

(1) Minutes of a Meeting held Dec. 1st, 1868  
in the Mechanics' Institute, Toronto  
to organize the first Astronomical Society  
in Canada.

Also (2) Minutes through 1869.

(3) Sketches of Elvin's life  
dictated by himself.

(4) List of Recreative Science  
Association, 1872

Magnetic Observatory  
Toronto

Dec 1, 1859

Dear Sir,

Secretary to

of Proposed Astronomical Society

Sir

I have to acknowledge your  
everable invitation to a meeting  
to be held at the Mechanics Institute  
for the organizing of an Astronomical Society.

After thinking over the matter I have  
come to the conclusion that instead of  
forming a separate Society it would be  
better that those gentlemen whose tastes  
lead them to astronomical pursuits  
should become members of the Canadian

Institute, at whose meetings and in  
the pages of whose journals the  
communication of any new astronomical  
fact would be sure to meet with a  
cordial welcome.

If their astronomical discoveries  
should prove to be sufficiently numerous  
& important it might become  
expedient hereafter to form an  
Astronomical Section of the Canadian  
Institute, as there already is a Medical  
Section; or indeed it might be necessary

to establish a separate Society; but  
my fear is that if a Society with  
such a title were to be started now  
it would lead to disappointment.

Believe me

Yours truly

G. T. Kingston

Toronto Astronomical Club.  
Members.

Manojo Susskhill,

Andrew Elviss, 25

Daniel K. Winder, 25

James Hughes 25

J. Samuel Clark 25

John Sidgney 25

Charles W. 25

G. Bunt 25

# Minutes

Of a meeting held Dec 1<sup>st</sup> 1868 in the  
Mechanics' Institute, to take into consideration  
the propriety of forming a society for the  
pursuance of astronomical science.

Present: - Messrs Mungo Turnbull  
Andrew Elvins, Daniel K Wender, James L.  
Hughes, Samuel Clare, Robert Ridgway  
Charles Potter, G. Brunt.

On motion, Mr Ridgway was appointed  
Chairman of the meeting, and Mr Clare, Secretary.

Moved by Mr Elvins, seconded by  
Mr Turnbull, that a society be formed under  
the name of "The Toronto Astronomical Club"  
having for its object the aiding of each <sup>other</sup> in the  
pursuit of astronomical knowledge; - in order  
to which it is proposed: -

I. To meet monthly at such time and place  
as may be agreed upon

II. To spend the evening somewhat as follows: -

- (a) Reading extracts, from papers or publica-  
tions, of any thing new or otherwise in-  
teresting, bearing on the subject of As-  
tronomy.
- (b) Reading original papers connected with  
any department of Astronomy.
- (c) Examining anything new in Astronomical

(d) Observing celestial objects if circumstances should favor our doing so.

(e) Conversation &c

Unanimously adopted.

Moved by Mr. Fumhill and seconded by Mr. Potter, That Mr. Daniel H. Winder be President for the ensuing year.

Carried.

Moved by Mr. Elvins, and seconded by Mr. Hughes, That Mr. Samuel Clare be Secretary-Treasurer for the ensuing year.

Carried.

Moved by Mr. Winder and seconded by Mr. Hughes That Messrs Ridgway, Elvins Clare & Fumhill be a committee to draft a set of Bye-Laws for the government of the Club.

Carried.

Moved by Mrs Potter, seconded by Mr. Hughes, That the meetings be held on the first Tuesday evening of every month.

Carried.

Moved by Mr. Winder seconded by Mr. Brint That the next meeting be held at the house of Mr. Elvins, on the first Tuesday in January 1869, at 7 o'clock p.m.

Carried.

Paper to be read at next meeting by  
Mr. Turnbull, entitled "A brief notice of the  
past & present state of Optical Science, viewed  
chiefly in its bearing on Celestial discovery.

Mr. Winder gave notice of a paper to  
be read by him at a subsequent meeting  
on the "Spectroscope - its construction &  
application to Celestial Chemistry

at Mr. Elvins'

Regular Meeting Jan 5<sup>th</sup> 1869.

Present: - Mr Winder, President, in the chair, Messrs Elvins, Turnbull, Ridgway & Clare

On motion the minutes of previous meeting were adopted.

The Committee appointed to draft a code of Bye-Laws brought in the following report which on motion of Mr. Winder seconded by Mr Braunt (per Mr. Elvins) was adopted

Bye Laws of The Toronto Astronomical Club.

I Admission to membership shall be by ballot. The person proposed for admission at one regular meeting may be appointed at the next regular meeting. Two black-balls shall be required for the rejection of any one regularly proposed. Entrance fee shall be determined by the Club.

II That regular meetings shall be held on the First Tuesday in each month commencing at 8 p. m. and closing when practicable by 9-30 p. m. Adjourned or special meetings, however, may be appointed as often as may be deemed necessary by the Club, requisite for the transaction of extra or pressing business.



- III The order of business shall be:—
- 1<sup>st</sup> Reading the minutes of last meeting.
  - 2<sup>nd</sup> Reading Communications, letters &c.
  - 3<sup>rd</sup> Proposal and election of persons proposed for membership.
  - 4<sup>th</sup> Reading extracts from publications, connected directly or collaterally with astronomical research and science.
  - 5<sup>th</sup> Reading original papers, accompanied by such illustration, oral or manual as may be deemed requisite.
  - 6<sup>th</sup> Examining instruments, suggesting experiments, viewing objects &c.
  - 7 Incidental business.
- IV In formal debate speakers will be restricted to five minutes.
- V Members addressing the meeting, will be expected, as a matter of courtesy, to stand while so engaged.
- VI If anything should arise not provided for by the previous by-laws it shall be decided by the club.

