NOVA NOTES

BI-MONTHLY JOURNAL OF THE HALIFAX CENTRE

ROYAL ASTRONOMICAL SOCIETY OF CANADA
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1977 Halifax Centre Executive

Honourary President: Rev. M.W. Burke-Gaffney

President:	Dr. David L. DuPuy, Dept of Astronomy Saint Mary's Univ., Halifax
Vice-Pres.;	Dr. Larry Bogan, Wolfville, N.S.
Treasurer;	Alan Bent, Summerset Place, South Park St Halifax
Secretary;	Dr. Peter H. Reynolds, Dept of Physics Dalhousie Univ, Halifax
Editor;	Randall C. Brooks, Dept of Astronomy Saint Mary's Univ, Halifax
Centre Rep;	Dr. Roy L. Bishop, Dept of Physics Acadia Univ, Wolfville, N.S.
Observing Chairman;	Michael Edwards, 8 Sullivan's Hill Bedford,N.S.

UP COMING MEETINGS

21 January, 8:00 pm at the Nova Scotia Museum

Mr. Walter Zukauskas, having been brought up in the historic city of Cambridge Mass., had an opportunity to work and observe around the historic astronomical community of the Smithsonian Astrophysical Obser. He still has a strong interest in historical aspects of astronomy but on this occasion, he will not tell us about the numerous anecdotes surrounding the pros at the SAO but, has an interesting talk about the many amateur astronomers who have contributed to the progress of their hobby. Perhaps he will include the story of the Yorkshire amateur who discovered and correctly interpreted the observations of the most studied of the eclipsing binary stars--Beta Lyrae. And perhaps he will tell us of the observatory janitor who discovered more comets than just about anybody. It should be an interesting evening. Refreshments will follow as always.

FEBURARY MEETING:

18 Feb. (Friday) at 8:00 pm at the Museum
Speaker: David DuPuy
Topic: Interacting and Colliding Galaxies

OBSERVERS GROUP:

Beginning on the 5 Feb (Sat) and on the first Saturday of each month, there will be a meeting of all Halifax Centre members interested in observing at the Burke-Gaffney Observatory. This will follow the regular observatory tour and will for Feb, March and April, begin at 8:30. These will be held in spite of clouds. The format will be very flexable but in general we hope someone will give a short talk on some observational topic such as photography and then be followed by observing. Members will be instructed in the use and setting up of the telescope and you will be encouraged to start an observing project of your choice. Mike Edwards is to be the Chairman responsible for setting up and co-ordinating the programs but it will make it much easier for him if interested persons would indicate their areas of interest around which he can build the programs. R. Brooks will normally supervise the use of the telescope and equipment.

The programs will be held in the observatory itself so we are not looking for great turnouts each month. Too large a crowd will result in too much standing about, hence we hope to have a dozen people each time. Here is a chance for you to do some observing for the Toronto GA's Observing Contest, a chance to learn something we hope, and a chance to chat with other members about our common hobby. The younger members may particularly like this set-up as it will give them a chance to use a telescope if they do not have one and it will give them an opportunity to learn of some observing techniques and equipment which they may only have read about til now. From time to time we will try to demonstrate the use of the spectrograph, camera and photometer.

THAT FIRST OBSERVING MEETING IS 5 FEB AT 8:30 in the Observatory at SMU.

PRESIDENT'S REPORT

1976 was another active year for the Halifax Center. The membership has been growing, and ten well-attended regular meetings were held during the year:

Jan. 16	Some Small Scopes R. L. Bishop
Feb. 20	Members' Night
Mar. 19	Spectra and Spectrographs Dr. Ted Bednarek, Dr. Gary Welch
Apr. 30	Grand Tour of the Solar System (7 members)
May 21	Naked-Eye Observing Mary King
June 18	Calgary Assembly Larry Bogan
Sept.17	Universal Illusions R. L. Bishop
Oct. 15	Telescope Makers' Seminar (4 members)
Nov. 19	Stellafane: Bill Parnell Astro-Europe: Randall Brooks
Dec. 17	Interstellar Molecules Dr. George Mitchell

During the period May 20 to June 13 the Center participated in the annual Societies' Show of the Nova Scotia Museum. Much of the credit for the success of this, our first such display, is due to the work of Randall Brooks and Debby Burleson who acted as the co-ordinators for our Society. Several members contributed to our display by donating photographs or equipment, by grinding a disc of glass before the wondering masses, and by assisting on three public star nights held during the show.

The 1976 General Assembly was held in Calgary during the long weekend in May. Larry Bogan was our official delegate. Larry presented a paper on his Cylindrical Astrolabe, and on his return gave us a comprehensive report at the June meeting. Two other members, our secretary Peter Reynolds and your president (who presented a paper entitled: Magnitudes, Photons, and the Eye) also attended the Calgary meetings. Special thanks is due to Peter who accepted nomination for the 2nd Vice-President of the RASC. Although he was unsuccessful, it is a good sign that members from other than the Toronto-Ottawa area are willing to take an active interest in the National Office of the RASC.

