NOVA NOTES

BI-MONTHLY JOURNAL OF THE HALIFAX CENTRE

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NOVA NOTES are printed bi-monthly (Jan., March, etc.) through the courtesy of the Nova Scotia Museum. Contributions on any aspect of astronomy and related topics are welcomed. Closing date for the next issue will be Oct 25. If possible articles should be typed in the format of this issue on one side of each sheet.

UP COMING EVENTS: At the Nova Scotia Museum

Friday, 17 Sept. — First meeting of the 76/77 year and one of our most important. NOTE the regular meeting will begin at 7:00 with a talk by our President, Dr. Bishop titled Universal Illusions which I am sure you will find interesting(I've heard him give a similar discussion which evoked a certain amount of thought). At 8:30, weather permitting, we are sponsoring a Star and Sky Party for the general public which will include slides, movies and of course observing with telescopes. Again we ask your assistance, by coming out with your equipment and showing and explaining the heavens to the public. Even if you don't have an instrument of your own,we have several extras which we need manned. This event will be getting publicity in the media, so if at all possible try to keep this evening clear and give us a hand—if it is clear we may be swamped with eager beginning astronomers!

MINUTES OF JUNE MEETING

P.H. Reynolds

Our regular monthly meeting was held on Friday, June 18 at 8:00 p.m. in the Nova Scotia Museum. Dr. Bishop opened the meeting and, as usual, gave us a brief resume of upcoming astronomical happenings. This time the things to note are: the Summer Solstice on June 21, the imminent arrival of Viking 1 at Mars, the Earth at aphelion on July 2. It was announced that the National Office is making available to each centre a collection of back issues of the RASC Journal. Our set should arrive within the next month or so and will be available to interested members. Our next regular meeting will be on Friday, September 17, beginning at 7:00 P.M. with a star night to follow at 8:30 (weather will, of course, permit!). For those who can't resist a good bargain, the Observer's Handbook (1976) is now on sale, price per copy only $2.00. Also available (free) are a limited number of brochures published by the National Research Council of Canada on the Canada-France-Hawaii Telescope (CFHT). For either of these contact either the secretary or the treasurer.

Our speaker for the evening was Dr. Larry Bogan, the Centre's official delegate to General Assembly '76 in Calgary. Larry presented an excellent summary of the happenings in Calgary, despite the fact that his camera failed him at the crucial moment and he failed to get any pictures. Larry began his story at Halifax International Airport where he and Roy Bishop almost missed the appropriate flight and hence almost didn't make it at all! The first formal event at the assembly was the 'beefalo banquet' at Heritage Park on Friday evening, May 21. Following a formal welcome by a representative of the city of Calgary, the Past President of the RASC, Dr. J.D. Fernie, spoke to the gathering on the subject of quasars. There followed a star-gazing party outside, and inside, of particular interest to the three of us from Halifax, a film showing highlights of GA '75, of course, was hosted by the Halifax Centre.

Larry described in considerable detail the Papers Session on Saturday morning. In all, eleven papers were presented; with Larry and Roy each presenting a paper. After lunch the Annual Business Meeting took place. A cause for some considerable discussion was the news that the old National Headquarters property at 252 College Street in Toronto had been sold for $185,000. The Society will carry out during the next year a complete review of its financial state. Further decisions regarding the disbursement of these funds will be deferred until that time. Results of the election of National Officers was announced. Dr. Alan H. Batten is our new President.

The main event Saturday evening was the Province of Alberta banquet held at the University of Calgary. RASC Service Awards were presented at that time, as well as the General Assembly Observing Competition Awards. Following the Banquet, the Toronto Centre presented a slide show advertising next year's assembly, to be held July 1 weekend in Toronto. And last but not least, Dr. J.L. Locke brought us right up to date on the progress of the CFHT.

On Sunday afternoon-evening the delegates were treated to a trip to Banff, and for those remaining on Monday there was a tour of the University of Calgary's astrophysical observatory. High points of the trip for Larry were i) the scenic flight to Calgary, ii) the opportunity to talk to other amateur astronomers from all across Canada, and iii) the observing competition which the Calgary Centre introduced at their assembly.

We all thank Larry for so ably representing the Halifax Centre on this occasion and for his excellent summary presentation. Congratulations are also due to the Calgary Centre for the fine job they did.

This meeting adjourned over coffee cups about 10:00 p.m.

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New RASC Headquarters: (for those who missed it last time)

RASC, 124 Merton St., Toronto, M4S 2Z2

RASC MEMBERSHIPS DUE ON 30 SEPT

May we remind you now that your 1977 Halifax Centre membership fees should be paid as soon as possible. Hopefully a postal strike will not create some of the problems that our treasurer, Bill Sheppard, had to contend with this time last year. Fees for the forth coming year are unchanged. REGULAR membership--$12.50. STUDENT membership--$7.50 (any full time student may claim student fees again this year as the Halifax Centre is prepared to subsidize those over the 18 year limit imposed by the National Office) and LIFE members --$150. which is, to coin a phrase, one of the great bargins of our time.

FEES MAY BE PAID AT THE SEPT. OR OCT. MEETINGS

OR

SEND THEM TO:

MR. BILL SHEPPARD,
1122 Tower Rd., Apt 206,
Halifax, N.S.

The Halifax Centre Executive hopes you have found our activities informative and interesting and we hope you will continue to support our efforts to promote astronomy in the Maritimes. Again we would urge you to give us suggestions on ways to expand and improve our activities in the future.

