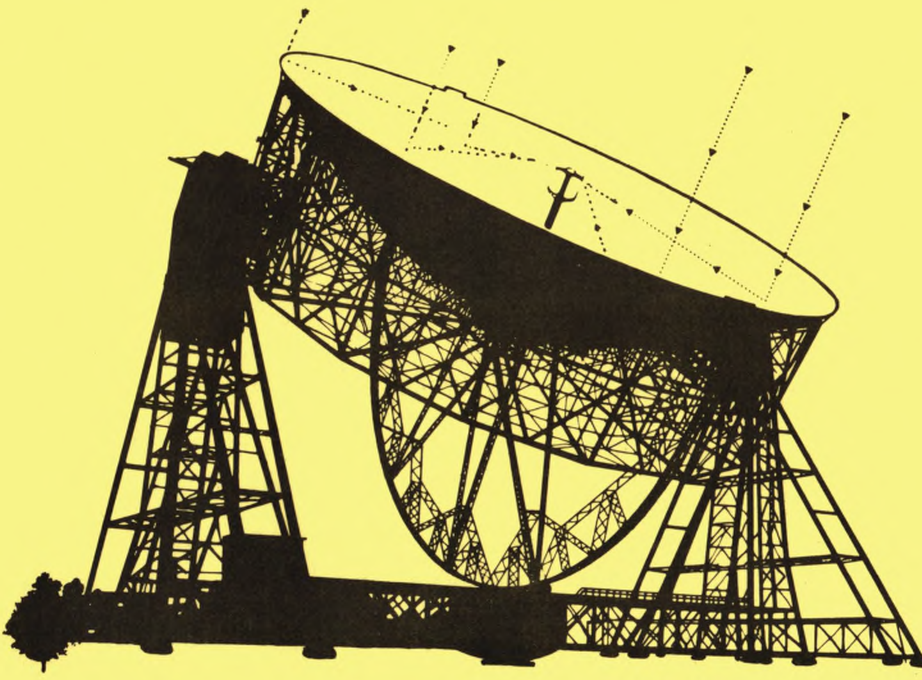
NOVA NOTES



BI-MONTHLY JOURNAL OF THE HALIFAX CENTRE

MARCH - APRIL 1980 VOLUME 11 NUMBER 2

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NOTICE :

Due to the rising cost of material, handling and shipping it has become necessary to charge a nominal fee for non-members of the Halifax Center of the R.A.S.C. The Center executive has determined that this fee shall be set at the rate of 35¢ per single issue or $2.00 for six issues per annum. At the present time there are still a few copies of the January and February issue available to allow us to fill orders for the complete 1980 subscription year. Contact the editor for more information.

MINUTES OF JAN. AND FEB. MEETINGS :

The January meeting of the R.A.S.C., Halifax Centre was held in the N.S. Museum as usual on the third friday, January 18th. The speaker was Dale Ellis of D.R.E.A. in Dartmouth; his subject was Neutron Stars.

Neutron stars were predicted about 50 years ago. The neutron was only discovered in 1932. Baade and Zwicky predicted that neutron stars could be created from super nova explosions. In 1967 pulsars were discovered. In 1968 Gold stated that pulsars are neutron stars.

Neutron stars have atmospheres of iron molecules about ten metres thick - the outer layers are gaseous iron, the inner is solid iron but there is apparently no liquid phase. Other elements are found that do not occur on earth because of the extremely high density. The composition of the stellar centre is unknown; it may be the source of the quark. (I find this hard to believe.)

A neutron star has VERY large gravitational and magnetic fields. (Remember the four forces - gravitational, electromagnetic, the weak force (let's have a better name for this nuclear force) and the STRONG NUCLEAR FORCE which holds the nucleus together.) Neutron stars are denser because of the dense packing of neutrons more so as the centre is reached. It does appear to have layers how - ever: - A very thin atmosphere (Fe), a solid crust and then a "fluid" of neutrons in which are a few protons and electrons. Then in all this mess there are muons (very fast) and other particles which we have little know - ledge of. Wow!

The February Meeting of the Halifax Centre R.A.S.C. featured **Mr. Pat** Kelly.

The Topic - FROM VULCAN YOU SAY?