The 1977 General Assembly will be held in Toronto on the Dominion Day weekend. The annual meeting will likely be an important one for the RASC as much thought is presently being given to the structure, financial goals and purpose of the Society. I urge as many members of our Center as possible to attend the Toronto meetings. Aside from the decisions that will be made concerning the future of the RASC, the Toronto Assembly promises to be the largest, longest, and most interesting one in the Society's history.

I wish to thank all members of the executive for their work and support during the past year. Randall Brooks has continued to produce an excellent newsletter, and with his wife Diane, has invariably provided nourishment at the regular meetings. In addition Randall deserves much of the credit for the work that is always necessary for the smooth and efficient running of the Center. Debby Burleson, our Vice-President, provided valuable assistance during preparations for the Museum display. Our Secretary, Peter Reynolds, has performed his duties so well (detailed, even enjoyable minutes, etc.) that he was recently re-elected to a third term! Bill Sheppard is stepping down after ably guiding the finances through the two busiest years in the Center's history. We all owe Bill a special vote of thanks for the time and effort he has devoted to this task.

For 1977 the new executive is:

President:	David DuPuy
Vice-Pres:	Larry Bogan
Treasurer:	Alan Bent
Secretary:	Peter Reynolds
Editor:	Randall Brooks

I thank all of these individuals plus Bill Calnen, Michael Edwards, Lamont Larkin, and Walter Zukauskas for allowing their names to stand for election this fall. The number of people named here, the good return of ballots, and the closeness of the votes is indicative of a strong Halifax Center as 1977 begins.

Roy L. Bishop
President, Halifax Center
December 16, 1976

MINUTES OF THE NOVEMBER MEETING

The November meeting of the Halifax Centre was held at the Nova Scotia Museum at 8:00 pm on the 19 th. The annual elections were held with almost all ballots being returned by mail or in person. The results are given in the President's Report. Dr. Bishop thanked all who had allowed their names to be placed on the ballot and the membership responded in appreciation also. The new executive is to assume office beginning in January.

Following the elections, Mr. William Parnell, a Centre member from Liverpool, was introduced by Dr. Bishop. Dr. Bishop led into the evening's topic by giving a brief history of Stellafane, its instigator's backgound and the development that has made this annual party of telescope makers and admirerers the largest and most popular anywhere. Russell Porter, 50 yrs ago, began the annual event when 25 or 30 people inspected the instruments made by amateurs who were in the first place inspired by Porter. He was of course, himself interested in the art but had only discovered his interest late in life.

Bill first of all, gave an overall look at the grounds and the prospects for good weather on the weekend during the display and judging of the telescopes. After setting up house keeping, Bill and his wife headed off to the museum at Governor Harkness' (a govenor of Vermont who gained Porter's interest in telescope making) residence in a nearby community. Some of you may remember the Turret Telescope featured in a recent Sky and Tel. That instrument was constructed by Harkness and was connected to the house by a long tunnel and the telescope permitted observations without going out of doors. Bill was not able to inspect the interior but got to see and photograph this interesting telescope.

Back at Stellafane ,the telescopes came out and the many thousands of visitors had a chance to glimpse some of the prize winning telescopes and some of the new designs for different components. Bill has built one or two instruments himself and one of his prime interests in visiting Stellafane was to glean ideas for his next instrument. He showed views of a number of instruments and the various ways their makers had avoided various construction problems. Everyone waits for an opportunity to view the stars with the displayed telescopes but the heavens were not layed open to allow testing of optics. As a result only mechanical awards were given and Bill had to return home without getting a chance to set an eye to a telescope eyepiece.

Randall Brooks then took over, with a presentation of some slides taken while he and his wife toured parts of Europe this summer. They visited a number of observatories and a couple of planetariums, but many were closed for vacations and they had to satisfy themselves with pictures of the domes. Amoung those visited where the Urania Obs. in Vienna, the Swiss Polytechnic Obs. in Zurich and the Zurich Public Obs. A number of astronomically related artifacts in various museums were shown and these included old globes of the Earth and Moon astrolabes etc. Following this refreshments were served and as usual lively conversation followed.

BK

MINUTES OF DECEMBER MEETING

Our regular monthly meeting was held on December 17 at 8:00 pm in the Nova Scotia Museum. The first item of business concerned the expansion of the Centre's executive. two members-at-large were eleced: Roy Bishop who will serve as our National Representative and Mike Edwards who will organize and coordinate observing activities.

Dr. Bishop then introduced the guest speaker for the evening, Dr. George Mitchell of Saint Mary's Univ.. Dr. Mitchell formerly well-known in cosmological circles, now spends most of his research hours in the field of interstellar molecules. Dr. Mitchell began by describing in general terms, the nature of the interstellar medium- the gas and dust inhomogeneously distributed throughout the Galaxy. One of the most famous concentrations of matter is of course in the constellation Orion. Here we see H II (ionized hydrogen), gas excited to fluorescence by ultraviolet radiation from nearby hot, young stars.