Note of Thanks

Again Mike and Pete Edwards deserve thanks for helping the Editor in getting the July/Aug. issue of Nova Notes to you. Because of holidays at the printers, NN's did not get back to the Editor before he went on vacation so our regular faithfuls finished the job off. Thanks again guys!

TELESCOPE RAMBLINGS

Stars and Pseudostars

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.

Roy L. Bishop
Maktomkus Observatory

OCTOBER MEETING

15 Oct., 8:00 pm at the Nova Scotia Museum.

A Telescope Makers Seminar: This rather less formal meeting is intended to help get you started with your first (or maybe fifth) telescope. Maybeyou've thought about starting your own mirror but weren't too sure how to go about it. Well here's your chance to save up all your queries and advance them to our panel of experts (defined as anyone who has finished one or more telescopes sucessfully). If you fall in the last category, try to recall your problems and also the methods which proved to be succesful for you. The exchange of information should prove useful for all. Even if you have no intention of building your own telescope wouldn't you like to know what those of us who do go through? Any aspect of the fabrication of telescopes can be covered providing someone has some experience in the area. Anyone having reference books should bring them along as well.

METEORITES:

THE EASY WAY TO MAKE A HUNDRED DOLLARS

Meteorites are pieces of rock and metallic iron that have fallen to earth from outer space. They vary in size from that of a pinhead to masses weighing several tons. Large ones may impact with sufficient force to produce craters a mile or more in diameter, but the smaller ones generally land with little effect and are often found loose on the surface. Although meteorites may differ widely in their chemical composition and physical properties, they all have one thing in common: they are of extra-terrestrial origin, coming from space far beyond the earth's atmosphere.

Meteorites are related to meteors which are the "shooting stars" that are often seen streaking through the night sky with a brilliant, silvery light. Meteors are the incandescent paths that the objects produce as they crash through our skies. Fragments and pieces of meteors that reach the earth are called meteorites.

Meteorites are generally believed to occur when comets or small planets (called asteroids) collide with each other in space. Each one of these fragments that nears the earth is set ablaze by the tremendous friction developed as it hurtles through the earth's atmosphere. The brightly glowing fragment and the tail of glowing debris produces the luminescent streak or fireball of a meteor. Most fragments burn up completely but fortunately, some survive. A meteorite fall may consist of only one specimen or a shower of several hundred.

Because meteorites are natural materials recovered from space, they are invaluable as a source of information to scientists in their study of outer space and space vehicle re-entry problems. Also, because they are probably pieces of broken planets, they can provide important clues as to what the interior of our earth is like. For these and other reasons, they are in great demand by the Geological Survey of Canada and also Canadian Universities and Museums.

The importance of these meteorites is such that the Geo - logical Survey of Canada will pay $100 or more for the first specimen of a Canadian Meteorite. Should you find a specimen possessing the apparent characteristics of a meteorite, please forward it to:

Director
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario K1A E08
Attn. Meteorite Identification

The specimen will be examined and reported on free of charge and payment will be made after positive identification. If the specimen is too large for mailing, a letter describing its appearance and exact location should be sent instead.

Meteorites are divided into three groups which vary widely in both appearance and properties. They are as follows:

STONES or AEROLITES	- resemble common rocks, are the most abundant group
IRONS or SIDERITES	- masses of metal with some silicate minerals; are very heavy
STONY-IRONS or SIDEROLITES	- composed of about equal parts of metals and silicates

Despite many resemblances to natural rocks and minerals, meteorites possess a number of distinctive characteristics as listed below.

Meteorite specimens generally possess a fusion crust, which is dull black to brown and quite soft. This is more prevalent on the stones and stony-irons and may have partly flaked off.

Irons and stony-irons are strongly magnetic. They are irregular in shape and their surfaces have many smooth pits much like thumb prints.

Stones contain scattered metallic iron grains that are

visible on broken or polished surfaces. Also small spheres of silicate minerals (called chondrules) are visible to the eye on broken surfaces. Surface pits on stones are shallower and less noticeable that on irons.

Some meteorites may not exhibit many of these characteristics and may require laboratory tests to confirm their identity.

- reprinted from Energy Mines and Resources pamphlet

This article was gleaned from <u>Stars & Things</u>, Vol. 2, No. 1 Summer 1976--a quarterly journal produced by the Centennial Planetarium, Calgary, Alberta, Canada

TELESCOPE MAKERS TAKE NOTE

Have you had the annoying experience of running out of grinding compounds while fashioning a mirror surface? You have? And were you disgusted with the price of a pound of No. 80 from the regular suppliers? I can't imagine why?

Well for these problems I have found a solution--and right here in Halifax too!

CRAFT JEWELLARY AND LAPIDARY

1883 Granville St. (next to the Promenade entrance to Historic Properties) sell grinding compounds normally used for polishing gems but which are perfectly suitable to the ATM's trade. And the price is right too! $1.50 for #80 per pound. A small variety of finer grades are obtainable, however since they are not in sealed containers, you should use caution if using them on your carefully worked surface. The #80 can be used without fear however and at any rate this grade is the one most frequently required.

Bk

SOME EARLY VIKING RESULTS

Bill Calnen

"History was made on July 20, 8:12 AM (EDT) when the unmanned Viking A Landing Craft landed on the surface of Mars. This day also markes the seventh anniversary of America's first manned moon landing."

The Viking A spacecraft entered orbit in late June and remained in orbit around Mars while finding a safe landing site. Besides photographing the surface, other experiments on the craft were testing the atmosphere. On July 18, infra-red spectroscopy instruments confirmed that the planet is obviously wetter than anticipated. It may be possible to observe ground fog at different times of the day. Water vapour readings showed that 30 microns (scale height) of water had been found in the atmosphere near the landing site—sufficient to cause frost or fog.

