NOVA NOTES

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SEPT-OCT

1977 Halifax Centre Executive

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UP COMING MEETINGS:

Friday, 16 Sept.: 8:00 pm at the Nova Scotia Museum

Activities Night This month we will attempt something a little different from the usual. We have prepared a number of short quiz type activities to test and expand your knowledge of astronomy. These will range from a slide quiz where your recall of some familiar (and not so familiar) objects will be tested; a cross word puzzle; a simple lab type project where you will be introduced to a technique to deduce astronomical data. In the past meetings where the audience has had an opportunity to participate in an activity have proven very successful and we believe you will enjoy this month's meeting. This should prove a good evening for the budding astronomer. Don't forget to bring a pencil or pen.

Saturday, 17 Sept.:

Observing Meeting at Castle Frederick--possibly the first observing session at the first optical observatory in the Americas in over two hundred years. Meet at the Museum at 6:45 for directions and transportation to Falmouth. Bring your telescope and participate in this historic occasion and lets hope for clear skies!! (Stay home Mike!)

TELESCOPE CONTEST & OBSERVING MEETING

As you may be aware, the Halifax Centre now has a 6" mirror kit which we hope to covert to a working instrument in the next few weeks. This telescope will be available for loan to Centre members with those who work on it being given preference. To make this instrument of the highest quality for the money spent, we are organizing a contest for the design of components of the telescope. What we want you to do is to give us your best ideas for the construction--ones which are easily made with easily available tools from easily obtained materials. All components have to be made, so give us ideas for any single part or a design for the whole thing! Here are the general constraints:

the telescope will be an f/8,

6" Newtonian.

Other than that there are no other things to hold you back. The best suggestion received (as judged by a select panel of distinguished ATM's, namely, Mike Edwards, Peter Edwards and Walter Zukauskas) will entitle the author of the suggestion to some suitable prize which has yet to be suggested. The suggestor of the best design may even get his (or hers) mug shot printed in NN's.

How to entre you say????.....send or preferably bring your design to the next Observing Meeting at the Burke-Gaffney Observatory Saturday 24 Sept. at 8:00pm. If it is necessary to mail your design, send it to the Editor at the address given on the first page to arrive not later than the 23 Sept. The best design will be chosen at the Observers Meeting and work will commence on the telescope that evening. Why not come out and see how we go about fashoning the most accurate thing made by man's hands? Even if you have never laid your hands to a piece of glass, we can show you and let you practice in just 5 minutes...and we can probably use your help and ideas. So remember to start thinking about the contest as soon as you finish reading NN's!!!

BK

MINUTES OF THE JULY MEETING

A regular monthly meeting was held on Friday, July 15 at 8:00pm in room L155, St. Mary's Univ. Our President, Dr. David DuPuy was in the Chair.

The speaker for the evening was Dr. Roy Bishop and the title of his talk was: An 18th Century Observatory in Nova Scotia. The 'astronomer' here was one Joseph Frederick Wallet DesBarres, a rather well-known figure in Nova Scotia in the 1760's and 70's, although not (at least until now) because of his astronomical exploits. He was born in 1721 in France (or possibly Switzerland), later attended the Royal Military Academy in England, first came to the 'colonies' in 1756 at the start of the Seven Year's War. He became involved here in various of the military ventures but his real forte was hydrography. Consequently, he spent the ten years following the war carrying out a detailed survey of the local coastlines for the British Navy. The next ten years (1773-83) were spent in London putting together his great work, The Atlantic Neptune, a complete picture of the coast from the mouth of the St. Lawrence to Florida. Later in his life, Des Barres served as Lieutenant Governor of Cape Breton and of Prince Edward Island. He died here in Halifax at the ripe old age of 103!

What interested Roy Bishop in this man is that he may have been the first locally to man an astronomical observatory. He certainly did build a home and an observatory on 500 acres of land in Upper Falmouth, a tract of land which was granted him in 1763 at the end of the war. Roy found references to this observatory only four or five times in the whole 7000 pages of Des Barres' life as recorded in our local archives. The observatory at Castle Frederick was certainly initially designed as a base in which the various instruments used in Des Barres' surveys could be tested. However, Des Barres is known to have had an astronomical education (he once tutored the subject to the famous explorer Cook), and it is also known that on two occasions (in 1767 & 1769) high quality telescopes had been sent to him in Nova Scotia. It is intriguing to note that on each of these occasions the orders

preceded by a few weeks a noteworthy astronomical event --in the first case, an annular eclipse of the Sun and in the second a transit of Venus.

Roy finished by showing slides--perhaps the most interesting of these was a picture of the house (and the Observatory?) which was gleaned from the archive material.

The meeting was adjourned over coffee and a vote of thanks to the speaker.

P.H. Reynolds
Secretary

Castle Frederick, the home of JFW Des Barres, built by him in 1764 and shown here in a water color painting believed to have been drawn by Des Barres. The Observatory may have been the small building on the left. This will be the site of the Sept. observing in Upper Falmouth.

APPOINTED TO NAT'L EXECUTIVE COUNCIL

At the recent General Assembly in Toronto, Dr. Roy Bishop was appointed to the National Executive Council of the RASC. This group consists of the Executive of the National organization plus two others appointed by the Council. Although not used a great deal in the past it is hoped to revive the use of the Executive Council to aid in the running of the Society. The duties as described by the Constitution are to "carry on the routine business of the Society when Council is not in session and shall deal with all matters requiring immediate action". HE will tell us more at the next meeting in Sept.

OBSERVING/CAMPING WEEKEND -- A SPECIAL REPORT

Mike Edwards (OC)

The planned outing of the Halifax Centre took place at the Blomidon Provincial Park on July 22, 23 and 24. It was considered by all to be well worthwhile, in spite of the lack of good viewing. Over the course of the weekend about 35 people (members and families) were seen at some point. Though the devised competition was not used, some good viewing was done by those who stayed up late enough. By the conclusion of the weekend, hopes were expressed that this type of activity become more evident in the Halifax Centre, and that this Camping/Observing trip becomes an annual event.