The Orion Nebula is of interest to the 'molecular' astronomer since it turns out that this ionized nebula is imbedded in a huge molecular cloud. Indeed, this is one of the two main sources of interstellar molecules, the other being in the constellation Sagittarius in the direction of the Galactic centre. The molecules themselves, range from simple things like H_2, CO and OH to rather complex species such as formaldehyde (HCHO) and methylacetylene(CH_3C_2H); in general, they consist of various combinations of the elements H,C,N,O,S and Si. As Dr. Mitchell pointed out, there is an abundance of low-proof alcohol!

Dr. Mitchell devoted the last part of his talk to the problem of molecular formation. Apparently dust grains are important for the formation of molecular hydrogen,H_2. The idea here is that two H atoms merge to stick to a single grain and then later come together to form a molecule. The other species are most probably formed in interstellar space by various gas phase reactions. Cosmic abundances, interstellar densities and radiation fields are the necessary input parameters to Dr. Mitchell's long and complex computor programs. Output are the predicted abundances of the various molecular species. Dr. Mitchell reported that to date, predictions are in reasonable accord with direct observation for about 12 species. There remains, however, some 35 more to do!

Following a brief question period, we all thanked our speaker for his very excellent summary of this rather exciting astronomical frontier. The meeting adjourned over coffee at about 10:00 pm.

P.H. Reynolds, Sec'y

1976 HALIFAX CENTRE FINANCIAL REPORT

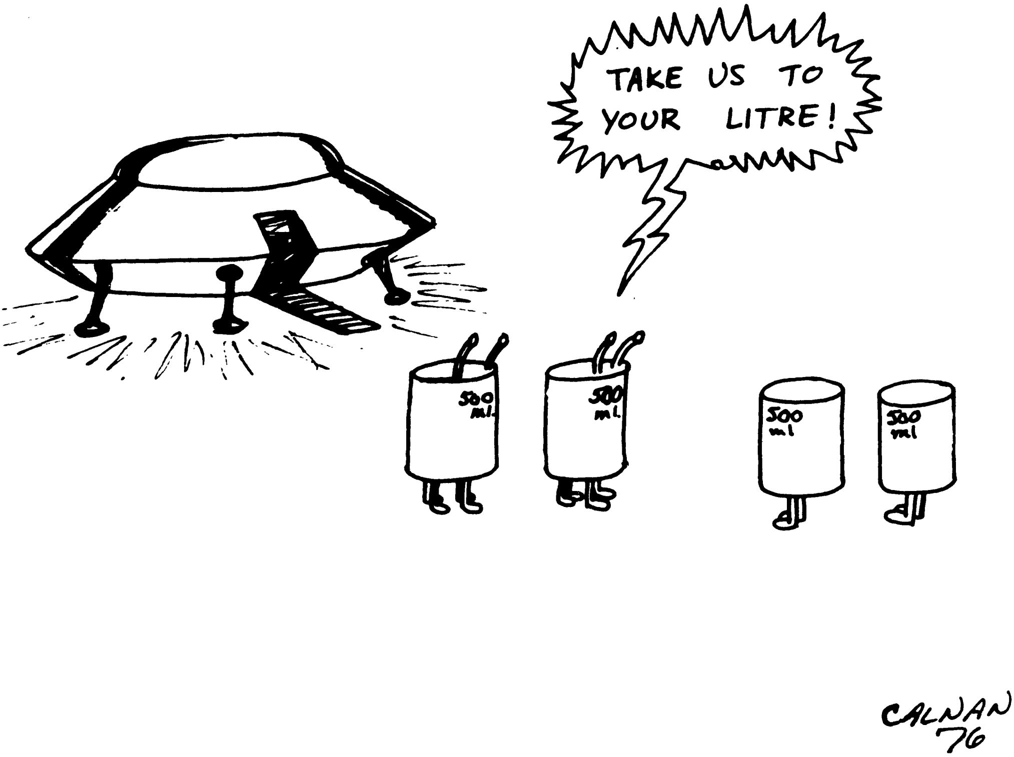
The following is a statement of the financial position of the Halifax Centre, RASC, as of 15 Dec 1976.

REVENUE:	Balance from 1975	781.05
	Memberships, Regular	362.50
	Student	157.50
	Sale of Handbooks	99.00
	Interest on account	18.84
	Grant to L. Bogan	175.00
	Life membership grants	12.00
		1605.89

Revenue:	Total	1605.89
EXPENSES:	To Nat'l Office, memberships	329.75
	To Nat'l Office, Handbooks	146.25
	Supplies and refreshments (stamps, refreshments, slides, Sky & Tel)	172.88
	Expenses for L. Bogan	386.00
EXPENSES:	Total	1054.88
	Bank Balance	571.01
	Change	2.25
	Total Balance	573.26

Any errors or omissions should be reported to me at or before the January Meeting.

Bill Sheppard,
Treasurer



THE GALILEAN SATELITES

Bill Calnen

Probably the most interesting planet to explore with your telescope is Jupiter. Astronomers have long been attractec to the mysteries of the great Red Spot, but recently the satellites have become more popular targets of observtion. During the early 70's, NASA has been sending spacecraft to photograph and study the planet and its numerous satellites. Pioneer 10 and 11 focused their cameras on the Galilean moons (Io, Ganymede, Europa and Callisto which were discovered in 1610 by Galileo) for a time as they slipped past the giant planet.