CETI is Communication with extra terrestrial life

SETI is Search for extraterrestrial life

The Number of "people out there" who could talk to us is $N = R_* F_p n_e f_l f_i f_e L$

where

R_* is the mean rate of star formation

F_p isthe fraction of stars withplanetary systems

n_e is the number of planets per system with ecology

f_l is the fraction of such suitable planets

f_i is the number with intelligence

f_e is the no. with high Intelligence that could talk

L is the mean lifetime of a high technology culture (this could be 10^6 years)

You work this out- it comes to one such civilization per parsec!!!

What do we look for? In the radio spectrum the H OH ans HO frequencies are possible @ 1Hertz

Ames Laboratories are concentrating on regions of high H lines ($6 million)

Jet Propulsion Laboratories are scanning the whole sky ($10 million)

That's all receiving, how about us sending?

We have sent out by radio digital pictures

We sent out the pioneer probe with a plaque on it.

Now for the far out proposals:

CYCLOPS is an array of 2500 radio telescopes which could receive from 7000 parsecs !!!

And finally there's
DAEDALUS a rocket 5 times taller than Saturn V
-it would be powered by thermonuclear explosions at
a rate of 250 per sec.! At full speed it would reach
14% of c (the speed of light) The hydrogen for this
of course would have to be mined ! on Jupiter. If
it were aimed at Barnards star a good likely close one,
it would take 47 years to reach there.

So don't wait for it my friends. Enjoy this
planet, preserve it and come to the GENERAL ASSEMBLY
in NOVA SCOTIA.

Nobody as far as I can hear saw an occultation
by an asteroid here.

Jan. and Feb. Announcements and Notices :

Announcements- there will be three grazing occultations
in the coming week of those pesky little asteroids in
front of rather insignificant stars. Please read on
to find out what was seen in this Centre.

February Meeting- Feb. 15th

Notices-There will be a Solar observing session at
the Burke Gaffney Observatory tomorrow using their new
solar filter.

Mercury is now visible in the west.

Comet Bradfield is visible. Where?

Dr. Murray Cunningham,
Secretary.

RECENT OBSERVING

The Hyades will be occulted five times this year by the moon, and Jim Himer (a local astronomy fanatic) and myself deceided to observe the first such passage, on January 27. Despite a temperature of -30°C (remember this is Calgary) and the uncertain weather, we arrived at the Rothney Observatory at 7:00, to find that the warm hut also registered at -30°C. Despite the novel ice formations in the sink, we deceided to fix the furnace before the pipes burst. It was fixed, but the warm hut wasn't warm for us that night.

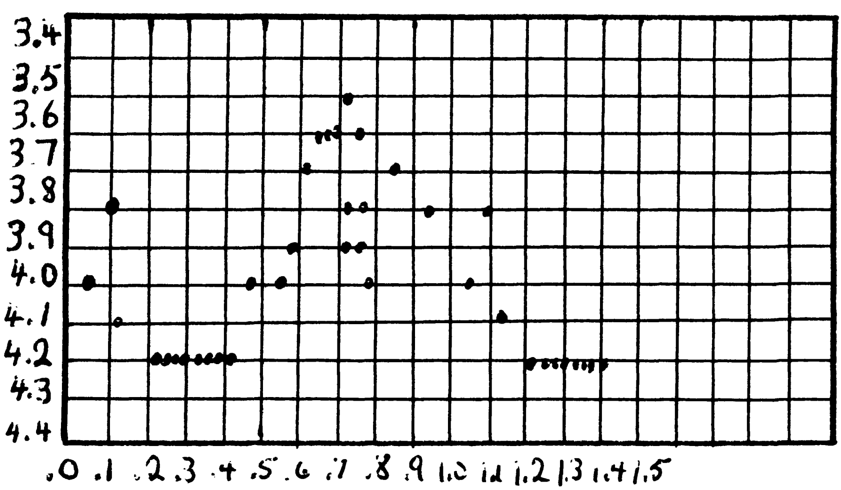
Setting up the telescopes, it was clear that the night was too poor for viewing the Hyades themselves. High uniform cirrus created a very attractive moon ring, but also lit up the sky alarmingly. Using an 8-inch Celestron, the Orion nebula looked inconspicous, which should give you some idea. It brought back memories of the night I spent observing in Toronto. But never fear, Aldebaran would also be occulted. As the appointed time approached, Jim manned the massive 16-inch with stop - watch ready and the short-wave bleeping away, while I peered, eyes watering, through the Celestron at the bright, ten day old moon. And then suddenly, there it was, gone! Jim got a timing of 10hours, 41minutes, 31.4seconds, + or - .1seconds MST (Mountain Standard Time), which will be duly sent to some astronomer who bothers with these things. Our contribution to astronomy done for the night, we headed home.

