NATIONAL NEWSLETTER

December 1976

Celeste Peters, Robert Pike, Steve Morris, and Keith Hadley (trying to save his dark adaption) use the 10-inch F/16 Cave Cassegrain telescope in Toronto Centre's new observatory. The observatory was built by Centre members on land near Schomberg, Ontario, loaned by Rick and Rosemary Kelsch. The telescope is courtesy of the Ontario Science Centre. Photo by Bill Peters.

NATIONAL NEWSLETTER

December 1976

Editor: HARLAN CREIGHTON

Assistant Editors: MARIE FIDLER / NORMAN GREEN / J.F. HEARD / CELESTE PETERS

Western Regional Editor: PAUL DEANS, 10707 UNIVERSITY AVE., EDMONTON, ALBERTA T6E 4P8

Art Director: BILL IRELAND

Please submit all material and communications to:

THE NATIONAL NEWSLETTER
c/o William T. Peters
McLaughlin Planetarium
100 Queen's Park
Toronto, Ontario
M5S 2C6

Deadline is two months prior to the month of issue.

John Frederick Heard

It is with sorrow and deep regret that we learned recently of the death of Dr. John Frederick Heard.

Dr. Heard suffered a severe heart attack several years ago, but after recovery he continued his research career with the usual vigour. A further attack early last summer incapacitated him only for a short time, but a third attack on October 5th proved fatal.

Dr. Heard played an active role in the Society for more than thirty-five years. He held numerous offices, including those of National President and National Treasurer. For the past several years, he served as an Assistant Editor of the *NATIONAL NEWSLETTER*.

He was one of the small group of astronomers that formed the original staff of the David Dunlap Observatory when it opened in 1935. From 1952 to 1965, he was Director of the Observatory and Head of the Department of Astronomy of the University of Toronto. From 1965 until his death, he continued his research as Chant Professor of Astronomy.

Anyone who met Dr. Heard was immediately aware of a feeling of warm friendship. He had a concern for all about him, and revealed this quality of life by his involvement in community activities beyond the professional sphere. Teacher, author, scientist, Christian gentleman, raconteur – Dr. Heard was all of these and more. As a professional astronomer, he will be missed as one of a worldwide fellowship; as a personal friend, he will be missed by an even more numerous multitude.

A full obituary will appear in the February issue of the *JOURNAL*.

Ken Chilton

As this issue went to press, the editors were saddened to learn of the death, on November 14, of Mr. Kenneth E. Chilton, after a long illness. Mr. Chilton was an active member of the Hamilton Centre, having held many offices, including that of president. He was also an active organizer of national observing programmes. At the time of his death, he was the treasurer of the Hamilton Centre, and publisher of the Centre's newsletter, *Orbit*.

The Society extends its deepest sympathies to his family at this time.

A full obituary will appear in the April issue of the *JOURNAL*.

Editorial

I find it hard to believe that this is the last issue of the *NATIONAL NEWSLETTER* for 1976. How time flies! I hope that all members have enjoyed reading the *NEWSLETTER* as much as the editorial staff has enjoyed producing it.

This year, there have been more pages to the *NATIONAL NEWSLETTER* than ever before. There are a number of reasons for this. First, I wish to acknowledge with sincere appreciation the support, encouragement and assistance of the members of National Council. Special thanks are due to Dr. Lloyd Higgs, Chairman of the Society's Editing Committee, and to Dr. J. D. Fernie, Immediate Past President, for their interest and assistance.

Second, more members than ever before have provided material for publication. To all those members who have contributed in any way, I wish to extend my thanks for your participation.

Third, a great deal of assistance has come from Mr. Jan Davidse and the staff of the University of Toronto Press. Their many helpful suggestions and superb workmanship have been greatly appreciated.

And last, but not least, I wish to express my sincere gratitude to those who have served on the Editorial Committee of the *NEWSLETTER*: Assistant Editors Marie Fidler, Norman Green, Bill Peters, Celeste Peters, and the late Dr. J. F. Heard; Western Regional Editor Paul Deans; and our artist, Bill Ireland. Each of these people has contributed an astronomical amount of time, talent and effort to the *NEWSLETTER*. To them must go a large share of the credit for this year's "yellow pages".