A day later, it was found that 80% of the inert gas, argon, was to be found at the south polar cap region, but much smaller amounts cover the remainder of the planet. Amoung other data sent back was the fact that the temperatures at the south polar area are colder than thought—below the condensation point of CO_2. Atmospheric readings showed the planet has about 3% nitrogen and 1.5% argon in its carbon dioxide rich atmosphere.

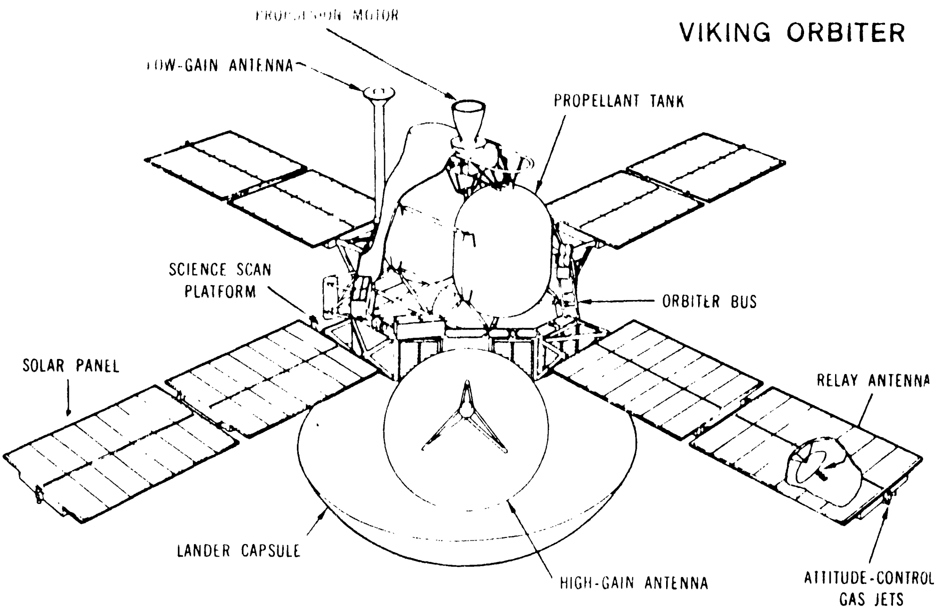
On July 20, the Viking lander departed fron the Orbiter. the craft landed 460 miles northwest of the site orignally chosen for a landing on 4 July. That landing was of course called off when the terrain was found to be too rough. Seventeen minutes later, the Jet Propulsion Laboratory (JPL) received the first signal from the lander confirming its safe landing. After arriving on the planet, the lander sent back its first picture from the surface of red planet showing a rock strewn landscape looking much like a desert with craters and dunes in the distance.

The first weather report from the three legged observatory: light easterly winds in the afternoon shifting to south-westerly after midnight and reaching a maximum force 24 km/hr. Temperatures ranged from -85° c to -30°c. No signs of any precipitation—atmospheric pressure, 7.70 milibars.

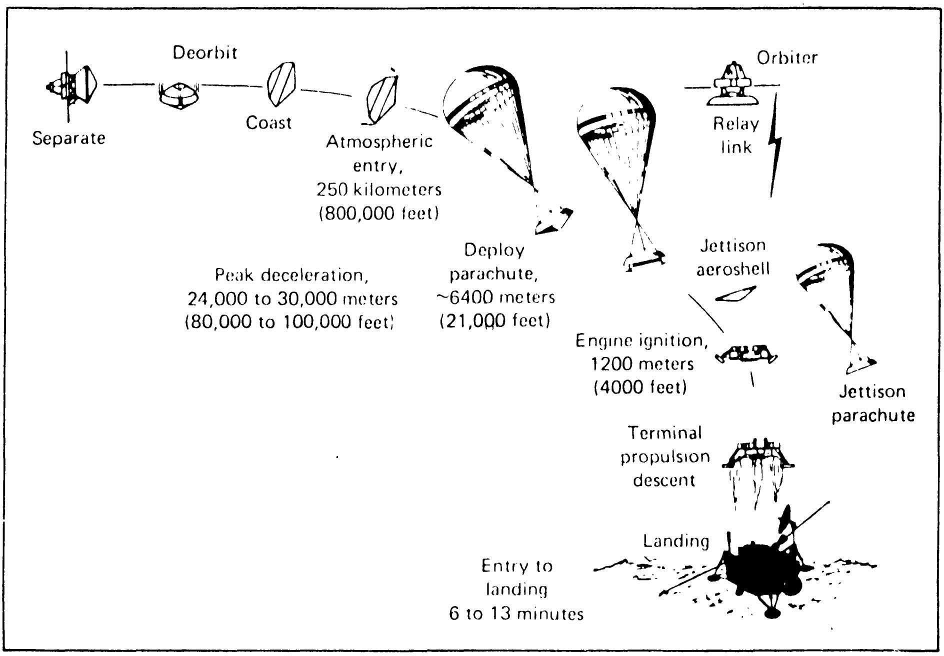
One of the Viking A experiments, designed to detect respiration, showed that 15 times as much oxygen as the scientists expected had come from the Martian soil sample; The other, which uses radioactive tracers to look for signs of metabolic activity, "a very strong positive respronse was received at JPL. The oxygen might simply have been released from some mineral in the soil sample when it was placed in the heated experiment chamber, and the radio-active gases produced in the other test might have been caused by an oxidation process not connected with life. The pyrolitic release experiment, which looks for carbon assimilation by micro-organisms, showed a radioactive curve six times higher than anticipated. Another puzzling result came from the labeled release experiment which showed a second surge of radioactivity when more nutrient was added to the martian soil in its test chamber.