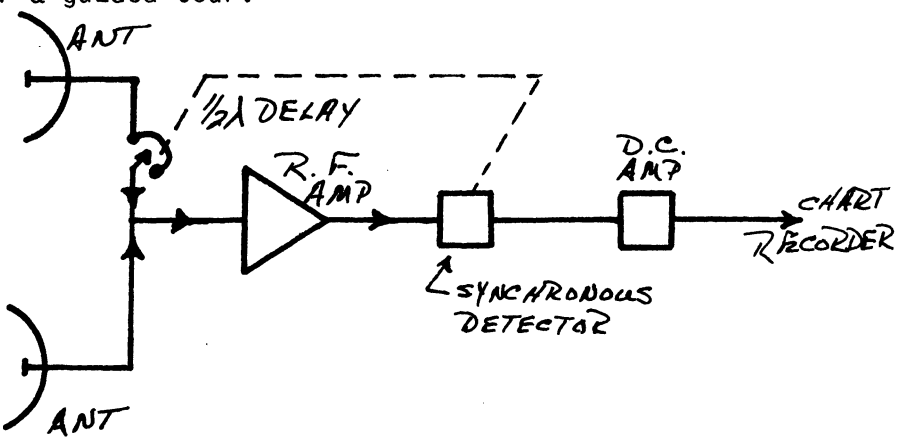
On the first evening, Friday, the telescopes were set-up and the preliminary sheets were passed around. Though the instruments were put away, due to a narrow band of showers, some views of the Moon were achieved and for those who stayed later, observations of deep sky objects were made. However, earlier in the evening a short walk to the park entrance afforded us with a surprising sight. Dr. Bishop was pointing a small demonstration laser towards the park. It easily out-shone the nearby light house. (Maktomkus Observatory and the lighthouse have a clear view of the campground). Saturday afternoon saw the first annual Marathon for the Halifax Centre. This was the 'hike' out to Cape Split. Again, Saturday night was cloudy until very late (at which point no-one much cared being too tired from the 10 mile hike and much too large supper following--Ed.). There were many stories around the camp fires of the meteor that got away. Sunday afternoon was the time set aside for another hike, but this one was only about 2 miles, the pace being much more relaxing. This was the tour of the fossil shales around Avonport. Sherman Williams and Roy Bishop guided us about pointing out the best fossils and geological formations. The most fascinating of all were the tracks (about the size of a mans foot) of a two-toed creature who had run across the mud flats of the day leaving tracks which can be followed for 50 feet or more. The tracks are apparently 1½ galactic years old according to Sherman (1½ galactic years equals about 350 million solar years). A quick tour of Maktomkus Obs., then home.

IMPROVEMENTS TO THE SMU RADIO TELESCOPE

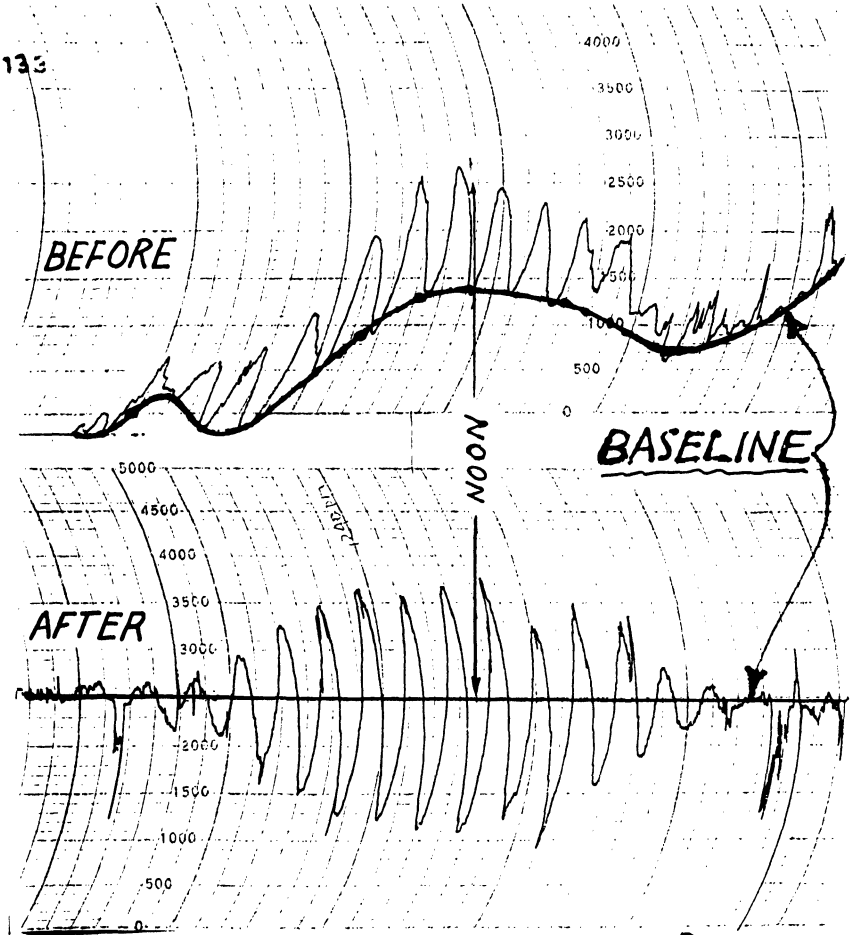
Fr. Lonc, S.J.

Recently, a modification known as 'phase-switching' was added to the existing 1.15m (260MHz) radio telescope at Saint Mary's with rather pleasant results, witness the two interferometer tracings below. The tracing labelled 'before' is a fairly typical observation (of the Sun) on the interferometer before installation of the phase-switch and the other one is a fairly typical observation with the phase-switcher. The major improvement is in the stability of the baseline, which then allowed us to use more receiver gain....in other words, the signal-to-noise ratio was quite definitely improved. Each observation represents about 4 hours of running time.

The basic idea of the phase-switcher is indicated in the diagram: the signal in one arm of the interferometer is delayed cyclically by a time equivalent to a half wavelength. The cyclic switching is carried out about 400 times per second in our installation. The combined signal entering the receiver proper is therefore 'labelled' with a 400Hz modulation, which then allows synchronous (ie. coherent) detection to be used, with its attendant noise-reducing properties. Anyone wishing to have a closer look at the radio interferometer need only phone me at 425-3210 for a guided tour.