In closing, I wish to extend to all members and their families the best wishes of the editorial staff for a very Merry Christmas and a happy and prosperous 1977.

Harlan Creighton Editor

Where to go and how to get there . . .

by John R. Percy

The National Council of our Society has recently established a committee, with the undersigned as chairman, to consider *the long-term goals of the Society and its Centres, and the relationship of these goals to the finances of the Society*. By the time this note appears in print, I shall have sent a more detailed notice to the presidents and secretaries of the Centres. I urge them to discuss "goals" at their council meetings, and send me their views. I also urge unattached members, and other individual members, to feel free to write to me about this important matter if they wish. It would be helpful for them to read some recent annual reports of the Society; these are published in the annual supplement to the *JOURNAL*.

The major sources of income of the Society are (i) membership fees, (ii) publications (sales, page charges, government grants), (iii) interest on investments. The major expenditures of the Society are (i) rebates of membership fees to centres to support local activities, (ii) publications (printing and mailing), (iii) rental and maintenance of a national office and (iv) salary of an executive secretary.

Among the questions which our committee might consider are the following. Why do people join the Society? How can membership be retained and increased? What are the long-term goals and aspirations of the Centres? Are the relationships between the Centres and the Society adequate: should they be looser or stronger? Are the present services of the Society (publications, library, national meetings, secretariat) to its members adequate? Should publications be expanded, both in number and in circulation? Should the Society embark on new programmes in the educational or observational areas? What fees, what division of fees between Society and Centres, and what investment strategy would best meet these goals now and in the future? What new sources of income might the Society develop?

My committee hopes to hear from the Centres by *mid-January 1977*, to report to National Council in the spring, and to report to the membership of the Society at the 1977 General Assembly in Toronto. My address is: Department of Astronomy, University of Toronto, Toronto, Ontario, M55 1A7.

Due$ Due

All members are reminded that their 1977 fees were due on October 1, 1976. Members of Centres should remit directly to their Centre's Treasurer; unattached members should send their fees to the National Office, 124 Merton Street, Toronto, Ontario M4S 2Z2. Please include apartment numbers and your postal code.

Fees are $12.50 for regular members and $7.50 for members *under the age of 18 years* as of October 1, with proof of age required to be eligible for the student rate. As well, some Centres have special fees in addition to the above. Please consult your local Treasurer for further details.

Treasurers of Centres are reminded that all membership fees received up to December 31 must reach the National Office by January 15 in order to permit membership lists to be updated in time to mail the February issue of the *JOURNAL*. It will not be possible to retain membership and receive the publications of the Society unless such fees are received by January 15.

Nominations for RASC Executive and Council 1977-1978

The By-Laws of the Society provide for a Nominating Committee composed of the three surviving immediate past presidents, whose duty it is to prepare a slate of candidates for the offices of the Society.

During the General Assembly next summer, we must elect the following officer: Secretary. If any member wishes to make suggestions in this regard, he should contact the committee Chairman, Dr. J. D. Fernie, c/o The National Office, 124 Merton Street, Toronto, Ontario, M4S 2Z2.

As well, the By-Laws provide that "any five members of the Society, in good standing, may nominate additional candidates for any office, provided that such nomination, accompanied by a letter of acceptance from the nominee shall be received by the Secretary of the Society, not less than sixty days before the date of the annual meeting."

It would be appreciated if any nominations and/or suggestions were submitted no later than April 1, 1977 to allow for the printing and mailing of ballots.

Full details pertaining to nominations are outlined in By-Law 1, Article 11(a), as published in the June, 1969 *JOURNAL*, pages 155–168.

Astronomy Book Display Available

Sir John Herschel's *Astronomy*, Simon Newcomb's *Astronomy For Everybody*, Percival Lowell's *Mars and Its Canals* – although many of us have heard of these now rare classics, few of us have been lucky enough actually to see copies of them.

Members who attended the May 1976 General Assembly held at Calgary, however, will remember the eye-catching display of fine old editions of books on astronomy, part of a large and very beautiful collection assembled over the past few years by Professor J. E. Kennedy of the University of Saskatchewan.

