TRANSACTIONS

OF

THE TORONTO ASTRONOMICAL SOCIETY

FOR THE YEAR 1900

INCLUDING ELEVENTH ANNUAL REPORT.

PRICE ONE DOLLAR

TORONTO:
THE CARSWELL COMPANY, LIMITED,
PRINTERS TO THE SOCIETY.
1901.

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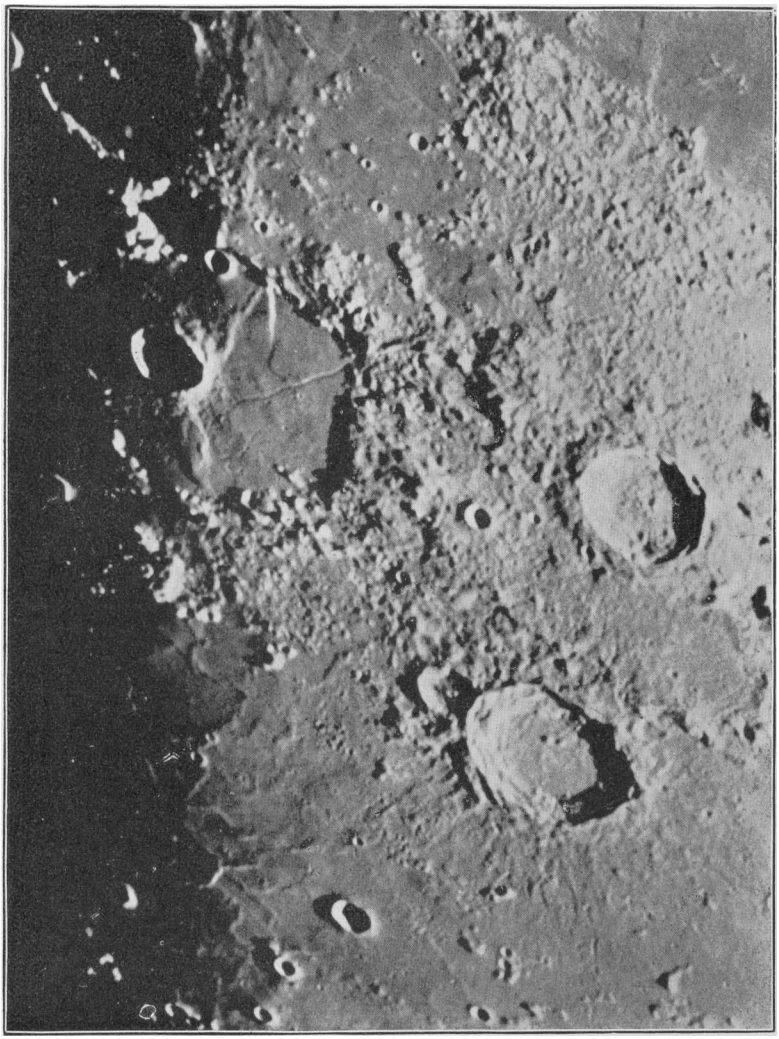

LUNAR CRATERS ARISTOTLE AND EUDOXUS, AND SURROUNDING REGION.

Photographed with the 40-inch visual telescope of the Yerkes Observatory with color screen. October 12, 1900, exposure ½ second, enlarged 5¼ diameters from original negative.

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The Toronto Astronomical Society

DURING THE YEAR 1900.

FIRST MEETING.

1900, January 23rd. This being the annual public meeting was held in the Library of the Canadian Institute, the new President, Mr. G. E. Lumsden, F.R.A.S., in the chair. The attendance was large.

After the transaction of some formal business, the President spoke briefly upon the history and work of the Society. In the course of his remarks, he said that during the past ten years as an incorporated body, and during the five years prior to 1890, as a group of observers united together by the strong bond of common interest in the practical study of Astronomy, the members of the Society had endeavored to keep alight at this northern outpost the lamp committed to their charge, a lamp which had been lighted long years ago by men who, in a new country, were denied many of the advantages now within the reach of the majority of the students of Science. The wick of the lamp had been trimmed by loving hands and its flame, sometimes bright, sometimes dim, had been an object of solicitude to men whose heads had been whitened by the frosts of advancing years. It was matter for congratulation that most of these men were still spared, setting, as they did, examples worthy of emulation, for they had

exemplified the virtues of patience and application and had manifested a steady determination to make the best of their opportunities. The Society had much for which to be thankful and had in more than one respect been very fortunate. It had been fortunate in having for some years as its Honorary President the late Minister of Education, the Hon. G. W. Ross, LL.D., who had, by deserved advancement, recently become Prime Minister of his native province, and owing to whom it had for some years enjoyed the practical advantages of an annual grant. And now he was succeeded as Minister of Education by a gentleman no less a friend of scientific pursuits, the Hon. Richard Harcourt, Q.C., whose cheering letter accepting the position of Honorary President they had just heard read. The President felt that the interests of the Society were safe in the hands of Mr. Harcourt, who appreciated and would doubtless recognize its efforts to make provision for popularizing Astronomy in Ontario, one of its undertakings when it had received a subvention from the Province. The Society was equally fortunate in having elicited the practical sympathy of the Mayor and City Council and would show that it deserved these marks of confidence from the Province and the City. It must, however, continue to depend upon its own energies, which had been highly creditable, and to rely upon its own resources, which were capable of further development.

The President then introduced Mr. Arthur Harvey, F.R.S.C., the retiring President, who read the Annual Address, entitled "Astronomy,—in Infancy, Growth and Maturity," which was published *in extenso* in the Transactions for 1899.

At the close of the paper, the members and their friends spent a pleasant hour in social intercourse.

SECOND MEETING.

February 6th; the President in the chair. Mr. J. Britnell, Sen., and Mr. J. Britnell, Jr., of Toronto, were elected active members.

Mr. D. J. Howell, having explained the principles underlying the construction of a chromoscope which had been lent him by Mr. Laidlaw, of Hamilton, exhibited and described several beautiful slides representing fruits and flowers, the natural colors of which were faithfully portrayed and were heightened by the admirable stereoscopic effect. Mr. Howell reviewed the ingenious processes employed in the preparation of the slides.

The paper of the evening on Liquid Air, illustrated by numerous diagrams, was read by Mr. J. Edward Maybee, C.E. It was exhaustive in its treatment of the history of the subject and discussed the commercial uses to which liquid-air had been and may probably be put. The claims of various investigators and inventors were impartially analysed and the processes employed in the manufacture of the new agent were discussed. The exposition was clear and comprehensive and evoked an animated discussion.

THIRD MEETING.

February 20th; the President in the chair. Mr. A. F. Miller presented, on behalf of Mr. A. F. Hunter, M.A., of Barrie, two interesting tracings of the curve of an aneroid-barometer showing distinct eleven-day minima deduced from observations extending throughout 1899, December, and 1900, January. A short but timely and highly instructive preliminary paper upon the approaching total solar eclipse of May 28th, was read by Mr. T. Lindsay. Mr. J. R. Collins reported having successfully introduced glass-fibres as spider-lines in a telescope-finder and that the results had been satisfactory. It was announced that Sir Sandford Fleming, an Honorary Member, was endeavoring to

have the 24-hour system of time notation, of which he was the consistent advocate, used on the dials of the new City Hall clock, partly for educational purposes and partly as a compliment to Toronto, where, under the auspices of the Canadian Institute, Sir Sandford had first propounded his plans for reforming the counting of time.

The President laid before the members his views as to certain changes which he thought could, with advantage, be made in some of the details of their work as a body, and in still further carrying out the excellent general policy formulated and promoted by his predecessors. He suggested that, when permissible, funds should be set aside for the purchase of a first-class electric-lantern and other apparatus; for slides, in series, to illustrate papers of all kinds and for use not only in the meetings of the Society but on public occasions, and that the library, already by far the best of its kind in Canada, should receive still further attention, chiefly as regarded the acquisition of popular as well as standard books. He pointed out that this was the pioneer Canadian Society and that as other Societies were formed, it would be looked to for guidance and advice and possibly assistance. It occupied a proud position, one that it could maintain if it continued to move along wisely considered lines. He urged all the members to take up practical work, the value of which was beyond estimation in engendering and sustaining interest in the ends the Society had been endeavoring to achieve,—the popularization of Astronomy. He said he hoped that the excellent example set by some of the members in affording to others opportunities for observation, even if they did not belong to the Society, would be followed by other members, for the results were bound to be beneficial not only to the Society, but to themselves as practical workers.

A committee, consisting of Mr. C. A. Chant, B.A., Mr. A. F. Miller and Mr. D. J. Howell, was appointed to select and purchase a lantern as a first step in carrying out some of the President's suggestions.

FOURTH MEETING.

March 6th; the President in the chair.

Short papers of a popular character were read by Rev. Robert Atkinson, Mr. A. F. Miller, and Mr. Andrew Elvins upon "Mercury," "Venus," and the "Zodiacal Light" respectively. Mr. Atkinson explained the various theories regarding the rotation and revolution-period of Mercury, and made many practical suggestions as to the observation of the planet. In the course of his remarks upon Venus, Mr. Miller alluded to the importance attributed to the transit of that planet and described the observations, in which he had joined, made at the Toronto Observatory of the transit in 1882. Speaking of the Zodiacal Light, Mr. Elvins described its appearance as seen in these latitudes, and regretted that owing to the introduction of electric arc-lamps, Toronto was no longer a good observing station. These graphic and valuable papers were followed by discussions which evidenced the interest they had awakened among the younger members,—the object in view.

FIFTH MEETING.

March 28th; the President in the chair.

Mr. C. Bartholomew was elected an active member. The Librarian reported, among the many contributions received, a copy of Sir William and Lady Huggins' "Atlas of Representative Stellar Spectra." Short papers upon solar observations by projection were read by Mr. F. L. Blake, Astronomer at the Observatory, and Mr. G. G. Pursey. The latter described his simple and inexpensive, yet efficient, apparatus, and the former produced his working-book and showed a series of drawings made from day to day at the 6-in. Cooke refractor of the Observatory. Mr. T. Lindsay read a paper upon the variations in the brilliancy of Venus, and explained the method used in constructing the tables in the Nautical Almanac giving the illuminated portion of the disc.

SIXTH MEETING.

