library of the Observatory.)

June 3, 1901, Chief Astronomer to Deputy, asked authority to order telescope and to visit Cleveland and Allegheny to make contract. The Minister approved and our 15-inch telescope was ordered.

On June 18, 1901, the writer called on the Minister, when the latter said he had tentatively chosen a site at the Experimental Farm (being the little rising ground where now the large supply tank stands). He asked the writer to look over the Farm, as the Observatory must be on Government ground, as there was no appropriation for the purchase of land.

On June 19, 1901, the writer examined the Farm and determined upon the best site.

On June 20, 1901, the Chief Astronomer and the writer visited the Farm together. The Chief Astronomer agreed and concurred in the choice made by the writer, and immediately 'phoned the decision to the Minister—Mr. Sifton—who agreed thereto, also the Minister of Agriculture, under whose jurisdiction the Farm is. And so the final site of the Observatory was settled, and there the Observatory stands to-day.

On June 22, 1901, the writer made a survey of the Observatory site for expropriation purposes.

On June 25, 1901, the writer showed the Minister the rough ground plan drawn for the Observatory, which he asked him to show to the architect; the Chief Astronomer had similarly drawn a rough plan for the architect. The former plan had a straight front, while the latter was in the form of an L. The architect combined the two with an angle of 150° between the two wings, to which we agreed, and this form the Observatory has.

To Warner & Swasey, of Cleveland, was awarded the contract for the mechanical parts of the equatorial, and also for the dome, while J. A. Brashear, of Allegheny, received the contract for the optical parts of the 15-inch equatorial; spectroscopic grating, etc.

From Clemens Riefler the standard sidereal clock was obtained. Fauth & Co., of Washington, made, under the supervision of the U. S. Coast and Geodetic Survey, a half-seconds pendulum apparatus—Medenhall type—for the Observatory. Troughton & Simms, of London, received the order for the meridian circle, 6-inch aperture; and for a transit theodolite, 12-inch horizontal and vertical circles.

From the Zeiss Optical Works, Jena, a comparator was ordered. During 1901, the Chief Astronomer, contemplating installation in the Observatory, as well as in the Parliament and Departmental Buildings, of a system of electrically-controlled clocks, corresponded with many manufacturers, institutions and observatories: Paul Bunge; Howard Watch & Clock Co.; The Self-Winding Clock Co.; U. S. Coast and Geodetic Survey; U. S. Naval Observatory; Royal Observatory, Greenwich; Case School of Applied Science, Cleveland; Kullberg, London; E. Dent & Co., London; Favarger & Co., Neuchatel; Brèguet, Paris; and G. Borel, Paris.

On November 15, 1901, the printed specifications for contract for the erection of the Astronomical Observatory were received by the Chief Astronomer from the Department of Public Works.

On February 19, 1902, the Chief Astronomer gave to the writer a memorandum to proceed to Washington concerning the half-seconds pendulums ordered; the iced-bar base measuring apparatus, and precision level.

On February 28, 1902, the writer furnished a long report on his visit to Washington. Iced-bar apparatus was ordered.

On September 4, 1902, the writer observed for azimuth and defined the east and west line for contractor.

On October 12, 1902, the Chief Astronomer informed the writer that the Minister (Mr. Sifton) authorized the trans-Pacific

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longitude work, utilizing the newly-laid "All Red Line" cable, thereby wiring the British Empire together astronomically and completing the first astronomic girdle of the world. The writer had charge of this work.

In January, 1903, the Chief Astronomer directed the writer to proceed to Cleveland to inspect and examine the completed equatorial, and if satisfactory, have shipped. Cost, with accessories, \$14,625.

On June 30, 1904, the Chief Astronomer submitted memorandum of furniture and fittings required for Observatory, at a cost of \$6,500. Building was now completed.