Pioneer 11 passed 470,000 mi. from Io, the closest moon to Jupiter, on Dec 4, 1974. Its surface reflects about 60% of the incident light. This high albedo may be due to a surface coated with sulphates and salt flats of sodium and potassium. One theory has been developed which suggests that the salt flats may be the relics of ocean beds left behind when the primative Jupiter boiled off Io's water. Io is probably cratered and is the densest of the large Jovian satellites--an estimated 3.5 times that of water. Io's peculiar properties include a reddish-brown surface covered with evaporate crystals (perhaps crystals of common salt), darker reddish brown sulfur deposits at the poles and a sky often aglow with a yellow aurora. Its surface pressure is estimated to be as low as one billionth the Earth's atmospheric pressure.

Exactly one year before, Pioneer 10 approached Europa within 200,000 mi.. It has a rocky surface like Io and compared to our Moon, it appears a bit smaller and has a density of 3.28 gm cm^{-3} and a surface devoid of water. Recent measurements taken from Earth indicate the possible presence of water ice. Its surface reveals dark areas in the northern hemisphere, large impact craters and ice covered plains. Upcoming missions to Jupiter and Saturn may solve the question of whether or not the Galileans show evidence of the bombardment that molded the inner planets.

Ganymede, having a diameter of 5270 km (Mercury only has a diameter of4880 km), was photographed by Pioneer 11 from 460,000 mi. The surface of this low density body (1.95 gm cm^{-3}) is believed to be covered by a deep ocean which is covered by floating icebergs. Spectroscopic readings from Earth tend to support the idea of an ice covered surface but the extent of the coverage is probably less than on Europa. Radar measurements indicate that the surface is covered by many large rocks mixed with layers of ice. Some surface details have been compared to lunar maria, while others could be high plateaus. The size of the moon is sufficient to hold an ammonia and methane atmosphere however, Io remains the only satellite in the solar system with a known atmosphere and ionosphere. Ganymede is believed to have a silicate core.

The outer most of the Galilean satellites is Callisto and it has the lowest density of the four bright moons--1.62 times that of water. Pioneer 11 also turned its cameras to the moon when it was some 490,000 mi. away revealing light regions and dark areas which look remarkably like lunar maria. Like Ganymede, it has a silicate core but it remains a mystery how its ice surface could retain features which appear to be impact basins.

New Moons discovered:
Recently a young astronomer, Charles Kowal, of the Hale Observatories discovered the 14^{th} moon orbiting Jupiter. The 10 mi. long object is 4 ten millionths as bright as the largest Jovian satellite, Io. This newest and as yet unnamed moon was discovered in September 1975 one year after the discovery of the 13^{th} moon, Leda, also by Kowal. Leda has a mean distance from the planet of 10,206,000 km. is less than 10 kms. in diameter, has a orbital period of 210.6 days and appears as a 20^{th} mag. object.

Diagrams showing the relative sizes of the Galileans, Earth and Moon follow on the next page. The photograph of Jupiter and the Galileans was taken with the 16" o Tri-X with an exposure of 30 seconds by some students of Tantallon Junior High. --Editor.

Looking on pg. 79 of the Hdbk. you will find that sat. 1 will disappear at 0 52 on the 6 Jan.--this will be t_0 and we can find several other times when we may make the necessary observations.

$t_o = 0^h59^m$	$t_1 = 0\ 54$	$E_1 = 745,000,000$ km
$t_2 = 21\ 33$	$t_3 = 21\ 29$	$E_2 = 845,000,000$ km (Feb6)
$t_4 = 18\ 30$	$t_5 = 18\ 28$	$E_3 = 820,000,000$ km (Ap 2)

$t_0 - t_2 = (24^h52^m) - (21\ 33) = 3\ 19$

$t_1 - t_3 = (24\ 45) - (21\ 29) = 3\ 25$

$= -6$ min.

$E_1 - E_2 = 100$ million km

That is in 6 min. light travels 100 million kms, at least according to our observations. So in one second light travels: 100,000,000 / 360 sec = 278,000 km/sec. Now calculate $t_0 - t_4$ and $t_1 - t_5$ (6^h22^m and 6 26 respectfully) and the difference is -4 min. $E_1 - E_3 = -75,000,000$ km so in 4 min or 240 sec the light photons travel 75,000,000/240 = 313,000 km/sec. We now have two values which are different but which is right? Neither is the exact value but if we take the average of the two our value will be closer to the truth or at least we can have more confidence in it since it depends on two rather than just one set of observations. That average is: (278,000 + 313,000) / 2 = 591,000/2= 296,000 km/sec. which is our final value. The real value is 299,800 km/sec so our observations have led to a reasonably correct measurement. Of course the more eclipses you can make the calculations for, the more accurate the result. And if you know how, you can get % accuracy of the determined value.

The times of disappearance can be found to greater accuracy in the Ephemeris and Nautical Almanac. Good luck if you try this experiment. Let's hear your results!