Now R.A.S.C. centre members who would like a closer look at these epoch-making works will be given an opportunity to enjoy them at close hand. Professor Kennedy has very kindly offered to make a selection of books from his collection available on loan as a travelling exhibit.

Centres interested in obtaining this distinctive exhibit for display (perhaps in a suitable space provided by either a university or public library) should contact:

Professor J. E. Kennedy
Assistant Dean of Arts and Science
Room 236, Arts Building
University of Saskatchewan
SASKATOON, Saskatchewan S7N 0W0

Stars and Pseudostars

By Roy L. Bishop

Maktomkus Observatory

It has been recognized for more than a century that the human eye is one device in bright light and a quite different device in dim light. In the latter instance there is no color response and visual acuity is relatively poor. As a consequence, when observing the night sky all objects but the brightest stars display only various intensities of white, and the shape and structure of galaxies and gas clouds are difficult to discern. Also, dim sources of light of small angular extent (point-like) will give the same response in the eye-brain system as will a distant star.

This past August I experienced the remarkable visual similarity of tiny, nearby, dim sources of light to the stars in a memorable way. I was on a small yawl anchored in a secluded cove on Mahone Bay. The night was clear and dark with the Milky Way glowing above the silhouetted evergreens. In the sea were many star-like points of light — some steady and some blinking off and on. The steady ones were stars reflecting in the mirror-like water. The others were phosphorescent plankton, microscopic creatures nearby but which gave nearly the same visual impact as the reflections of first magnitude stars. A careful search with a plastic cup and flashlight was inconclusive: a few, very tiny, transparent creatures peered back at me but I could not be certain if they were the ones responsible for the transient bursts of photons.

Not being one to pass up an opportunity, I left my worldly possessions behind, lowered myself into the Atlantic, and enjoyed a cold few minutes swimming among these pseudostars. In the turbulence the phosphoresence was much more pronounced. Kicking my feet in the inky depths beneath produced an array of sparkles and glow not unlike that of a rich cluster of stars embedded in glowing gas. The time scale was, of course, sped up by perhaps fifteen orders of magnitude, but then that must be one of the fringe benefits of being in a position to create such a cluster of stars.

Reprinted from *Nova Notes*, Halifax Centre

Catadioptric Telescope Systems-II

By Jack Winzer
Edmonton Centre

(2) The Schmidt:

The classical Schmidt telescope, or more properly the Schmidt camera, as it is virtually impossible to use the instrument as a telescope, refers to the type of instrument first produced by Bernhard Schmidt in 1930. For the story of the first Schmidt, and a history of the inventor himself, the reader is referred to the interesting account by Hodges in *Amateur Telescope Making*, volume 3 (page 365).

The Schmidt camera utilizes the fact that a spherical mirror has no axis of rotation in the sense that other conic sections do, and hence has no coma or astigmatism. A spherical mirror, however, does have spherical aberration and field curvature, both of which depend only on the curvature (F/number) of the mirror. The spherical aberration can be eliminated by adding a zero-power aspheric correcting lens. The introduction of such a lens, however, defines an axis to the system and introduces both coma and astigmatism, unless the lens is placed at the *centre of curvature* of the primary mirror. Thus, if we use a spherical mirror with an aspheric corrector plate placed at its centre of curvature, we have the classical Schmidt camera. There are a number of other optical systems also called Schmidt telescopes by virtue of using an aspheric corrector in conjunction with a spherical or near-spherical primary mirror. These are not true Schmidts, but they will nevertheless be included in the present discussion.

(a) The Classical Schmidt:

As the techniques for designing and producing a Schmidt camera are well documented elsewhere (see, for example, the articles by Paul and by Hendrix and Christie in *Amateur Telescope Making*, volume 3, pages 323 and 354 respectively), the present discussion will be kept to a minimum.