Figure 1 shows my completed light curve for delta Cephei, which I have been observing for several months. The scatter near the maximum is curious; I hope the star is not behaving like that. The flat minimum is more easily explained; the fainter of the two comparison stars I have used has a magnitude of 4.2. I suppose when delta Cephei dropped a little below 4.2 I tended to believe that the two stars had equal brightness. Despite the scatter, the shape of the curve is clearly evident, and was certainly a good exercise in naked-eye astronomy.

All recent asteroid occultations have been clouded out in Calgary, and there won't be any more till the autumn. The diagram I drew of Vesta last issue has unfortunately had to be scrapped; the asteroid was found to be right on time by other observers, and not ten minutes late as we had thought we had observed. The dip in the light curve was either cloud or guiding error.

But no matter. We have a new observing chairman imported from Edmonton, and who can say what observing projects we'll dream up. Now, if only it would get a little warmer.....

Figure 1:



Steven Morris

THE USE OF A RADIO TELESCOPE FOR DETERMINING DISTANCES ON THE EARTH.

The main purpose of this paper is to discuss the use of an interferometer for determining the distance of two points on the earth. However, before going into details, let us describe a radio telescope, since most people may not have seen one, and since an interferometer is a simple modification of a radio telescope.

A radio telescope consists of three main elements: an antenna, a radio receiver and recording equipment. The radiation that is collected by the antenna is brought to a focus and is either collected in a metal horn and passed to the radio receiver down a waveguide, or is picked up on a dipole where the electric field of the radio waves sets up an oscillating voltage in the dipole which is then passed along wires to the radio receiver. As the radion frequency signal oscillates rapidly it has to be converted by means of a detector into a direct current, in order to produce an output that that can be recorded. Since the received signal is very weak it has to pass through an amplifier. The signal is finally converted into "readable" form either by digitizing equipment in the form of punched cards, magnetic tape, or by pen chart recording.

A good radio telescope has a narrow beam width. A radio telescope receives the maximum signal when it's pointing straight towards the source. If it points slightly away from the source it still receives some signal and we say, the source is within the beam of the radio telescope. The beam width decreases as the diameter of the antenna of the telescope. So the larger the antenna, the better the resolving power, the bigger the ability to resolve sources that are close together, or to find the precise shape or structure of a source.

The introduction of interferometer methods in radio astronomy has proved its great value in different techniques. The simplest interferometer consists of two separated antennas connected together, so that the combined signal then is fed to the receiver. The line joining the two antennas is called the baseline. Therefore with the interferometer we are able to achieve a resolving power of 1 minute of arc without constructing a continious antenna, but just by spacing two simple antennas at a distance (D) apart.

The operation of the interferometer is based on the principle of constructive and distructive interference, corresponding to the wave form of the electromagnetic radiation and obtaining a series of maxima and minima. Since the signal changes from one max to the next when $D \sin \theta = \lambda$, the distance (D) can be easily calculated. This distance could be any distance on the earth.

For example we'll use measurements obtained from the two (2) element interferometer which is established on the roof of Saint Mary's University. The source used was the Sun on 10/10/79 at universal time (U.T.) of 17 hours, 23 minutes and 18 hours, 20 minutes. Notice that the Sun's declination for that day was -7°. The corresponding wavelengths were $\lambda_1 = 1.145$ m., $\lambda_2 = 0.735$ m. and the

corresponding baseline D_1=27.5 m., D_2=31.5 m.

