

# NATIONAL NEWSLETTER

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Dr. John N. R. Scatliff observing Mars during the opposition of 1965. Temperature minus 27 degrees Celsius.

## NATIONAL NEWSLETTER

April, 1978

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## The Indefatigable Amateur

Consider the amateur astronomer; surely he fits the Reader's Digest Dictionary definition, – One who is fond of, one who practises a thing, esp. an art or game as a pastime. He must be "fond of" his hobby to succeed in face of the obstacles he faces. He stands on the top of a stepladder and endures temperatures at the other end of the scale from those traditionally associated with the damned, to produce a few sketches of fleeting glimpses of things he never expects to reach. He hears of a graze a hundred kilometers away, and drops everything to get equipment ready and drive out to the location where he finds aurora blanketing the star. He hears of a meteor shower, and lies on his back for several hours counting falling stars. He hoards his spare shekels to buy a better telescope so that he may take photographs of objects so faint that only an infinitesimal few of the world's inhabitants ever know of their existence.

Probably that last factor is what gives him the feeling of accomplishment, that puts him in a class by himself. Then again, there may always be in the back of his mind the remembrance that Sir William Herschel, after spending twenty-nine years as a professional musician, switched to astronomy as a full-time occupation.

But to regard the amateur astronomer as just a frustrated professional is surely to do him a gross injustice. Of his own right he adds immeasurably to the breadth of understanding of this vast and awe-inspiring subject of ours; the study of the Universe of which we are an intimate part, but on whose development we yet have no concept of our influence.

The amateur produces, for all his frustrations and difficulties, such contributions to the deciphering of that puzzle as Jack Newton's book DEEP SKY OBJECTS; or he accumulates 6,335 estimates of variable stars as Chris Spratt of Victoria Centre did in 1976–1977 to earn the Top Observer of the Year award from the AAVSO.

That the professional branch of the fraternity do appreciate and utilize the contributions of those of us who do it for the love of the sport is shown in the following quote: (AAVSO Circ. 87, Jan. 1978)

Recent letter from Frances Cordova, the coordinator of simultaneous x-ray and optical observations for HEAO-1 expresses again the thanks of the HEAO-1 soft-x-ray team for the "outstanding contribution" to their efforts. \*\*\* The HEAO-1 team strongly urge AAVSO to continue in the simultaneous coverage of the variables. They feel that it is the only way the team will know what state these stars are in, if they are observed to emit x-rays.

There are so many stars; and so few astronomers.

## J.F. Heard Fund

The above-named fund established by decision of National Council in memory of Dr. J. F. Heard will remain open for contributions until May of this year. It will be remembered that the objective of the fund is to arrange for reprinting of a number of the anecdotal accounts of well-known astronomers for which Dr. Heard is so well remembered. Members who knew Dr. Heard are urged to add their contributions to those already received.

## The National Secretary

by **Dr. A. H. Batten**  
Victoria Centre

His many friends will be sorry to learn that Mr. D. J. FitzGerald, who was recently re-elected by acclamation to the post of National Secretary has found it necessary to tender his resignation. "Fitz" has served as National Secretary since 1974. Before assuming that office he had a long record of service in the Toronto Centre, where his many years on the Centre Council included terms of office as Director of the Observers' Group, on the editorial committee, and most importantly, as President. We are indeed sorry to see Fitz go, and tender our thanks to him for his many services to the Society, and wish him well.

The office of National Secretary is an important one, and your Council, which has the right to make an appointment in the circumstances that have arisen, has, through its Executive, given much thought to the question of a successor to Fitz. We were delighted when our first choice accepted the appointment. The new National Secretary, Mr. Norman Green, is no stranger to the Society since he has held that same post before. His appointment will run until the next General Assembly when, we are happy to note, he will be a candidate for election to a full term of office in his own right. We are most grateful to Norman for helping us out in this way, and we welcome him back to the National Council.

## Astronomy Update

by **Dr. Doug Hube**  
Edmonton Centre

### Recent Results of Research in Astronomy

During the past two centuries, much effort has been devoted to the systematic observation and cataloguing of positions and magnitudes of various types of stellar and non-stellar objects such as double stars and nebulae. In particular, some of the best-known astronomers of the 19th and early 20th centuries are responsible for the discovery of the tens-of-thousands of visual double stars now known. One might think that these would have exhausted this field, at least as far as new discoveries are concerned. Such is not the case. Among others, Worley and Holden in the U.S.A., and Cousteau in France continue to produce important results in this classical and fundamental field. Over a period of many years, Cousteau, for example, has examined more than 70,000 stars with 50 cm and 74 cm telescopes, and has found 1500 new visual binaries. Most, though not all, have separations of less than one arc second and severely test the skill of the most keen-eyed observer.

*(Astronomy and Astrophysics Suppl. 29, 249, 1977)*

## Notice Regarding Overdue Books and Slides

Members are reminded that the loan period for books from the Society's library is four weeks; slides two weeks. Some members have books and other library material that is overdue. We want to avoid expenses involved in sending out individual reminders to borrowers. Under revised Library Regulations recently approved by the National Council borrowers may be charged for postage and secretarial costs involved in such letters. Please, if you have books or slides belonging to the Society, return them to the library at once. The address is; RASC Library, Fourth Floor, 124 Merton Street, Toronto M45 2Z2.

Frederick L. Troyer  
National Librarian

## The National Library of the Society

### General Information and Regulations (Revised January 1978)

The Society's library, located at the National Headquarters, 124 Merton St., Toronto M4S 2Z2, comprises about 1500 books and monographs, various astronomical periodical publications (some in foreign languages), a slide collection and other materials. The Society offices are located about a seven-minute walk from the Davisville station on the Yonge subway line. Normal hours are 9:00 am. to 4:30 p.m., Monday to Friday.

Most of the books in the library are available for loan to members, either by dropping in during the Society office hours, or by request sent by mail. A few rare books and some reference volumes are restricted to use in the reading room, except by special permission of the Librarian.