For the purpose of this presentation, the example of an 8-inch F/3 Schmidt camera illustrated in figure 2 will be used. The designation "8-inch" refers to the clear aperture of the correcting plate. As can be seen from the figure, the primary mirror is considerably larger. This is necessary to minimize the vignetting (non-uniform field illumination). For an unvignetted field of linear diameter ϕ, the diameter of the primary mirror D for a correcting plate of diameter d is given by the formula:

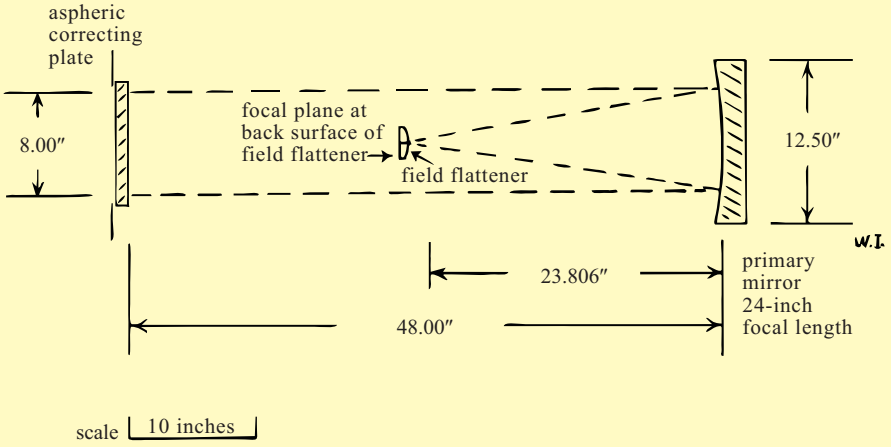
$$D = d = 2\,\phi$$

In the case of our 8-inch F/3, assuming a 2-inch unvignetted field, the primary should be at least 12 inches in diameter. Herein we see one of the disadvantages of the Schmidt design: the tremendous loss in light gathering power of the primary mirror.

A second important disadvantage is seen in the placement of the corrector at the center of the curvature of the primary mirror. As the centre of curvature is twice the focal length distant from the primary mirror, the Schmidt camera is over twice as long as, say, a comparable Newtonian. In the present example, although the focal length is only 24 inches, the overall telescope length is 48 inches.

FIG. 2–The classical Schmidt design.

(a) Diagram of the optical system drawn to scale for a nominal 8-inch F/3 camera.

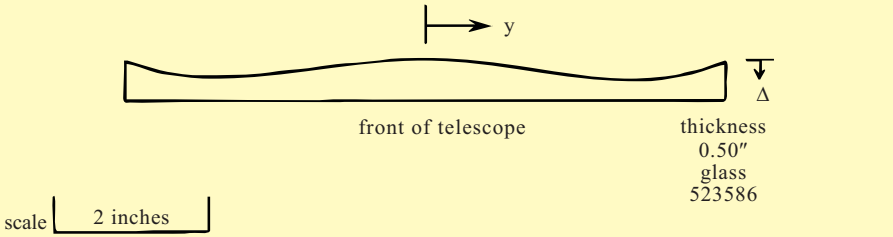


The figure of the aspheric corrector plate (shown in figure 2b) is described by a fourth-order mathematical equation of the form:

$$\Delta = ay^4 + by^2$$

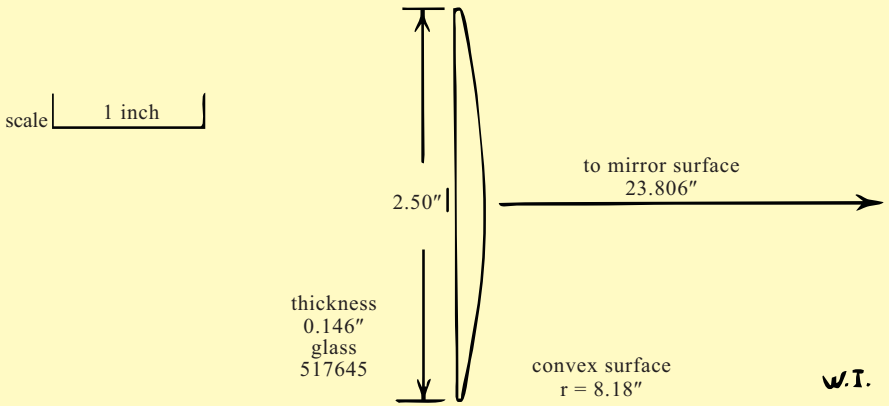
where Δ is the deviation of the surface from flat at distance y from the center. The numbers "a" and "b" (in the present example 3.458×10^{-5} and -5.53×10^{-4} respectively) determine the shape of the curve.