Mr. Turnbull read his paper entitled "A brief notice of the past and present state of optical science; viewed chiefly in its bearing on Astronomical telescopes and celestial discovery."

An interesting conversation on the subject of the paper followed

Moved by Mr. Elvins, seconded by Mr. Ridgway "That the thanks of the meeting be given to Mr. Turnbull for his instructive paper and that he be requested to allow the original manuscript to become the property of the club, as being the first paper read before the society. Carried.

Mr. Turnbull kindly consented, Mr. Ridgway offering to write out a copy for him.

Mr. Turnbull announced that by next meeting he hoped to have his Reflecting Telescope completed.

Mr. Elvins produced a drawing of the appearance of Mars. as observed by him Dec 29<sup>th</sup> 1868

Agreed that the next monthly meeting be held at the house of Mr. Winder.

Paper to be read at next meeting by Mr. Winder on "The Spectroscope - its construction, and application to celestial chemistry"

On motion of Mr. Ridgway, seconded by Mr. Turnbull the meeting adjourned until the 2<sup>nd</sup> Feb 1869 -

Regular Meeting Feb 2<sup>nd</sup> 1869.

at the residence of Mr Winder.

Present: - Mr Winder President, Messrs Turnbull,  
Elvins, Ridgway, Potter, Brunt & Clare.

Visitors: - Mr Brodie, Mr Winder Mr Clare  
Miss Winder, Messrs Kennedy, Brodie,  
Scott & Long.

The minutes of previous meeting were  
read and, on motion, adopted.

Mr Elvins proposed Mr W. Long as  
a member of the Toronto Astronomical  
Club - Referee, Mr Geo. Brunt.

Mr Elvins called the attention of the  
members to the subjects which had been  
occupying the attention of astronomers  
since last meeting, making reference  
to Brossen's and Encke's Comets - the  
changes taking place in the nebula  
surrounding Eta in Argus - the late  
transit of Mercury - and the coming  
transit of Venus. He also alluded to  
the principal objects of interest visible  
in the heavens, and suitable for ob-  
servation, at the time.

Mr Turnbull, in reference to his  
Reflecting Telescope in course of construc-  
tion, informed the meeting that the spec-  
ulum

had undergone some change in curvature, having passed from the parabolic to the hyperbolic curve; that it would be necessary to bring it back to the parabola, that he was giving his attention to it, and was hopeful of the result.

Mr Winder, having been appointed to read the paper of the evening, vacated the chair, which on motion was taken by Mr. Turnbull.

Mr Winder then read an original paper on the Spectroscope - its construction and application to Celestial Chemistry. He commenced by alluding to the deep interest which attached to his subject owing to its being yet in its infancy. He referred to the properties of light, distinguishing between its heating, its illuminating and its chemical powers - the explanation which the spectrum affords of many problems which without its aid would be very difficult of solution, as, for example, the fact that a blue dress takes white <sup>in</sup> a photographic picture; the cause of the tremulous motion of heated air &c. Reference was made to the causes of

producing the Lines of Fraunhofer, illustrated by diagrams; and an explanation given of the lines which do not coincide with the lines of metals volatilized in the flame of a lamp - of the new lines that appear when the Sun is near the horizon, and also those which appear near mid-day: The Spectroscope (which is of Mr Winder's own construction, & varies in some respects from those described by writers on the subject) was explained both as to its structure and its application to various useful purposes. Mr Winder concluded by calling attention to the large amount of Spectroscope work in store for <sup>the</sup> earnest votaries of this department of scientific research.

A number of questions relating to the subject were asked by the members and visitors present, which were answered by Mr Winder.

Moved by Mr Brunt, seconded by Mr. Collins that a vote of thanks be tendered to Mr Winder for his instructive & interesting

"

Lecture.

Moved by Mr. Turnbull, second-  
ed by Mr. Brint that next meeting  
be held at Mr. Potter's, on the 2<sup>nd</sup>  
March.

The Club then adjourned.

Regular Meeting Mar 2<sup>nd</sup> 1864

at the residence of Mr Potter, Optician.

Present: - Mr Winder, President; Messrs Elvins  
Potter, <sup>Brumst</sup> Turnbull & Clare, Mr. Long, the mem-  
ber proposed at previous meeting, and as  
visitors, Mr. Faircloth & Miss Winder.

The minutes of previous meeting were read  
and confirmed.

Mr Long was unanimously elected a mem-  
ber of the society.

Mr Brumst called attention to some  
celestial phenomena suitable for observa-  
tion during the month - to Jupiter, Mars  
Saturn & Neptune. He especially sug-  
gested the making of observations on  
the Zodiacal Light, to be reported at  
next meeting - a careful examination  
of this phenomenon being expected  
to throw some light upon the theory  
of comets.

The paper of the evening was read by  
Mr. Elvins; subject "The Moon - its phy-  
sical constitution and motions"

Mr. Elvins glanced at the position of the moon in the universe; referring to the motion of the solar system in space, the motion of the earth round the sun, and that of the moon round the earth. He took a rapid survey of the lunar surface, illustrating his description by means of Rutherford's photographs and Nasmyth's drawings shown with the magic lantern. In describing lunar motion Mr. Elvins contended that the moon has but two motions, one round the sun in common <sup>with</sup> ~~round~~ the earth and one round the earth itself - the latter performed in a lunar month. He discarded the idea of the moon revolving on an axis of its own, the centre around which it revolves not being within itself, but at the earth's centre.