In analysing the soil, a photograph taken by the Viking A lander showed a foot-print like trench about 6.5 inches long, 2.5 inches wide and 2 inches deep that had been scooped out by Viking. Scientists were struck by the fact that the sides of the trench had not collapsed. "it's strange material—it looks and acts like wet sand". The material looks much darker and seemingly more cohesive than the dirt above it. Sharp edges along the bank of the trench seemed to indicate that the Martian subsoil was not dusty as had been thought.

After the first colour photos, scientists studied them and came up with some information about the red surface. The soil seemed to consist of a fine-grained reddish material interspersed with small blue-black or blue-green patches. Many of the rocks were also coated with a reddish stain, strongly suggesting the presence of iron that had been rusted by atmospheric or water bound oxygen. Other rocks, blue-green and opalescent, reminded some scientists of copper ore. The organic chemical



Sections of the orbiter are identified in the diagram above. Unless otherwise credited, illustrations with this article are from NASA.



The lander's atmospheric entry and touchdown on Mars will occur after the orbiter's cameras and other monitors have thoroughly inspected the landing sites.

investigation found at least 34 elements in the soil sample including some rare earths. The inorganic chemistry lab's first findings showed that the soil sample contains calcium, silicon, Titanium, aluminium, iron and the iron oxide responsible for the reddish hue of Mars.

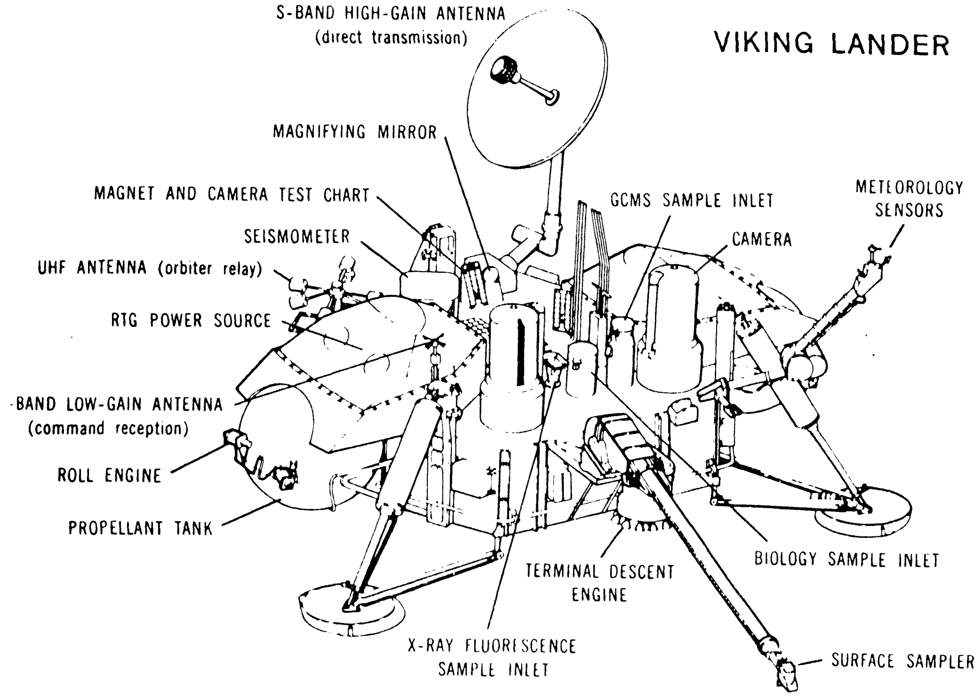
Surprised scientists inspected still other photographs which showed objects formed by the rocks. There was one rock that resembled a car muffler and another which looked like a horsehead. The latest was one showing markings of letters 'BNG' on it. Geologists quickly recognized that this was a natural phenomenon--not a marker left by some past martian civilisation. A geologist from the photographic team, said the 'B' was simply the result of shadowing effects under certain solar angles. "Things like this are very common on earth and we didn't take this thing seriously when we saw it. We obviously knew what it was."

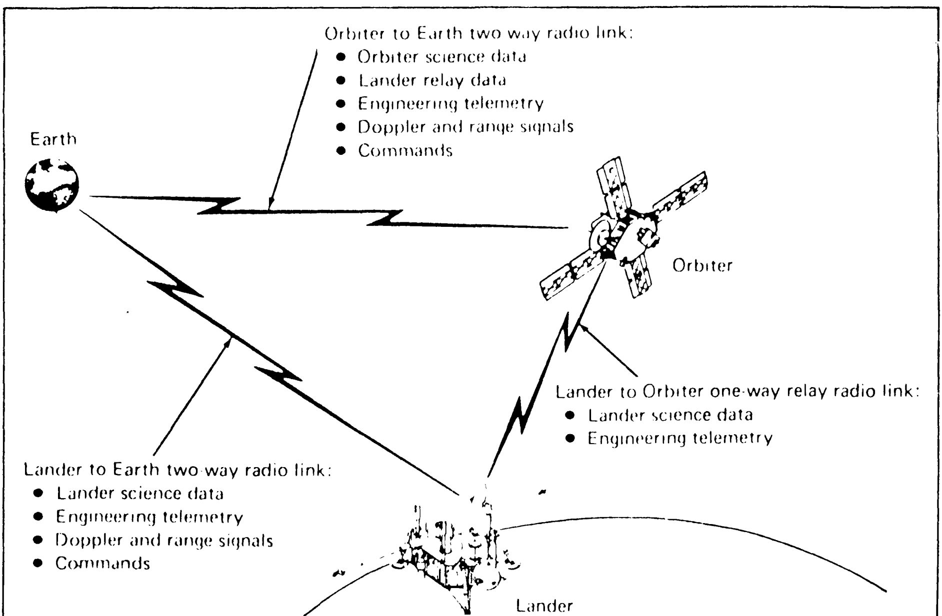
On Saturday, August 8, Viking B slipped into an egg-shaped orbit around Mars, preparing to land a second life seeking robot on September 4. Hopefully the landing will be successful and if so the next issue of Nova Notes will probably have a review of some results as well as more from Viking A.