Phase-Switched Interferometer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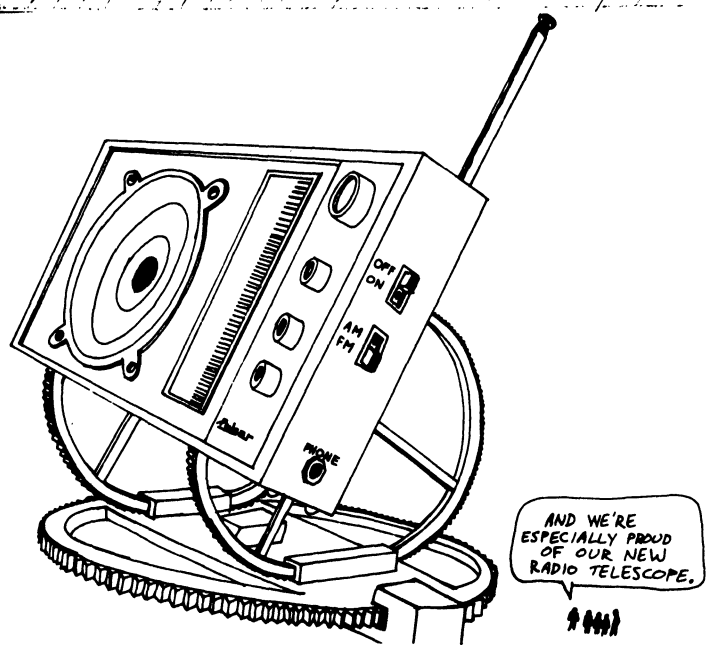

OFF ON
AM FM
PHONE
AND WE'RE ESPECIALLY PROUD OF OUR NEW RADIO TELESCOPE.

CALAHAN '77

"The Awkwardness of Imposition"

Larry Coldwell
Magamagapseck Peninsula

Stargazing can be a real pain in the neck! This is justifiably dictated by the nature of man's physical morphology. A lot can be said for telescope designs and supports, however there is little mention concerning the uncouth and seemingly ridiculous postures they impose upon the novice or serious observer.

Living in a province where an observer can remain starbound or fogbound for hours, optical observation time may accumulate sporadically. An intuitive feeling often compells the observer to take full advantage of clear nights, with the impending notion, though partially incorrect, that others will never occur again. These long hours spent under the rotating star dome are intellectually stimulating, and most enjoyable. However, this practice can lead to numerous physical discomforts; aching back, stiff neck, rubbery legs, and that old worn-out feeling. These are all the familiar star-struck symptoms of a well spent night.

As can be expected with the large diversity in telescope mounting designs, each one has its own unique set of awkward or impossible positions. Depending on the type of telescope you own, and your physical agility or stamina, you will fit into one of the three categories or any combination thereof, that I have arbitrarily chosen.

The first series of positions are entitled the "neck-knee" effect, necnee for short. This phenomenon is caused most frequently by refractors pointed vertically to the zenith in search of those hard-to-see objects, which abide only in this tranquil region. The observer must therefore uncannily position himself or herself, in a humble praying position beneath the eyepiece. To the average bystander this posture may give the appearance of religious dedication - but we know better.

The second series of positions are entitled the "tip-toe" effect, and occurs most frequently at social gatherings. How often have you literally reached for the stars in an effort to see them? Astronomers are an odd lot of people, rarely of uniform height, or size for that matter. The 'curled' effect is part and parcel of this same phenomenon, caused by those low-to-see-through eyepieces and is very distressing for those with a modest waist line. Altazimuth and equatorially mounted reflectors comprise the largest offenders of this category.

The third and final series of positions I have labelled the "ballerina" effect, for lack of an appropriate scientific name to describe these most colourless mosaics of human contortions. Tripods, German equatorial, pillar and claw, and English yoke mounts are the real culprits of this phenomenon. If your apparatus fits into one of these classes, you will know that many bodily configurations are humanly possible, but few as graceful as this title might suggest. A good display of physical dexterity in shifting declination, right ascension or azimuth and altitude among celestial objects is a product of many years of practice, and should not be observed lightly.

In closing, I would like to suggest a solution, a relief, or a new hope for these physical distresses which proceed to hamper the following days' productivity. By sacrificing a little magnification, resolving and light gathering power, I have discovered that a good pair of binoculars (7 35mm or 10 50mm), while prostrate on a comfortable horizontal surface is pure luxury! Yes, there is that compelling feeling to see objects bigger, brighter, and closer, but isn't this an illusion? Physical discomfort is not! (Participaction is going to love me for this!) When it comes to stargazing, the object is up and lying down is actually a comfortable and practical way to enjoy ones' hobby--the way I see.
P.S. Lying down is actually less conspicuous and will draw fewer obscene phone calls or remarks from inquisitive neighbours.

"THE AWKWARDNESS OF IMPOSITION"

ASTRONOMICAL CALANDER

Diane Brooks

SEPTEMBER/OCTOBER

1 Sept. 1855--Classic observation of connection between a sharply defined solar event and an equally sharply defined magnetic disturbance, made by Carrington and Hodgson.
1859--First recorded solar flare, by Carrington and Hodgson.
1908--Discovery of Comet Morehouse.
1963--Harlan J. Smith became director of McDonald Observatory, Texas.

2 Sept. 1804--K.L. Harding discovered asteroid number 3, Juno.
Mean solar time agrees with apparent solar time.

3 Sept. 1752--Became Sept. 14 by Gregorian calander.
1908--Possible existence of steam in sunspots suggested by A.K. Cortie, S.J.

4 Sept. 1964--Orbiting Geophysical Observatory (OGOI) launched.

5 Sept. 1877--Close opposition of Mars. Schiaparelli began study of "canals" that summer.

7 Sept. 776 BC--First certain eclipse date from Chinese annals.

8 Sept. 359--Naked eye sunspot recorded in China in Encyclopedia of Ma Twan Lin "like a hen's egg".

9 Sept. 1892--Bernard of Lick discovered Jupiter's fifth moon.

10 Sept. 1784--John Goodricke discovered variability of Beta Lyrae.
1956--Death of R.J. Trumpler, specialist in stellar statistics.