April 3rd; the President in the chair.

Miss Elsie A. Dent and Miss Lilian M. Dent were elected active members. Reports of the occultation of Saturn on March 24th were made by Dr. J. J. Wadsworth, of Simcoe, and the President, who observed under excellent conditions. Mrs. A. G. Savigny read an interesting account of recent planetary work done at the Lowell Observatory by the members of the staff, with whom she had been in communication.

By request, Mr. A. F. Miller read a preliminary paper on the work of Sir William and Lady Huggins in the field of spectroscopy. The object was to acquaint the members of the Society with some of the achievements of those eminent observers and to point out the valuable and comprehensive character of the volume on this subject which had recently been donated by them.

Mr. J. Edward Maybee, C.E., followed with a highly practical paper on the construction of planispheres, he having given the subject special attention and having succeeded in designing a serviceable and very convenient form of working-chart into which he had introduced several improvements. One of these planispheres was shown and the method of its construction explained.

SEVENTH MEETING.

April 17th; the President in the chair.

Several short sketchy papers of a popular character and expressly dealing with the approaching solar eclipse were as follows:—"The Eclipse as seen from the Sun," by Mr. A. Elvins; "The Eclipse as seen from Venus," by the President; "The Eclipse as seen from the Moon," by Rev. Robert Atkinson and Dr. J. J. Wadsworth; "Searches for Intra-Mercurial Planets during Eclipses," by Mr. J. Balfour Musson; "What Professional Astronomers Hope to Discover," by Mr. J. H. Collins, and "The Examination of Solar Prominences during Eclipses," by Mr. A. F. Miller.

The Society's new electric-lantern, in charge of Mr. D. J. Howell, was tried for the first time, with highly satisfactory results. By its means, a series of slides illustrating the subjects of the evening was shown. The papers proved to be decidedly interesting to the large attendance of members and their friends. The subjects had been selected by the President and entrusted to the members mentioned, the object being to still further heighten the rapidly growing interest being taken by the public in the approaching eclipse of the Sun.

Premising that the eclipse in question, or indeed any other planetary phenomena, could not be visible to an observer on the Sun, owing to the constitution and character of its envelopes, Mr. Elvins, at some length, described these appendages and explained how it was, in his opinion, they would effectively interfere with observation. It was even possible, he thought, that the inhabitants of the Sun, if there be any, are not aware of the existence of planets, stars, comets or other celestial bodies.

By means of diagrams, the President endeavored to show how the transit of the lunar-shadow across the Earth would appear to an observer stationed, with a good telescope, on the night, or dark-side of Venus, using, as a parallel, some account of the transit-phenomena on Jupiter's disc as seen from the Earth. An effort was also made to describe the beauty of the Earth-Moon system as it is visible from Venus, forming as the two bodies do, at inferior conjunctions, the most lovely object in the night-sky of that moonless planet.

Rev. Mr. Atkinson graphically described the eclipse as it would probably appear to an observer, with a telescope, and centrally situated on the Moon, and dwelt on the many interesting phenomena that would attend upon the rapid passage of the lunar-shadow over the surface of the Earth from the waters of the Pacific Ocean on the west, across the American continent, and over the waters of the Atlantic Ocean, to and across Portugal, Spain and northern Africa. The transit, whether over clouds, or over the land and waters of the, Earth, would be undoubtedly a marvellously beautiful phenomenon. He explained, too, how

it was that the shadow which would be slightly oval at the beginning and ending of the eclipse, would be more nearly round when in mid-Atlantic.

Dr. Wadsworth said that he had stationed himself with his 12½-in. reflector upon the central hill in Triesnecker, a beautiful ring-plain, about fifteen miles in diameter, with a circular rampart. His first glance assured him that, compared with Triesnecker, Toronto was a poor place for observational astronomy. What we call fifth-magnitude stars seemed to him as bright as Capella usually does from the Earth, while "Sirius excelled any arc-lamp" on Toronto Island, as seen from Toronto. The ratio of sixteen to one which the books give as the comparative brightness of earth-light proved to be a delusion as it should, of course, in the absence of smoke, clouds and other sources of terrestrial obscurity. The Earth was well placed in the sky, being about 22 degrees from his zenith. Its disc being two degrees in diameter, he could make out the Pacific Ocean, which was much darker in tint than the continent—a sort of slate colour. The north polar region was brilliantly white; so was the south pole, but much of it could not be seen as it was turned away. Occultations of stars by the Earth were frequent, but owing to her dense atmosphere they were not so beautiful as occultations by the Moon seen from the Earth. Antares, a few degrees south of the Earth, was a fine object, and he saw its greenish companion with the greatest ease through the telescope. The glorious constellations which we usually see in summer evenings—Scorpio, Lyra, Aquila and many others—were in attendance on this gorgeous Queen of the lunar night. As the time for the eclipse of the Sun, as seen from the Earth, approached, he saw an almost imperceptible hazy cloudiness grow upon the Pacific Ocean. This was the penumbral fore-runner of the true shadow, and increased in density until a small black spot seemed outlined on the face of the Earth. It was barely visible to the naked eye for it did not subtend an angle of two minutes, but the telescope showed it to be far larger than the black-spots cast by the moons of Jupiter, though hardly so well defined. This spot travelled steadily eastward, crossing Mexico, Texas and other States as it neared

the sea-coast of Virginia, whence it sailed out into the Atlantic and traversed Spain and northern Africa until near the Red Sea it faded away. This was truly a wondrous phenomenon. In closing, Dr. Wadsworth said: "I cannot say I have seen the eclipse of the Sun, as instructed by the President, but I have seen the shadow of it. I have not seen the on-rush of the vast canopy of darkness that awed those who viewed it in Georgia. I have not felt the dumb helplessness of men under the gathering frown of the Infinite. But this comes of sending me to Triesnecker."

Mr. Miller pointed out that it was not until curiosity had been aroused as to what caused the phenomena known as Baily's heads that any special attention was paid to the phenomena of solar eclipses further than to check the accuracy of the times of contact which had been predicted, these observations being regarded as necessary only as tests of the correctness of the lunar theory as understood. It was true that solar prominences had been known for ages, but they were thought to be associated in some way with the Moon. But once scientific attention came to be paid to Baily's beads, other phenomena were examined and one discovery followed another until observers succeeded, not only in dispelling unsound views as to eclipses, but in showing what the protuberances really were. Mr. Miller described the instrumental means employed in the spectroscopic examination of these red flames and the method by which they are photographed. He mentioned the men who had assisted in the scientific work that had been done and was being done, and explained why it was that no opportunity for studying eclipses was now lost.

Mr. Musson's paper related to the searches which have been made for supposed intra-Mercurial planets, and to the observations accredited to Lescarbault and various astronomers, amateur and others, which have been reported since it was announced that the perturbations of Mercury could be explained only on the assumption that some, yet unknown, body is revolving between Mercury and the Sun. Though necessarily brief, the paper contained a synopsis of all that was known on the subject, and made reference to the proposed special investigations—photographic

and otherwise—that would be undertaken by members of various professional parties which would be in the path of the shadow.

In the course of his interesting paper, Mr. Collins dealt with some of the discoveries astronomers had made and hoped to make, and described the coronas typical of periods of solar maxima and minima. He referred to the desirability of settling beyond dispute surmises which had been made as to the composition and character of the solar corona. The plans of various astronomers were outlined, and the new means of observation and methods for photographic and spectroscopic work were described. It was shown that if the conditions proved to be favorable valuable information should be obtained.

Mr. Arthur Harvey said the Council of the Solar Institute of Monte Video, Uruguay, had requested that information be sent to them as to the variations in temperature during the approaching solar eclipse. They think they perceive indications that there is a nucleus within the solar-photosphere which emits direct heat-rays, which do not become diffused in our atmosphere. It was therefore thought that there would be a decided fall in temperature when the Moon, passing between the Earth and the Sun, shut out these direct rays, and a corresponding rise of the thermometer when she ceased to obscure that part of the Sun's disc. To prove or disprove this theory it was important to compare the curves of temperature at the exact time of the eclipse (1) when the eclipse is total; (2) when it is partial, and (3) when no eclipse is visible.

EIGHTH MEETING.

May 1st; the President in the chair.

On the motion of Mr. A. Elvins, seconded by Mr. A. F. Miller, a report from the Council recommending that the name of the Society be changed to that of " The Toronto Astronomical Society" was adopted, it being understood that the work of the Society would, as heretofore, continue to embrace astro-physical as well as astronomical subjects. Dr. G. E. Hale, F.R.A.S., Director of the Yerkes Observatory, was elected an Honorary Member of the Society.

Mr. C. A. Chant, B.A., one of the Vice Presidents of the Society, and Lecturer in Physics at the University of Toronto, assisted by Mr. D. J. Howell, with the lantern, delivered a highly instructive and practical lecture on "Standing or Stationary Light Waves." Many new slides, some made at the University by Mr. Chant and his assistants, were projected on the screen for the purpose of showing the beautiful and interesting phenomena caught by the camera during experiment and investigation. Mr. Chant's exposition of the subject was popular as well as scientific and was followed by a discussion in which many members took part.

NINTH MEETING.

May 15th; the President, who was in the chair, laid on the table an Order of the County Judge, dated 1900, May 5th, by which the name of the Society had been changed, under the statute in that behalf, to that of "THE TORONTO ASTRONOMICAL SOCIETY." Mr. Arthur Harvey, F.R.S.C., read a note upon the periodicity of sun-spots and of magnetic-disturbances, and pointed out that the great group of spots seen in April had not been central when the magnetic storm of that month occurred.

Mr. R. F. Stupart, one of the Vice Presidents of the Society and Superintendent of the Meteorological Service of Canada, read a graphic paper on Seismology. Having traced the history of the

science down to modern times, Mr. Stupart explained the instrumental means by which at the Toronto Observatory and at Victoria, B.C., the farthermost western station under his charge, in common with other seismological observatories throughout the world, the intensity of earthquake shocks is recorded photographically. He also described the phenomena attending some very notable 'quakes, including the Krakatoa eruption and other terrestrial disturbances, where the shocks were found to pass through the Earth as well as along its crust. By means of a series of slides, he projected upon the screen various diagrams of Milne's Seismograph and of its delicate parts; also tracings or seismograms, made by this instrument at various stations in Europe, Asia including Japan, and Canada. The paper, which was most attentively listened to, was followed by an animated discussion in which Mr. S. Mogi, of Toronto, but formerly of Japan, a witness of the destruction caused by some earthquakes in that country, took part.