He contended that the following results were the necessary consequences of the moon's motion - first, the elongating of the moon's body by centrifugal force, so as to render it, not spherical, but elliptical in shape, having its longer axis pointing toward the earth; second, that by the action of centrifugal force, fluids and liquids must be thrown to the opposite side of the moon; a gradual lowering of temperature as the atmosphere became less dense would follow, until all vapours would have



been deposited as snow on the lunar surface and the seas converted into ice; the whole surface being possibly covered with ice as with a coat of varnish. He contended that the different rates of motion between the nearer and most distant parts of the moon is the cause of libration in longitude; and that the sun's attraction changes the position of the major axis of the moon's elongated body, causing the point nearer the earth to be turned upward when the sun is above the plane of the moon's orbit, and downward when the sun is below that plane, causing libration in latitude.

Mr. Olwin submitted that as these results must necessarily follow on the supposition of his views being correct, the generally received notion of the equable motion of the moon on an axis combined with an unequal one in her orbit is not necessary to account for libration in longitude; nor is the inclination of the lunar axis of rotation to the plane of the moon's orbit necessary to account for the libration in latitude.

Moved by Mr. Clare & seconded by Mr. Long that the thanks of the meeting be tendered to Mr. Elvins for his elaborate paper  
Passed

Moved by Mr. Brunt & seconded by Mr. Long that an adjourned meeting be held at the residence of Mr. Elvins on this day fortnight Mar 16<sup>th</sup> to afford an opportunity of discussing Mr. Elvins' paper.  
Passed

Next monthly meeting to be held at Mr. Brunt's, April 6<sup>th</sup> 1869

On motion by Mr. Brunt seconded by Mr. Elvins the meeting adjourned till the 16<sup>th</sup> March inst.

Adjourned Meeting March 16/69 (At Mr. Elvins).  
Mr. Elvins gave further illustrations on the Moon's motion &c

A conversation ensued among us which  
The end of the world is very

Regular Meeting April 6<sup>th</sup> 1869  
at Mr. Brunt's residence, York George Street,  
Present:— Mr Winder, President, Messrs Turnbull  
Brunt, Ridgway, Elvins and Clare  
Visitor:— Mr. Wm Thompson

Mr Brunt read a paper by R. A. Procter  
B.A., F.R.A.S. on "The great Nebula in  
Argo". The article has reference to two re-  
markable communications lately addressed from  
southern observers to astronomers in the north.  
One, by Mr. Abbott, of Hobart Town, the other  
by Lieut. Herschel, son of Sir John.

In regard to the nebula in Argo—"the glory of  
the southern skies"—Sir John Herschel while  
at the Cape directed a large share of attention  
to it, and described it as a diffuse mass  
of cloudy light extending over a space of  
about 6 times as large as the apparent surface  
of the moon. He remarks that the nebula could  
not be distinguished by the naked eye even  
on the darkest night, and also that he saw  
no reason to suspect that any changes of  
position were taking place among the fixed  
stars which are strewn over the nebulous back-  
ground. Mr Abbott finds that a great increase  
has taken place in the brightness of the nebula.

so much so that it can now be clearly distinguished in twilight so strong as to obliterate all stars below the third magnitude. The changes which have taken place in the figure of the nebula are still more startling. There is no resemblance between two pictures representing the appearance of the nebula as seen in 1863 and in 1868 (Feb 13) by Dr. Abbott, nor between either of these and Sir John Herschel's drawing. Taking the well-known variability <sup>whose changes however have not yet been ascertained by</sup> of the star β Argos in connection with the variability of the nebula in Argos, the probability is suggested that the two objects are connected.

The same month which brought Dr. Abbott's communication brought also that of Lieut. Herschel's, announcing that the spectrum of the great nebula in Argos, <sup>having been found to</sup> consisting of a few bright lines, the nebula must be luminous gas or vapour. It will become then an interesting problem for astronomers to solve, by what strange sympathies these stars are associated with the nebula, that as it varies in figure they vary in their distribution. <sup>How shall the waning and waxing light of the nebula be accounted for, and the accordance which these changes exhibit with the waning and waxing light</sup>

of the star Eta Argus? Lastly, what are the forces under whose influence the enormous masses of vapour which constitute the nebula are wafted so and fro, like clouds before a shifting wind?

In reference to Lunar changes Mr. Elvins called attention to the appearance of the spot Messier in the sea of Serenity as observed by him on the 18<sup>th</sup> and 20<sup>th</sup> of March. On the 18<sup>th</sup> (the moon being about 4 or 5 days old) the craters were plainly seen, were quite round, and the one nearest the western edge of the moon was much smaller than the other from which the bright rays streamed. The comparative diameters were about 1 to 3 showing a difference when compared with early observations. On the 20<sup>th</sup> March, the shadows in both craters had entirely disappeared. Both craters were now seen as white spots, precisely similar in brightness, shape & size. He had subsequently observed them twice, with similar results. Mr. Elvins concluded that if the early observers spoke of the crater proper, a change had certainly taken place, but if they, speaking more loosely, referred

19

to the spot when under high illumination  
show there had been no change.