11 Sept. 1909--Halley's Comet first found by photography by Max Wolf of Heidelberg.

12 Sept. 1959--Lunik 2 struck the moon.

13 Sept. 1945--Harvard College Observatory plate No. 39209 taken.

16 Sept. 1848--Bond and Lassell discovered Saturn's 8th moon, Hyperion, independently.

17 Sept. 1789--Herschel discovered Saturn's 7th moon, Mimas.
1882--Transit of a comet across sun's disk.

18 Sept. 1965--Comet Ikeya-Seki discovered by 2 Japanese comet seekers. It has the 4th longest tail on record--70 million miles.

21 Sept. 1960--Death of Frank E. Ross who advanced celestial photography.
Autumnal equinox.

23 Sept. 1846--Galle of Berlin Observatory found Neptune from Leverrier's calculations.

24 Sept. 1969--The x-ray source, Cen x-4, became undetectable with the then available space instruments.

25 Sept. 1752--Prediscovery observation of Uranus by Tobias Mayer.
1909--Aurora seen in Singapore (1^{o} 25' N).
1950--Sun reportedly obscured by interplanetary dust cloud.

28 Sept. 1943--Plate of Andromeda Nebula helped lay basis of stellar populations.
1953--Death of Edwin Hubble.
1971--Japan's first scientific observation satellite.

29 Sept. 1943--Plate of NGC 205 helped lay basis of stellar populations.
1962--Canadian satellite, Alouette I, launched.

30 Sept. 1880--First photo of Orion Nebula, by Henry Draper.

Sept. 1186--Conjunction of 7 members of solar system (within 12^{o}).

1 Oct. 1847--Maria Mitchell was first American and first woman to win gold medal, established by Frederic VI of Denmark, for discovery of a telescopic comet.
1888--Isaac Roberts took 3 hour exposure of Andromeda Nebula revealing convuluted structure and 2 attendant nebulae.
1962--300' radio telescope at Green Bank went into operation.

2 Oct. 1897--Years of toil ended when Ahnighto meteorite arrived at New York Navy Yard aboard the Hope.

3 Oct. 1911--J. Palisa discovered "earth-grazing" asteroid number 719, Albert.
1962--Mercury Atlas VIII launched with Walter M. Schirra.

4 Oct. 1957--First artificial satellite, Sputnik I, launched.

5 Oct. 1582--Became Oct. 15 by Gregorian reform.
1967--Japanese astronomer, K. Tomita, recovered 4 known comets in one night.

7 Oct. 1959--First photos of moon's hidden side, by Lunik III.

8 Oct. 1976--Viking's soil sampler collector arm successfully pushed a rock which had not moved in over a million years.

9 Oct. 1933--Draconids shower; one of most impressive of 20th century.

10 Oct. 1846--William Lassell detected Neptune's larger satellite, Triton.
Maximum concentration of Draconids, debris of Comet Giacobini - Zinner.

11 Oct. 1758--H.W.M. Olbers was born.
1852--J.R. Hind found first verified case of a nebula that varies in brightness--NGC 1555.

12 Oct. 1947--Harvard College Observatory plate No. 40455 taken.

14 Oct. 1066--Battle of Hastings. Halley's Comet was

taken as a good omen for William the Conqueror's cause against Harold. It proved true and the comet appeared in the Bayeux tapestry, worked by William's wife.

17 Oct. 1963--Shadow of Saturn eclipsed outer satellite, Iapetus.

19 Oct. 1859--Wilhelm Tempel discovered diffuse nebula surrounding Merope in Pleiades.
1955--Death of Eugene Delporte who drew up constellation boundaries of northern sky.

20 Oct. 1912--Brooks claimed his last comet discovery.

21 Oct. 1914--Death of Adam Massinger at Ypres. He specialized in photographic studies of galaxies, nebulae and clusters.

22 Oct. 2137 BC--Probably the earliest recorded eclipse.
1942--Death of Karl Muller, Vienna selenographer.
1975--First surface pictures of Venus (Venera 9).
Maximum concentration of Orionids.

23 Oct. 4004 BC--Creation of the world according to Archbishop J. Ussher.
1838--Letter from Bessel to John Herschel telling how to solve parallax of a star.

24 Oct. 1601--Death of Tycho Brahe.
1851--Discovery of 2 inner satellites of Uranus, Ariel and Umbriel, by Lassell.

26 Oct. 1968--Oldest man launched--Col. Beregovoiy (age 47½).

27 Oct. 1780--First American solar eclipse expedition from Harvard College to Penobscot Bay.
1972--Mariner 9 transmission ceased.

28 Oct. 1959--Death of Walther Bauersfeld, chairman of board of directors of Carl Zeiss, W. Germany.
1969--Murchison meteor fall.

29 Oct. 1656--Edmund Halley born.
1937--K. Reinmuth discovered asteroid, Hermes.
1951--Death of Robert Aitken.

30 Oct. 1937--Closest measured approach by an asteroid, Hermes, to earth.

31 Oct. 1961--210' radio telescope at Parkes, New South Wales, was officially commissioned.

Oct. 1967--OSO launched.
Oct. 1969--Saturn's 4th ring, D, discovered by Guerin.
Oct. 1610--Galileo discovered phases of Venus.

1978 RASC MEMBERSHIPS

It's that time of the year again and we want to remind you to send or bring your memership fee to our treasurer, Alan Bent, as soon as is conv enient. The fees for the 1978 membership have been set as follows:

STUDENTS under 18 .....$7.50
STUDENTS over 18 .....$10.00
REGULAR $12.50
LIFE $150.00

The fees are the same as last year except for students over 18. The last two years, the Halifax Centre has subsidized this group and we have decided we can no longer support them to such an extent. Even so, we have the lowest fees of any Centre. We would like to point out that LIFErs are getting a real bargin and if you can afford it now, DON'T WAIT 'til next year!