Current periodicals are, as a general rule, not permitted to be taken away. The Librarian may, however, permit a member to borrow a periodical for a brief period in order to photocopy an article. (The Society does not have photocopy facilities.)

Books are lent for a period of four weeks unless other arrangements are made at the time the book is borrowed. An extension for a further four weeks may be arranged by telephone or letter addressed to the Librarian provided there is no urgent need for the book. This request should be made before the original period of loan has expired.

Members requesting books by mail should send 50 cents per volume to help defray the costs of postage and packaging. Borrowers are responsible for the care and safety of library materials in their custody and materials being returned to the library must be packed in proper manner to protect them from damage in the post. Return postage is to be fully prepaid.

The Society reserves the right to assess borrowers for costs – postage, secretarial time, etc. – involved in retrieving overdue books or other library material.

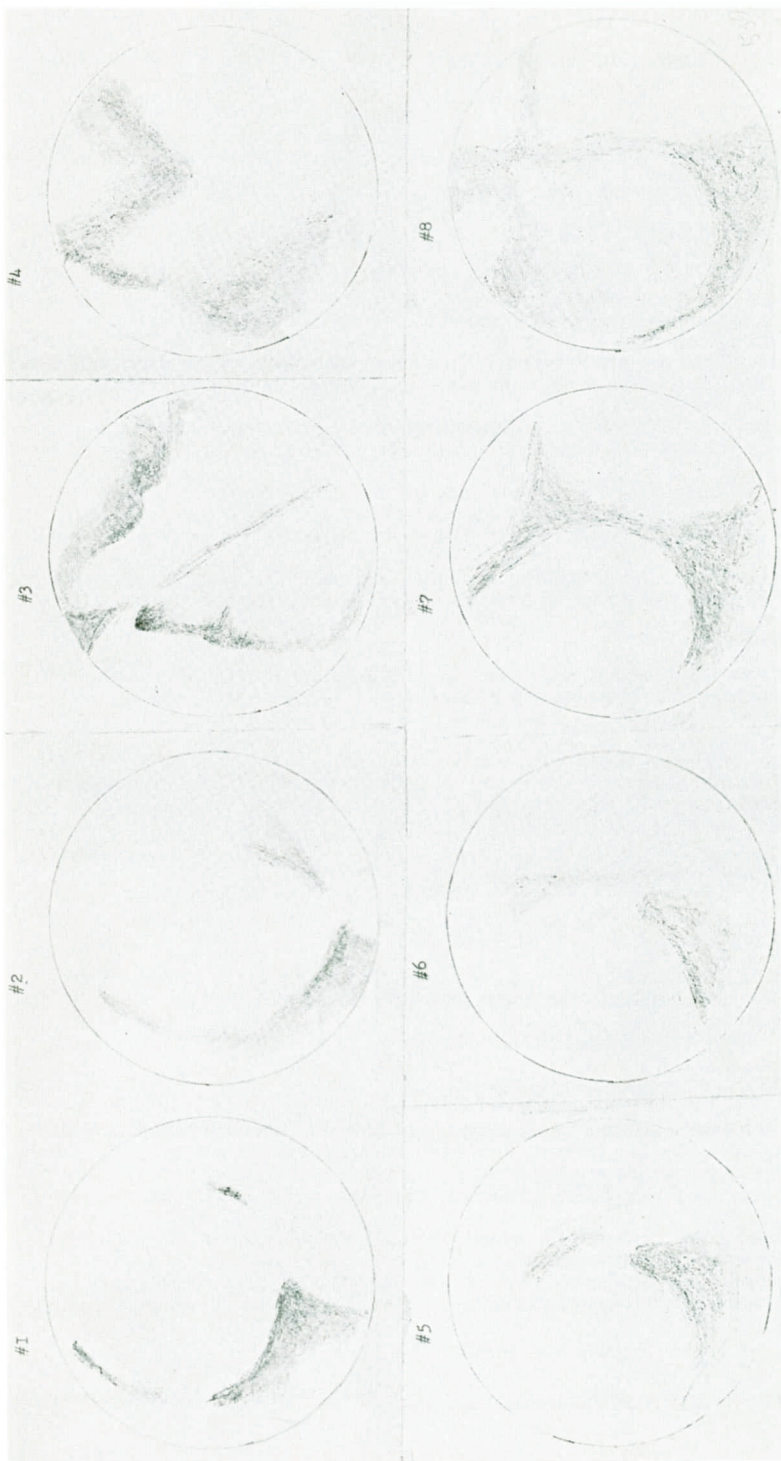
A 40-page catalogue of books in the library was issued in 1970, with manuscript supplements since that time. Every Centre of the Society has been provided with several copies of the catalogue and members attached to Centres may inspect these on request to the Centre's secretary or other officers. Lists of new acquisitions will appear in the *National Newsletter* from time to time. While the supply lasts, members not attached to a Centre may obtain a copy of the library catalogue on request sent to the Librarian or Executive Secretary. (Please note that because of customs problems books are not, as a rule, sent outside Canada.)

While the Society's library does have some fairly recent books, we do advise members that most of our collection is quite old. There is much of interest in reading these older books but the reader should take note of the year of publication (indicated in our catalogue as well as in the book itself) and make allowance for the fact that astronomy, like all science, is a rapidly progressing field, and that changes undoubtedly have been made since even the newest book went to press. Don't expect to read about pulsars, quasars and black holes in a 1962 book!

It is suggested that readers use the RASC library catalogue and supplements as a guide to a selection of astronomical books available. In many cases these titles may be readily obtained in libraries close at hand. Many Centres of the Society have libraries of their own. Local public and college libraries probably can offer you hundreds of books which, because of our limited budget, are not in the Society's library. In most provinces local libraries can obtain books from other nearby libraries by inter-library loan, and members at a distance from Toronto will often find it quicker and more convenient to try to obtain a desired volume locally. But, when you find a desired book is not available in your area, we will be glad to lend it (if available) from the Society library.