Calculations Required:

Theoretical values for resolving power θ

Since θ is a small angle sin θ≅θ

Therefore;

$$\theta_1 = \frac{\lambda_1}{D_1} = \frac{1.145 \text{ m.}}{27.5 \text{ m.}} = 0.04164$$

$$\theta_2 = \frac{\lambda_2}{D_2} = \frac{0.735 \text{ m.}}{31.5 \text{ m.}} = 0.02333$$

The analogous D's are;

$$D_1 = \frac{\lambda_1}{\theta_1} = \frac{1.145 \text{ m.}}{0.04164} = 27.49 \text{ m.}$$

$$D_2 = \frac{\lambda_2}{\theta_2} = \frac{0.735 \text{ m.}}{0.2333} = 31.50 \text{ m.}$$

Observed values for θ;

$$\theta_1 = \frac{\lambda_1}{\cos\delta \, D_1} = \frac{1.145 \text{ m}}{\cos(7)\, 27.5} = 0.0420$$

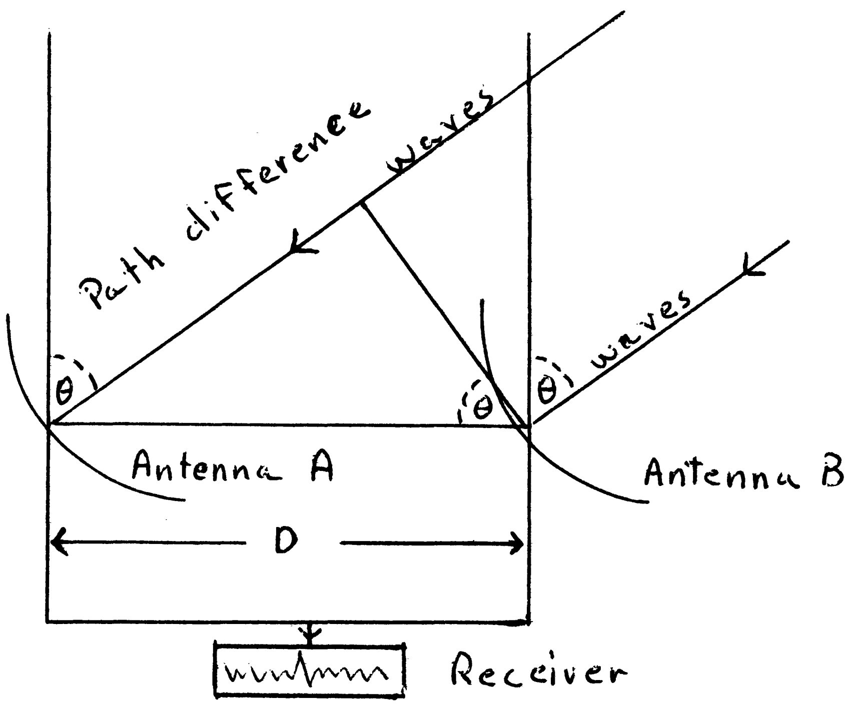
$$\theta_2 = \frac{\lambda_2}{\cos\delta \, D_2} = \frac{0.735 \text{ m.}}{\cos(7)\, 31.5} = 0.0235$$

The analogous D's are;

$$D_1 = \frac{\lambda_1}{\theta_1} = \frac{1.145}{0.0420} = 27.26 \text{ m.}$$

$$D_2 = \frac{\lambda_2}{\theta_2} = \frac{0.735}{0.0240} = 31.26 \text{ m.}$$

Since the values agree with the theoretical predicted, that means that the distance (D) is calculated and therefore by using the same technique we'll be able to calculate any distance on the earth. This is going to be applied in the future for verifying the Tectonic theory corresponding to the motion of the continents in the science of Geophysics.



John Haranas,

COMET HUNTING AND OBSERVING

Do you want to discover a new comet or observe a found one? Well let's see what equipment will be necessary. Before we start observing, it is most important that your eye is trained to see faint objects. One cannot have a new 20 cm. (8 in.) telescope and go right out and find a comet. The eye must be trained and this takes a year or so. A good place to start is on the planets such as Jupiter. Keep observing every clear night and make drawings.