If any of you Carl Sagan fans are interested, a four page verbatum copy of an interview with Sagan and Bruce Murray concerning Viking results that was shown on ABC TV can be had for 25¢ by writing:

Tyler Business Services, Inc.
1201 Connecticut Ave., N.W.
Washington, D.C.
20036

VIKING LANDER





Once it has safely reached Mars' surface, the lander will set up a series of communication links with its orbiter and the tracking antennas on Earth.

A NEW THEORY TO EXPLAIN UFO's

Bruce Torquemada

At a recent conference two illustrious members of the astronomical community formulated a new theory concerning the origin of so-called Unidentified Flying Objects (UFO). After considering all (or at least, most) of the characteristics displayed by these elusive objects, for example their velocities, abrupt motions, related electrical and magnetic effects, appearance and effects on landing sites, we (the two illustrious so-and-so's) have concluded that UFO's are black holes. A black hole (Fig. 1) of small

Fig. 1

size and mass could orbit Earth, possibly even being partly inside the Earth (part of the orbit, we mean) and its forays through the atmosphere would be observed as an apparition resembling the classic UFO.

Consider: black holes (Fig.1) absorb mass gravitationally, and as the mass is swept into the hole it swirls around somewhat. Extreme tidal effects near the hole (Fig.1) would cause molecules of the air to be ripped apart and closer in even atoms are endangered. Released energy would make the object glow and where the hole itself was located would be seen as a bright spot, which would no doubt be described as 'shiny'. The nature of the ionization of the air about the black hole (Fig.1) would even allow radar observations of it.

The orbital motions of the black hole would provide tremendous velocities for the objects, but the most famous UFO characteristics would be due to the electric charges the black hole would pick up(Fig. 1). It is to be expected that since the hole is almost randomly absorbing matter that it would occasionally pick up one charge or another (the choice being limited, as far as the writer knows, to two) and the charge coupled (if I may use the word) with the black hole's spin would cause it to react with the Earth's magnetic field. This reaction, as the black hole (Fig. 1) randomly aligns and maligns with the field would make the hole randomly change directions. Further reactions with the recently discovered East and West magnetic poles (as reported by Vincent Sheepdip de von Foopdeck in the Am. Jour. of Geophys. Stmp. Coll. an. Br. Drnkn.) would even cause stranger flight gyrations, and it is this writer's opinion that studies of the motions of Black Atmospheric Holes (as I believe UFO's should be termed) would reveal a wealth of information on the magnetic structure of the Earth.

Another phenomena explained by charged BAH's would be the stalling of automobiles (or 'cars', as they are sometimes called) and failures of other electrical devices like telephones and radios while BAH's are around. The magnetic fields set up around high tension power lines would also attract BAH's, and indeed this has been observed. The burning of grass (lawn grass) and the scorching of the earth near places where BAH's have set down (as we know these are spots where they were magnetically attracted or approached on their orbit) is no doubt due to the amount of X-rays given off by the black hole (Fig.1).

It is possible that two black holes orbiting each other (Fig.1 twice) would provide saucer or segar or a shape oscillating between the two shaped UFO's, excuse me, BAH's depending on the orientation of the orbital plane. And even more black holes (Fig. 1 several times) could provide for most of the observed shapes of BAH's. Several black holes on similar orbits around Earth but not revolving about each other is undoubtedly the explaination for observations of groups of BAH's.

Since the West Pole is located Bermuda many more BAH's than usual would congregate there and possibly they would go through and sink aeroplanes and ships located in this area. It would be a good project for some Master's student to check and see if there has been an abnormal loss of vessels in this and the area surrounding the East Pole off Japan. Studies of the Gambolputty effect (Cleese, Chapman, Gillam, Jones, Idle and Palin, Ap. J., 1975) suggest that the residue tidal-electromagnetic-gravitic forces from BAH orbits in conjunction with the West-East Pole interactions may tend to concentrate under NSEW aligned tetrahedra or possibly even pyramids. This could be another avenue to check into and much serious work could be done here too.

Knowing the true nature of UFO's some predictions are possible. One is that the mass exchange between BAH's and Earth would cause Earth's rotational period to decrease and even cause the Moon to recede. Periodic variations in its rotational period should be observable as a result of the periodic motion of the BAH's in their orbits. Such variations may already have been observed and attributed to incorrect hypothesis--recalculations and new measurements are urgently required. Another prediction is that concentrations of BAH's following the East-West polar lines would tend to weaken Earth's crust to repeated passages through it in the area around the pacific ocean. It should be fairly easy to check this area for possible volcanic and other disturbances of this type.