Because of our small budget we do rely heavily on donations from members and friends to enhance our collection, and on gifts from publishing observatories and institutions. Please note that the RASC library is always ready to welcome gifts of books or other materials from members who no longer have need for them. It is interesting to note that many of our books contain the signatures of former active members who have left them to the library by bequest.

Frederick L. Troyer  
National Librarian.



Mars as sketched by John N. R. Scatliff in our cover illustration

Drawing	Date	U.T.	w	$\phi$	Seeing	Drawing	Date	U.T.	w	$\phi$	Seeing
2	Mar. 14	0300	311.3°	+21°	Good	5	Mar. 19	0500	232.6°	+21°	Very poor
3	"	0330	318.6°	"	"	6	"	0530	239.9°	"	"
4	"	0530	347.8°	"	"	7	"	0600	247.2°	"	"
	"	0700	009.7°	"	Heavy hoar-frost	8	"	0630	254.9°	"	"

w — Longitude of central meridian.  $\phi$  — Latitude of centre of disk. Telescope: 12½ inch aperture Newtonian, focal length 105 in. Magnification: Drawings Nos. 1-7,  $\times 210$ ; Drawing No. 8,  $\times 167$ .

## Nouvelles des Centres Québécois

de Damien Lemay

### CENTRE D'ASTRONOMIE DE MONTREAL

De nouvelles publications sont disponibles au magasin de la S.A.M. Il s'agit de:

#### LA CONSTRUCTION D'UN TELESCOPE D'AMATEUR et LA FABRICATION D'UN MIROIR DE TELESCOPE

Ces deux livres sont spécialement destinés aux étudiants, au coût de \$4. pour les membres et \$4.40 pour les non membres.

Aussi, "L'INITIATION A L'ASTRONOMIE", par Jean Vallières. Ce volume de 86 pages, 8½" x 11", est un succès. Après quelques mois une réimpression était nécessaire, la première s'étant envolée. Coût: \$2.

A la page 4 du *Québec Astronomique* de janvier, le professeur Serge Demers annonce qu'un cours d'astronomie générale sera donné à l'intention des non-scientifiques, à l'Université de Montréal.

Près de la moitié du cours traite du système solaire et inclut une description détaillée des découvertes de l'ère spatiale concernant la Lune et les planètes. La dernière partie du cours décrit l'univers des galaxies et discute des propriétés qui permettent de spéculer sur son avenir.

Le Québec Astronomique, revue officielle du Centre d'Astronomie de Montréal, atteint de nouveaux sommets. Il est maintenant imprimé à plus de mille (1000) exemplaires.

### CENTRE DE QUEBEC

Le Centre de Québec de la S.R.A.C. a été chargé d'organiser le prochain congrès de l'Association des Groupes d'Astronomes Amateurs (A.G.A.A.), laquelle regroupe tous les clubs d'astronomie de la province (les petits comme les grands) et publie la revue "Magnitude Zero" quatre fois l'an.

Grâce au travail du Dr Eloi Boiduc et à la collaboration du directeur du Département de Physique, le Dr Claude St-Pierre, l'Université Laval fournira gratuitement des locaux au Pavillon de KONINCK du vendredi soir le 16 juin au dimanche après-midi le 18 juin 1978.

Le responsable des enregistrements est Mario Lapointe, 821 route Kennedy, Pintendre, G0R 2K0.

L'expérience acquise lors de cette manifestation servira peut-être à un événement de plus grande envergure éventuellement, c'est-à-dire, la Reunion Annuelle de la S.R.A.C..

## La magnitude d'un groupe d'étoiles

par Ronald Ouellette, membre de la S.R.A.C. (R.A.S.C.)

### La magnitude d'un groupe d'étoiles

Dans divers problèmes d'astronomie, il est parfois intéressant de connaître la magnitude totale d'un groupe d'étoiles. Les livres d'introduction à l'astronomie contiennent souvent un certain nombre d'exercices de ce genre. Pour résoudre ces exercices, nous devons évaluer la luminosité de chacune des étoiles puis déduire la magnitude à partir de la somme de ces luminosités.

Nous proposons ici une expression qui permet de résoudre rapidement de tels problèmes sans passer explicitement par la luminosité.

Considérons une étoile particulière (i) d'un groupe d'étoiles. Si  $m_i$  est sa magnitude et  $m_o$  la magnitude d'une étoile de référence quelconque et si  $l_i$  et  $l_o$  sont leur luminosité respective, alors nous aurons:

$$m_o - m_i = 2.5 \log l_i/l_o \quad (1)$$

ou

$$\log l_i/l_o = (m_o - m_i)(0.4) \quad (2)$$

en prenant l'antilogarithme:

$$l/l_o = 10^{0.4(m_o - m_i)}, \quad (3)$$

et

$$l_i = l_o 10^{0.4(m_o - m_i)}, \quad (4)$$

La luminosité totale s'obtient par la somme des luminosités de chacune des étoiles du groupe considéré:

$$l_t = \sum_i l_o 10^{0.4(m_o - m_i)}, \quad (5)$$

( $l_t$  est la luminosité totale)

Nous pouvons aussi écrire  $l_i$  en fonction de la magnitude totale; avec  $m_t$  la magnitude totale, on aura d'après (4):

$$l_i = l_o 10^{0.4(m_o - m_i)}. \quad (6)$$

Des equations (5) et (6) nous obtenons:

$$l_o 10^{0.4(m_o - m_i)} = \sum_i l_o 10^{0.4(m_o - m_i)}, \quad (7)$$

ceci peut s'écrire:

$$l_o 10^{0.4m_o} \times 10^{-0.4m_i} = \sum_i l_o 10^{0.4m_o} \times 10^{-0.4m_i}; \quad (8)$$

simplifiant par  $l_o 10^{0.4m_o}$ :

$$10^{-0.4m_i} = \sum_i 10^{-0.4m_i}. \quad (9)$$

Nous remarquons que l'équation (9) permet de trouver  $m_i$  sans passer explicitement par la luminosité. Généralisant (9) pour le cas où plusieurs étoiles sont de même magnitude:

$$10^{-0.4m_i} = \sum_j N_j 10^{-0.4m_j}, \quad (10)$$

où  $N_j$  est le nombre d'étoiles de magnitude  $m_j$ .