(b) The figure on the aspheric corrector lens (magnified by a factor of 100).



$$\Delta = 3.458 \times 10^{-5}\, y^4 - 5.53 \times 10^{-4}\, y^2 \text{ inches}$$

(c) The field flattener.



The first number “a” actually provides the shape necessary to correct for spherical aberration, while the second number “b” modifies the shape to give a curve that is easier to produce. The aspheric figure is not a shape that can be obtained by direct polishing, but rather requires complicated and tedious localized figuring. However, this is true of any aspheric surface (including a parabola). The corrector improves star images by about a factor of 100. For an uncorrected spherical F13, the images would be about 60 seconds in diameter. The correcting plate reduces these to about 0.6 seconds. But there is a limit. If we had constructed an F/1.5 Schmidt, the uncorrected images would be about 500 seconds in diameter, and the corrected images 5 seconds or about 8 times worse than the theoretical resolving power. The problem lies in the introduction of high order aberrations by the aspheric corrector. The limiting F/ratio for a Schmidt is about F/2, although if image quality is not a prime requisite, a faster F/ratio can be used.

There is a third disadvantage to the Schmidt; namely, that the field of best definition is curved with a radius equal to the focal length. This curvature can be corrected either by bending the film over a suitably shaped holder, or by use of a field flattener. A flattener has been included in the present example and is seen (figure 2c) to be a simple plano-convex lens, with the convex curve having a radius approximately 1/3 of the radius of the field curvature. Such a lens will introduce additional light loss and aberration.

Although there are these difficulties with the Schmidt system, the advantages must not be forgotten. The 8-inch Schmidt discussed here is capable of producing almost resolution limited images over a field some 6 degrees in diameter. This is a feat that cannot be accomplished by any other optical system. Nor can the basic simplicity of the system be ignored. The Schmidt is composed of a total of two optical elements: a spherical mirror which is the easiest of all optical elements to produce, and an aspheric correcting plate that is almost indistinguishable from a flat piece of glass. Compare the simplicity of the Schmidt to any camera lens which would have at least twice as many elements yet give images an order of magnitude worse. The Schmidt camera is truly a remarkable device.

Let us Now Praise Famous Men

by Frank Shinn

Winnipeg Centre

Ecclesiasticus xliv, verse 1 begins with our title, and continues in part; "such as found out musical tunes, ** living peaceably in their habitation ** that have left their name behind them."

There is one amongst us who had created a certain 6-inch telescope, and was engaged in viewing the heavens. And there was at a neighbour's house one who performed upon the piano, an instrument of eighty-eight keys, but whose profession it was to instruct those who were interested in viewing the heavens.

He who performed upon the musical instrument, hearing that there was an interested amateur near at hand, did invite him that he should join the Royal Astronomical Society of Canada, and he did so.

The name of him who performed upon the musical strings was Robert Lockhart, Professor of Astronomy at the University of Manitoba. And the name of him whose amateur interest in the heavens caused that he be invited to join the Society was B. Franklyn Shinn of the same province. He who played is with us no more, but his memory lives with him who viewed the heavens.

I could continue, with much labour, in the same vein as the above, but please let me make it much easier for myself. I just want this opportunity to express a word or two of gratitude to the Great Men and Women that Bob Lockhart introduced me to when he gave me the chance to join the Society.

From time to time I must confess to a twinge of fear: fear that our professional friends may begin to feel that the RASC would like to become a strictly amateur organization, concentrating on the problems and interests of the little guys like me. I have a feeling that there must be times when they feel that perhaps they have something more important to do with their time than attend Council Meetings and try diplomatically to iron out those administrative problems that always beset a group of people who by the natural diversity of their backgrounds see different roads down which they would lead the group.

Time brought me the *JOURNAL*. The first few copies sailed completely over my head. After a few months, – or was it years? – I began to get some idea of what it was all about. Then, in fear and trembling, at National Assemblies I began to ask some of the experts in certain fields questions about some aspect of their specialty that was puzzling me. I found that I need have no fear. They were only too ready to help with answers, and I began to realize that not only were they learned men, they were willing to treat me as if somehow I had earned the right to be considered a colleague.