TELESCOPE RAMBLINGS

Reflections of Reality

Except for the imaging elements in the eyes of animate matter, the most common type of optical element is the plane mirror. Every quiet body of water and window pane provides mirror reflections. Although a reflecting plane cannot form a useable image by itself, the "virtual" image associated with this simplest of optical elements is nearly perfect. The image is free of geometric distortions, chromatic aberration, and all the other aberrations associated with lenses and curved mirrors.

Despite the near perfection of the mirror image however, it differs from the real object in an interesting and profound way: unless the object possesses a high degree of symmetry, the object and its image cannot be superposed. Any asymmetric system, such as the Pleiades, a human hand, or a periwinkle, cannot be oriented to correspond to its mirror image. The mirror world is so like the real world, yet so different. A plane mirror transposes an object, point by point, perpendicular to its plane an equal distance behind the mirror. Because of our own bilateral symmetry and tendency to mentally project ourselves into the image space, it is often said that a mirror reverses objects left for right —— a convenient but misleading statement since a mirror inverts front to back, not left to right.

The image produced by a single plane mirror in general does not correspond to reality. For combing one's hair the difference is not serious and usually even goes unnoticed

despite the fact that the person in the mirror parts his hair on the opposite side; but, try to read a newspaper in a mirror! It is very difficult to tell if a photograph of an unfamiliar scene has been reversed left for right unless it contains some bilaterally asymmetric, man-made object. This is because a mirror image of a natural scene is a possible real situation, at least on a macroscopic scale. Asymmetric molecules exist, but those due to inanimate processes occur in an equal (racemic) mix of left and right handed forms. However, living matter contains many types of asymmetric molecules that are entirely left handed or right handed. An example is the DNA molecule which has the shape of a right handed helix. Although a mirror reflected person is permitted by the laws of nature, such an individual would likely soon die since his molecules would not be compatible with the handedness of the molecules in ordinary food. The molecular asymmetries in living things are apparently due merely to a chance occurrence early in the history of life some four billion years ago. However, an asymmetry displayed by inanimate matter at the subatomic level seems to be more profound and is said to violate conservation of parity, a quantum mechanical concept involving a mirror reflection.

In astronomical work reversed images can be troublesome. The comparison of telescopic views with star charts is significantly more difficult if the former are mirror images. Aesthetically, the fact that a reversed view of the sky does not correspond to reality goes beyond mere inconvenience. Fortunately it is not necessary to dispense with mirrors

to obtain unreversed images. All that is necessary is that there be an even number (0, 2, 4,...) of reflections in the system. A familiar example is a slide projector: the reverse side of the slide is projected (in effect one reflection) and we view the light reflected from a screen (a second reflection). Systems having an odd number (1, 3,...) of reflections provide reversed images. Below are examples of telescopic systems having various numbers of reflections (n):

n = 0 Unaided eye.
Refractor without a star diagonal.

n = 1 Refractor with a star diagonal.
Reflector with observer at the prime focus.

n = 2 Newtonian reflector.
Cassegrain type without a star diagonal.
Refractor with a roof prism star diagonal.

n = 3 Cassegrain type with a star diagonal.

n = 4 Binoculars (porro prism type).
Cassegrain type with a roof prism star diagonal.

Only the Newtonian provides both an unreversed image and a comfortable viewing angle while also avoiding the decrease in image quality associated with diffraction in a roof prism.

Roy L. Bishop
Maktomkus Observatory

ASTRO-PROBE

Darlene English

S P O T A R I M O R T S G N A

M L B L R P O C E T U S H M S

U A S A P A L L A S I N N E T

R N E D E U R A N U S K M T R

T E R I S R P O N A T I T E O

C T V Z A U O P N C L T E O N

E A E V E N E D I K K T O R O

P R R A D I A L Y S S I H P M

S Y M A R G L I A R I T U N Y

O I N D E X N I L H U A G O R

M R R L L E B B M U D N A O A

S U I W S P E S E B J L M G N

O F L O W A N O L B O Z M A I

C R A B N R A T S L K C A L B

C E N O I S L U M E E L G N A

To complete this puzzle use the clues on the following pages. The words will be found in the letters above in horizontal, verticle or diagonal directions in a forward or backward direction. The answers will be found in the Sept. issue. Have fun!

THE CLUES:

A--the eye opening science (9 letters)
---unit of wavelength measurement (9)
 --its in Hercules (4)
 --a Hale astronomer (5)

B--approximately 35% of stars are in these systems (6)
 --do these holes exist? (5)

C--Greek order (6)
 --open and galactic (8)
 --pulsar marks 1054 supernova (4)
 --celestial sea monster (5)
 --abbreviated half-man (3)

D--planetary in Vulpecula (8)

E--level (4)
 --located at La Silla (3)
 --photographic recorder (8)

G--cgs mass unit (4)
 --third letter of the Greek alphabet (5)

H--first to notice Zeeman effect in sunspot spectra(4)
 --the time variable "constant" (6)
 --regions found in spirals (3)

I--this may be colour or metallicidy (5)
 --large satellite of Jupiter (2)

J--astronomical time recorded in these days (6)

K--Arizona peak home for many telescopes (4)

L--gaseous nebula in SGR (6)
 --darkening observed on sun (4)

M--provincial representative (3)
 --"shooting star" (6)
 --this way our home (6)
 --comet seeker (7)
 --type of long-period variable (4)

N--beginning of new Julian day (4)
 --old name for anything not resolvable (6)

O--hunter of the skies (5)
--planetary in Ursa Major (3)
--project for the search for extraterrestrial life(4)
--one who observes (8)

P--black-bodies follow this curve (6)
--one of the largest minor planets (6)
--southern constellation (6)
--the possible fate of the sun (9)

R--this velocity important in the study of binaries(6)

S--'twinkle, twinkle, little .....' (4)
--ancient address (4)
--source of much of stellar knowledge (7)
--namer of quasars (7)
--this red one seen for over 300 years (4)

T--Earth's other moon (4)
--god of thunder (4)
--these effects cause distortion of galaxies (5)
--table or lawn (6)
--only satellite known to have atmosphere (5)
--abbreviated bull (3)