At the close of the meeting it was announced that Mr. Thomas Lindsay, Recording Secretary of the Society, had decided to go to Wadesboro, N. C., for the purpose of observing the total eclipse of the Sun, and that he would take with him a telescope and a spectroscope.

TENTH MEETING.

May 29th; Mr. R. F. Stupart, Vice President, in the chair. After the transaction of routine business, reports of observations of the partial (in Canada) eclipse of the Sun on the previous day, were received from Mr. Walter H. Stevenson, of Fenelon Falls; Mr. R. Kimber-Johns, of Gravenhurst; Rev. Dr. Caswell, President of the Meaford Astronomical Society, and from several of the members present. Mr. D. J. Howell showed some photographs from negatives taken with a small camera. The attendance of members and of the public was large, the phenomenon having been almost universally observed in Toronto, where the sky was clear, and throughout Canada. It was announced that

Mr. Lumsden, the President of the Society, had gone to Thomaston, Ga., as a member of the Lick Observatory Expedition, and that at the next meeting the evening would be devoted to hearing reports of the eclipse observations made along the path of totality.

A paper on "Lunar Rays" was read by Mr. A. Elvins, and was illustrated by lantern views. The subject was one to which Mr. Elvins had in the course of many years of observation given deep attention. He described the various theories which had been advanced and defended by astronomers in their efforts to account for the "rays," and showed some interesting drawings which he had from time to time made at his telescope.

ELEVENTH MEETING.

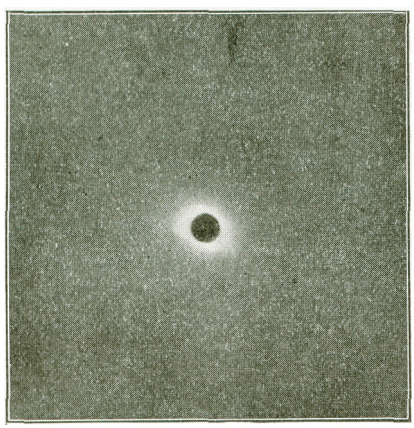
June 12th; the President in the chair. Further observations of the total solar eclipse of May 28th, were received from Mr. Samuel Byrne; Mr. J. H. Weatherbe; Mr. J. R. Connon, of Elora; Mr. C. A. Marriel and Mr. W. Watson. These gentlemen had made interesting notes on the phenomena accompanying the partia1 eclipse as seen in and near Toronto. The President having called upon the Recording Secretary to report the observations he had made at Wadesboro, N. C., on the path of the lunar shadow,

Mr. T. Lindsay said that, on the 26th of May, he joined the official parties of the Yerkes' Observatory, Princeton University and the Smithsonian Institution and the Royal Astronomical Society. Among the distinguished men present, were Professor S. P. Langley, an Honorary Member of this Society, Professor E. E. Barnard, a Corresponding Member, Professor C. A. Young, Rev. J. M. Bacon, F. R. A. S., of England, Professor J. L. Campbell, of Wabash College, Indiana, and Mr. D. E. Hadden, of Alta, Iowa, an Associate Member of this Society. His journey and his stay had been rendered especially pleasant by his friends, Mr. John Lindsay, of South River, N. C., who, with Mrs. Fowler, the postmistress, and others described to him the phenomena,

but more particularly the splendid corona, which had characterized the famous eclipse of 1869, visible in that region. Having mentioned the locations and the equipment of the several camps and stated the plans of individual observers, including himself, Mr. Lindsay addressed his remarks to the eclipse itself, which he described in a graphic and interesting manner. The first contact was noted by Prof. Reed, of Princeton, by the spectroscopic method, as having occurred at 7 h. 36 m. 01 sec. During the time yet to elapse before totality, Mr. Lindsay concerned himself with the best course to pursue, and he decided to use in his telescope a terrestrial eye-piece with a glass-shade of neutral tint, which gave him a wide field and permitted the examination of the Sun and his surroundings as they moved across. His spectroscope he placed within convenient reach. Others having been assigned to the duty, he did not observe the landscape for changes in aspect, nor did he pay careful attention to the deepening darkness. At the last moment, however, he did look toward the west for the approach of the shadow, but saw nothing of it. He had heard a great deal about the on-coming of the shadow in total eclipses; how hard it was to dispel the idea that the shadow was something tangible; how the most prosaic of men became peculiarly excited as the blackness leaped upon them, and he set himself to observe just what effect it would have upon his own nerves. Thinner and thinner grew the crescent of solar-light in the telescope until suddenly there was a vision of Baily's beads, and then out went the light, for the shadow had leaped upon the camp. He used the word "leaped" advisedly and as the only one that adequately expressed the approach of the umbra, as it did literally leap upon the observers, but that was all. An excessively bright but small portion of the Sun's disc seen for one moment and gone the next! No tangible thing had touched them, and yet he felt conscious of a distinct physical change of some sort. To his mind, the sensation experienced at the moment of totality is a real sensation. It might be due entirely to shock to the optic nerve, as when a very bright object suddenly disappears, or it might be attributable to a change of temperature, supposed or real, as the gloom due to the sudden fall

of darkness settled down upon one. In a peculiar nervous condition, is a person susceptible to a change of one or two degrees? for the temperature fell two degrees during totality; at any rate the first observation he made, rightly or wrongly, was that totality gives rise to a real sensation to an observer watching for its approach. Simultaneously with the disappearance of the crescent, he was conscious of a faint halo surrounding the black lunar ball, and of several excrescences appearing around it; by that peculiar process of the mind by which we recall even what has not been specially noted at the time, he seemed to remember that the faint halo was there before the crescent went out, that, in fact, he saw the corona before totality. He had been using the shade-glass over the eye-piece throughout, according to a printed set of instructions. Undoubtedly, this was a mistake. Everything seen had been so exceedingly bright and clear, even Baily's beads, through the shade, that he forgot the neutral glass was there. It should have been removed before totality, but he had seen the prominences so beautifully that he feared if he took his eye away from the telescope he would see these forms only as little dots, if at all. This was no doubt true for the eye could not possibly have a view of the prominences and also of the inner corona, which he examined with a magnifying power of about 20. He further noticed that the scene was rapidly changing, and became aware of the simple fact that the phenomenon of an eclipse was not a mere flashing out of the corona and then its disappearance, but was a panoramic, pyrotechnic display around a great black ball hung in the heavens—a something that the cinematograph alone can reproduce, and he caught himself hoping that success would attend Mr. Maskelyne, of the English party, who was using such an instrument, the motion of which was audible. The prominences were now lost upon the inner corona in his eye-piece, and he could see an excessively bright halo entirely surrounding the Sun, but no color of course, and only the faintest trace of the extension of the corona. Mr. Lindsay said he had intended to take a look with the eye away from the telescope, and a look at the spectrum of the corona, but—he had lost the official count. From the instant of totality, the seconds had been called out by one of the Princeton observers in

a loud clear voice; but so intent was he in looking into his telescope that he seemed only to hear the "one" and the "ninety"; and then just as he decided to take his eye from the instrument a brilliant crescent flashed out on the other side and all was over! On comparing notes the observers agreed that it had not been dark at all. Those of them who had seen eclipses before thought this a particularly light one. Mr. Hadden had exposed three plates, had looked at the inner-corona in the telescope and had looked with unaided eye, following out his programme perfectly. Mr. Lindsay exhibited a reproduction of the picture taken



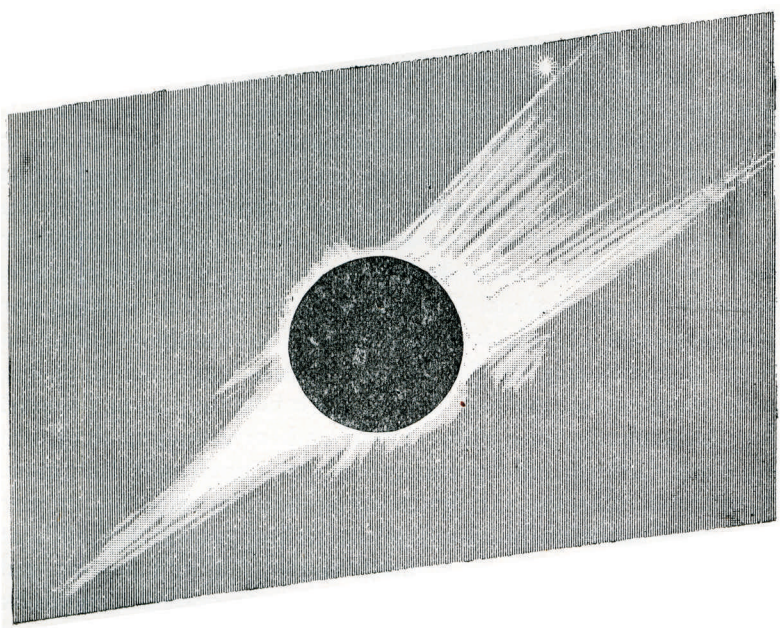
with Mr. Hadden's 8 x 10 camera, and said what he had principally to offer as a result of his expedition was a set of rules for the amateur who goes to see an eclipse for the first time. First, take a telescope with a polarizing eye-piece; never mind what the books say about shade-glasses; keep clear of them, second, pay no attention to the official count. If you are with a party, keep far away so you cannot hear the count, but have some one close to you calling the seconds in a low voice, and, third, write down a series of questions and hints as follows: Do you see the corona yet? Watch for Baily's beads. Now, the prominences. What colour? Where are they? Look hard at the inner-corona. Look at the equatorial streamers. Note the poles of the Sun.

Quick now; half your time is gone, etc., etc., and when you have written down a complete list, as you will make it up from the records of a dozen eclipses, have a third party commit them to memory and let him prompt you right through to the end. By this simple method, he was quite sure any one could make better use of sixty seconds than without such preparations one could make of three minutes the first time. It might be all right the second time, but who could expect to see more than one eclipse in a lifetime! Not many certainly. Several excellent photographs taken at Wadesboro by Mr. Hadden, were then shown.