As time went on I found a list had been published of those engaged in astronomy and allied fields. As I was on the staff of the Planetarium by then, I found my name listed among them. This was not by any earned status of mine, but solely an accident of fate. I am still the rankest amateur in astronomical matters, but the Ladies and Gentlemen of the RASC's Professional Ranks have never treated me as such. I have found myself amongst the greatest persons I could hope to meet.

It would be very dangerous to name names, though faces and names keep passing before me as I write. That doesn't happen easily to me, as I so frequently can't recall names. I have, of course, as most of you have, a file of photographs of people on the steps of various buildings spread across this country of ours. Each photograph contains faces and faces. In each face there is a smile, for National Assemblies are happy affairs.

But the warmth of the smile on those faces is nothing to the warmth of the smile on the faces I recall as they swim before me in memory, faces of those whom I never expected to count as friends, yet in their kindly tolerance of my amateurism I am sure they are happy to be called my friends.

And I am honoured beyond all hope or expectation thereby.

One of the reasons that National Assemblies are in all our recollections as happy events is simply that the delegates, with only very few minor exceptions, are so tolerant of the mishaps that occur in any plan, so willing to adjust to the exigencies of the moment, to "take-it-in-their-stride". That was so obvious to those of us on the Committee in Winnipeg a few years ago.

And I think it is only indicative of the noble people they are that any complaints do not come from them, but from some of us tiny little folk.

I thank God that He not only created a Universe in which astronomically speaking man is a nonentity, but he also created a Universe in which Man is the Astronomer.

And I do hope that somehow we can keep these Famous Men and Famous Women in our ranks. If we don't it will be our faults!

However, even if that hope isn't realized, my experience tells me that they won't be too far away to lend a helping hand if we need it.

The whole human race needs people of their stature.

Letter to the Editor

Dear Mr. Creighton:

Re: your inquiry about the *NEWSLETTER*'s new look – I do like the Planefield India – very posh and seems to carry a certain dignified authority with it. I can't tell why, it just seems to affect me that way.

I have had a great deal of pleasure reading the *JOURNAL, 'SCOPE*, the *NEWSLETTER* and of course your articles, etc. since first joining the R.A.S.C. in 1962.

Would you be interested in publishing the enclosed *Total Lunar Eclipse* in the Newsletter? It has been steaming in my head since I first saw a total eclipse of the moon. It finally jelled about a month ago.

My verses are usually sent out to various magazines even though they are sometimes on astronomical subjects but this time I thought of the *NEWSLETTER*. The total lunar eclipses I have been lucky enough to observe have greatly impressed me and I just hoped to convey a little of the beauty I saw (Unfortunately one can only approximate this.)

Sincerely,
Doris L. Cooper,
Courtnay Farm, R.R. #1,
Midhurst, Ontario L0L 1X0
May 19/76.

Ed. Note: Thanks for your kind words. We are pleased to publish your poem, below:

TOTAL LUNAR ECLIPSE
By Doris L. Cooper

Silver sailing was your game
until tonight
but look now,
earth's shadow touches your silver,
slowly encroaches again
and again.
You are bulging now,
pregnant with saffron glow,
and for awhile I shout inside
with silent delight.
You hang in the black sky
an incredible rosy bauble,
fit plaything for a faery child
of outer space.

L82

Skies over Labrador

By Dora Russel
St. John's Centre

We were tracking, single file, over the snow. It was early March, and by now I had been in Northwest River, Labrador, for three days, to attend my daughter's wedding.

I hadn't exactly been sitting on my backside all the time. Even visiting mothers are expected to pitch in and do their share, when the event is a wedding.

Doing my share seemed to involve a great deal of plunging about through snow. The spring snow lacked firmness. It was beginning to soften and sink, a trap for the unwary tenderfoot. I had by this time begun to develop something of an instinct for the true path, which had come to me through repeated flounderings and sinkings into the much softer drifts that flanked the path.

Indeed, with experience, one learned to carry on a satisfactory three-way conversation while walking in single file, and I greatly admired, even if I could never acquire, the knack the livyers had of throwing the words back and forth through their teeth, so that they landed, like an aimed missile, straight at the listener's ear.