ASTRONOMY FOR YOUNG RASCals

Ed. note: This feature which I hope will become a regular of NOVA NOTES, is intended to introduce our younger members to some of the fundamental concepts of astronomy and some simple experiments they can carry out with a pair of binoculars, small telescope or no aids at all. Any questions which you may have can be directed to the Editor for answer in this column. Anyone may contribute material for this feature.

MEASUREMENT OF THE VELOCITY OF LIGHT
ROEMER'S Method

Since Bill Calnen's article has introduced us to the Galilean satellites of Jupiter and since Jupiter is giving us some splendid views this winter, I think it is appropriate to describe how you can measure the velocity (speed) of light--one of the most fundamental of physical quantities. The method which I am about to describe, was conceived by a Danish astronomer, Ole Roemer and the first measurement was carried out in 1675, just 301 years ago. This,and the method of aberation of starlight (which was not observed for another 50 yrs.) were the only ways of measuring the speed of light until 1849.

Roemer noticed that occurances of eclipses of the moons of Jupiter varied from the predicted times. He attributed this to the time for light to cross the orbit of the Earth as the relative positions of the two planets changed. The principle of the observations is shown on the next page. t_o is the time a moon enters the shadow of Jupiter. On Earth we are not aware of the occurance until t_1, the delay being due to the travel time of the photons of light. When the event is observed, the Earth is at position E_1. In the mean time the satellite continues to orbit the planet and at some time, t_2, it again enters eclipse and this is recorded at t_3. The Earth has between t_o and t_2 moved away from the planet and is now at position E_2. Therefore the difference of $t_1 - t_3$ is a longer interval than $t_O - t_2$ representing the time for light to travel the distance $E_1 - E_2$. If the Earth is on the other side of its orbit the real time between eclipses ($t_O - t_2$) will be longer than the observed time between eclipses.

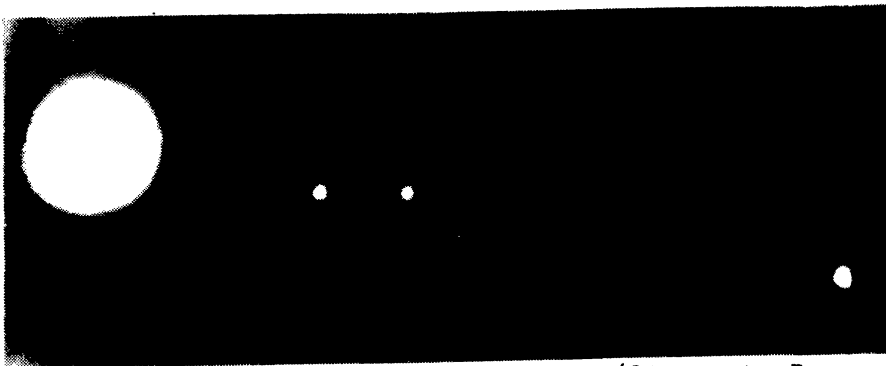
Observations indicate that the time to traverse the diameter of the Earth's orbit about the Sun by a photon of light is 16½ min., that is twice the time for light to reach us from the Sun itself. Hence if you know the diameter of the Earth's orbit, you can simply calculate the velocity of light. In kilometers the radius of the orbit is 149,000,000 km and the diameter 2 x 149,000,000 = 298,000,000 km. is divided by the time for light to cross that distance, but the time must be in seconds. 16.5 min. x 60 sec.= 990 sec. That is

298,000,000 km x 990 sec = 299,800 km/sec

which is the velocity of light. When Roemer made the observation of the delay or advancement of the eclipse times the diameter of the Earth's orbit was unknown with accuracy so the velocity he determined was quite inaccurate. You, with a little care can get better results than Roemer so if you have a telescope or binoculars why not try this experiment.