Plutôt longues à évaluer à l'aide d'une table de mathématiques, les expressions (9) et (10) s'exécutent très rapidement à l'aide d'une petite calculatrice de poche. De plus, si le nombre d'étoiles est petit (cinq ou moins par exemple), (9) se calcule facilement avec une règle à calcul munie de l'échelle logarithmique (L). En isolant  $m_i$  dans l'équation (10), nous avons:

$$m_i = -2.5 \log \sum_j N_j 10^{-0.4m_j}. \quad (11)$$

Pour trouver  $m_i$ , il suffit d'exécuter pour chaque  $j$  l'expression correspondante ( $N_j \times 10^{-0.4m_j}$ ), de faire la somme cumulative de ces expressions et de prendre  $(-2.5 \times \log)$  du total. Sur un calculateur programmable le calcul se fait au fur et à mesure que l'on entre les données, ce qui représente une grande économie de temps.

### Exemples

1) Albireo (Beta du Cygne), est une étoile double dont les composantes sont de magnitude 3.07 et 5.11. Quelle est la magnitude totale du couple?

Utilisant (11) avec  $N_j = 1$ :

$$m_i = -2.5 \log \sum_j 10^{-0.4m_j},$$

avec  $j = 1, 2$ .

On a:  $m_1 = 3.07$  et  $m_2 = 5.11$ .

Alors:

$$m_i = -2.5 \log (10^{-0.4(3.07)} + 10^{-0.4(5.11)})$$

$$m_i = -2.5 \log (0.0592 + 0.0090)$$

$$m_i = 2.91$$

L20

2) Un amas d'étoiles contient 130 étoiles se répartissant comme suit:

$m_i$ : 7 8 9 10 11 12 13 14

$N_j$ : 10 10 15 20 25 20 15 15

Évaluez la magnitude de cet amas. Cette distribution correspond approximativement à celle de M44.

Utilisant (11):

$$m_i = -2.5 \log \sum_j N_j 10^{-0.4m_j},$$

écrivant explicitement les valeurs de  $m_j$  et  $N_j$ :

$$m_i = -2.5 \log [(10)10^{-0.4 \times 7} + (10)10^{-0.4 \times 8} + (15)10^{-0.4 \times 9} + (20)10^{-0.4 \times 10} \\ + (25)10^{-0.4 \times 11} + (20)10^{-0.4 \times 12} + (15)10^{-0.4 \times 13} + (15)10^{-0.4 \times 14}]$$

$$m_i = -2.5 \log [(0.01585) + (0.00631) + (0.00377) + (0.00200) + \\ (0.00100) + (0.00032) + (0.00009) + (0.00004)]$$

$$m_i = -2.5 \log (0.02938)$$

$$m_i = 3.83 \text{ (La valeur acceptée pour M44 est de 3.9.)}$$

3) Évaluez la magnitude totale de l'amas galactique Byurakan 2.

Réponse:  $m_i = 7.28$

(Voir: the Journal of the Royal Astronomical Society of Canada, Vol. 70, no. 6, déc. 1976, p. 169)

Présenté par:

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## Gathering the History of a Centre

by Ella Dack  
Winnipeg Centre

Writing a "history" of any kind naturally calls for a great deal of research. Since 1967, in particular, many histories have been written concerning the various communities and organizations across Canada.

But precisely what does the word "history" mean? Briefly the dictionary describes the word as: "a continuous methodical record in order of time and importance of public events... the study of the formation and growth of communities...connected with a particular country, person, thing...past events in the general course of human affairs."

It was never intended to compile the story of the Winnipeg Centre as a formal history, in the light of the foregoing definition. Rather, my aim was to share past experiences of people who built the Centre, in the form of reminiscences, so that definite personalities would emerge; the editing therefore would have to be minimal in order not to obscure the personalities involved, both past and present. For example: the Variable Star and Occultation observers would have some interesting anecdotes to relate regarding some of the funny and not-so-funny experiences they had when looking for the exact site from which to observe; the Solar and Lunar Eclipse groups would reminisce about the time they travelled a considerable distance to view the event only to be clouded or rained out. Telescope making also played a prominent part in Winnipeg's Centre story. Altogether it could make very stimulating reading. After all, the story was intended chiefly for the present and future members of the Centre; most of our members joined since 1966, and, therefore, would not be too interested in who was President in 1918, or in the Gay 20's or the Dirty Thirties, as the names would mean nothing to them. Many of our citizens are relative newcomers to Manitoba.



In researching the Centre's files, it was a shock to me to learn that the Winnipeg Centre actually came into being in 1908. Not infrequently, one got the impression that the study of astronomy was a nice hobby for the members of the socially and academically elite only.

The Centre weathered two World Wars, as well as the Depression, and like most other centres, for many years had no permanent home, but met at Universities, (Manitoba and later Winnipeg) in Church Halls, schools, the Shinn Conservatory of Music, and even private homes; telescope-making took place as a rule in somebody's basement; distances seemed no obstacle when it came to viewing a solar or lunar eclipse or a meteor shower.

The membership of the Centre sometimes fell to dangerously low levels, in fact, to a point at one time when it was seriously considered advisable to wind up the organization. But fortunately this drastic step was never taken, although at one time it appears the attendance fell down to four! However, an intensive membership drive proved most effective, the attendance at one time soaring to the dizzy heights of something like 300. Despite this the membership remained for many years at a figure something less than 100.