* * * *

"The Lights are good tonight," came to me, whether from for'ard or stern, I couldn't say. Of course, I had already discovered the miracle of the Lights, and had missed my footing repeatedly because of them.

They were better than good. They were most beautiful, far beyond anything I had ever seen of them before.

The Northern Lights can come in many ways. They can come as a ghost in the night, tantalizing fancies of their true forms. You are looking at flimsy clouds or distant fog, you decide, and not until you notice that you can still see the stars shining through the haze are you aware that you are looking at an aurora. As you watch, this diffuse illumination shifts and glows. Usually, the lights are white, but often they show varying shades of yellows, reds and greens.

They can come, slithering across the sky, pushing out a shy, coloured ray to the zenith, drawing it back again nervously. Other times, they are in feverish haste, darting back and forth, shooting out sharp fingers of light, or sending out streamers and beams that remind one of searchlights criss-crossing the sky.

They can come in great waves like the surging sea. Or they can come as I saw them then, a vast glow of white light that spread from east to west like a giant rainbow. Along its path shot out smaller arcs of light, spreading upwards and outward; sharp like icicles, pointed like moon mountains.

Another year I was to see them more in keeping with their summer surroundings; softer, subtler, more gently waving. They started as a long glowing ribbon of light about five degrees wide, stretching across the sky from north to south, like the ghost of a Milky Way. The band broke up into shimmering shoots of pale green light which spiralled upwards, spreading insidiously until the entire sky was covered. Through them shimmered the brighter stars, no less glorious than the lights that wrapped them in gentle, warm beauty.

One felt one was standing in the centre of a vortex of spiralling lights, and looking up to the zenith it seemed one was being drawn upward, being sucked up into that ever-glowing, swiftly changing vortex.

Did I ever hear them crackle? I would dearly love to say I did, but no, they were silent. However, the trappers declare they have often heard them.

These, say the Eskimos, are torches held by spirit hands. These torches light the way to a Better Beyond, when the spirits come to seek the souls of those who have passed away.

* * * *

It was not until the night of the wedding that I had my first really good opportunity to look at the heavens. Everybody was energetically stomping out the measures of a Newfoundland Set to the full-blooded rhythm of four lusty guitars. And where was I?

Out, staring at stars. Like Robert Frost:

But no, I was out for stars:
I would not come in.
I meant not, even if asked,
And I hadn't been.

Nobody missed me. Nobody would miss me. I was only the mother of the bride, no longer capable of rioting through the lengthy measures of the square dance. In defense of my aging bones, I might say that in Labrador, as in most parts of the province, the success of a wedding is judged by the length of time it is "kept up", sometimes for days. While such a feat of endurance as this would impose on me was not altogether beyond me, I was, shall we say, ill-prepared to cope with it.

I had just stopped outside for a breath of air, and also as an excuse to pass more closely by a group of chittering Montaignais youths. The stars looked as if they had been splashed on by the lavish hand of a tipsy painter. They did not twinkle, so still was the atmosphere, and I might have been looking at 3000 planets.

I thought of my binoculars. Rummaging in my capacious bag, I managed to extricate them. They had become entangled with a corsage of artificial pink mums, which I had impatiently whisked off as a piece of superfluous finery.

I was delighted with the richness and variety the heavens offered me, for into my field of view leaped literally thousands of stars. I hadn't felt so delighted since a Northern Downy woodpecker entertained me in my garden some months before.

Binoculars at a wedding? Why not? I warrant stranger things have been brought to weddings in mothers' handbags!

Refractor vs Reflector

By Roy L. Bishop
Maktomkus Observatory

One of the perennial topics amongst amateur astronomers must be that of refractor versus reflector. I shall enter the fray by stating two facts (biased opinions?), and then present arguments to support these facts.

Facts

1. For apertures less than 15 cm (That's 6 inches for those who also object to kilo-Pascals.) the refractor is better. For the apartment astronomer and field naturalist this is the ideal instrument.
2. For apertures 15 cm and larger, the reflector is supreme. For the amateur who wants to resolve globular clusters, locate Pluto, and really see the galaxies this is the way to go.

Arguments:

1. In small apertures the refractor and the reflector are of comparable overall size, so this is not a determining factor. However, the refractor's superior image quality (due to the closed tube and to the absence of diffraction around obstructions in the light path) and relative freedom from maintenance (no mirrors to recoat or align) make it the preferred instrument by far.