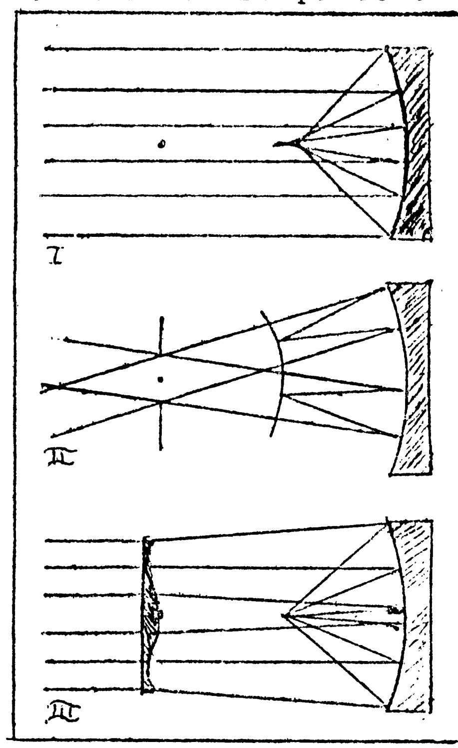
The only factor holing back the studies of the BAH's at this time is that due to the erroneous calculations of Stephen Hawking and others of his ilk who have managed to convince most people that black holes (Fig.1) of the size necessary for BAH's would vanish inside a year. But then again maybe SOMETHING SOMEWHERE is creating black holes (Fig.1) to appear as BAH's...hmmm ...I'd better think this over. Expect a followup article.

THE LENSLESS SCHMIDT CAMERA
or
A PROJECT WITHOUT AN OBJECTIVE

Due, perhaps, to the May '74 Sky and Telescope article on the "lensless Schmidt Camera" there has developed a keen interest in constructing such instruments amoung members of the Halifax Centre. At present there are three or four cameras being built by individual members.

Knowledge of this degree of interest, amidst a small group, in an optical system similar to his design, would have no doubt thrilled Bernhard Voldemar Schmidt since, in spite of the revolutionary qualities of his camera, he could not find a buyer for his instrument in 1931. Prior to the invention of the Schmidt Camera, the problem of taking photographs of the heavens was, first, the time required to capture enough light(from the small available field) to make an impression on the plate. Therefore it was necessary to guide one photograph for hours. Second, since it took so long for one photograph, the number (and sky area) which could be taken was greatly restricted. The field could have been increased by making a mirror of shorter focal length but this introduces two additional problems. First,a large diameter mirror of short focal length is difficult to parabolize. Second, the shorter the focal length the worse the coma. It increases proportionally to the inverse square of the focal ratio. So in 1931 Schmidt published a paper which described how a high-resolution, deep-space, camera of small focal ratio and wide field could be constructed. Also, it would produce images without coma. In 1936, the year after Schmidt died, an 18-inch f/2 Schmidt Camera was put into operation at Palomar. Due to the success of this insrument the famous 48-inch f/2.5 Schmidt Camera was put into operation in 1949. Mapping the celestial sphere north of declination -27, the first project took seven years (it would have taken the 200-inch Hale telescope 10000 years).

The most difficult challenge in development of the camera was the elimination of spherical abberation without introducing coma. Schmidt reasoned that if a spherical mirror is used in conjunction with an aperture at its center of curvature, the stellar images would be free of coma and astigmatism over a wide flat field. He also reasoned that if the aperture stop is replaced with a suitably figured aspheric correcting plate, spherical abberation could be practically eliminated. The diagrams at right will illustrate his logic. The top diagram illustrates spherical abberation resulting from a spherical mirror. Here three concentric beams from infinity are reflected at different angles and hence have different focus points. Also the greater the diameter of the outer beam the greater the spread of focus. One way to reduce the abberation is to place an aperture at the mirror's center of curvature (center diagram). As it lessens the diameter of the largest beam, the degree of abberation lessened as is also the spread of focus. The stop is placed at the center of curvature so as to reduce the spread of focus over the entire field uniformally. Also,



Compare the light paths in: I, a simple spherical mirror; II the simplified Schmidt design; and III, a conventional Schmidt with a correcting plate.
Sky &Tel. Oct '59, p703

every full aperture beam which enters the camera will strike the mirror at the same angle and all beams being the same diameter will reflect to a focal regionof considerably diminished depth. By this system spherical abberation is reduced over the entire field without introducing coma or any other form of abberation. However since the focal surface is curved the instrument cannot be used as a telescope. L.A. Jones states in his article on the "simplified Schmidt Camera", in Sky and Telescope, October 1959, "In small cameras of medium to long ratio (eg. 4-inch, f/6) a flat filmholder is still allowable but otherwise it will be necessary to use a curved filmholder...." The lensless system was however dismissed by Schmidt as being impractical because in order to eliminate abberation to the point of being less than Rayleigh's limit of resolution, the aperture stop would have to be such that the system would be f/10 or greater. But, by accepting slight abberation and by not expecting the quality of a true Schmidt, the lensless Schmidt Camera of reasonably faster focal ratio is acceptable to the uses of the amateur astrophotographer. The bottom diagram on the previous page, shows how Schmidt replaced the aperture stop with a thin, zero power, aspheric lens. The lens is weakly convex at the center and weakly concave around the periphery.

Prior to the construction of such an instrument it will be necessary to decide upon which criteria to relax, and therefore the tolerances to be accepted in the end result. A formula for use in determining the size of stellar images was given by L.A. Jones:

$$d = 0.008\ a/N^2$$

d=image diameter, a=aperture, N= focal ratio (a and d are given in inches). One other specification which applies to any Schmidt system is that of the relation of primary and aperture diameters. The primary should be larger than the aperture by twice the diameter of the filmholder.