Mr. Turnbull suggested the propriety  
of having a synopsis of the matters of  
interest contained in the *Astronomical Reg-  
ister* read at the monthly meetings.  
Mr. Turnbull reported favorably of his  
progress with his Reflector.

Mr. Winder referred to the interest man-  
ifested by many in Toronto in spectroscopic  
research. He was now able to throw the  
spectra of various metals on a canvas  
so as to exhibit them to a large audience.  
He also stated that chemical plates had  
been prepared by which the spectra  
could now be photographed.

Mr. Elvins read an extract referring  
to the comet shortly to appear.

Mr. ~~Elvins~~ Turnbull thought he should  
be able to give his paper on the eclipse  
by the June meeting.

Mr. Ridgway promised a paper on the

figure of the earth for an early meeting;

Mr Brunt promised a paper on the Tides.

The thanks of the Club, on motion of Mr. Farnball, seconded by Dr Ridgway, were given to Mr Brunt for the reading of Mr Procter's paper.

Next meeting to be at Mr. Clovis on the 4<sup>th</sup> ~~of~~ May.

Regular Meeting May 24<sup>th</sup> 1869.

at Mr. Elvins'

Present: Mr. Winder, President, in the Chair, Messrs. Jasp. bull, Brunt, Ridgway, Potter, Elvins & Clare.  
Visitor, Mr. Davidson

The minutes of previous meeting were read and confirmed.

Mr. Brunt proposed, seconded by Mr. Elvins that Mr. Wm. Thompson be a member of the Astronomical Club.

Mr. Ridgway intimated that he would have presented his paper on the figure of the earth but was anxious first, as a necessary preliminary to the full consideration of the subject, to investigate the phenomenon called mirage.

Mr. Brunt called attention to the principal astronomical phenomena of interest for the month. Winick's Comet although vainly sought during the preceding month, we might possibly hear of, if not see, during this month. It would probably be found in the neighbourhood of Leo. The Sun, too,



as having arrived nearly at its maximum period of solar spots was worthy of attention. These periods occurring at intervals of about eleven years, the solar spots will arrive at their maximum in 71, consequently there would be few days now when we might not expect to find see spots. He also made allusion to the successful completion of Dr. Gurnbull's large reflector, the companion to the pole-star appearing through it as <sup>large as</sup> a star of the 14<sup>th</sup> magnitude to the naked eye. Also, to the safe arrival of the great telescope sent-out to Melbourne.

Mr. Winder, the president, read a paper relating to the late brilliant displays of Aurora especially as they appeared on the evenings of April 15<sup>th</sup> and May 3. On the former occasion almost the entire sky was covered with brilliant coruscating light sometimes arising <sup>in columns</sup>, and passing the Zenith, and sometimes waving like canvas thrown to the breeze. An unusual appearance feature was the appearance of an arch of light toward both the north and the south, the latter being the more distant.

23

On the evening of May 3, the light arose about 11 o'clock, and was seen as an exceedingly beautiful luminous cloud along the horizon in the North, extending from NW to NE by E. From this high, bright cloud, at times majestic columns of a remarkably beautiful purple colour ascended towards the zenith, the display continuing until obscured by clouds after one o'clock, and differing from that of April 15<sup>th</sup> in being quiet and grand, while the former might be compared to a Kaleidoscope, from the rapidity of its changes. Reference was made to the fact that during these displays the magnetic needle becomes restless, and varies several degrees, that lines of telegraph may be worked without the aid of the batteries, and that the centre of the arch of light in the north is found to be exactly in the direction of the magnetic needle at the place of observation. He also alluded to the proximate coincidence between solar phenomena and the displays of Aurora Borealis and Aurora Australis as pointing to a cosmical origin like that of meteoric showers. He

believed the aurora to be connected with  
of electric origin, and probably connect-  
ed with excessive humidity in the  
upper strata of the earth's atmosphere.

During the display of Aug. 3, he tested  
the Aurora with the Spectroscope, and  
also with the Polariscopes and inferred  
from his observations that the light is  
exceedingly diffused, the brightest col-  
umn ~~forming~~ a spectrum of less brilli-  
ancy than that of a 5<sup>th</sup> magnitude  
star. He did not think it was re-  
flected light as he failed to detect  
the slightest trace of polarization.

Mr. Elvins read a paper on the Lu-  
nar Craters, Messier and Messier A.  
He stated that he had observed these  
spots with care under different illumi-  
nations in reference to the change which  
they have been thought to have undergone,  
and had come to the conclusion that in  
all probability they are the same now-as  
they were seen long ago. He stated that the  
two craters are not alike when the sun  
is just rising on them, or two or three  
days after, when the true craters are

seen filled with shadow, but they soon become two white spots like Linné, and are seen thus through the greater part of the lunation. During the whole of this time they are perfectly alike, and he thought it likely that it is the white spots to which the early observers refer and not to the black shadows in the Craters proper.

Mr. Elvins also presented a paper on the "Zodiacal Light during the spring of 1869" and another on the "Aurora of April 15<sup>th</sup> 1869"

Mr. Winter showed a drawing of the appearance of the sun on that day (April 15<sup>th</sup> 1869), showing the spots on the sun. He spoke of the probable connection of these spots with the Aurora

Observations were made by several members in reference to their recollection of more than usually brilliant auroras, and it was suggested that each member should collect what information he could on this subject with the view

of arriving at some definite conclusion  
as to their periodicity.