   In summary: Image quality, convenience, and ruggedness favor the small refractor.

2. In apertures of 15 cm and above the refractor no longer has the edge on image quality. The culprit is the residual chromatic aberration of the large refractor objective. Long focus refractors (F/l5 to F/20) of two or three times 5-cm aperture can perform well, but such "cannons" are neither physically nor financially manageable by amateur astronomers. In contrast the mirrors of the reflector are perfectly achromatic, and the overall size of even a 30-cm reflector can be kept within reasonable limits. Both of these latter points make the reflector ideal for photography (no color aberration and low F-number), while the relatively short focal length facilitates wide fields of view. Another non-trivial consideration is that the sales tax on a large refractor will buy a reflector of equivalent performance!

   What of the reflector's open tube and obstructions in the light path? These are still present, but in a well designed tube (for example: square, wood, with ven-

tilation) and a focal ratio of 8 or 10 (to permit the use of a small secondary mirror), the insult to image quality is almost negligible. The thin lens of Schmidt or Maksutov type reflectors provides a closed tube, protection for the mirror surfaces, and a transparent secondary mirror support, but diffraction around the relatively large secondary and slight colour error are minor problems.

In summary : Achromatism, compactness, and economy favor the large reflector.

Roy L. Bishop
Maktomkus Observatory
Reprinted from *Nova Notes*, Halifax Centre

Astronomy Update

By D. P. Hube

Edmonton Centre

Recent Results of Research in Astronomy

To date it has been possible to determine initial orbits for only three recovered meteorites. This was possible for the Pribham and Lost City meteorites because both were recorded by meteor camera networks and their atmospheric trajectories were directly deduced from photographs. For the third, a chondritic meteorite which fell in the state of Kansas in June, 1890, it was necessary to make use of extensive newspaper reports of sightings. The orbit of the Kansas meteorite turns out to have been similar to that of the Apollo asteroids: high eccentricity and a perihelion within the Earth's orbit. The paucity of nuclear tracks in this object indicates that it was exposed to galactic cosmic radiation for only about 25,000 years. It has been concluded that the meteorite was probably a fragment of an Apollo asteroid which was at least partially broken apart about 25,000 years ago, presumably as a result of a collision with another object. [*Icarus* **28**, 307, 1976]

Measurements from Mariner 10 revealed that Mercury has a dipole magnetic field with an intensity of, at most, 0.001 that of the Earth's field. Either the field is produced by a presently active dynamo in a liquid core, or it is a remanent field. A remanent field, in turn, could have resulted from an active dynamo in an early stage in the planet's evolution which has since ceased operating, or it could have resulted from exposure to a strong external field. For various reasons (e.g., the bombardment which cratered the surface would have made retention of a uniform, dipolar remanent field very difficult), it is believed that the field is due to a presently operating dynamo. Only more extensive exploration of Mercury will settle this question. [*Nature* **262**, 765, 1976]

During a meeting devoted to megalithic astronomy, and held during the 1976 General Assembly of the International Astronomical Union, it was revealed that one of the greatest concentrations of megalithic Indian stone monuments (circles) in North America is to be found in southern Alberta and Saskatchewan.
[*National Geographic*, to be published]

Due to planetary perturbations none of the orbital elements of the Earth remain constant with time. The same is true, of course, for the other planets. Much attention is being devoted to these element variations because of their possible influence on the climate of our planet. The eccentricity, e, of Earth's orbit is a measure of the degree to which it differs in shape from a circle (e = 0). At present, e = 0.016 but, in fact, this quantity varies with a fairly regular period of 95,000 years. The extreme values are 0 and 0.073. The major axis of Earth's orbit revolves in space with 'periods' between 20,000 and 312,000 years. The inclination of the Earth's equator to the ecliptic (which is itself moving) varies between 22° 2′ and 24° 30′ with an average period of 41,000 years. This angle, in turn, determines the latitudes of the arctic and antarctic circles, etc., on Earth. [*Astronomy and Astrophysics* **51**, 127, 1976]

Reprinted from *Stardust*, Edmonton Centre