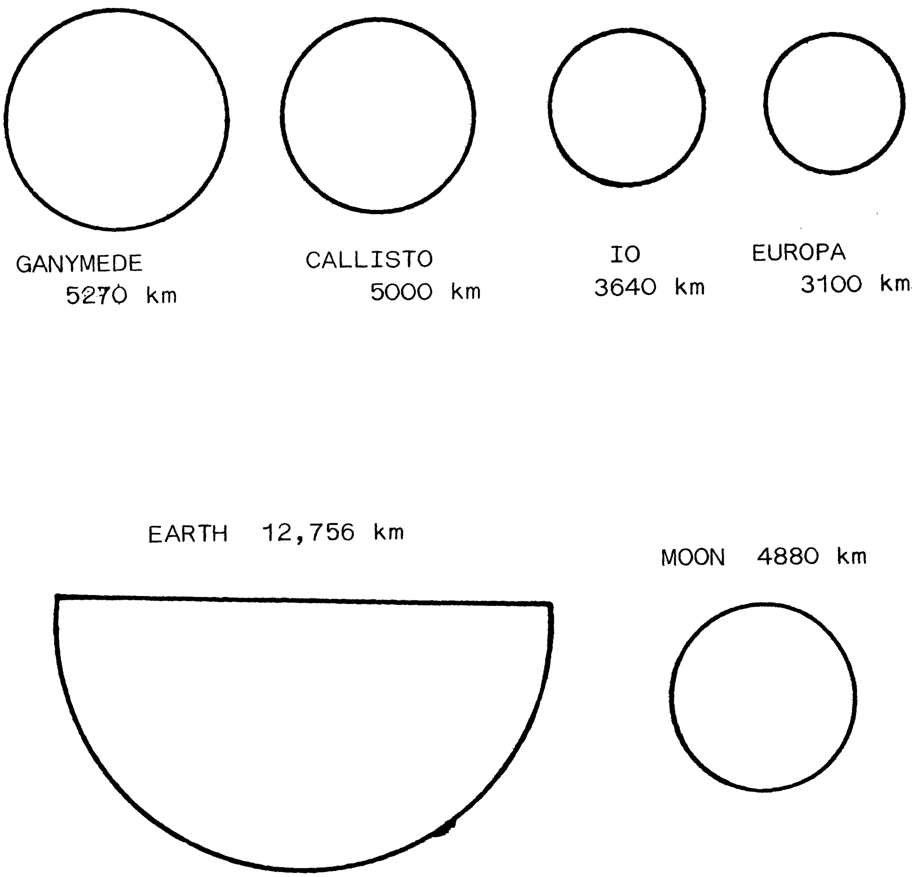
First you will have to consult your Observer's Handbook pg. 79 for the precise times of eclipse events. On the day you plan to observe an eclipse, you will have to set an electric clock precisely with a time signal (2:00 on CBC AM stations for one source). Then a short time before the event train your instrument on Jupiter and identify the moon about to disappear. As it is lost to sight in the shadow of Jupiter note the time hopefully with an accuracy of a couple of seconds. Repeat this process for several events over a period of a few weeks recording the times for each events. The observed times should be designated with odd-number subscripts and the times taken from the Hdbk. with even-numbered subscripts.

For the next step you will have to go to a library and find the Ephemeris and Nautical Almanac for 1977. In it you will find a table giving the distance to the planets for any date and from this table record the distances of Jupiter from Earth for the dates on which you have made observations--these will become your E_1 E_2 etc. You are now ready to make the necessary calculations, and an example of how to do it follows.



JUPITER AND THREE GALILEAN MOONS (lt to rt. Io, Europa and Ganymede)

THE GALILEAN SATELLITES



RELATIVE SIZES OF EARTH, MOON AND GALILEAN MOONS

FROM THE CENTRES--SASKATOON

(book review by
Dr. B.W. Currie)

The Evolution of Radio Astronomy:
by J.S. Hey

This book, published in 1973 as one of a series of semi-popular science history publications, has been on my shelves for three years--only recently read by me. I recommend it as a book well worth reading about the astonishing advances in astronomy achieved by radio.

The beginning of radio astronomy came about more or less by accident. Radio performance depends not only on the sensitivity of the equipment, but also on conditions in the atmosphere governing the propagation of radio waves. Radio noise due to lightning flashes is a well known example of radio static or noise. In 1932 Jansky, a Bell Telephone researcher, undertook the study of the direction of arrival of radio noise at 15-meter wave-length . He discovered a 'hiss' in his receiver arriving in a direction from outside the Earth, the direction traversing the sky according to sideral time. Analyses of the data showed that it was coming from the centre of the Milky Way.

Grote Reber, a young graduate engineer, decided to pursue research on this source of radio waves as a hobby at his own expense, recognizing that Jansky had made a very important discovery. He built the first radio telescope--crude it is true. He discovered that the most intense noise was at about 1.87 m wave length and predominantly along the Milky Way, and attributed it in 1940 to inter-stellar electrons. At last the problem attracted the attention of astronomers. They turned their attention to the search for the discovery of the sources of the radio waves out in space, like the Sun and planets, stars and nebulae. Hey, the author of the book, was the first to report on radio waves from the Sun, observing them on Feb 28, 1942 when an active sunspot region was on the central meridian of the Sun. By the end of WW II he had established that meteors scattered radio waves, and that radars could be used to study meteors penetrating the Earth's atmosphere. By 1945 a prediction was made that interstellar hydrogen should emit 21 cm waves, and this established a valuable method of studying the structure of the Galaxy.

Radar reflections from the moon were observed in 1946, the time delay of the return of a radar pulse of about 2½ sec proving that it was from the Moon. A high-light of the official opening of the Prince Albert Radar Facility in 1961 by Mr. Diefenbaker (then Prime Minister) was a radio message by Pres. Eisenhower reflected by the Moon and picked up by the 85-ft diameter 'dish' on the Prince Albert radar.