U--seventh planet (6)

W--class of emission line stars (4)

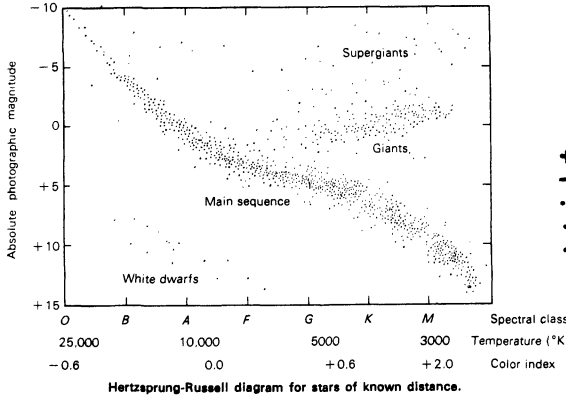
Hidden Word

useful representation found in 1910's by them(18)

ASTRONOMY FOR YOUNG RASCals

WHAT IS AN H-R DIAGRAM?

The Hertzsprung-Russell diagram is probably the most widely used diagram in astronomy and therefore deserves some attention. This diagram ia a tool used to classify stars and to follow the stages of evolution or life cycle of stars. The H-R diagram was discovered independantly by Belgian astronomer, Ejnar Hertzsprung and Henry Noris Russell, an American in 1913. They found that by separating stars according to temperature and brightness most stars fell along a definite line and were definitely not scattered randomly across the diagram. Fig. 1 shows what they found.



Hertzsprung-Russell diagram for stars of known distance.

Fig.1

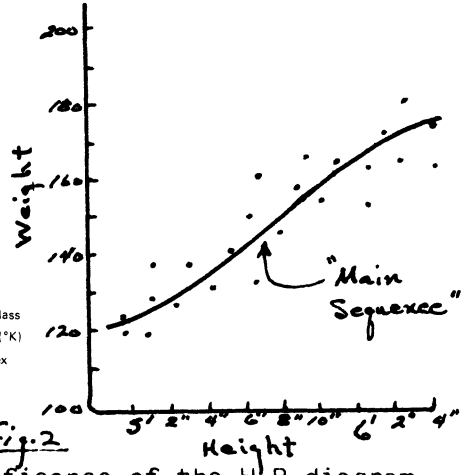


Fig.2

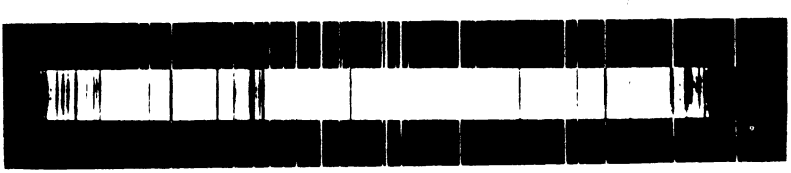
To help you understand the significance of the H-R diagram, try to think of 2 ways in which people differ. Well , there are lots of ways in which people are different--for example, age, height, size of feet, weight etc. Suppose we choose height and weight. Fig. 2 shows how height (across the bottom) and weight (up the verticle axis) are related. As you well realize, as you become taller you gain weight; so the line shows what the <u>average</u> person of a given height should weigh. Of course, people of the same height do not all have the same weight so there will be points scattered above and below this average line corresponding to where individuals fall on the diagram.

Now let us expand this idea of classifying to stars. The

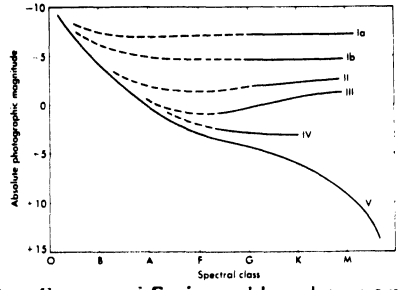
two quantities that H&R compared were brightness (absolute magnitude) and temperature (T, colour and spectral type are all interchangable as is shown in Fig. 1). The problem of specifying an absolute magnitude (M_v) for a star is a problem to be considered another time. Simply it is defined as the brightness a star would have if it could be placed at a specified distance (10 pc=32.6 light years). If you can somehow measure the distance to a star & if you can somehow measure its apparent magnitude, then a mathematical formula will give the absolute magnitude required--we have measured one of the parameters of that star.

Next we would like to measure the temperature, but since we can not obviously fly off in the Enterprize to make a direct measurement, we will have to find an indirect method to estimate this characteristic of the star. The method used commonly is to make use of the spectrum of the star. A spectrum may be obtained by placing a triangular glass prism at the focus of a telescope. This spreads the beam of light out into a band having the colours of the rainbow (which is really the spectrum of the Sun). If this spectrum can be spread into a wide band & photographed, then you discover that the band is broken by dark lines. It is these dark lines which betray the temperature of the stellar surface. Each of these dark lines is due to some particular atom, for example hydrogen, helium, carbon, iron and oxygen etc., each of which can exist only under certain temperature conditions. Hence the problem of taking the star's temperature is reduced to identifying as many of the dark lines as possible and assigning a spectral class and then looking up the corresponding temperature for the class. There are of course complications with this method--in particular, stars have different diameters and densities and must be assigned what astronomers call a luminosity class. There are 6 luminosity classes--Ia brightest supergiants, Ib supergiants, II bright giants, III giants, IV subgiants and V main sequence. Each of these classes occupy diferent

Fig. 3



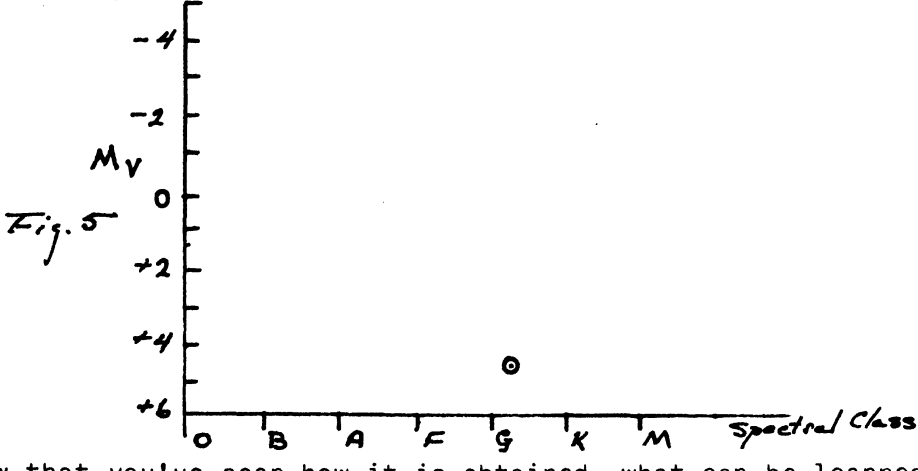
parts of the H-R diagram which is shown in Fig. 4.