For most comet hunting, amateurs use "Richest Field Telescopes", these R.F.T.'s with a wide angle eyepiece give a low power and a wide field of view from 1° to 4°. R.F.T.'s come in various sizes, from 10 cm. (4 in.) to 30 cm. (12 in.) and in various focal ratios. The most common type is the reflector though a Mr. Bradfield in Australia uses a 15 cm. (6 in.) refractor and we know of his success. The equatorial mount is not used, an altazimuth mount is. The telescope is slowly moved in azimuth while the observer checks his field very carefully. Once he has moved enough in azimuth the telescope is then raised in altitude a field diameter and the sweep carried out again. If the observer does come across a nebulous patch he must consult all available maps on that region, the best to use are "Norton's Star Atlas" and the popular "Skalnate Pleso Atlas". Most often the object will be a faint galaxy (watch out in the Virgo region) or two close stars. The latter can usually be verified by a higher power eyepiece. If doubt remains, a careful watch on the object for one hour will disclose if it is a new comet, if it has moved. If not, then

write down its location and check on the next clear night. If it turns out to be a new comet then send a telegram to:
INTERNATIONAL ASTRONOMICAL UNION,
HARVARD COLLEGE OBSERVATORY,
CAMBRIDGE, MASSACHUSETTS, U.S.A.
in care of Dr. Brian G. Marsden. Your name will most likely be attached to it. Make sure to give its magnitude, motion, R.A., Declination and the time you first saw it (in Universal Time).

If a new comet is found by someone else, take the time to observe it. Also make drawings and take photos of it in different colors and check the nucleus and coma for changes. Some comets are unpredictable like Schwassmann-Wachmann 1 which has outbursts in its nucleus. It can reach 11th. magnitude while its normal magnitude is 18.

A comet has the following parts: Head, coma, nucleus, tail and a hydrogen cloud as discovered by the Skylab Astronauts while observing Comet Kahoutek in 1973, but you won't see it.

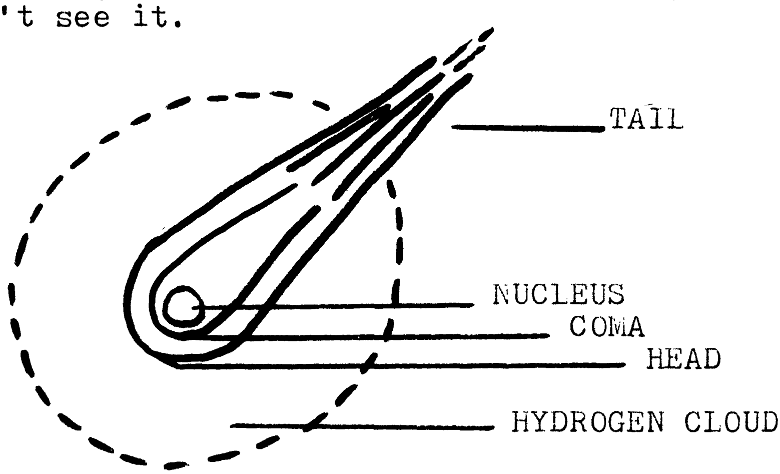


FIGURE 1: STRUCTURE OF A COMET

Anyone with a telescope can find a comet. It may take 300 hours or it can sometimes be longer, up to 1200 hours. One amateur used a Schmidt-Cassegrain of 15 cm. (6 in.) aperture at f/10. So your own telescope will usually suffice in comet hunting but a R.F.T. is to be preferred. You need not buy one ready made; just order a mirror kit and build your own and it will save you some money.

The best place to look for comets is from dark skies but there has been some talk about Light Pollution Rejection Filters (LPR's) whereby one may find a comet faster than without the LPR. This applies to our city also. I must admit that a new comet here would need to be of 9th. magnitude to be found without the LPR filter.

Your local comet hunter (me) intends to give my LPR filter a complete testing on our skies. So far I have found M76, a 12th. magnitude planetary nebula in Perseus with my CELESTRON 5 at 31X. I have yet to find M97, the Owl Nebula in Ursa Major , it is of 12th. magnitude also. These were found without the LPR filter.

A helpful hint is to follow Olber's Method:
1. Check the west at sunset.
2. Check the north during the rest of the night.
3. Check the east at dawn.

If you don't want to observe you can attach your camera to a clock driven telescope and take some 5 minute exposures of different areas of the sky. Do this over a period of a week or two and compare the negatives to see if any fuzzy spot has been found. Keep very accurate records of each exposure. Avoid observing or photographing near full moon, unless it's a fairly bright comet, say something like magnitude 3 to -1.

Look in the "Handbook" and observe the 3 listed on page 102, this year, the second one will be a good test for your eye. Comet Tuttle will be good for most of November but then goes farther south. What will be the last date that you will be able to see it? Follow it until it is out of your sight. This will be a good time to find out who has a better telescope. The owner of a refractor, Newtonian or Cassegrain. Remember to use a low power and to make drawings. Send these to "Nova Notes" editor.