The need for an observatory to do serious observational work was ever present and for many years discussions took place and plans were formulated towards this end, but without coming to fruition. World War II and the period following it brought tremendous growth to the cities and outlying towns, and therefore building an observatory within easy reach of the majority of members presented a serious problem; city lights are not conducive to effective observing.

Many sites were considered, but it was not until 1976 that Mr. Roy Belfield, the Centre's President, was able to make satisfactory arrangements with the University of Manitoba for the building of an observatory at Glenlea, some 17 or 20 miles south of Winnipeg. It is an absolutely fantastic achievement (See J. ROY. *ASTRON. CAN.* Vol. 71 (L72) Dec. 1977. Ed.) the work done entirely by a relatively small group of young (and some not-so-young) members, totally dedicated volunteers, who spared no effort to make this long-cherished dream a reality.

Women have also made a considerable contribution to the cause of astronomy, not only on a professional level, but as amateurs, and the Winnipeg Centre is no exception in this regard. (Miss Sheila Nixon was President of the Centre 1966-1969. Ed.) Mrs. Phyllis Belfield, wife of the current President, has worked indefatigably for the Centre in every phase of its activities.

While the Centre continues to hold its regular meetings at the University of Winnipeg, its real home is the lovely little observatory at Glenlea. Congratulations to all of you who made it possible!

*Editor's Comment:* Ella Dack will be well remembered by members at headquarters, and at the Montreal Centre where she was a most active and enthusiastic participant in the Society's activities. She is always in our mind with her welding glass making naked eye sunspot observations. While Ella started collection of data as outlined above, final editorship of the History of the Winnipeg Centre was turned over to Mrs. Phyllis Belfield with Ella Dack and Patricia Berezowski as assistant editors. Some copies are still available from the Secretary of the Centre, price \$2.50 per copy. See address on inside cover of the *JOURNAL*.

## Highly Successful Observing in Halifax

by Michael P. Edwards  
Halifax Centre

On the night of October 8, 1977 a most successful observing session was held by the Halifax Centre members. A significant fact that made this occasion memorable was the location; the ground of Castle Frederick, Upper Falmouth, N.S. (About 45 miles from Halifax) described by Dr. Roy L. Bishop at the 1977 General Assembly. This paper, "An Eighteenth Century Nova Scotia Observatory" was reprinted in the *Journal* (Vol. 71, No. 6, Dec. 1977, 425).

Dr. Bishop has found that the Castle Frederick was most likely the site of the first astronomical observatory in North America. (At least since prehistoric times. Ed.) Built in 1765, it was the home of Col. J. F. W. DesBarres, surveyor, cartographer, and military engineer.

The site is now owned by Mr. Bruce Saunders, whose warm home and hospitality were appreciated by all of the approximately 25 members of the Halifax Centre who turned out.

Telescopes were set up on what may have been the Colonel's eastern patio, the hollow shown in the photograph marking the remains of the DesBarres home. It indicates the location of the basement of the house as seen from the location of the observatory.

Among the telescopes shown is an antique Dolland now owned by Dr. Bishop.



## Amateur Radio Astronomy

### Part II

K. F. Tapping  
Ottawa

#### *TYPES OF RADIO TELESCOPE*

##### *The total Power Radiometer*

The simplest type of radio telescope is the so-called total power radiometer. A typical amateur version of this type of instrument might operate at a wavelength in the 1 to 6 meter range. The antenna would usually be a Yagi or similar antenna. Beamwidths would be 10–30°. Some recordings obtained using such an instrument are shown in Figure 2. This radiometer operated in the region of 2.2 metres wavelength – in one of the bands reserved for satellite transmissions. Spikes due to satellite signals are evident on the records. These observations were made by directing the antenna at the desired declination – on the meridian – and allowing the earth's rotation to move the sky through the antenna beam. The large “bump” due to the galactic continuum radiation increase along the galactic plane is very evident.

Simple radiometers of this type are usable for measurements of the galactic continuum radiation and for reception of the emissions associated with solar flare activity. A carefully designed and set up total power radiometer is capable of detecting some of the brightest radio sources but if serious work is planned, there are more suitable receiver arrangements which can be used.

As the sensitivity of the radiometer is increased, the number of sources which can be detected increases until eventually confusion becomes a problem. Serious monitoring of solar emissions entails this difficulty because as the Sun moves along the ecliptic, it passes close enough to some of the bright sources for confusion to occur. In addition when the sun is

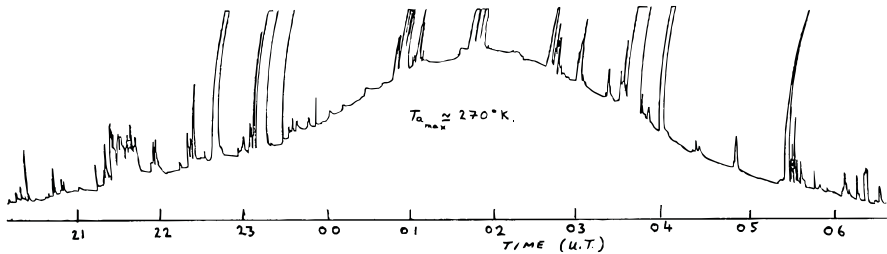


Figure 2. Caption: A Typical Output Recording from a Total Power Radiometer, showing a drift scan of the Milky Way at Declination + 15°. The antenna was a 10 element Yagi and the wavelength was 2.2 meters. The spikes are due to satellite signals. Observation by author, Abbey Wood (U.K.). May 5, 1970.

inactive, its radio emission at the longer wavelengths falls to a lower level than the brightest sources. Therefore in order to detect unambiguously the fainter sources and the "Quiet" sun, an increase in the resolving power of the antenna system is necessary.