A second method of specifying the temperature is to photograph (or by use of a photometer) a star once in the blue and once in violet light. The magnitude of the star is estimated in each colour and then the violet mag is subtracted from the blue to give the colour index (B-V). Referringto a table, we can obtain the temperature or we can plot the colour index itself.

Now that I've explained briefly how the 2 quantities that we wish to compare may be found, you are ready to draw your own H-R diagram using stars found on Pg. 94-96 of the Observer's Handbook (table of Brightest Stars). For each star, try to plot the point corresponding to the star's "type" and absolute mag, M_V, on the graph below. The position of the Sun is shown--it is a G2 type star and its M_V is +4.8

Fig. 5

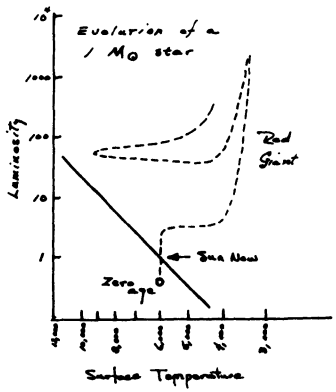


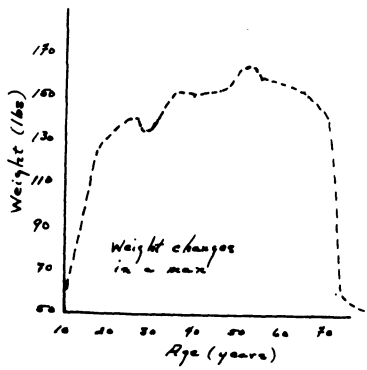
Now that you've seen how it is obtained, what can be learned from the H-R diagram? Well, we've already seen how stars separate into different luminosity classes, which depends essentially on density but Fig. 4 also shows where stars of equal radius fall, ie. on the slanted lines. Another

parameter, mass, also has an effect on the diagram. In general, more massive stars will be higher on the diagram, ie. greater M_v, but stars at different stages of development cause a scattering of masses in the H-R diagram. The stars you have plotted are where the stars fall now. Over millions of years these positions will change--can we determine the path across the H-R diagram as the star ages? The answer is yes!

Consider Fig.2 where we plotted light vs. weight. If you had kept a record of your height and weight as you grew up then you could follow your 'evolution' over a period of years as is shown in Fig.6. Likewise a star's characteristics could be monitored and its position marked as it ages. Obviously since 1913 few stars have changed very much so computer models must be developed to follow the changes. Fig. 7 shows the evolutionary path of a star like the sun. It starts off to the right as a cold cloud of dust and gas which gradually shrinks heating up and appearing towards the upper right. You can see the ages and follow its development through the main sequence to giant and eventually to white dwarf form.

Another use of the H-R diagram is the determination of distances to clusters of stars, which is done by determing apparent magnitudes for cluster members. If you plot the H-R diagram for the cluster members, using the apparent mags and if you plot this on Fig. 1, then the vertical difference between the main sequence of the two gives us the loss of brightness due to the cluster's distance beyond the 10 pc we mentioned earlier. The difference can then be applied to the appropriate formula and the distance is obtained.





Finally Fig.8 shows another use--estimating the age of clusters. The point where each of the illustrated clusters starts to move away from the main sequence is called the "turn off" point. The higher up the MS the turn off point is, the younger the cluster age! In Fig.8 on the right hand axis, the age is given for turn off points at various points. To find the age of M11 for instance, one would draw a horizontal line through the turn off point to the right hand axis as shown and then all that remains is to estimate the age from the scale. For M11 this is about 0.7×10^9 yrs. (700 million years).

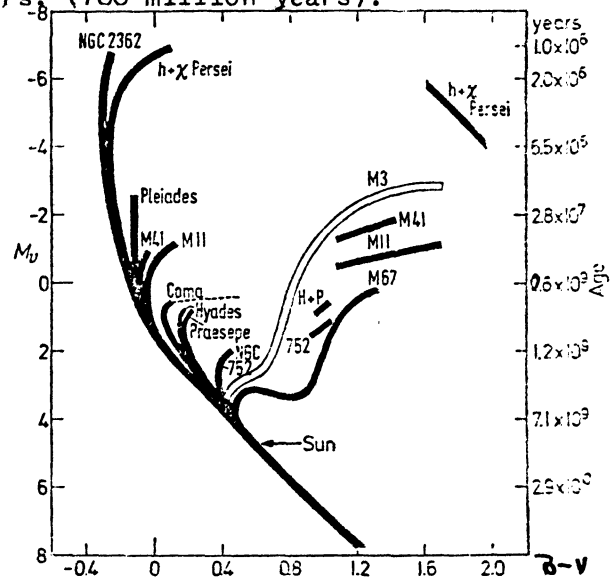


fig. 8

The use of the Hertzsprung-Russell diagram if properly understood, is a very powerful tool for astronomers and the uses are by no means restricted to the ones I have described. But I am sure there is quite sufficient material to keep you occupied for at least one cloudy evening in the above. The most important thing to understand about this diagram is that stars fall into definite predictable classes dependant on the mass & age of the star. Aging causes the brightness, temperature, colour, luminosity class and spectral type to vary in a predictable manner which can be mimicked reasonably accu rately by use of computers. Our ability to mimic the changes gives us some confidence that our understanding of the processes in a star's interior is correct in most respects.