One last word helps - GOOD LUCK!

Michael E. Boschat

UFO's Pollution !

Flying saucer buffs may be brought down to earth by the latest research from Russia.

Scientists at the Soviet Institute of Oceanology say those unidentified flying objects are not visitors from another galaxy or even figments of the imagination. They're just pollution.

The scientists have discovered that turbulent weather causes pulverized dust or water particles to form into saucer shapes right in their own laboratories.

They also say their theory explains why there have been so many UFO sightings lately. Since there's more pollution these days - there's bound to be more UFO sightings.

THE GA IS COMING !!, THE GA IS COMING !

That's right, let the bells ring out and the banners fly, it's too good to be true, but that's right....

During the period form June 27 to June 30th, this summer, the Halifax Centre will host the 1980 General Assembly of the RASC. The planning committee for this event has, as you well realize, named the GA, the Bluenose General Assembly. This is a notice to members of our Centre to make known some of the plans, such that we all will be prepared for this great event.

You will also recall that this GA is to be held jointly with the Canadian Astronomical Society (CAS) and the location for the meeting is SMU.

Members of our centre may want to prepare displays for the display area, if so contact Peter Edwards. If you are contemplating a paper presentation, an abstract must be approved by the centre exect. prior to being given to Dr. Cunningham,the paper session chairman. And there will be the now traditional slide show. If you have something for this see Walter Zukauskas. Those in the centre who are gifted with a loud (not necessarily good) sining voice must be prepared for the song competition which we are continuing, after its iniation by the London Centre last spring. More details will be found in the next National News Letter.

Mike Edwards,
Chairman, Organizing
Committee, BGA

A SURVEY ON MODERN TELESCOPE DESIGN

Mike Edwards

As we know, technology has advanced a great deal in recent years. One result of this has been the rapid growth in the number of astronomical telescopes being constructed. Optical and radio telescopes have all come a long way in design, from the days when reading glasses were used to form the first telescopes.

The beginnings of astronomy are hidden in the mists of prehistory. Hundreds even thousands of years before the development of the other sciences, men were making suprisingly accurate measurements of the seasons, of lunar cycles, and of planetary motions. They were predicting eclipses and estimating the sizes of the sun and moon. Ancient tablets and carvings show that the movements of the planets were fairly well understood before the year 3000 BC. Legend says two Chinese astronomers were put to daeth when they failed to correctly predict the eclipse of the sun in 2136 BC.

Advances in astronomy have been paced by what technology could offer. Considerable developments have occurred in the past two decades, in many areas of optics under the stimulus provided by studies directed to develop systems to be used to make observations from the space enviroment. Today's astronomers reach into many fields to fill their needs. Telescopes are pointed precisley by computers; advanced gear designs are used in telescope mounts; and high precision servo control systems guide the large instruments under severe accuracy and drift specifications; and large telescope mirrors are formed from the latest ceramics. The telescopes built in the last decade have in some areas conformed to traditional design, but as mentioned mirror materials and drive systems have greatly improved. Mirror supporting methods have also improved in recent yaers.

Despite the numerous new observatories throughout the world, the field of astronomy still uses some instruments which are relatively old. The 200" Hale telescope on Mt. Palomar was completed in 1948, and a few other instruments have been functioning for almost 100 years. Their long useful life is because their light-gathering ability does not diminish with time. In many cases the light-gathering ability of these telescopes has been upgraded by new sensing systems.

The need for continuation and expansion of present programs in space astronomy, has been recognized by the scientific community. One of the great disturbances affecting ground based telescopes is the atmosphere. Atmospheric distortion limits the resolving capability of the Hale telescope to that which a 12" telescope would have if in space orbit. The problem of improving telescopes has received only infrequent attention until recent years. Now that orbital and lunar observatories are being considered, the designer will be called upon to create optics with the staediness and perfect transparency of a remote site, in mind.

From the May 1974 National Geographic we find, "Most of the radio astronomical observations below 100 MHz have been the result of considerable effort on the part of a relatively small number of astronomers and engineers.