#### The Adding Interferometer

The beamwidth of an antenna is related to its size compared with the wavelength of operation. In order to make the beam narrower, the physical size of the antenna must be increased. Development in this direction is, however, likely to be limited by the available space and by the probable requirement that this space also be available to oneself and/or one's family for non-astronomical applications. A way out of this problem is offered by the radio interferometer. This device consists of two antennas, separated by a distance in the East-West direction, feeding a common receiver. Figure 3 shows a block diagram of such an interferometer. This type of instrument is known as an adding interferometer. The response obtained from the transit of a point source would appear as shown in Figure 4. The width of one of the interference fringes is given by

$$\theta \text{ (degrees)} = 57\lambda/d$$

where  $\lambda$  is the wavelength of operation and  $d$  is the East-West separation of the antennas.

When an adding interferometer is used for the observation of faint discrete radio sources, two problems are encountered. Firstly, as fainter sources are investigated, the background radiation due to the galactic continuum radiation becomes an embarrassment. Although only point sources will yield fringe patterns, the galactic radiation will produce base-line shifts which will make observation difficult. The second problem is due to shortcomings in the receiver itself. The cosmic radio radiation is very weak, much smaller than the receiver's own internal noise, and must be amplified by a large amount ( $\approx 10^{12}$ ) before it is large enough to be used to deflect a recorder pen. It is almost impossible to prevent the gain of the system from drifting, again causing baseline wandering which would make interpretation of the results very difficult. Both these problems are largely avoided by the design variation described below.

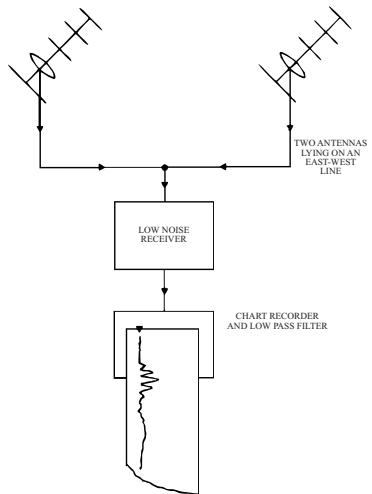


Figure 3. Block diagram of an adding interferometer.

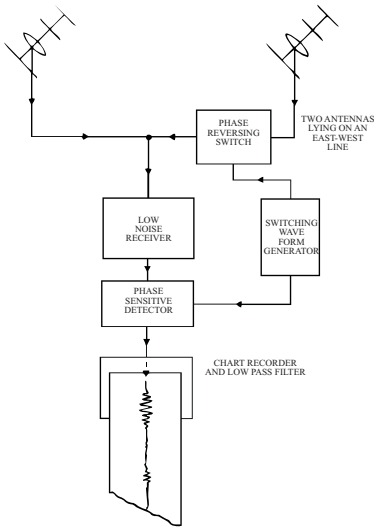


Figure 5. Block diagram of the phase-switched interferometer.

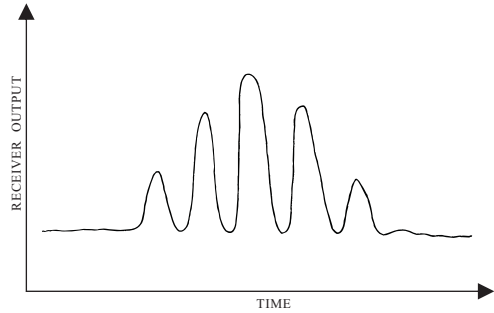


Figure 4. Response of adding interferometer to a 'point' radio source.

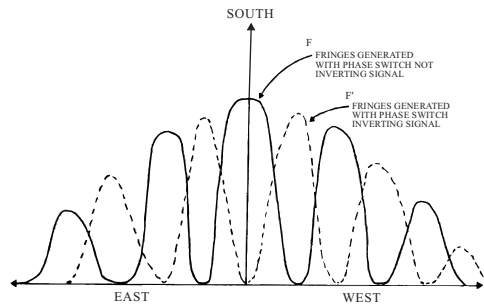


Figure 6. Phase switched interferometer fringe patterns.

### *The Phase Switched Interferometer*

A block diagram of a phase-switched interferometer is shown in Figure 5. In this type of interferometer a phase reversing switch is inserted in the cable from one of the antennas. Reversing the phase of the signal from one of the antennas has the effect of converting the maxima in the interference pattern to minima – as shown in Figure 6. The radiometer also incorporates a synchronous detector module – which is used to derive the difference between the signals received via the two fringe patterns F and F' as shown in Figure 6. Broad sources, such as the galactic continuum, fall into both sets of fringes and consequently cancel out. Thus, this type of instrument is only suitable for studies of sources which are small compared with the angular width of the fringes. In addition, because the instrument measures a difference signal, the receiver noise voltage, being common to both receiver configurations, cancels out. This minimises the consequences of gain variations – and in the absence of any point sources the output of the radiometer is zero. The passage of sources through the fringe pattern produces the traces shown in Figure 7. An instrument of this type is the easiest means by which the amateur may obtain useful results. Although the phase switched interferometer is the most complex type of radiometer yet discussed in this article, it is the most resistant to many of the problems encountered by the amateur radio astronomer. With the limited resources available, construction of stable receiving systems with a gain of  $10^{12}$  or so is difficult, and gain drift is inevitable. The instrument described above is relatively immune to this.

Unlike his professional counterpart, the amateur radio astronomer cannot pick his observing site with radio astronomy as the only consideration. Consequently the amateur radio astronomer has to contend with limited space and the proximity of sources of electrical interference. The phase switched interferometer has considerable invulnerability to these problems. Unless interference reaches both antennas, it will have little effect upon the output record – and even if it reaches both antennas, it is unlikely that it will produce a fringe pattern which might be confused with a record of a celestial source. The records shown in Figure 7

were obtained from a site close to a main road in the city of Ottawa – they are surprisingly “clean”. There are other types of radiometer, but those already described are the ones of most use to the amateur planning to operate at meter wavelengths.