The President said he had had the signal fortune to be favored by Prof. W. W. Campbell, who was in charge, with an invitation to join the Lick Observatory Expedition at Thomaston, Ga., where he arrived on the 26th of May and found Prof. Campbell and Prof. C. D. Perrine, who composed the Expedition proper. With them were associated several astronomers from a distance, who had gladly offered their services, and a dozen or so of the residents, including the Mayor of Thomaston, who had volunteered to assist. Among the professional observers were two Astronomers from Holland, who had been sent out by the Dutch Government to acquire the experience necessary to enable them to take charge of the Dutch Expedition to be fitted out to observe the great solar eclipse visible from Borneo, 1901, May 19th. Drilling had commenced on the 26th and by the morning of the 28th, Prof. Campbell had everything going like a clock. The work of the expedition being entirely photographic and spectroscopic, no telescopes were allowed on the grounds, which were beautifully situated on a gentle slope facing westerly and well suited for a camp of observers, especially as it afforded a good view of open country across which the swiftly travelling eclipse shadow must approach. The batteries of instruments consisted of four spectroscopes, four small cameras and three photographic telescopes, including the 40-foot. The early morning of the 28th was very cloudy, but the sky partially cleared as the Sun grew hotter and though clouds hovered in the distance and

an occasional thin cloud passed over head the hopes of the observers were high. The first contact was taken in a clear sky. Prof. Campbell then saw that every man was at his post and the last two or three drills were had and the final preparations made. To Prof. Buchanan, of Cumberland University, Lebanon, Tenn., a Veteran of the War and a distinguished scientific man, and himself (the President), were assigned the duties of judging of the brightness of the eclipse by the appearance of various objects in the landscape during the gathering darkness, to be, later on, compared with deepening evening twilight; observing for shadow-bands and drawing the corona. Being occupied with the first-mentioned of these, they did not see the phenomena attending the instant of totality, and it was not until Prof. Perrine called out to the observers "Go!" and one of the constables shouted "Oh!" when he saw the corona flash out upon the sky that they turned toward the east and beheld that which must ever be the most impressive and noble phenomenon associated with Nature,—a total eclipse of the Sun, for there upon the hitherto whitish sky, but now draped in sombre gloom, hung a black ball from two opposite sides of which streamed out a soft pearly sheen of indescribable beauty. This was the corona, which on the easterly side of the Moon tapered to a point, and on the westerly side expanded into a sort of "fish-tail" formation, with Mercury blazing like a white star of the brilliancy of Venus, near the upper edge. Those to whom the enchanting spectacle was new were simply lost in amazement at the glorious object in the sky. Of these, one was the speaker who could only persuade himself to give glances at the landscape and at his drawing. The ninety seconds of totality were gone as it were like a flash, for the Sun soon reappeared and all was over. Though the glorious panorama lasted but a few moments it left impressions which can never he effaced. Instantly, Prof. Campbell left his spectroscope and went the rounds getting reports from each observer, and soon expressed himself as satisfied, and well he might for in a few seconds the sky was covered with dense clouds. Having regard to the peculiarly weird conditions, the silence in the camp during totality was oppressive notwithstanding the loud counting

of the seconds and the curious grating noises due to changing the plate-holders in the cameras. This silence seemed to brood over the entire city, though it was crowded with visitors and though groups of observers were stationed on the roofs of the cotton-mill, the court-house and many other buildings, and about the streets and squares. One might imagine Science herself, conscious of the importance of the occasion, commanding the hush



of silence everywhere. The effect was heightened by an incident almost dramatic. Fifteen seconds before totality, Prof. Campbell saw rapidly approaching an express train which, if not stopped, would go rumbling by within a hundred yards of the instruments at the most critical moment. At a word a constable dashed

The President is indebted for the above cut to the courtesy of the proprietors of The Atlanta (Ga.) "Constitution," a journal which easily led all other newspapers in the fullness and accuracy of its reports and illustrations of the eclipse, the result of the ability and enterprise of its staff, including Mr. Edward G. Lowry, who had charge of the work in Georgia. The cut is from a drawing made within half an hour of totality.

towards the train which was sharply brought to a stand in a cutting almost within the grounds, where, in the darkness, it looked like a guilty thing as it waited until the same imperious hand which had stopped it, majestically waved it permission to proceed. So thoroughly were arrangements carried out that not a human being, except the observers, was permitted to approach within a quarter of a mile of the camp. Once totality was over, the tension was relaxed, joyous observers compared notes, the camp and staff were photographed,—and nobody paid any more attention to the still partially eclipsed Sun. As for his report as an observer, all he could add was that, though the landscape gradually darkened, at no time was it impossible to distinguish even distant objects, such as the horizon, or trees or houses, at least, in outline, as the darkness did not greatly exceed, if it reached, ordinary twilight. Though most carefully looked for the approach of the shadow was not detected, though a second or two before totality some diaphanous clouds lying in its path, at an elevation of about 45 degrees, suddenly took on a deeper pinkish-purple hue which did not seem to change during the total phase; clouds in the horizon assumed and maintained a rich orange tint. As for the shadow-bands they were detected only a moment or two before totality, when he caught sight of a confused fluttering along the ground of lights and shadows in a direction following the Moon. Precisely the same phenomena were seen immediately after totality. The so-called "bands" or "fringes" seemed to be broken, shadowy dark waves, several inches wide and separated by whitish spaces or crests of about the same width, moving diagonally across the sheets which had been laid on the grass and in a tremulous manner as if reflected by some liquid that had been suddenly shaken. The play of light and shade was not unlike that of shadows flickering along a wall upon which they have been cast by water gently rippling in the sunlight, with the exception that there was no brightness. While they were passing, the landscape was darkened to almost the depth of the first gleaming of twilight, which may have rendered the bands less easy to be sharply defined by the eye. Roughly speaking, the fringes were composed of alternating,

rapidly travelling, badly broken or confused wavy bands of light and shade several inches wide and about the same distance apart. Their general appearance as they fluttered across the sheets would suggest shaking or agitation. It was stated to the President by the members of a party which stationed itself on the roof of the cotton-mill, that they distinctly saw the bands as they crossed the fields towards the mill and again while gliding down a slope at a distance of several hundreds of feet. The wind was scarcely more than a breath of air moving from a point a little west of south. There seemed to be a lull in the wind, such as it was, during totality. In the course of the day he had had the privilege of comparing notes with Mrs. Jere Horne, of Memphis, Tenn., a distinguished authoress and traveller, who had observed two other total eclipses, the one in Colorado in 1878, and the other in Norway in 1896, and who was planning to go to Borneo in 1901. She had found the eclipse of 1900 less interesting and striking than the others, a view taken by other observers and attributed to the facts that it had occurred during a sun-spot minimum and that totality had been very short. Before closing the President said he would like to say that, to him, the stars as seen in Georgia were brighter than in Canada, the sky blacker at night, the setting in of night much more pronounced and rapid, twilight being preceptibly shorter even to the casual observer and darkness coming on sharply. Owing to the intense blackness of the sky and to the brilliance of celestial objects, the heavens were, to an observer from the north, really a panorama of beauty. In the telescope, such objects as are familiar to us in the Milky Way, including the Trifid Nebula, were of surpassing loveliness. As for the brighter stars, they were certainly magnificent objects. Jupiter shone like Venus is seen in the north and Venus herself rivalled an ordinary lamp. Probably this was due to contrast, for the nights seemed to be darker so far as both the skies and the landscape were concerned. He noticed, too, that such constellations as Scorpio, which are seen from Toronto near the southern horizon were, say, ten degrees higher on the sky at Thomaston, while the Pole Star was depressed by the same quantity toward the northern horizon. To him it was interesting to note that on the day of the eclipse, May 28th, the Sun

set at Toronto at 7.48, with a long twilight lasting until, say, 8.30, while at Thomaston, roughly speaking, one thousand miles nearer the equator, he set at 7.17, and it was dark as midnight in less than half an hour. In other words, it was night at Thomaston very soon after sunset at Toronto. The President, who said his note-book was full of memoranda, astronomical, physical, scientific, social, political, racial and anecdotal, assured them that his journey was a truly delightful one, and said that it closed, scientifically, with a visit paid to the 26-in. telescope at Washington, in charge of Prof. T. J. J. See, and with which Prof. Hall discovered the two satellites of Mars, a subject he had the pleasure to discuss with Mr. Geo. Anderson, who was on duty with the Professor the night the discovery was made.

TWELFTH MEETING.

June 26th; the President in the chair. Mr. T. Lindsay stated that on the evening of May 27th in the camp at Wadesboro he had observed Venus very close to a faint star in Gemini. This star was thought to have been occulted to observers in the southern hemisphere. The President confirmed this, the observation having been also made at Thomaston. Mr. A. Harvey reported observations of Venus, noting especially that the northern cusp was distinctly blunted on the evening of June 17th. Saturn had been well seen by him and a party of friends; three bands were plainly visible on the ball and the division of the ring was glimpsed. Mr. A. F. Miller stated that he had recently observed that Nu Scorpii had become a comparatively easy triple star, whereas some eight or ten years ago it could not be divided with the same optical power.

Mr. J. R. Collins read a paper on "The Phenomena of Surface Reflection of Light," which was, in substance, an endeavor to show why surface reflection from a transparent medium, such as glass, must necessarily take place, and that the phenomena of surface reflection of light is really a reflection from an ether surface modified by the presence of matter, and not from the material surface itself. Mr. Collins said that when a light-wave travelling

through the ether, strikes a glass-surface its velocity is slackened on account of the change of density or elasticity of the ether contamed within the boundaries of the glass. A part of the wave-energy may be transmitted and a part absorbed, but always a definite percentage must be reflected or thrown back by the reflex action of the modified ether surface. In support of this view, the facts were cited that when a beam of light is intercepted by a lens having its second surface in contact with Canada balsam—which has an ether density nearly the same as that of glass—the reflection from the contact surfaces is extremely faint. With the same surface of the lens in contact with water—the ether density of which is much less than that of glass—the amount of reflected light increases to about two per centum, but when this surface of the lens is in contact with air—the ether density being much less in air than water—about four per centum is reflected; finally, when the glass surface is against a vacuum—a vacuum being really ether unmodified by the presence of matter—the maximum amount of reflection takes place, viz., from five to six per centum. The amount of change of ether-density or elasticity at the surface of a medium transparent or otherwise, determines the intensity of the reflex action produced by the passage of a wave of light from one medium to another, or through a single medium having definite surfaced strata of different density or elasticity. As a corollary of this, it was pointed out that total reflection at perpendicular incidence would he impossible except at an ether surface against blank space or absolute void. If the molecular arrangement of the material medium is such as to form an optically even ether surface the reflex action of the surface will be uniform and simultaneous successively as the incident wave crosses it; the reflected wave will then be a continuation of the incident wave (though changed in direction) plus the curvature, if any, of the reflecting ether surface and when focussed will give an image of the true source of the light. If the molecular arrangement of the material medium is such as to form an uneven ether surface, the reflex action for each particular part of an advancing wave part cannot then be simultaneous, and not being so each of the uneven points in the entire ether surface affected by the wave

must become a centre of disturbance itself, each point independently giving out its own reflex action in behavior as if each point were a true, and not a secondary radiant. If any arc of the face of this network of reflected outcircling waves be then focussed, the resultant is a series of images of these points in the reflective surface and not of the true source of the light.