The size of the instruments needed for such observations has precluded the construction of more than a few in the world. However, larger and larger grow the bowls of the radio telescopes as scientists attempt to gather fainter and fainter incoming waves. It is interesting to note that astronomers estimate that all the energy received by all the radio telescopes ever built equals only the inpact of a few snowflakes on the ground."

Refinement is the key-word in the giant optical materials of today. Massive plastic lenses, huge glass and silica mirrors are meeting strict specifications. This is due to the precise quality control and advanced materials technology in existance. Methods have been developed for producing almost haze free surfaces on plastic optical elements. Haze has been a major longtime drawback to palstic lenses, which are used as cost savers. Fused silica and glass are the best materials where highest tolerences and preformance are demanded of optical components. Only the purest materials with the lowest possible expansion properties are used in astronomical instruments. For telescope mirrors, fused silica is preferred almost exclusively.

A consideration other than cost of glass, is that of weight. The ability to predict the deflection of mirrors under various support or mounting configurations has long been of interest to scientists working in many disciplines. A theory has been developed for thick plates which includes shear deformations.

It can be shown how the results for solid mirrors can be reduced to obtain the results for cared mirrors, as used in Cassegrain optical systems. It is found that mirrors having a thickness to diameter ratios greater than 1/10, shearing deformations can contribute significantly to the total deflection. Therefore the shearing deformations should not be neglected in telescope design.

A configuartion suitable in large telescopes has been developed specifically for lightweight mirrors. The opportunity to use a lightweight mirror and mounting cell offers us the option of placing the mirror above the declination axis. This allows for a long instrumentation volume at the cassegrain focus. The only drawback of this option is that the instrumentation weight must be balanced by counterweights to bring the balance point coincident with the declination axis. The location of the mirror above the declination axis results in very little travel of the eyepiece in either the vertical of lateral directions. This is an important advantage for an observing astronomer. One other advantage of lightweight optics is that the secondary assembly mass is significantly lessened. Lightweight optical components, therefore, are one of the major considerations in telescope design.

To be continued....

A REFLECTION UPON "NEW" MIRROR LENSES !

Recently camera lens deseigners have come up with some new ideas in connection with catadioptric or "mirror lenses". If you're like me you've probably thought of these mirror lenses as being sort of smallish C-90's, but this is only partially true.

A conventional mirror lens works on the same principles as a Maksutov-Cassigrain telescope (such as a C-90) where a spherical primary mirror is used. By using a spherical primary, all aberrations except spherical aberration are avoided. To correct for this, a "correcting plate" is located at the front of the lens which produces just the right amount of negative spherical aberration to balance with the primary's aberration, producing virtually aberration-free images - on axis anyway.

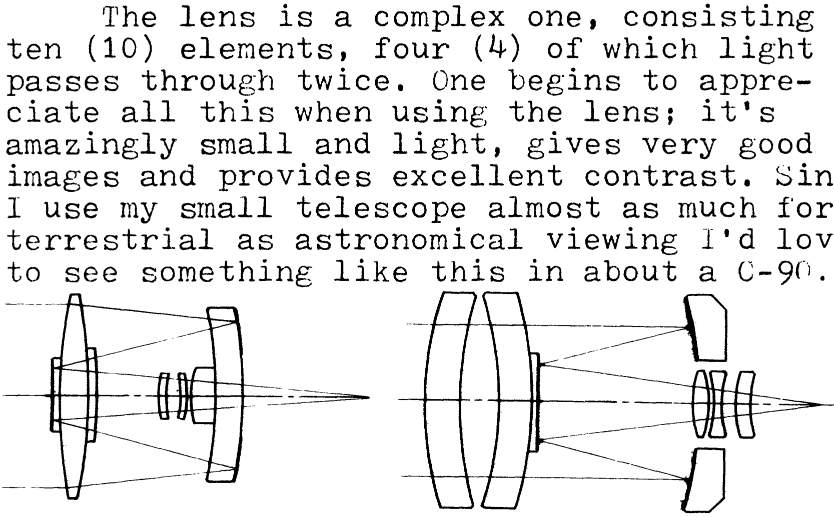
A camera lens has to do more than this, however. It not only must provide excellent resolution and even illumination over a wide field, but it must do this at all focusing distances. Since most mirror lenses are focused by moving the front corrector and secondary ("the front group") to and from the main mirror, this brings us to the critical distance between the corrector and primary so that the closer the lens is focused the worse the image becomes. It's no coincidence that most mirror lenses have very conserva - tive closest focusing distances.