BK

THE REAL MEANING

Found in A Random Walk in Science by R.L. Weber, Crane Russak & Co.

When Scientists Write	They really mean
It has long been known that	I haven't bothered to look up the original reference
While it has not been possible to provide definite answers to these questions	The experiments didn't work out, but I figured I could at least get a paper out of it
High Purity Very high purity Extremely high purity Super-purity Spectroscopically pure	Composition unknown except for the exaggerated claims of the supplier
Three of the samples were chosen for detailed study	The results of the others didn't make sense and were ignored
..accidently strained during mounting	..dropped on the floor
..handled with extreme care throughout the experiments	..were not dropped on the floor
Typical results are shown	The best results are shown
Although some detail has been lost in reproduction, it is clear from the original micrograph that...	It is impossible to tell from the micrograph
Presumably at longer times	I didn't take time to find out
It is suggested that.. It is believed that.. It may be that..	I think
It is generally believed that	A couple of other guys think so too

It might be argued that..	I have such a good answer to this objection that I shall now raise it
It is clear that much additional work will be required before a complete understanding	I don't understand it
Unfortunately, a quantitative theory to account for these effects has not been formulated	Neither does anyone else
Correct within an order of magnitude..	Wrong
It is hoped that this work will stimulate further work in the field..	This paper isn't very good, but neither are any others in this miserable subject.

TIME GENTLEMEN--PLEASE

Walter Zukauskas

It is now possible to obtain accurate time signals any time of day or night by telephone. The NRC provides this new service to supplement its CHU broadcasts and its daily CBC 2 o'clock "beep". A voice announcement of the time is given every ten seconds, followed by the "pip" marking the value of Eastern Standard Time. The telephone numbers are (613)-745-1576 for the English service and (613)-745-9426 for the French. The number is not toll-free, so better call after midnight (and get those low, low rates--MT&T). However, if you need the signals, and atmospherics are bad, at least you have a way out.

When I called the other day, to try out the service, I noted that their time signal differed from my kitchen clock by some 12 seconds. Presumably, the bugs in their system will be cleared up with increased experience. Or perhaps, the fellow giving the voice announcements, after 19 hours 20 minutes and 20 seconds on the job was just too tired to press the time key sharply.

OBSERVING MEETINGS

Mike Edwards

It has almost become a bylaw of the Halifax Centre's constitution that the eighth night following the regular monthly meeting of the Centre shall be occupied by the involvement of members, in the use of the 16 inch Ealing reflecting telescope housed in the Burke-Gaffney Observatory situated atop the Academic/Residence High Rise II building in the south western corner of the property on which stands Saint Mary's Univ. (SMU) located on lands which fall within the boundaries of the city limits of Halifax, capital of Nova Scotia. Now if we could have had clear weather we could have demonstrated our interest in telescopy.

It now seems traditional that the weather on this night is such as to make viewing the wonders of the heavens an impossible task. In grain with this newly adopted tradition, the June observing meeting was clouded out. The July observing meeting as you recall, was the Observing/Camping Weekend at the Blomidon Provincial Park Those who stayed up late enough were able to put in some rewarding observing time. Clearing took place when everyone except the Burton s from Dartmouth and the members of the BOG (Bedford Observers Group) had retired for the night. So let's put an end to the grumblings of impeachment the Observing Chairman has heard.

(Ed. note--the August picnic was held under beautiful skies until the OC arrived. Then we observed the thickest fog I have ever seen! No wonder there are grumblings of impeachment--Mike has a perfect 1000 batting average for clouds on observing night!)

The full moon has caught up to the eighth night after a meeting, so in the near future the observing sessions will be scheduled for the night after the regular meeting. However, may we remind you that the B-G Obs. is open for RASC members to use every Saturday evening after the tour until midnight--just arrive before the tour is done otherwise the door may be closed and the observer will proceed with his own work. Tour times: 9 in Sept, 7 in Oct.

FUMBLING THROUGH THE AUTUMN SKIES

Mike Edwards (OC)

Summer has come and gone, the Observing/Camping Weekend has done the same. Autumn is now with us to make the most of the clear and cool night ahead. These are, sometimes, the best nights for studing the skies. Darkness comes early and the temperature of the air is not too cold, as to take from comfortable telescope time.

By now the two 'strange lights' in the morning sky have drifted farther apart. Perhaps we should call them wandering lights.

As the Halifax Centre has made an attempt to become more active in observational astronomy, do not plan to take it easy now that the warmer time of the year has passed. The first observing session of the autumn is planned for Sept. 17 at Castle Frederick, the site of J.F.W. DesBarres' 18th century observatory in Falmouth. This may well be the first optical observatory in the Americas and will be the first time that telescopes have been used there since about 1773--so come along and participate in this historic event.

Don't put that lawnchair away yet so you can use every opportunity to search the heavens--you might even be lucky enough (or skillful enough) to find your very own comet! There have not been too many about this summer. If you are heading west near the end of September, be sure to take a look at the penumbral eclipse of the Moon on the night of the 26-27. And if you keep going you may make it in time to see a total eclipse of the Sun on October 12. But if you are not planning to go that far or even plan to stay at home, you will be able to see a short partial eclipse in the late afternoon of the 12 th. But don't forget to look at clear night skies which are coming. In the mean time good viewing, no, that should be---good fumbling!

Notice of Meetings--Regular, Sept 16 127
--Special, Sept 17 127

Telescope Contest and Observing Meeting 128

Minutes of the July Meeting, P.H. Reynolds 129

Appointment to Executive Committee 130

Observing/Camping Weekend Report, M. Edwards 131

Improvements to SMU Radio Telescope, Fr. Lonc 132

The Awkwardness of Imposition, L. Coldwell 134

Astronomical Calander, D. Brooks 137

Membership Reminder 141

Telescope Ramblings, R. Bishop 142

Astro-Probe, D. English 145

Astronomy for Young RASCals, R. Brooks 148

The Real Meaning (what scientists really mean) 153

Time Gentlemen--Please, W. Zukauskas 154

Observing Meetings, M. Edwards 155

Fumbling Through Autumn Skies, M. Edwards 156

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