Moved by Mr. Ridgway, seconded by  
Mr. Turnbull that the name of the Asso-  
ciation be changed from "Astronomical  
Club" to "Astronomical Society" Passed.

Moved by Mr. Elvins, seconded by  
Mr. Ridgway that Mr. Turnbull be  
Vice President for the remaining portion  
of the present year of the Society.  
Mr. Turnbull declining

Mr. Elvins moved, seconded by  
Mr. Turnbull that Mr. Ridgway be  
appointed Vice President for the re-  
maining portion of the present year  
of the Society.

Next meeting at Mr. Turnbull's, 25.  
Nassau St.

Regular Meeting June 1<sup>st</sup> 1869  
at Mr. Turnbull's

Present: - Mr. Windes, the President, in the Chair  
Messrs. Turnbull, Ridgway and Elvins. Two  
or three visitors were also present.

The minutes of previous meeting were  
read and confirmed

Mr Wm Thompson, who was proposed at  
the May meeting was duly elected a member  
of the Society

Mr Turnbull read a lengthy paper, and  
gave an oral exposition with illustrations on  
the doctrine of Eclipses in general, and especial-  
ly on the great eclipse of the sun which will  
be visible from the City of Toronto, on the after-  
noon of Saturday 7<sup>th</sup> August next.

The writer took occasion to notice among  
other things the fascinating qualities of this  
department of Astronomy, as it is in this divi-  
sion especially where it gets the character of  
being above all others one of the exact sciences.  
In every age, especially since the invention of  
the telescope, the magnitude, the order and  
the progressive motions of the celestial bodies

have arrested the attention and engrossed the faculties of the most gifted of the sons of men from Pythagoras down to the present Astronomer Royal, Professor Airy. We find every nation or tribe on earth which has made any intellectual mark in the world's progress giving proof that the mind, when free from the cares of busy life, has had an earnest desire to lift higher and still higher the veil which hangs between it and those wonderful sparkling objects scattered so profusely in our nocturnal sky. We find ours is no exception to the onward operation of this law, for if we take for example this speck of space in the Universe which we name the Solar System. Our forefathers could count only about nine primary members belonging to it, even including the great luminary of day and that which at times doth regulate the night. Now, in 1869, we can number them by scores upwards of one hundred having been added since Olber discovered Pallas in 1802. Now, this passing allusion to the progress of Astronomy in this century suggests the subject more immediately before us this evening, for of all the members of the Solar System, the moon

has attracted the greatest notice, her motions have been the most scrupulously scrutinized; she has also been the most refractory, for it is only since the beginning of this century that the practical astronomer has been able to ascertain her motions with the precision attained in the cases of the other planets. The essayist enumerated a number of the causes, and stated as an illustration that to ascertain the place of any of the planets it requires the employment of only five or six equations, while to get the moon's true place at an eclipse by the modern tables it is necessary to use at least twelve times that number. Tycho Brahe and Kepler, a German astronomer were the first to register the lunar irregularities for the use of the computer.

This was before the application of the telescope to accurately graduated instruments to find her true place in the heavens.

He then noticed the various tables which have been issued within the last century, for the perfection of our knowledge of the lunar motions, and mentioned in particular, Halley's and Flamsteed's tables. Then Meyer's which were published in 1753, with about



fourteen tabular arguments. Next came Mason's, about the end of last century with twenty two arguments. Then the French Bureau of Longitude issued Bérard's tables with 28 corrections. The next was Burckhardt's, and Damoiseau's, and lastly, Carlini's, which bring the arguments from 14 to 79. Carlini's tables include also Hauser's and Airy's two inequalities arising from the action of Venus on the lunar orbit, an addition which shows how closely the Astronomer has sifted the Moon's orbital variations even in her longest cycle of change, and traced them to their proper source. In the study of the mechanical phenomena of the Moon's motions as resolved by the tables the importance of considering Space geometrically or physically was sharply touched upon showing how it was here in a great measure that the mind can grapple with space as a quantity, and examine clearly the positive and negative equations exhibited by the solar and lunar anomalies, and also to keep before the mind's eye the true place and position of the terrestrial and lunar apsides of the two orbits as rendered by the anomalies.

The next part of the subject examined was to find the various elements by the tables, to exhibit the obscuration for Toronto; - that is, when the umbra in its transit over the northern hemisphere was at its nearest point to the city and consequently, the visible conjunction of the two luminaries.

The several findings as given by the tables which were exhibited in large type may be summed up as follows: -

First Contact at Toronto (Toronto Solar time)	}	4h. 48m 30sec
Greatest phase		5h 46m
Last Contact		6h 38m
Duration		1h 49m 30s.
Greatest obscuration		10½ twelfths.
Diameter of Penumbra		4223 miles
"    Umbra		5½ do

The centre of totality in its transit over the earth's disc crosses the path which Toronto describes on the 7<sup>th</sup> Aug next at the exact place where the city is situate at twenty eight minutes past four o'clock in the afternoon. Had the umbra been so far advanced on the earth at this time Toronto would have

experienced nearly midnight darkness for the space of about two minutes.