THIRTEENTH MEETING.

July 10th. This meeting was to have been held on the lawn of the Observatory by courtesy of Mr. R. F. Stupart, the Director, for the observation of the occultation of Saturn, and seven or eight telescopes had been placed in position. The weather, however, proved to be unfavorable and the Society met in the Observatory for the transaction of business, the President in the chair. Mr. J. H. Weatherbe was elected an active member. The President briefly reviewed the changes in the by-laws of the Society which the Council had decided to recommend. Mr. T. S. H. Shearmen, of the Woodstock Observatory, sent in a report of his eclipse work at Norfolk, Va. He had organized a party of observers from among the passengers on the streamer Yennasee and had obtained four photographs, with a small camera, during totality, and six with a lens of 42-in, focal length in an attempt to secure the corona during the partial phase. Successful shadow-band observations had also been taken on a 6 by 8 feet white cotton surface, and before second contact a brief spectroscopic examination had been made. An interesting discussion followed on the general subject of eclipse photography.

FOURTEENTH MEETING.

July 24th; the President in the chair. This meeting which had been announced for out of door observational work, was held at the residence of Mr. J. A. Paterson, M.A. The weather being quite unfavorable, the members assembled indoors and an interesting discussion took place respecting variable star observations and delicate measurements of temperature. The latter was occasioned by a paper, in a current periodical, read by Mr. Paterson, dealing with the measurement of the heat of the solar corona. Mr. A. F. Miller explained the construction of the instruments mentioned and showed that the greatest care was taken to avoid error. He thought the work of experimenters like Professor Langley should be accepted as authoritative. Short papers on Constellation Study were read by Mr. Paterson and the President. The former dealt with Scorpio and gave an interesting description of the beauties of the Constellation and some account of its history, the probable origin of its name and of the importance with which it was regarded by the ancients. The President followed on somewhat similar lines with respect to the Constellation Libra.

FIFTEENTH MEETING.

August 21st; Mr. A. F. Miller in the chair. Miss M. McEachren, of Toronto, was elected a member of the Society. The communications read were from Professor W. R. Brooks, of Geneva, N.Y.; from the President of the Solar Institute of Monte Video, and from Dr. J. J. Wadsworth, of Simcoe. Professor Brooks presented some interesting notes on "Comet-seeking" which were read and discussed. Valuable hints to amateurs were given and many instances from the writer's own experiences as a comet-seeker were related. Mr. D. J. Howell reported observations of the Perseid meteors on the evening of August 17th. Mr. Miller stated that he had been engaged in making micrometric measurements of the system of Jupiter and that on comparing these

with the data as given in the Nautical Almanac, the agreement was found to be very close. Some discussion followed on the important subject of "Irradiation," where work of this kind is carried on. Mr. A. Elvins presented some drawings he had made of the Trifid Nebula at his telescope, and also read some notes on the possibility of the existence of a ring of small bodies between the orbits of Venus and Mercury.

SIXTEENTH MEETING.

September 5th; the President in the chair. A communication from the President of the University of California announced the death of Professor James E. Keeler, Director of the Lick Observatory, and an Honorary member of the Society. Mr. A. Elvins voiced the very deep regret with which the Society heard of the decease of the distinguished astronomer, a man universally respected and beloved. In reviewing the life-work of Keeler, Mr. Elvins showed how important and far reaching had been his discoveries. His name was inseparably connected with the solution of several of the great astronomical problems presented during the century. He instanced specially the discovery of the motion of nebulæ in the light of sight, and the final triumphant answer given to the question of the rotation of Saturn's rings. Mr. A. F. Miller called especial attention to the extreme care with which Keeler's work had always been done. His announcements were at all times taken as authoritative; the scientific world knew that not the smallest point had been overlooked. Mr. T. Lindsay referred to the kindness which Keeler had always shown to inquiring amateurs. If one were sincere in his search after knowledge, he could never be so humble that Dr. Keeler would not assist him and this, too, in the midst of his arduous professional work. It was then resolved that the Secretary place on record the sympathy of the Society with the friends of the deceased and the scientific world generally in the great loss sustained. Communications with photographs, referring to the recent solar eclispe were received from Professor G. D. Swezey,

of the University of Nebraska, and Professor A. H. Buchanan, of Lebanon, Tenn., who had been a member of the Lick Eclipse Expedition. Mrs. Jere Horn of Memphis, contributed two interesting papers descriptive of the total solar eclipses of 1878 and 1896, which she had observed. A series of reports of successful out-of-door meetings for telescopic work were received. It was mentioned as matter for congratulation that Rev. R. Atkinson, Dr. A. D. Watson and Messrs. A. Elvins, A. Harvey, T. Lindsay, J. E. Maybee, A. F. Miller, J. H. Weatherbe, J. H. Collins, Z. M. Collins, the President and other members had willingly set up telescopes for the evening on public and private lawns in various parts of the city in order that the public might be enabled to observe celestial phenomena and had themselves attended and had presided at their instruments or had given practical instruction in Constellation study. Some of these meetings had been held under the auspices of churches and of public and private schools, and one of them on the grounds of the Harbord Collegiate Institute at the instance of the Froebel Society; another on the grounds of the Normal School when the teachers attending the school were present, and a third on the grounds of St. Andrew's Boys' College. These meetings had been attended by large and appreciative gatherings, and the Society had been thanked for what it had done. The President added that during a holiday in Muskoka he had placed a telescope on the lawn every clear evening, and had welcomed any one who chose to use it. Sometimes as many as fifty guests and others were present. The Muskoka air was admirably adapted for observation. During August, Venus was a beautiful day-light object being easily visible to the naked-eye in bright sunshine. In the telescope she was, of course, still more attractive. To many people, ability to see a star in the daytime was a pleasing novelty.

SEVENTEENTH MEETING.

September 18th, the President in the chair. The Corresponding Secretary, Mr. W. B. Musson, stated that he had sent authorized communications to several scientific periodicals in explanation and support of the claim of the Messrs. Z. M. and J. H. Collins to the invention by them of monoplane telescopes, the first of which had been constructed and exhibited, as members of the Society knew, so early as the spring of 1896. These communications had been drawn up by the Special Committee consisting of Mr. J. A. Paterson, Chairman, the President and Messrs. A. Harvey, J. R. Collins and himself. Documentary evidence of a perfectly satisfactory character had been procured and was available for use whenever required. Mr. T. Lindsay reported that while examining the spectrum of the flashes of lightning during the severe storm of the evening of September 15th, he had noticed bright lines in every flash. Messrs. J. E. Mayhee and C. P. Sparling described three peculiar parallel streaks running to earth, observed by them. Mr. Elvins said that during the course of another storm he had noticed that the spectrum was continuous, a very rare observation. Discussion having arisen as to the cause of the lightning-flash, Mr. A. F. Miller pointed out that there was no difficulty in learning the cause of the brightness of the flash, as the spectrum clearly indicated that it is due to the highly heated atmospheric gases.

Rev. R. Atkinson, read a paper on the "Great Nebula in Andromeda," illustrated by many excellent slides. Mr. Atkinson's treatment of the subject was exhaustive as relating to the special object named, after which he briefly reviewed the nebular hypothesis as usually accepted. The description of the Andromeda nebula and of the several announced brightenings of the central portion proved of especial interest; while the slides showing the "lanes," so-called, around the great central mass enabled the lecturer to very clearly explain the physical changes which might be expected to occur, as the nebula rotated. In showing views of other nebulæ, Mr. Atkinson brought out the fact that no one particular form prevailed, and, while admitting the possibility of

systems having been formed in other ways than are suggested by the Laplacean hypothesis, still held to the latter as being in the main correct so far, at least, as our system is concerned. An interesting discussion followed, during which Mr. Atkinson spoke of telescopic observation of nebulæ and the interest attached to such work; the pleasure in finding objects not so easy as those in Andromeda or Orion and the best method of working for the amateur armed with the ordinary 3-inch telescope.

EIGHTEENTH MEETING.

October 2nd, the President in the chair. Mr. George Ridout and Mrs. King, of Toronto, were elected active members. The communications included one from Professor T. J. J. See, of the Washington Observatory, who forwarded a copy of an interesting paper on "The Improvement of Definition in Refracting Telescopes," a summary of which was read. The Curator, Mr. D. J. Howell, presented a formal report upon the number, condition and character of the lantern-slides in the possession of the Society. Mr. J. R. Collins, read a paper on "Recent Criticisms of the Nebular Hypothesis." The views urged both by supporters and opponents of the generally accepted theory were stated front the standpoint of modern physics. Apparatus was introduced to illustrate how retrograde motion became possible, this being one stumbling block in the way of many investigators. Mr. Collins' conclusions were favorable to a slightly modified form of the Laplacean hypothesis. Mr. D. J. Howell assisted with lantern-views of nebulæ.

NINETEENTH MEETING.

October 16th; the President in the chair. Professor A. J. Bell, Ph.D., of Victoria University, Toronto, was elected an active member.