This is another specification which may be subject to compromise. If you are willing to permit some vignetting you could slightly reduce the primary diameter, and hence reduce the camera's weight.

Some of the advantages of the lensless camera to the conventional instrument, as mentioned in the 1959 article follow. Reflections at a correcting plate tend to waste light. Ultraviolet light may be strongly absorbed by the corrector. One other advantage is that the aperture of the lensless camera can be made larger on certain occasions. The effort in constructing the lensless is much less since, as Dr. Ashcraft put it Sky and Telescope, May '74, the figuring of the "corrector plate" is really a breeze. (sorry)

Finally, when calculating the light loss of an intended system and finding that you are loosing most light due to the relative sizes of filmholder and aperture, recall the comments of Robert E. Cox at the conclusion of Dr Ashcraft's article.

> "For visual observing, the diameter of the secondary mirror should not exceed about 30 percent of the aperture, but in photographing star fields a filmholder fully one half the aperture is quite acceptable."

References:

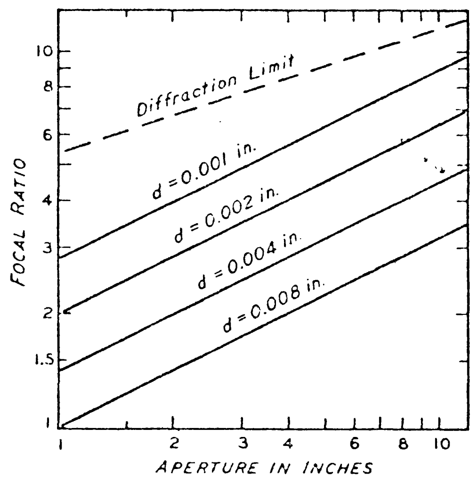
The Celestron Schmidt Camera, Celestron International, Torrance , Calif.

Sky and Telescope, "Gleanings for AMT's", October 1959, and May 1974, Sky Publishing Corp., Cambridge, Mass.

Michael P. Edwards

Editor's Addendum:

Since this type of telescope is even easier than a conventional newtonian to build (no parabolizing to do), it might be of use to some of you to have the following diagram (also from the article mentioned by Mike). And anyway I had a page to fill out.



In using this diagram to decide what size and what focal length (or ratio) is suitable for you, one must remember that seeing is rarely of sufficient quality to demand a diffraction limited mirror. Also your mount and guiding will not require such rigorous standards of the optics, and will themselves result in images of at least ½ mm in diameter more often than not. With this in mind and that 0.004 in. equals 0.1 mm, then you can use the graph to make a decision on the parameters for the mirror. One NOTE you should be especially aware of is that aperture here refers to the diameter of the diaphram (see fig.**ii** in the article) and not to the mirror diameter. I would suggest (not from any experience with lenseless Schmidts) that a choice for the size of the stellar disc around 0.004in should provide excellant photographs and that it would be a rare occasion when you would regret not having made your instrument to tighter constraints.

THE PERSONAL EQUATION IN ASTRONOMY AND THE RISE OF EXPERIMENTAL PSYCHOLOGY

Part 3: The Contributions of Helmholtz and Donders

Despite the discovery of new automated techniques which made the problem of individual differences in perception a less serious issue for astronomy, interest among astronomers in the phenomenon had continued. While astronomers were struggling with the problems of developing more sophisticated equipment and were attempting to determine the range of astronomical factors for which the personal equation was relevant, there was a revival of interest in the earlier theory that a possible explanation of the observed perceptual differences among observers might lie in physiological differences among them. Was it possible that there were differences in the speed of neural transmission from one observer to the next? Could this have been the reason why Kinnebrook consistently differed from his supervisor, Maskelyne, in the making of stellar transits? It was Hermann von Helmholtz (1821-1894) who reintroduced this line of argument.

Helmholtz, the son of a Prussian officer, was educated with the intention of becoming a surgeon in the army, however, the exact scientific methods of his teacher, Johannes Müller, sparked his interest and led to "the eager acceptance of the inductive and mathematic approach" to physiological and psychological questions (Murphy & Kovach, 1972, p.137). Müller had thought that the speed of neural transmission was comparable to the speed of light. As a result of this widely held view, the idea that individual differences in perception might be due to differences in the speed of neural transmission among different observers had been rejected more-or-less out of hand, when Bessel had first searched for an explanation.

Beginning to work first on the frog, Helmholtz devised a method for determining the speed of conduction in motor nerves. Stimulating an exposed nerve at varying distances from a muscle in a frog's leg, he measured the time it took for the muscle to respond in each case. The difference in time could be used to determine the length of time it took the impulse to be transmitted between two points along the nerve at different distances from the muscle. This method produced results which suggested that the speed of neural transmission--at least in this experimental animal--was approximately 30 meters per second. Instead of being quicker than light, the nervous impulse appeared to travel slower than sound! The old notion that "mental" processes were practically instantaneous was clearly untenable.

Recognizing the possibility of inter-species variability, Helmholtz moved on to the study of humans. This work is known through his correspondence with his father during the year 1850. His approach here was similar to the work he had done with animals, although it involved the stimulation of cutaneous sense receptors in the skin rather than the exposed nerves he had used with his frogs. Instructing his human subjects to move a hand as soon as they felt the stimulus, Helmholtz stimulated them on the toe and the thigh. He then noted the difference in time for the motor response to occur and again tried to work out the length of time it must have taken the impulse to travel between these two points based on the observed time difference. These were the earliest "reaction time" experiments as such.