On July 4, 1904, the Chief Astronomer submitted a memorandum to the Minister (Mr. Sifton) which is herewith given in full:

As large expense is being incurred for the erection and outfitting of the Dominion Observatory, and as the sole justification for public expenditure is resulting public benefit, the following remarks upon the object of the observatory, with special reference to its utility, are submitted.

1. Primarily, the equipment of the Dominion Observatory is designed for the carrying out of definite lines of observation and investigation of a scientific character. These observations will not be astronomical only, but meteorological, seismological, spectroscopic, etc.

Such observations are for the general advancement of science, and, if conducted on a systematic plan, are of the highest value, though this value computed in dollars and cents may be remote. The absence of direct return from astronomical investigations calls for the aid of Government in a greater degree than do most other branches of science. State aid is given to astronomy by all civilized nations, and it is fitting that Canada should take part in the development of this branch of science.

2. The advantage to a nation in supporting such a science as astronomy is not confined to the ultimate results. In the very course of the work the men who do it derive special training, not only in the observing itself, but in the practical application of many branches of science which are closely bound up with modern astronomy.

This tends to develop a class of men of special training and knowledge, who will be useful to the country, wherever accurate observation and investigation is required. For instance, explorations, geodetic work, etc., call for men of this stamp whose trained intelligence enables them to adapt their methods to overcoming the peculiar difficulties which they encounter.

3. A branch of the work of the Observatory is the determination of

longitudes. The determinations which have already been made under this office have proved useful in the construction of maps, the correction of surveys, etc. They have from time to time been asked for by various departments of the public service. Under the organization which the completion of the observatory will render possible, they can, it is believed, be made more rapidly and economically.

4. Another branch of the work will be the transmission of accurate time to the city and the public buildings.

5. Arrangements will be made for testing chronometers, a service frequently required by many departments, but for which there are now few facilities. Minor instruments can also be tested, such as sextants, aneroid barometers, etc.

6. An indirect advantage will be the public interest which it is hoped to arouse in astronomy and science generally by the exhibition of the instruments to visitors at stated times. In many countries, above all the United States, large contributions to scientific objects have been made by private persons. There seems to be no reason why similar benefactions should not be made in Canada, if public interest were directed towards these objects.

Respectfully submitted,

(Signed) W. F. KING,

Chief Astronomer.

HON. CLIFFORD SIFTON,
Minister of the Interior,
City.

In October, 1904, the equatorial was mounted.

In April, 1905, the Chief Astronomer and staff moved from their old quarters in the Thistle Block in the city to the Observatory. On April 29, 1905, the press visited the Observatory in the evening, was entertained, and the next day the Dominion Astronomical Observatory became known throughout Canada, and Dr. W. F. King became its Director, holding in addition as heretofore the title of "Chief Astronomer of the Department of the Interior."

In conclusion, a few statistics may be given of the money invested in the Dominion Astronomical Observatory. On August 28th, 1902, the contract for the main building was awarded to Theophile Viau for \$74,990, and completed on June 25th, 1904. The heating contract was for \$2,749, and was carried out by Butterworth. The transit house was built by McGillivray and Labelle for \$14,780, and finished November 30th, 1905. Besides

the above, there were built two azimuth mark buildings, a small observatory for stellar photometric work, a magnetic hut, the Director's house and a machine shop, besides laying out and improvements to the grounds, so that the whole may be summarized :

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|---|-----------|
| Observatory and auxiliary buildings..... | \$180,000 |
| Instrumental equipment..... | 100,000 |
| Library, 9,000 volumes..... | 30,000 |
| | <hr/> |
| Total investment, Dominion Observatory..... | \$310,000 |

The above is a brief story of the genesis of the Dominion Astronomical Observatory. The data are mostly taken from official reports and files, and supplemented by extracts from the diaries of the writer, which are continuous in foolscap volumes from August 16, 1866, to date, over fifty years.

OTTAWA,
DOMINION ASTRONOMICAL OBSERVATORY,
July 6, 1918.