In drawing the subject to a close Mr. Turnbull contrasted the different objects sought in prosecuting the study of Astronomy in our times with those aimed at by the ancients. In early times, the astronomy was practised only as an art, and the chief object of the art was to know the seasons, to appoint public meetings and to record passing events. This era has passed away, still their motions are as closely watched, but, relative to social affairs, for a different purpose. The great science of Navigation on which both commerce & civilization depend has now, in a great measure its foundation resting upon the accurate observations made of the solar and lunar motions. <sup>They were</sup> You are aware that along the Moon's path there are at least nine conspicuous sparkling objects that are used for determining longitude at sea. They are named nautical stars, and constitute, as it were, the great hours fixed on our sky dial-plate. They were aware also that at that noble establishment, the

Greenwich observatory, whose history in the past has so many attractions to the telescope observer in every part of the globe. One of the great objects sought at the Observatory is to register the true place of the solar and lunar centres with the above-named stars. All the findings being arranged afterwards in the "Nautical Almanac" department under the superintendence of the highly gifted astronomer Hind, so that "the whose tread is on the mountain wave and whose home is on the deep" can pilot his vessel with safety, thus contributing directly to give prosperity to Commerce and boundless wealth to our commercial cities. It is here where our noble science gets its peculiar lustre in an intellectual point of view. Indeed, the bearings of this theme in every direction are of a lofty character. To the pious or devout especially, the motions of the two great luminaries he had been trying to scan furnish great consolation. Because the mind is completely emancipated from that mental terror which seized our forefathers on the approach of an obscuration of the solar disc in

a clear sky, or of the moon by night.

It is fine, to have a clear view of a presiding divine power working by the unerring laws of nature.

How it attunes the soul to join Addison in his beautiful, devotional stanza which paints the fascinating grandeur of our great luminary.

"The unwearied Sun from day to day  
Does his Creator's power display,  
And publishes to every land,

The work of an Almighty hand.

Andrew Mason  
Dr. Watts

Moved by Mr. Elvins, seconded by Mr. Ridgway that the thanks of the Society be presented to Mr. Turnbull for his very able and interesting paper

The members then went out to examine Mr. Turnbull's Reflecting Telescope which he had lately finished. The skill and perseverance of the maker were plainly seen in the workmanship, but the night being unfavorable observations could not be made.

It was decided that the next meeting should be held in the open air in the park, near the guns.

July 14<sup>th</sup> 1869  
In the Park.

The meeting appointed to be held in the Park took place this evening, but the night being unfavorable for observations, none could be made. Present Messrs Ridgway, Turnbull, Elvins, Potter & Clare.

Mr Turnbull suggested the laying out of some definite plan for the more successful observation of the Eclipse of the Sun to take place on August 7<sup>th</sup>. The matter was referred to the regular meeting to be held Aug 3<sup>rd</sup> the ~~Monday~~ <sup>Wednesday</sup> preceding the day of the eclipse.

Regular Meeting Aug 3<sup>rd</sup> 1869  
at Mr Clark's

Present: Mr. Ridgway - Vice President, in  
the Chair, Messrs Turnbull Elvins  
& Brant, Thompson & Clark, Visitor  
Mr Moorhouse

The Minutes of previous meeting were  
read and confirmed.

An interesting letter from Mr Winder  
to Mr Elvins was read detailing his  
visit to the Observatory at Cincinnati,  
and his kind reception there by Prof.  
Abbé, a gentleman who had worked  
along with Prof. Huggins.

The place suggested and agreed upon  
for the observation of the Eclipse - west end  
of Nassau Street.

Mr. Elvins called attention to some  
celestial phenomena worthy of attention  
during the month

It was agreed that the work <sup>of observing the Eclipse</sup> should  
be apportioned as follows:-

Mr. Turnbull - Bailey Beads. Time of first  
and last contact. See Mr. Clark  
Mr. Elvins. Protuberances, Corona  
See Mr. Thompson  
Mr. Ridgway. Cusps  
Mr. Potter Barometer & Thermometer  
at equal intervals of time, of 5 min.  
Mr. Brunt Stars visible. &c  
Mr. Winder (if present) Spectroscope & Polaroscope

Mr. Elvins presented two papers - One on  
the "motion of bodies in elliptic orbits";  
the other on "Day-light Aurora, as seen  
by him on May 5<sup>th</sup>"

The former of these offered an expla-  
nation of the cause of the tails of com-  
ets pointing from the sun.

The latter - "Day Light Aurora" is in  
substance as follows:-

7<sup>th</sup> P.M. Sun just setting - beautifully shining  
out through an opening near the horizon -  
the rest of the sky quite covered with  
clouds - those clouds having a very pecu-  
liar color; white as a rule, but having patches  
of a beautiful and brilliant blue scattered  
through them. The clouds had the appearance  
of large clouds masses of snow with dark



hollows here and there through them.

At 7.15 I distinctly saw Auroral columns or pillars, streaming upward to a great height. One which appeared to join the top of St Michael's spire was very distinct, and had an eastward motion. Its color was darker than the rest of the sky - a strange dark transparent form exactly like Aurora at night, but with this difference, that instead of being brighter than the rest of the sky, it was darker. Auroras are seen as pillars of cloud by day, and of fire by night. \* \* \* \* \*

There can be no doubt but that Auroras are ~~due to~~ electricity in motion, but we have always seen electricity as flame spark, or at <sup>least</sup> luminous: but, here we have a display not brighter, but darker than surrounding objects, though having the same form and motion as ordinary aurora. How, or by what means it assumes this appearance, I cannot tell.

I may also notice that, <sup>in this case</sup> the streamers must have been below the clouds, or seen through them; we have usually regarded

Auroral streamers & arches as several miles high at least: in this case it would seem to be impossible for there were heavy clouds behind the columns which formed a back-ground for the display.