After some explanation of their purport by the President, and some discussion, a new series of By-laws for the Society was adopted and ordered to take effect at the close of the meeting. Several of the By-laws had for their object the better conduct of the business of the Society and making clear the work of the officers. The term "active member" was dropped and, for it, the term "associate" was substituted. Provision was made by which for merit only an associate may be created a Fellow. Under the By-laws Life, Honorary and Corresponding Members became Life, Honorary and Corresponding Fellows respectively. Persons conferring upon the Society substantial benefits may be elected Patrons of the Society as some acknowledgment of such benefits.

Mr. A. Elvins showed a drawing of Schroeter's Valley in the Moon, where it leads into Herodotus. He had been able recently to follow this valley, for the first time, into the crater of the mountain. Many observers and many drawings of this portion of the lunar surface differed on this point. It was contended by some able astronomers, possessing excellent telescopes, that the valley does not enter Herodotus. Other observers, equally able, hold that it does. However, possibly it was a matter depending upon illumination. At any rate, he was now satisfied on a point on which he had long been in doubt. Mr. A. F. Miller asked members to pay attention to Omicron Ceti (Mira) which had several attractive features for the observer. He had noted its color as orange and had seen its distant pale green companion of the 10th magnitude. The spectrum of the star was of the 3rd type, showing dark flutings.

Mr. J. D. Howell read a paper on "Color Photography," by the McDonough Process, and exhibited many special slides illustrating his subject. The collection was a varied and choice one and enabled the lecturer to explain the method used in their

preparation. As the opportunity for seeing the slides was entirely due to Mr. Howell, he was formally thanked for his paper and enterprise.

Mr. A. Harvey in reading an interesting note upon the "Aurora Australis; its synchronism with the Aurora Borealis," said that on the return of the Belgica from her Antarctic hybernation in 1898, he wrote to enquire about the magnetic observations which had been made, but was not so fortunate as to receive a reply. He found, however, in the Geographical Journal for July last, a paper entitled, "Observations on the Aurora Australis," by Mr. Henryk Arctowski, who was on the vessel. At the end of the observations Mr. Arctowski said that "it would be very interesting to know whether the familiar phenomena of the aurora borealis are repeated in every particular by the aurora australis. One might inquire whether there is a perfect similarity between the phenomena in the two hemipheres; if their distribution with respect to the poles is analogous; if the periods are the same, and if they coincide; and, finally, one might ask if the two phenomena are simultaneous." Mr. Harvey had been enabled to answer the last query in the affirmative, by comparing the observations recorded by Mr. Arctowski with those published in the Washington Weather Review. The auroræ observed on the Belgica were those seen between the beginning of March and the end of September, 1898. There were fine displays in March and the beginning of April, and then very few until September. They were described and classified in twelve categories. To each of these he (Mr. Harvey) had affixed numbers, such as would be given to similarly described auroræ here, so as to form an auroral curve, or an estimate of intensity, to compare with those seen in this hemisphere. The categories and the values thus affixed were:—

Homogeneous arc	1	Obscure rays	1
Double arc	3	Streamers	2
Multiple arc	5	Rays	3
Crown	5	Dark segment	3
Flames	5	Wavy ribbons	4
Luminous glow	2	Curtain	5

The Washington observations simply gave the number of auroræ seen by the numerous observers in correspondence with the bureau. He placed the figures in position for comparison.

March	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Washington Obs.	4	7	1	0	1	3	3	2	1	6	4	2	30	289	252	27	3
Belgica "	0	0	0	0	0	0	0	0	0	0	1	1	0	13	0	0	0

March	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Washington Obs	6	4	4	4	7	8	1	3	2	1	3	5	1	3
Belgica "	0	12	8	0	0	0	2	4	13	0	2	4	0	1

Thus the greatest auroral outburst was on the 14th of March, in both places. The magnetic disturbance at Toronto was very severe on the 14th, 15th and 16th of the month.

September.....	1	2	3	4	5	6	7	8	9	10	11	12	13
WashingtonObs.	1	30	3	1	1	2	1	5	62	26	21	14	3
Belgica "	0	2	0	0	1	0	0	2	10	10	0	0	0

Here the great outburst' was on the 9th and 10th in both hemispheres; there was also a very pronounced magnetic storm in Toronto. There were no noteworthy auroral displays and no magnetic storms between March and September.

TWENTIETH MEETING.

October 30th; the President in the chair. Mr. R. F. Stupart, Superintendent of the Meteorological Service of Canada, stated that the work of recording Earth-currents, which the Society had been instrumental in bringing about at Canso, N.S., was being continually and successfully carried on. Dr. J. A. Brashear, of Allegheny, Pa., announced the successful laying of the corner-stone of the new Observatory, the erection and equipment of which would, the President said, be largely due to the doctor's intelligent and enthusiastic work as an astronomer and public-spirited citizen. Mr. Joseph Pope, of Ottawa, was elected an associate of the Society. Dr. J. J. Wadsworth, M.A., of Simcoe, spoke briefly upon the subject of work among amateurs. He had been very much encouraged by the lively interest taken by the young people of his town in scientific matters. They were continually working in a humble way it was true—but working. His reflecting telescope had been placed at the service of observers whenever opportunity offered. An Astronomical Society would shortly be formed at Simcoe and there was reason to be pleased

with the prospects before it. Mr. P. J. HowelI projected upon the screen a series of excellent slides donated by Professor Charles Burckhalter, Director of the Chabot Observatory, California, and illustrating, according to a very satisfactory method invented by Mr. Burckhalter, the values of the various parts of the solar-corona as seen during the eclipse of 1900, May 28th. The views and the method were explained by the President, who was requested to thank the Professor for his valued gift.

Mr. A. F. Miller, in reading a paper entitled "Earth," briefly referred to the methods by which the figure and dimensions of our planet had been determined, and, by means of a diagram, illustrated the very small depth to which our actual knowledge of its interior is confined. He explained how greatly the mean density of the Earth exceeds that of the materials composing its crust, and gave illustrations showing the enormous volume of oxygen, chlorine and other gases existing as compounds in the known materials of the surface-layers. Mr. Miller also exhibited specimens of the various elementary bodies contained in the earths, the alkaline earths and the alkalies, among which were such chemical curiosities as calcium, silicon, etc. The paper, which was an able presentation of the subject, was illustrated by thirty highly interesting and instructive physical and chemical experiments.

TWENTY-FIRST MEETING.

November 13th; the President in the chair. Mr. J. E. Maybee presented an admirable black and white drawing, made at the telescope, of the lunar ring-plain Clavius, and explained his method of working and drawing lunar objects. Mr. T. Lindsay reported interesting observations of Schroeter's Valley and led in a discussion of the features of this ever-popular ril.

Mr. Lindsay read a paper on the "Recurrence of Eclipses," illustrating the subject by slides made from charts in Professor Todd's work on "Solar Eclipses." Several examples of the Saros period were cleverly worked out, attention being especially called

to the series in which would fall the total solar eclipse of 1905, August 30th, the next phenomenon of the kind visible in a comparative easily accessible part of Canada. To show how closely the lunation period of 29.5305887 days fits in when endeavoring to name the dates of eclipses past or present, an example was chosen of the number of days between B.C. 585, May 29th, and A.D. 1900, May 28th. Until the end of the B.C. era, there were 213,523 days. Since the beginning of the A.D. era, there were 693,745 days, a total of 907,268 days, which is, within a few hours, evenly divisible by the lunation period. Incidentally, it was explained that if we put in a year, Zero, A.D., so as to make the XXth Century begin with the year 1900, the above date for the eclipse is all astray. This showed that chronologists, when they adjusted the eras and placed the B.C. years on the leap year system, did not insert a year zero. They might have done so, but they did not, so that as our reckoning now goes it was arithmetically plain that the century began with the year 1901. Concluding, Mr. Lindsay hoped that some, at least, of those present would endeavor to see the total solar eclipse of 1905.

"The Observation of Shooting Stars," was the subject of a highly instructive paper by Mr. W. F. Denning, F.R.A.S., a Corresponding Fellow of the Society, residing in Bristol, England, and which was as follows:—

The observation of shooting stars is a very important and attractive branch of Astronomy. It has its difficulties and inconveniences, however, and though it requires no expensive and elaborate instruments, it needs great patience on the part of the observer as well as practical experience before results of fairly accurate and reliable character may be obtained. The photography of meteors has not been very successful hitherto, but efforts are being widely made to render this method more effective. It is not likely, however, that the camera will ever entirely supersede the naked eye as a means of recording meteor-paths. And there is evidence that the photographic plan will not always lead to results of much greater precision than those secured by direct visual observation. But, in general, it may be certainly expected to show a great advance towards accuracy when com-

pared with old methods, and it is to be hoped that those who are experimenting in this direction will be successful for they are endeavouring to ensure exactness in a department which sadly requires it.

With the unassisted eye an experienced observer who has a special aptitude for this kind of work, will be able to fix radiants to within 1° of probable error. This may not be near enough for the refinements of modern Astronomy, but it is highly satisfactory when all the circumstances are considered. The radiants are not absolute points but areas varying in diameter, and the exact centres of these are difficult to ascertain even from photographic trails. The radiant of the November Andromedids is fully 7° in diameter, but I believe this is an exceptional case and that the radiants of showers generally are pretty exactly defined and within 3° or 4° diameter.

Of course the centres of certain streams are capable of being determined with much greater accuracy than others. Those which furnish streak-leaving meteors are the best because the lingering streaks, or after-glows, afford an excellent guide from which the directions of the individual flights may be recorded. The quick, short meteors without streaks or trains like the Geminids are more difficult to deal with. To get the radiant of any shower well the observer should closely watch the particular region in which it is situated and register the tracks of meteors close to it and of stationary meteors which may appear exactly at the centre.