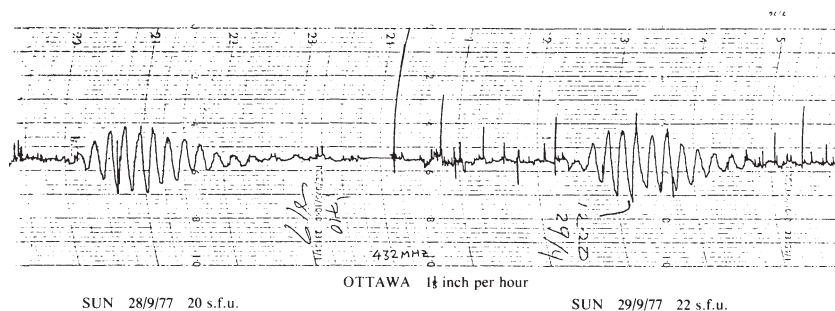


Figure 7. Recordings of sun obtained using phase switched interferometer.

*Editor's Note:* This series, which began in the February issue of the *NATIONAL NEWS-LETTER* will continue in subsequent issues. Copies of the back issues should be available on loan from the RASC Library.

## The Total Solar Eclipse of 1979, February 26

by William T. Peters

The Total Solar Eclipse of 1979 February 26 is the last in North America until 1991 July 11, when a path of totality will cross Mexico City. In 2008 a total eclipse will be visible in Canada's Arctic Islands, but the next eclipse that is easily accessible in Canada and the U.S. is one that sweeps across the U.S. from the Pacific coast to the Atlantic on 2017 August 21.

Astronomical, Meteorological and Geographical conditions coincide, to make Southern Manitoba a prime area to see the 1979 Eclipse. The accompanying map indicates the eclipse path and the Central Standard Times of mid Totality along the path. As the shadow of the moon sweeps eastward into Manitoba it will cover observers on the centre line for  $2^m 48^s$ , as the shadow leaves Manitoba totality will be  $2^m 49^s$ , the maximum possible for this eclipse. In addition the altitude of the sun will be favorable in Manitoba,  $25^\circ$  as the shadow enters the province and  $26^\circ$ , again the maximum for this eclipse, as it moves into Ontario. Portage La Prairie can expect about  $2^m 30^s$  of totality and Winnipeg  $1^m 20^s$ .

Since the Astronomical conditions are good across Manitoba, site selection is best made on the basis meteorological prospects and physical convenience. Jay Anderson of the Winnipeg Weather Office has provided a preliminary climatological forecast for eclipse day. Here are some of his results for locations along the eclipse path:

	Cloud Cover % Probability of:		Mean Wind Speed Knots	Mean Temp. at Mid Eclipse
	80–100%	0–20%		
Brandon	55	25	15–20	$-10^\circ\text{C}$
Gladstone	55	27	15–20	$-12^\circ\text{C}$
Portage	55	27	15–20	$-12^\circ\text{C}$
Winnipeg	50	30	15–20	$-12^\circ\text{C}$
Hecla	45	32	10–15	$-12^\circ\text{C}$

Adding the value for each place in the first two columns indicates roughly a 20% probability of 20% to 80% cloud cover. This confirms my impression as a relative newcomer to this region, and the experience of longtime Manitobans. If it is clear it is likely to be one of those stunning Prairie days when the deep blue of the zenith barely softens as you look down to the horizon. If it is cloudy, look for an airplane. Few days are in between. The anniversary preceding the eclipse was one of these relatively rare days. In Winnipeg at 11:00 a.m. the sun was casting

strong shadows, but thin, high altitude clouds marred the blue sky and caused a bright aureola around the sun.

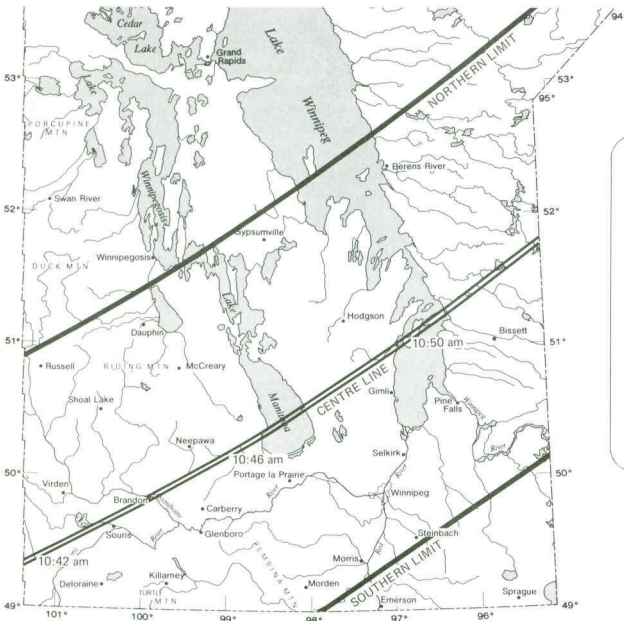
Brandon is the most interesting potential site. It is right on the eclipse path, and it provides all the services and convenience of a city of 60,000. The Trans-Canada Highway, which runs through Brandon and stays close to the centre line for over 100 miles, provides a good route to search for holes if the eclipse day is cloudy. This highway is very well maintained and the winter driving conditions are good. In Winnipeg the Manitoba Department of Highways provides road information at 204-946-7192, in Brandon at 725-1590 and in Arborg at 367-5221. Paved rural highways are usually blown clear of snow. They can be safely travelled without snowtires. Unpaved roads should be avoided unless they are known to be well maintained for winter driving, such as the stretch of road from Riverton, across the causeway to Gull Harbor on Hecla Island in Lake Winnipeg.