The developments in radio astronomy following WW II became rapid. The first great radio telescope was constructed at Jodrell Bank, England--a 250 ft diameter 'dish' that could be rotated. This was the one that received world-wide publicity for its ability to track by radar the Sputniks. Many other notable telescopes have been constucted since and some of these are described by Hey. The two major Canadian telescopes, Algonquin Park and Penticton, are mentioned

The resolving power of radio telescopes (ability to separate two closely spaced objects) like that of an optical telescope depends on the ratio of diameter of dish to the that of the received wave-length. In parallel with the development of telescopes with large diameter dishes, radio-type interferometers were being developed, first at Cambridge, England and Australia. The simplest consists of 2 radio telescopes at the ends of a long-base line, the longer the base-line the larger the resolving power. The more complex uses a number of equally spaced telescopes in a line or in the form of a cross. With these it became possible to identify discrete radio sources on the Sun, radio stars, radio galaxies, pulsars and quasars. All the significant advances are described by Hey, and brought into historical perspective.

Hey's concluding chapter is worth reading by itself. It is on the scope of radio methods in astronomy, summarizing the notable advances in our knowledge of the Universe within the brief period of about 40 years by applying radio technology as a complement to optical methods.

ASTRONOMICAL CALANDER

Diane Brooks

JAN/FEB

1 Jan 45 BC--Sosigenes made this date the first day of the year rather than march (new Julian Calander)

1801--Ceres discovered by Piazzi

1958--atomic time agreed exactly with UT2

1960--Ephemeris time adopted

1964--beginning of the International Year of the quiet Sun

2 Jan 1959--first satellite in solar orbit, Luna I

3 Jan --Earth at perihelion, Sun's disc largest (32'35")

4 Jan 1643--Isaac Newton born

7 Jan 1610--Galileo found the first 3 moons of Jupiter

8 Jan 1642--death of Galileo

11 Jan 1787--Herschel discovers 2 moons of Uranus, Ober and Titania

13 Jan 1610--Galileo finds 4th moon of Jupiter

14 Jan 1972--first objects observed with B-G O telescope

21 Jan 1979--Pluto moves closer to Sun than Neptune

23 Jan 1930--first of Pluto discovery plates taken

29 Jan 1930--second of Pluto discovery plates taken

30 Jan 1868-- Pultusk Poland has a fall of 100,000 meteor fragments

31 Jan 1966--Luna 9 executes first lunar soft landing

4 Feb 1906--Pluto's discover, Clyde Tombaugh, born

5 Feb 1962--most dramatic conjunction of planets, 7 members were within 16^{o} of each other

12 Feb --maximum negative discrepancy between apparent and mean solar time

15 Feb 1564--Galileo born
1970--Nova Serpens discovered

18 Feb 1930--Tombaugh discovers Pluto
1948--largest known example of a stony meteor fell in Furmas County, Nebraska

19 Feb 1473--Birth of Nicholas Copernicus

25 Feb 1969--Mariner 6 completes longest solar orbit by an earth satellite to date

26 Feb 1942--Radio emission from Sun discovered

29 Feb 1969--discovery of the first pulsar, CP 1919 (period 1.337 sec),at Mullard Radio Observatory

Feb 1994--Comet Encke is expected to"die" as it approaches Sun too closly

TORONTO GENERAL ASSEMBLY
1 - 4 July

This year's annual meeting of the RASC is to be held in Toronto on the July 1st weekend and like Calgary, they intend to hold a competition in which anyone may enter. However, you must submit an entry form by 1 June. The full list of rules were given in the National Newsletter in August and it is suggested that you refer to these before undertaking a project. You do not have to attend to enter since you can send an exhibit with our Centre's representative (assuming it is not too bulky)

The general categories are: atlas, photometric, solar system, deep sky or atmospheric phenomenon. Last year's Calgary winner, Damien Lemay of the Quebec Centre, was a run-away winner and you can see why if the photos on pgs. L40 and L41 of the June 1976 JRASC are any indication of the quality of his display. Some of our younger members might be interested and should begin planning their observations and display now. Anyone who wants to try out a dispay on the public should keep in mind that the Halifax Centre will again be participating in the Museum's Societies Show in May, and we can use any material you can gather together. START NOW!

TELESCOPE RAMBLINGS

The Telescope Number, T

On the large scale the basic units of the Universe are the galaxies. Although they cluster together here and there to some extent, a galaxy is a physically distinct, relatively compact, obviously interacting array of matter. Our bodies, the planet beneath us, and all the stars in the sky compose only our local corner of the Milky Way Galaxy; but, aside from this, it is curious that for the unaided eyes there is only one, distinctly visible, full-size galaxy. This is M31, a typical large spiral system and a familiar sight to amateur astronomers.

With the least optical aid other galaxies are accessible. Through the modest telescopes used by amateurs hundreds of galaxies emerge out of the blackness, like dim snowflakes frozen in the eternal night. Most of these are the largest galaxies, spirals or large elliptical systems. Since these are of roughly the same absolute magnitude, the illuminance provided by the dim light each sends to Earth varies inversely as the square of its distance (R^{-2}). The portion of this light intercepted by a telescope varies directly as the area or square of the telescope's aperture (D^2). It therefore follows that the distance R at which one of these large galaxies can be detected is directly proportional to the aperture D. Thus the ratio R/D is a constant, and, if the same units are used for both R and D, R/D becomes a dimensionless constant or pure number. Using M31 ($R \sim 2.1 \times 10^6$ l.y.) as being roughly at the limit of the dark-adapted unaided eye ($D \sim 7 \times 10^{-3}$ m):

$$\frac{R}{D} = \frac{2.1 \times 10^6 \text{ l.y.} \times 9.5 \times 10^{15} \text{ m/l.y.}}{7 \times 10^{-3} \text{ m}} \sim 3 \times 10^{24}$$

As natural pure numbers go, this is quite large. It pales beside the ratio of the electrical to gravitational forces between two electrons ($\sim 4 \times 10^{42}$), but it is intermediate between the CGS and MKS values for Avogadro's number. It surely deserves the status of a name and symbol. Perhaps "telescope number, T" would be appropriate.