It is a valuable and necessary help in these observations to hold a perfectly straight wand in the hand and to project it upon the path of each meteor at the instant of its appearance. Then carrying the eye along the wand, the direction of flight can be correctly noted by reference to the stars lying in the backward and forward line of motion and the course may be reproduced on the globe, or star-map accordingly. I much prefer a celestial globe for the work for it contains a representation of the whole heavens, and it can be set for the latitude and time and will show the position of a radiant relatively to the horizon. This is important, for long-pathed meteors are characteristic of radiants at

low altitudes. On the other hand, short meteors moving slowly and with a bushy train, or dense streak, are always close to their radiants. It is true that on the celestial globe the stars are reversed east and west, but after a little practice the observer will scarcely notice this disadvantage. The objects as seen should be catalogued in a convenient form for reference. As a specimen of a method which includes all essential details, I may transcribe a copy of part of my register for 1900, September 27th:—

Date 1900	G.M.T. h.	m.	Star Mag.	Began α °	Began δ °	Ended α °	Ended δ °	Length of Path °	Duration of Flight sec	Notes	Probable Radiant α °	Probable Radiant δ °
Sept. 27,	9	30·	4	26	+56	320	+ 44½	42	2·5	Swift streak.	76	+31
"	11	2·	2	2½	– 8	2	– 14	6	0·7	Slowish.	5	+12
"	11	15·	2	41	+ 0	39	– 8	8	0·5	Swift streak.	72	+64
"	11	20·	3	48	+13	46½	+ 7	6	0·6	Swift streak.	72	+61
"	11	25·	5	70	+55¾	75	+ 52	4½	0·5	Swift.	55	+62
"	11	36·	5	78	+20	64	+ 17	14	0·8	Swift streak.	110	+22
"	11	36¼·	2	67½	+ 16	74	+ 7	11	1·5	Very slow train.	335	+55
"	11	46·	1	94½	+39	97½	+ 48	9	0·9	Slowish streak.	90	+20

There are a vast number of feeble systems in action on every night of the year, and many of these can only be detected during long watches maintained on several nights, for they do not individually furnish more than about one meteor in ten hours within the sphere of vision commanded by a single observer. Little benefit will accrue to this branch of Astronomy by accumulating further evidence of very weak and doubtful systems. It will be really of more importance to clear up certain doubtful points connected with such prominent displays as the Lyrids, Perseids, Orionids, Leonids, Geminids, etc. The positions of the various radiants of these streams have been already ascertained with tolerable accuracy on the dates of their maxima. We now require a number of exact observations near those dates for the purpose of ascertaining whether the radiants are stationary or become displaced from night to night. The Perseid radiant certainly moves about 1° per day eastward during the five weeks or so, during which it continues visible. The Lyrid and Geminid radiants are also probably moveable ones, but that of the Orionids appears to be

quite stationary. The various showers named should be attentively watched a few nights before and a few nights after the maximum and the place of the radiant determined separately for each night of observation. It would then be seen on comparison whether the various positions indicated fixed or mobile centres.

The duration of visibility of the most conspicuous showers also stands in need of further investigation. The Perseids certainly remain visible from about the middle of July to the end of the third week in August. The Orionids endure for about three weeks, from October 9th to 29th. The Leonids are perceptible between November 7th and 20th. These several showers, together with the apparently short-lived systems such as Quadrantids and Lyrids, should be carefully watched every year so that the principal features attending their annual exhibitions may become better known. Observers should also notice, apart from the position of their radiant-points and durations, the visible strengths of the different showers from year to year. Though their meteors return annually at certain appointed times, they do so in varying richness, and it is desirable to record the horary number of meteors observed whenever a display is recognized. If a large number of records of this character were allowed to accumulate, they would furnish the data from which some interesting deductions might be made. Of course, the successive manifestations of any shower depend partly upon the weather and upon the position of the Moon. The character of the weather prevailing and the hindrance afforded by moonlight (if any) should therefore be always recorded equally with the observed strength of a shower, for the latter must necessarily be greatly influenced by the conditions under which it is viewed.

There is a grand field open in meteoric Astronomy for further useful work. A little has already been accomplished, but as yet, we stand only on the borderland of knowledge in this far-reaching and attractive field of enquiry. In the observation of fireballs and of ordinary meteoric showers we have still to rely upon eye-observations, though they must necessarily be only approximately correct. By care and diligence, however, these will be so reliable as to be of real service even in critical ques-

tions as to stationary radiation and as to radiants which, like that of the grand display of Perseids, run rapidly along from night to night amongst the stars! Observers who will patiently apply themselves to this work may reap a rich harvest in time and particularly in the southern hemisphere, which to this day remains practically unexplored. It is to be hoped that some able observer will shortly become the sentinel of the southern skies and present us with a catalogue of the many interesting showers of meteors visible there.

I have engaged in various lines of astronomical work but invariably found the meteoric branch peculiarly fascinating, and there are members of the Toronto Astronomical Society who would probably find it equally so. When we stand out in the open, gazing at the constellations and the luminous folds of the Milky Way, a fireball may appear at any moment lighting up the sky and landscape and providing us with a vivid picture surpassing any terrestrial scene. Or a small meteor like the faintest visible star may run its fugitive course along the Celestial domain. The latter, though apparently insignificant, is of equal scientific importance to the fireball, for every one of these objects, large and small, far and near, is capable of furnishing a lesson to those observers who are vigilant and accurate in their efforts to learn it.

TWENTY-SECOND MEETING.

November 27th; the President in the chair. It was announced that a letter of thanks had been received from the Froebel Society for the attendance of officers and associates of the Astronomical Society, with telescopes, on the occasion of an open-air meeting of the teachers held on the grounds of the Harbord Street Collegiate Institute, the use of which had been kindly granted by the High School Board. The President said the meeting had been a pleasing one in many respects. The attendance had been large and the results gratifying. He was under obligations to those associates who had attended and had either presided at their telescopes or had taken charge of parties and described

the constellations to them. The Recorder read the Report of the Council submitting the names of the candidates for office during 1901 which had been selected at a special meeting. To the names submitted, the Society added those of five Associates as candidates for election as members of the Council. The list was ordered to be printed and distributed as a ballot-paper.

"Some contributions of Astronomy to Practical Life and Thought," formed the subject of an interesting and instructive paper read by Mr. J. Edward Maybee, who, having pointed out that any form of study or of occupation may, on occasion, be properly put on its defence and compelled to maintain its right to demand the time and attention of intelligent men, proceeded to show the claims of Astronomy to hold a place in the affections of lovers of Knowledge. He said that many men were satisfied with the effortless enjoyment of the senses, while others sought to acquire knowledge and cultivate the powers of the mind. Some people found their chief pleasure in the study of Literature and Art, and various other branches of learning, while others were best satisfied when engaged in the contemplation of Nature. For the last mentioned, Astronomy afforded peculiar opportunities of satisfying their desires, owing to the number of widely varying branches into which it is divided, including, for example, Historical Astronomy, Spectroscopy, Celestial Photography, Mathematical Astronomy, Observational Astronomy, Star Study, Moon Study, Planetary Study and many other special lines of work. Besides its infinite variety, no other scientific study was so broadening and elevating in its tendencies, dealing, as it did, with the immensities of Time and Space. Astronomy had also many claims to be studied on the score of its utility. It enabled us to fix direction and position on the Earth's surface. It gave us Mean Time and Standard Time for the benefit of trade and commerce. It enabled us to fix important dates in ancient chronology, to predict tides and to present to the mariner a mass of data of the greatest possible service in the daily life of man. Probably the greatest service of Astronomy to mankind was the part it took in moulding and directing thought. For nearly eighteen hundred years, Astronomy had struggled hard against Ignorance and Prejudice. The general recognition of the inferior size and position of the Earth had brought

about a vast change in the conception of God and His relations to the Universe. Canon Farrar says: "We now know something of the immeasurable, inconceivable vastness of God's Universe, and, consequently, we can no longer rest in schemes and systems which professed to speak of God 'as though He were a man in the next room.'" Astrology had also received its quietus from the New Astronomy. After the position of the Earth was determined, it was soon perceived that the motions of the stars and planets could not have any relation to the affairs of men. The conception of the unity of the Universe was another triumph of Astronomy. The facts adduced in support of the Nebular Hypothesis, Darwin's Tidal Theory and the discoveries of Spectroscopy, had gradually convinced thinking men that the Earth is only a little part of a vast whole, a mere pebble, as it were, in the Creator's quarry, not greatly differing from multitudes of other bodies of vastly superior proportions. Mr. Maybee ably showed how intimately the work of Astronomy was bound up with our daily needs and how much was owing to it when we undertook historical research. No doubt, there were individuals who held there was little of practical use in the study of the motions and character of the orbs in space, but when the matter was examined in all its bearings, it was seen that we would be very poorly equipped indeed for social and material progress without the aid of that which Astronomy and kindred Sciences have taught us.

TWENTY-THIRD MEETING.

December 11th; the President in the chair. Miss Laura Fawcett, of Toronto, was elected an Associate of the Society. Among other observations reported, Mr. A. F. Miller stated that Omicron Ceti (Mira) had become quite invisible, and called attention to the interesting phenomena associated with that star, which, at times, is of the second magnitude of brightness and at times wholly disappears from view. Mr. A. Elvins presented some diagrams to show how, in his opinion, the so-called "magic numbers" of the ancients had been obtained, and, applying the method to the quadrature of the circle, how they might have arrived at their rule for

determining circular areas. This, as stated by the Egyptian mathematicians, was to deduct one-ninth from the diameter of the circle and take the square on the remainder as equal to the area of the circle.

"Art and Astronomy" was the subject of an eloquent paper read by Mr. J. A. Paterson, M.A., who, in the course of his address, said that Astronomy had been well called "the Queen of Sciences." She had sat enthroned amid the Centuries. The objects of her investigations ante-dated Time. Before the period set forth in Genesis, when Chaos reigned, when there were no heavens and no earth, when undigested world-stuff and nebulous-mists filled space. the Book of Nature which astronomers now study was being slowly formed to make a living habitation and resting place for Art and her myriad worshippers. And yet Art, in a sense, was the twin-sister of Science. Science and Art might be said to be invcstigators of Truth. Science inquires for the sake of knowledge; Art for the sake of production. When Science engages in productive application it becomes Art. The object of Science is knowledge, and knowledge is its own reward. The objects of Art are works. In Art, Truth is the means to an end. In Science, Truth is the only end. Astronomy teaches us the science of the stars and of world-making; traces out for us the gradations of aggregating systems and shaping-orbs and shows us how the great Architect, upon scientific principles, dynamical and chemical, and with the force of gravity—as the mighty dynamo to move invisible atoms as well as gigantic far-flung, unshaped nebulæ and as the adamantine power —binds together the elements of sun, satellite and sphere and thus moulds worlds and creates world-systems. Art the Producer stands beside Science the Teacher. Art, in one sense, is the perfection of Nature. All things are artificial, for Nature is the Art of God. Young, in his Night Thoughts, says: "The course of Nature is the Art of God," and Pope, in his Essay on Man, that "All Nature is but Art." But apart from the activities of Art as an embodiment of the constructive faculty, Art was most frequently within the thought of his audience as an embodiment of those higher faculties that betoken the development of mankind far beyond the rude savagery of Nature, where the æsthetic faculties

reign supreme. In that advanced stage, it might be safely premised that whatever branch of any pursuit ministered solely to the bodily comforts and regarded material uses only was comparatively ignoble, and whatever part was addressed to the mind only was comparatively noble. Astronomy more completely met the higher aims by investigating the nature of the solar-corona and by tracing the orbit of a dark and, therefore, invisible, sun than by teaching the laws of navigation or practising the base mechanical exercise of writing almanacks at so many shillings a page. The artist more completely met the higher aims of Art by putting on the canvas the stooping Apollo, up-gathering his spent shafts and putting them back into his golden quiver and thus painting for eternity, than when he sketches heads or landscapes for some illustrated monthly. Having discriminated between Art and Astrononmy, and yet showing their mutual dependence upon each other, Mr. Paterson proceeded to discuss his subject under the heads of Poetry, Architecture, Sculpture, Music and Painting, treating each of them in a happy manner and taking occasion, in the course of his remarks, to dwell upon the beauties of observational astronomy and the delightful lessons to be learned from a practical and earnest study of that ennobling Science.