For information about accommodation at any of the places in the Eclipse path, contact:

Manitoba Government Travel  
Marketing Branch  
304-200 Vaughan Street  
Winnipeg, Manitoba  
R3C 1T5

Recently I visited the Hecla area seeking possible sites. The Gull Harbor Lodge on Hecla Island provides superb accommodation. Tall trees near the lodge make it necessary to move to either the town of Hecla, or to Gull Harbor to see the eclipse. In both places there are large open areas suitable for observing. At Gull Harbor, telescopes could be set up on the snow covered ice of Lake Winnipeg. At Hecla, the road runs along the Lake shore, providing a fine view across the lake. This would be a good spot to try observing the moon's shadow sweeping across the ice. Arborg has two motels, restaurants, grocery stores, car service and a hardware store available. It too looks like a good location.

The Winnipeg Centre of the RASC has established an eclipse committee to assist visitors and organize observations. The chairman is Mr. Daniel Wright, 264 Winterton Aye, Winnipeg, Manitoba R2K 1K1 (204-667-8875).



**MANITOBA**

MILES 0 10 20 30 40 50 60 70 80 90 100  
KILOMETRES 0 10 20 30 40 50 60 70 80 90 100

THE TOTAL SOLAR ECLIPSE  
OF 1979 FEBRUARY 26

Map plotted by W. T. Peters  
at  
THE MANITOBA PLANETARIUM  
190 Rupert Ave. at Main St.  
Winnipeg, Manitoba

In addition to the places listed on this map, Gladstone, Arborg, Riverton, Hecla and Gull Harbor are close to the centre line. The times are Central Standard Times of mid-totality.

Dan and the other Winnipeg Centre members will be happy to provide site information and other assistance to visitors.

Two charter flights to Manitoba are already being organized.

The Toronto Centre is organizing a one-day flight which will depart from Toronto International Airport at 7:00 a.m. EST eclipse day. According to present plans the flight will arrive in Brandon at 8:30 a.m. CST, leaving lots of time to set up equipment at the airport, or possibly bus to a better site. The flight will depart for Toronto around 14:00 hrs. CST. If clouds interfere the charter plane will be flown up the eclipse path, so this flight practically guarantees a look at totality. For more information contact Mr. Mike Watson, Solar Eclipse Committee, 200 Millwood Road, Toronto, Ontario M4S 1J7 (416-481-5912). The charge for this flight is \$150.00 with the likelihood of a rebate to passengers after all the bills are paid.

Recently, Peter Twentus was in Winnipeg and Brandon, checking out sites for a charter being organized in conjunction with the Warren Astronomical Society and the Astronomical League. Mr. Twentus can be reached at 22107 Melrose Court, East Detroit, Michigan, (313-771-3283). This expedition will provide a group flight from Detroit, Michigan or Windsor, Ontario to Winnipeg with bus connections to a prime observing site along the eclipse path, likely in Brandon. Hotel accommodation and some meals will be provided.

The Manitoba Planetarium is producing a spectacular Eclipse Special which is due to premier in October 1978. In addition the Planetarium's solar telescope provides an excellent means of keeping track of solar activity on the days preceding the eclipse.

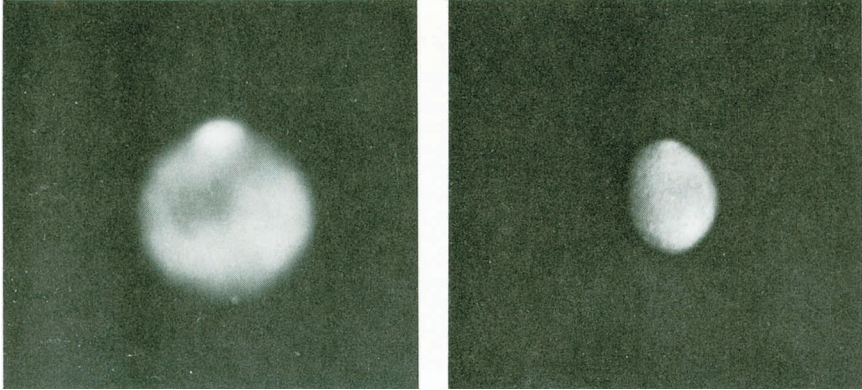
For general information about observing the eclipse in Manitoba, or arranging group bookings for the Planetarium's Eclipse Special, I may be contacted at:

The Manitoba Planetarium  
190 Rupert Avenue at Main Street  
Winnipeg, Manitoba R3B 0N2  
(204-956-2830 ext. 127)



Photograph of the Sagittarius region taken by Mark Sinkins, London Centre. Mark and Dale Armstrong are involved in a photographic project concentrating on deep sky objects in wide-field. This photograph, reproduced from a colour slide, was taken at a farm location near London with a Cannon camera, 50 mm f/1.8 lens piggybacked on a Dynamax telescope: exposure on Fujichrome 100 film, ten minutes. The streaks at the bottom corner were caused by car headlights. Mark and Dale plan to enter the Edmonton Centre observing competition, where the original will be exhibited.

*Mars Photographed at 1971 Opposition*



Two photographs of planet Mars taken by Roy Belfield, President of Winnipeg Centre. Left; Tri-X film, 3 minutes exposure. Right; Plus-X film, 3 minutes exposure. Both taken with Celestron C-8 telescope, eyepiece projection with 12 mm Kellner ocular.

**R.A.S.C. General Assembly, Edmonton, May 19–22**

Time is getting very short for advising our hosts at Edmonton that we'll be with them. In case you missed or filed your February *NATIONAL NEWSLETTER*, the coupon for registration is reprinted below. Let's all meet "eyeball" as our friends in the Amateur Radio fraternity say, at Edmonton next month.

R.A.S.C. General Assembly  
Edmonton, May 19–22, 1978

Mail to: Mr. Rick Newman  
c/o Queen Elizabeth Planetarium  
Edmonton, Alberta

Names(s) .....

Address: .....

Number in your party .....

University Accommodation?    Yes..... No.....

Other Accommodation?        Yes..... No.....

RASC members are reminded that travel assistance may be available from National Headquarters through your local Centre, if you are attending the General Assembly.