I had hoped that I might have been the first to ~~observe~~ record such an appearance, but in this I am disappointed. Prof. Loomis informs me that similar aurora have been observed and recorded by him in one or two instances. They have been published by the Smithsonian Institution in the Notices of 1865.

Next meeting to be held at W.  
Ridgway's on Tuesday 7<sup>th</sup> September.

Particulars of the Observation of the  
Solar Eclipse of Aug 7<sup>th</sup> 1869  
At Toronto.

	h	m	sec
First Contact, Angle 128° from Solar Vertex	4.	44.	50
Greatest Obscuration	5.	46.	20
Last Contact, Angle 75° from Solar Vertex	6.	36.	14
Duration	1.	51.	54

4. 48 Lunar ridges visible - jagged most towards the upper limb. E. Edge sharp and defined, showing no appearance of lunar atmosphere - (E) More brilliant round the edge of the moon, more so than the edge of the sun - more brilliant than in the sun's centre. (E)
4. 51 Ridges beautiful. Lunar margin still brilliant (E)
4. 52 Ridges more distinct. (E) Ridges more distinct towards the upper limb E.
4. 54 Cusps beautifully sharp E.
4. 56 Cusps so sharp that refraction may be considered impossible E.
5. 00 Getting very near a large solar spot. E.
5. 1 Solar spot becoming less distinct E.  
Cusps of the sun exceedingly rounded at present (E)  
Sharp in mine E. So in mine I.

W m

5. 2. Definition of the penumbra of solar spot good again E. One cusp sharp again, ~~E~~ the other rounded R.
5. 3 Spot rather hanging on the moon's edge E.
5. 3. 125. Contact of spot
5. 3. 40 Spot gone
5. 6 Cusps exceedingly sharp R. Moon at present as light as the sun itself I.
5. 8 A bright substance passing in front of the moon E. (Think this is moisture passing over my eye). Dirty appearance R. II.
5. 10 Two projections from the moon's edge quite plain R.
5. 12 Three of the white spots passing <sup>in succession</sup> over in front of the moon black surface of the moon E.
5. 19 Solar spots more distinct than they were before the contact E.
5. 26 Objects frequently passing across the sun like brilliant points E. There is no question that these moving spots are floating in the atmosphere as I see one turn and go in the opposite direction E.

N ml  
5.31

Rather a bright milky light extending round the sun's darkened limb - that is the sun artificially darkened I.

5.33

I see the protuberances very bright - the lunar - that is, mountains I.

5.37

Mr. Thompson has said "I saw a star"; (see with the naked eye)

5.41

Can see the edge of the moon distinct at some distance from the sun's edge - say five degrees E looking darker I.

5.42

Getting very near the spot

5.43

400. Contact of spot. Light is-  
suing from the cusp I. Has been  
for some time R.

6.0

" 25. Spot coming in. R

6.3

There are three spots I. There  
are four I. One of these is di-  
vided into a number of small  
ones R. Floating specks still  
continue R

6.29

350. Lower spot visible I.

Mr. Winder, President, was at Hamilton at the  
time, and from his observation the first con-  
tact was 4h. 144 m 144 s. He made some  
observations with the spectroscope, but was

not able to see more than he has observed  
at ordinary times.

	Thermom SUN	Thermom SHADE	Barom
44. 43.5	84.5	64.3	29.98
45	85	64.3	29.98
50	85.5	64.6	29.98
55	85.	64.5	29.97
5.	85.5	64.2	29.96
5	85.	63.7	29.96
10	82	62.9	29.96
15	79.5	62.3	29.96
20	78.5	61.7	29.955
25	76.5	61.2	29.955
30	76	60.8	29.95
35	75	60.2	29.95
40	72.5	59.2	29.94
45	71.5	58.2	29.94
50	69.5	58.8	29.94
55	69	58	29.94
6.	69.5	58	29.94
5	70.5	58	29.94
10	72	58	29.94
15	72.5	58.2	29.94
20	75	58.6	29.93
25	75.5	58.6	29.93
30	75.	58.	29.93
35	76.	58.	29.93

Regular Meeting Sep 6<sup>th</sup> 1869  
At W. Ridgway's  
Present Messrs. Winder, Turnbull, Ridgway  
and Elvins. The president in the chair

Minutes of last meeting read & confirmed.

Report of Committee who observed the  
Eclipse of Aug 7<sup>th</sup> adapted.

Mr Ridgway read a paper on the ve-  
locity of Light, which was followed by  
a conversation in which all took part.  
The conversation referred chiefly to  
the different colors of light emitted  
by some stars, and to the question  
whether the light of all colors  
travels at the same rate, Mr  
Winder's remarks showing clearly  
that in all probability different  
colored light moves at different  
rates.

Mr. Elvins read a paper on the  
August Meteors. He had been fortu-  
nate in seeing a few of them on the  
10<sup>th</sup>. They radiated from a point in  
45

or near Perseus. The sky was cloudy and only a few were seen. They were, however, of great beauty and brilliancy, having a mixture of Red and Yellow like the light of Sodium and Lithium in the Spectroscope.

Mr Elvins also had prepared some notes in reference to the observation of objects of interest astronomical interest visible during the month.

Mr Ridgway was called to the Chair when the President read a paper on the Aurora of Sept 3<sup>rd</sup>.

Regular Meeting Dec 7<sup>th</sup> 1859.