TWENTY-FOURTH MEETING.

December 27th; the President in the chair. Rev. T. C. Street Macklem, M.A., LL.D., Provost of Trinity College, Toronto, and Mr. Harold G. King, of Fox Point, were elected Associates of the Society.

A ballot having been taken, the following Associates were declared to be duly elected as the officers of the Society for 1901.

Honorary Presidents—Hon. R. Harcourt, Q.C., M.P.P., Minister of Education. President—Mr. G. E. Lumsden, F.R.A.S. First Vice-President—Mr. H. F. Stupart, Director of the Toronto Observatory. Second Vice-President—Mr. C. A. Chant, B.A., Lecturer in Physics, Toronto University. Treasurer—Mr. Chas. P. Sparling. Secretary — Mr. W. Balfour Musson. Recorder—Mr.

J. Edward Maybee, C.E. Curator—Mr. D. J. Howell. Librarian —Mr. Z. M. Collins. Members of Council—Reverend R. Atkinson, Mr. A. F. Miller and Captain J. G. Ridout.

The Treasurer read the Financial Statement for 1900, which was adopted and referred to Rev. Mr. Atkinson and Mr. Miller for audit. The thanks of the Society were voted to Mr. Sparling for the pains he had at all times taken in his department as Treasurer, and also to the retiring officers. The compliment was duly acknowledged by Mr. Sparling, as Treasurer, Mr. Lindsay, as Recorder, and Mr. J. Phillips, as a Member of Council.

Observations of the Moon were reported by Mr. A. Elvins, who drew some diagrams on the blackboard illustrating time appearance of Tycho before and at full moon.

"The Genesis of the Moon on the Theory of Vertical Projection and Tidal Action," was the subject of an interesting paper read by Mr. John Phillips, who, having stated his reasons for discarding his former views of many years ago and for having adopted the theory of tidal action, proceeded to inquire as to the means by which the Moon was probably projected from the Earth. It was known that a slowly condensing liquid globe of the density of the original Earth-Moon mass and of unstable equilibrium, when it had reached the stage of existence which must have preceded the separation of the Moon from the Earth, could not continue to retain a spheroidal form after attaining a rate of rotation of, say, two hours and a half, or, about ten times that of the present rate of the Earth. Let it be assumed that at this stage the whirling Earth, as a result of rotating with constantly increasing rapidity, was gradually changing in form to that of an extremely oblate spheroid of revolution; that her specific gravity was becoming greater, inasmuch as gases were condensing into liquids; that, as a consequence, her internal heat was growing more and more intense, and that, paradoxical as it might seem, the more heat she radiated into space, the hotter she became. This, however, would be a state of affairs which could not he maintained, and a critical point must have been reached when the mass had attained to almost its minimum hulk, its greatest density and its swiftest speed of rotation Supposing these conditions to be

existent, it was not difficult to conceive that presently, somewhere along the equator on the line of least resistance from below, a protuberance would begin to make its appearance, and that, under stress of the forces operating, it would grow in size and volume until the original mass had changed from its flat orange-like form into that of a pear, similar to Poincarè's apioid, an apioid or pear-shaped figure evolved from Jacobi's ellipsoid of revolution. In time, the influence of the forces at work would so act that the summit of the protuberance would lose all weight and be held only by its viscosity. Suppose just at that unique and critical stage in the cosmographic history of Earth-Moon system, one of the thousands of the great eruptions of by-gone times took place. Suppose the summit of the conical protuberance to become uncapped and the stem end of the great pear-shaped primitive mass detached and projected off at a velocity of a thousand feet a second —what would be the after career of that portion shot away? The projected mass would first be torn into fragments according to Roch's law. But those fragments would neither scatter far a-part and forsake the parent mass that cast them forth — nor come showering down again upon it — but would hold together in a cluster, find themselves a circular orbit, and revolve therein round and round the *earth*, as it might then be called. This cluster would soon raise a tremendous tide on the liquid Earth, if owing only to the proximity of the two bodies, and, revolving a little slower than the Earth was rotating, would begin to act at once so as to slow down the rapid rotation of the latter. The Earth, on the other hand re-acting on the cluster, would force it farther and farther away, while the fragments of the cluster themselves would gravitate towards each other, so that by the time the cluster had reached a distance of ten or twelve thousand miles, it would be compressed into a massive ball. From that time onward the Moon would have continued to recede from the Earth and the period of her revolution to lengthen. The Earth's speed of rotation would have lessened also, and the length of her days gradually increased. But, at first, the months increased faster than the days. This continued on until within a recent period, physically speaking, when the Earth rotated twenty-nine times during the lunar month. Then a change set in and the days began to increase *faster* than the months. This

last has continued on down to the present, so that there are now only twenty-seven and one-third days in the month, and the Moon has receded to her present distance. And this process will go on until far into the future—until the Moon has receded to her greatest distance and the day and month have become equal again; with this difference, that whereas the shortest or initial days, or months were only three hours or so, each, the future or longest will be one thousand three hundred and twenty hours or fifty-five of our present days. Then another change must set in, if the past and present state of things continues. From the above it is plain that the sheet-anchor of this theory, now as heretofore, is *Vertical Projection*—but that *Tidal Action* as treated of by Prof. Darwin is recently woven in with it.

Mr. T. R. Clougher in speaking briefly on "The Experiences of an Amateur in Popularizing Astronomy," referred humorously to some of the difficulties with which a lecturer had to contend when endeavouring to make perfectly clear to average public gatherings the elementary part of Astronomy, for he referred only to elementary work. It was necessary to find and use illustrations easily understood and to give very clear definitions where technical terms had to be employed. Pictures were always of interest and helped him greatly. In reviewing such subjects as the Nebular Hypothesis, he made it a point to put side by side the modern theory and the Mosaic account. He had never failed to explain that, when studied closely, there was a remarkable similarity, a fact which had been of great assistance in fixing the minds of the young on the truths revealed by astronomical research. In dealing with distances, he always made familiar illustrations, avoiding the use of bare figures, which only confused the mind. Mr. Clougher's experience generally had been satisfactory. He found amongst the young people of the city a very wide-spread desire for knowledge in natural science. He had never to complain of inattention when nature studies were brought before a popular audience. This spoke well for the future, there being certainly good seed sown when the young people could be interested in the beauties of Nature and thus brought to see the handiwork of the Creator everywhere.

After closing exercises, the President declared that the business of the year had been brought to a conclusion.

ADDENDA.

SUN SPOTS AND PROMINENCES–CLAIM OF PRIORITY.

Referring to a paper by Mr. A. Wolfer, of tho Zurich Obeorvatory, published in Vol. XXIX., Disponsa, 7*a*, of the *Memorie della Societa Degli Spettroscopisti Italiani*, in which that dinstinguished astronomer shows certain regions on the Sun to be more active than others in the production of spots and prominences, and publishes charts of the Sun which prove the facts of the case, the method and the chart being published as original work of importance, The Toronto Astronomical Society desires it to be known that the identical method and similar charts were shewn in Toronto, early in 1895, by Mr. Arthur Harvey, F.R.S.C.

As to spots, a paper by Mr. Harvey, then Vice-President of the Society, in the Transactions for 1897, page 71, gives the approximate date of the author's inquiry "as to whether, at more or less regular intervals, spots would break out In the same solar regions." In the Presidential Address for 1898, Transactions, 1898, page 135, Mr. Harvey mentions the reasons which led to his theory of "areas of continuous disturbance on the Sun." As to prominences, the charts were prepared from the data supplied by the *Memoire* in the same way Prof. Wolfer prepared his. The method is described in a paper by Mr. Harvey in the Memorial Volume of the Canadian Institute, 1899, page 350:—"In charting them upon a map of the Sun, which by means of meridians dividing the equator into 27 and 1.4 parts, which one can do, they arrange themselves in belts."

Members of the Society remember the distributIon .of the *active foci* to have been assigned to meridians as well as to parallels, and the appearance the charts presented, as if there were volcanic chains, like the Andes, on both sides of the solar equator; also areas of quiescence; The distribution in latitude was found to vary, each year, but there seemed to be a continuance of the foci of activity on at least one of the meridians.

Mr. Harvey's charts were made for 1894, 1895 and 1896. It is easy to make them from the data, when the method is once invented, and to superimpose them, which Prof. Wolfer has done as well as Mr. Harvey. Before resuming this subject, the latter has been awaiting some further work as to the true rotation period of the Sun, now being done by others. When solar activity revives, as it shortly will, the interesting study will be continued hare.

MEAFORD ASTRONOMICAL SOCIETY.

The President of the Meaford Astronomical Society, an affiliated body, reports that the organisation is as vigorous as ever, is holding regular meetings and is continuing to keep alive in the community an interest in Astronomy.

SIMCOE ASTRONOMICAL SOCIETY

Dr. J. J. Wadsworth, M.A., President of The Simcoe Astronomical Society, reports that the Society is actively working and has a promising future before it.