Let us use T to calculate the visual range of the Palomar telescope:

$$R = TD \cong 3 \times 10^{24} \times 5.08 \text{ m} = 1.6 \times 10^9 \text{ l.y.}$$

Photographic or electronic detection approximately doubles T, and if one switches to quasars rather than large galaxies as the distance beacons, a further factor of about 5 is appropriate, bringing T up to $\sim 3 \times 10^{25}$. Hence the range of the Palomar instrument using the best technology and observing quasars is:

$$R = TD \cong 3 \times 10^{25} \times 5.08 \text{ m} = 16 \times 10^9 \text{ l.y.}$$

a figure consistent with modern estimates of the distance to the observable edge of the Universe.

It is interesting that if the aforementioned electron force ratio ($\sim 4 \times 10^{42}$) is divided by T, the number obtained ($\sim 10^{17}$)

is of the order of the ratio of the diameter of the Palomar mirror to the smallest distances that have been probed in sub-atomic physics. No lesser an array of interstellar molecules than P. A. M. Dirac has devoted considerable thought to numerology of this sort, although I have not encountered speculations that involve the Palomar speculum as a step intermediate between the smallest and largest distances we have probed.

In summary, for observing the Universe on the large scale the telescope number T falls within a factor of 3 of 10^{25}, the actual value depending upon the detection method and object observed.

Roy L. Bishop
Maktomkus Observatory

METEOR TRAIN OBSERVED

At 12:26 am on Dec 29, Peter Steffin, who is a Halifax Centre member, observed an unusual meteor display while visiting Charlottetown. It appeared over the northern horizon moving slowly from west to east and lasting 2 to 2½ min. The meteor was 5° above the horizon and had a tail 15° in length which was pale white and untapered. In a newly acquired set of 7 x 50 binos, the tail revealed small particles following the main head and each of the small particles had its own short tail. After a couple of minutes it started to disintegrate becoming very reddish with large fragments falling Earthward. The horizontal path and slow motion are reminiscent of the discription of the Chant Trace Meteors of 1913 discussed in the July/Aug issue of Nova Notes. These meteors had a nearly circular orbit about the Earth which accounts for its horizontal path across the sky.

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N--unattached national members who receive Halifax publications

Total Halifax Centre Membership is now 60--the first time ever--however there are still a few members how have not sent in their membership. We of coarse want to see all our old members back again and to avoid unnecessarily long delays in receiving the Journal for Feb., you should ensure our treasurer gets your fees as soon as you can arrange it. All members should check your address for correctness and please inform the Editor of any changes or moves.

OBSERVING REMINDERS

Fri 14 Jan	Grazing occ'n by the moon of the 5.3 mag star 8Lyr. The track on pg. 72 of the Obs. Hdbk. is the southern limit so one must be NW to see this event low in the eastern sky.
Mon 17 Jan	Appulse (close approach) of star SAO 140546 and the asteroid, Juno
Fri 21 Jan	Appulse of SAO 176953 and Pallas at $3^h 04^m$ AST This event is low in the sky and a second Pallas appulse is shrouded in daylight
Fri 28 Jan	Greatest western elongation of Mercury when it will appear only 12° above the horizon at sunrise dispite the fact that it is 25° from the Sun. Mag is +0.1
Thurs 10 Feb	Pallas at opposition (180° from the Sun) Mag 6.7. See pg 77 of the Hdbk for chart
Sat 12 Feb	If you can find Mars in the morning sky, you can find Mercury only 0.1° S of Mars
Sat 26 Feb	1979 that is. A total eclipse of the Sun will be visible from southern Man. Start your preparations early--start an eclipse savings account now.
Mon 28 Feb	Venus at greatest brilliancy (-4.4) for this opposition passage. What phase do you expect you might observe? Take your telescope out and check it out.

Variable stars are one area where even beginners can make a contribution to astronomy. The differt varieties are briefly described on pg 102 ot the Hdbk. Some are bright enough that optical aids are not necessary and an observing program of 3 or 4 stars will take only a few minutes a night for long period types or if you want to stay out longer, a short period variable can keep you busy for several hours. Watching a plot of the magnitude vs time (the light curve) develope is quite satisying and loaded with suspence sometimes. After a few sessions you will think of your chosen stars as yours. o (omicron) Ceti is a long period variable that you might consider to start out with. β (beta) Lyrae, Perseus (Algol) and δ (delta) Cephei are some of the famous and easily observed short period types. I'm sure our younger members would find variable star observing an interesting and useful passtime.

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