Mr Elvins' Paper. Present Mr. Under Mr. Elvins  
Mr. Turnbull and Mr. Ridgway.  
Minutes of last meeting read and approved.

Mr. Elvins read a paper respecting meteoric phenomena. He introduced his paper by reference to a paper by Dr. Schumacher on a collateral subject with a diagram illustrating of Solar spots, Magnetic disturbances, and Auroral display, showing their harmony as regards frequency in increase or decrease.

Very interesting and instructive diagrams were employed.



in illustration of the theories laid down

Taken from Mr. Elvins' scrap reported in here by  
C. A. Chant - 1914 - (Given to C. A. C. May 27, 19 Spring 1914)

See p. 22 of this book

[July 14, 1869.

## SCIENTIFIC OPINION.

### TORONTO ASTRONOMICAL SOCIETY.

MAY 4TH.—Mr. Daniel K. Winder, president, read a paper relating to the late brilliant displays of Aurora, especially as they appeared on the evenings of April 15th and May 3rd. On the former occasion almost the entire sky was covered with brilliant corruscations, light sometimes arising in columns and passing the zenith, and sometimes waving like canvas thrown to the breeze. An unusual feature was the appearance of an arch of light towards both the north and the south, the latter being the more distant. On the evening of May 3rd, the light arose about 11 o'clock, and was seen as an exceedingly beautiful luminous cloud along the horizon in the north, extending from N.W. to N.E. by E. From this high bright cloud, at times majestic columns of a remarkably beautiful purple colour ascended towards the zenith, the display continuing until obscured by clouds after one o'clock, and differing from that of April 15th in being quiet and grand, while the former might be compared to a kaleidoscope, from the rapidity of its changes. Reference was made to the fact that during these displays the magnetic needle becomes restless, and varies several degrees, that lines of telegraph may be worked without the aid of the battery, and that the centre of the arch of light in the north is found to be exactly in the direction of the magnetic needle at the place of observa-

tion. He also alluded to the proximate coincidence between *solar phenomena* and the displays of Aurora Borealis and Aurora Australis as pointing to a cosmical origin like that of meteoric showers. He believed the aurora to be of electric origin, and probably connected with excessive humidity in the upper strata of the earth's atmosphere. During the display of May 3rd, he tested the aurora with the spectroscope, and also with the polariscope, and inferred from his observations that the light is exceedingly diffused, the brightest column giving a spectrum of less brilliancy than that of a fifth magnitude star. He did not think it was reflected light, as he failed to detect the slightest trace of polarization.—Mr. Andrew Elvins read a paper "On the Lunar Craters, Messier and Messier A." He had observed these spots with care, under different illuminations, in reference to the change which they have been thought to have undergone, and had come to the conclusion that in all probability they are the same now as they were seen long ago. The two craters are not alike when the sun is just rising on them, or two or three days after, when the true craters are seen filled with shadow, but they soon become two white spots like lines, and are seen thus through the greater part of the lunation. During the whole of this time they are seen precisely alike, and he thought it likely that it is the white spots to which the early observers refer, and not to the black shadows in the craters proper.—June 1st. Mr. Winder, president, in the chair, a long paper was read and an oral exposition given with illustrations by Mr. Mungo Turnbull, on the doctrine of eclipses in general, and especially on the great eclipse of the sun which will be visible from the streets of Toronto (weather permitting) on the 7th August next. The paper being the first on *practical* astronomy read before the society, the writer took occasion to notice among other things the fascination of this department of astronomy, as it is in this division especially that it gets the character of being one of the exact sciences. In every age, especially since the invention of the telescope, the magnitude, the order, and the progressive motions of the celestial bodies have arrested the attention and engrossed the faculties of the most gifted of the sons of



place where the city is situate, at twenty-eight minutes past four o'clock in the afternoon. Had the umbra been so far advanced on the earth at this time, Toronto would have experienced nearly midnight darkness for the space of about two minutes. In conclusion, the essayist drew a parallel between the objects sought in prosecuting the study of astronomy in our times and those aimed at by the ancients. In early times astronomy was practised only as an art, and the chief object was to know the seasons, to appoint public meetings, and to record passing events. This era has passed away, still the motions of the heavenly bodies are as closely watched; but, relative to social affairs, for a different purpose. Navigation, on which both commerce and civilization depend, has now in a great measure its foundations resting on the accurate observations made of the solar and lunar motions. Along the moon's path there are at least nine conspicuous sparkling objects that are used in determining longitude at sea. They are named nautical stars, and constitute, as it were, the great hours fixed on our sky dial-plate. One of the great objects of search at the Observatory is to register the true places of the solar and lunar centres with the above-mentioned stars—all the findings being arranged under the superintendence of the highly-gifted astronomer, Hind, so that "he whose tread is on the mountain wave, and whose home is on the deep," can pilot his vessel with safety, thus contributing directly to give prosperity to commerce and boundless wealth to our commercial cities. The bearings of this theme in every direction are of a lofty character. To the devout, especially, the motions of the two great luminaries furnish great consolation, since the mind is completely emancipated from that mental terror which seized our forefathers on the approach of an obscuration of the solar disc in a clear sky, or of the moon by night. A clear view of a presiding Divine power working by the unerring laws of nature attunes the soul to join Addison in his beautiful devotional stanza which paints the fascinating grandeur of our great luminary :—

"The unwearied sun from day to day  
Does his Creator's power display,  
And publishes to every land  
The work of an Almighty hand."

---