A mirror lens usually has several other elements to help correct some of these aberrations, (typically one or two groups of lenses just before the focal point) but until now mirror lenses have not performed as well as their "lenses only" counterparts.

Enter the new-style mirror lens, such as the "Tamron" 500mm f/8 tele-macro catadioptic lens. Tamron took a somewhat different approach to correcting aberrations. Instead of using one group to correct another, the Tamron lens uses rear-surface mirrors (called "hot mirrors") which light passes through twice as it is reflected. Thus the glass itself acts as a separate optical component, and at each point where the light is reflected, any aberration is compensated for by the accompanying glass elements. Each group is corrected separately and since aberration correction is not dependant on inter-group spacing, aberrations stay pretty much constant over the entire focusing range, even though the lens focuses down to an impressive five and one half feet ($5\frac{1}{2}$').

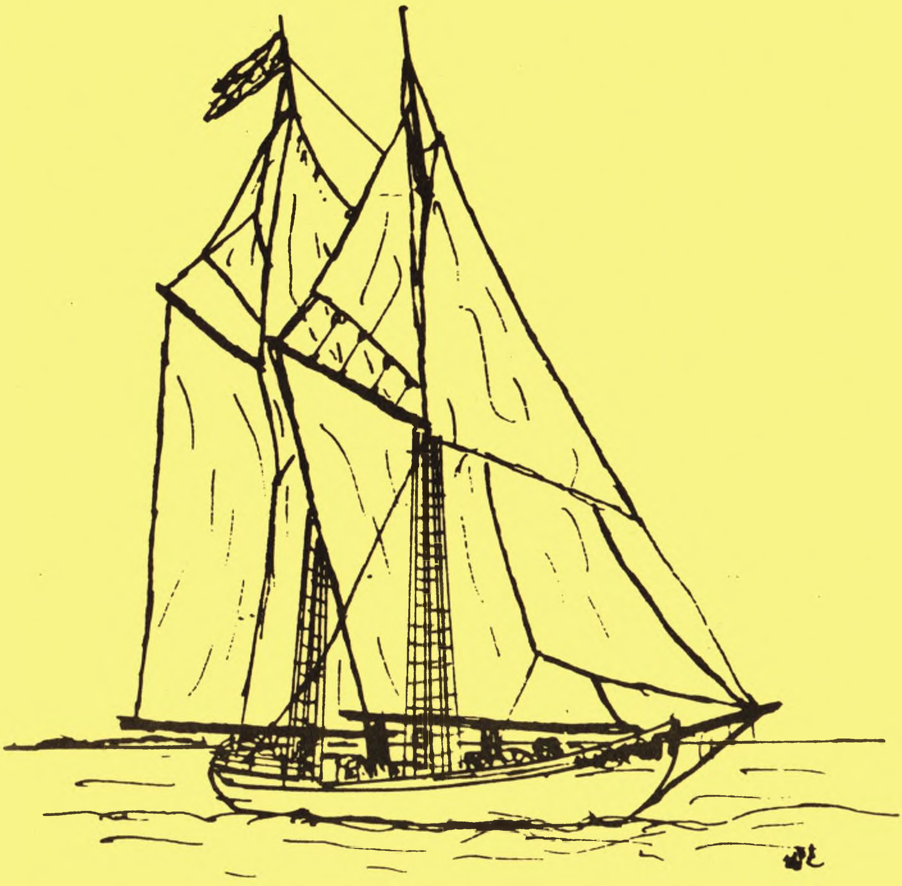
Another problem with mirror lenses is that moving the front group affects the lenses effective focal length by a multiple of this amount, changing the f-stop considerably. In the Tamron lens the front group moves only 7mm causing a change only of about one sixth (1/6th) of an f-stop.

The lens is a complex one, consisting of ten (10) elements, four (4) of which light passes through twice. One begins to appreciate all this when using the lens; it's amazingly small and light, gives very good images and provides excellent contrast. Since I use my small telescope almost as much for terrestrial as astronomical viewing I'd love to see something like this in about a C-90.



Tamron SP 500mm F/8 — Conventional mirror lens

FIGURE 1. Jody LeBlanc



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