Unfortunately, the results Helmholtz obtained were inconsistent with large differences appearing not only among subjects, but even within one individual over trials. As a result, Helmholtz abandoned the investigations. Like the astronomers before him, Helmholtz was disturbed to find these individual variations. Being primarily interested in "establishing reliable measures of nerve conduction, he considered inter- and intra-individual variability as impediments to precise experimentation" (Capretta, 1967, p.69).

Luckily, despite Helmholtz' disillusionment, the finding of the comparative slowness of neural transmission caught the interest of other scientists. The Swiss astronomer, Hirsch working (1861-1864) with the engineer Hipp, who had just invented the famous Hipp chronoscope, undertook to compare the speeds of reaction when various types of stimuli were used. They were particularly interested in comparing the different sensory modalities, and the results they obtained appear to have been reasonably accurate. The average reaction times they reported for different subjects and over different situations were:

RT to visual stimuli	200 ms
RT to auditory stimuli	150 ms
RT to electric shock on hand	140 ms.

Such findings, of course, raised the question of why differences among the modalities in speed of response should exist, but it remained for the sensory physiologists and early psychologists to discover the explanation.

Donders, a Dutch physiologist, already well known for his studies of the physiology of the eye, in the late 1860's took up the study of reaction time, and it was he who grasped the significance of the issue for psychology. If physical events such as heart beat or a reflexive movement of the muscles takes time, why whould not the higher mental processes occupy time? If thought (or stimulation) and movement follow one another at an appreciable interval, instead of being practically instantaneous, then the body does not instantly obey the mind.

> Once this was realized, there was opened up a whole series of chronometric problems which eventually kept the experimenters busy for several decades--problems concerning individual differences (which had been the original point of departure), concerning the relative delays caused in different parts of the sensori-motor apparatus (sense-organs, sensory nerve, brain, motor nerve, muscle), or concerning the effect of different kinds and different intensities of stimuli (Flugel, 1945, p.91).

The problem, of course was to determine the length of time which these various psychological processes took. Donders' early work, building on the beginning made by Helmholtz, dealt with simple reaction time, the reaction of a predetermined response to a predetermined stimulus. An example of this most basic form of reaction experiment might involve the subject pressing a key when an auditory stimulus such as a bell sounded; the time between the sounding of the bell and the pressing of the key was simple reaction time. Excited by the possibility of being able to measure a psychological process which conventional wisdom had considered to be more-or-less instantaneous, unmeasurable and, therefore, outside the realm of scientific investigation, Donders quickly moved on to more complex processes. If the reaction was made more complex, for example, could not the increased time taken to respond be attributed to what was added to complicate the reaction?

Donders theorized that there are two significant variables in reaction time situations--the stimulus variable involving the nature of the stimulus and the method of presenting it, and the response variable, involving the type of behaviour required of the subject. Some types of responses could be more complex than the straightforward response involved in the simple reaction experiment, requiring, for example, discrimination and choice. To examine the effects of these variables empirically, Donders devised three types of experimental situations. In the first, the a-method, a single stimulus is presented and the subject is required to make a specific movement as quickly as possible. In the other two situations, complications are added--the subject is required to do more than make a particular response. In the b-method, two stimuli are presented, and one response is required if one of the stimuli is presented first, and the other response if the second stimuli is presented first. Again, the independent variable is speed of response. In the c-method, there are two stimuli which might be shown; the task for the subject is to react if he sees one and not to react if he sees the other. Donders reasoned that the subject must discriminate between the stimuli but does not go through the process of selecting the right movement. There is, therefore, no act of choice or motor selection in the c-method. It was Donders' assumption that in complex reactions, one or more additional acts are inserted into the simple reaction and that the time they require may be determined by subtracting the simple reaction time from the more complex.

> In an experiment to try out the method, Donders used speech sounds as stimuli. The [Experimenter] pronounced one of the five syllables, 'Ka, Ke, Ki, Ko, Ku,' under the following conditions:
>
> a-reaction: the stimulus was always, 'Ki,' and the response also was to be 'Ki'.
>
> b-reaction: the stimulus was any one of the five syllables, and (the subject) was to respond with the same syllable.
>
> c-reaction: the stimulus was, again, any one of the five syllables, but (the subject) was to respond only to 'Ki', using this syllable as his response.
>
> The speech vibrations were recorded on a moving drum. The average (response times) were as follows:
>
> a = 197 ms
> b = 285 ms
> c = 243 ms.
>
> By subtraction, then,
>
> c-a = 46 ms, the time occupied by sensory discrimination,
>
> b-c = 42 ms, the time occupied by choice or motor selection (Woodworth, 1938, pp.302f).

Donders predicted that the a-experimental situation would require less time than the c-method; his theory was that a-method required only a simple reaction, while c-method involved first a sensory discrimination (was it stimulus one or stimulus two which had been presented?) and then a response. Donders thought "he could measure the discrimination time by subtracting the simple reaction time from that taken with the discrimination method" (Murphy & Kovach, 1972, p.109). The b-method was psychologically the most complex of all; it required a discrimination regarding which stimulus was presented first, a choice as to which way to respond, and finally, the reaction itself. Again, by subtracting, Donders believed it possible to determine the time the choice had taken (a comparison of methods b and c). While there were serious methodological problems in Donders' investigations, these first attempts to measure the speed of the higher mental processes were both ingenious and original. "Mental chronometry," as it was called, was launched, to be pursued by Wundt and others in the remaining decades of the nineteenth century.

Various critics have drawn attention to the relatively crude technique employed in Donders' early studies. He seems not to have been aware of the significance of either the "variable" or the "constant" errors in experiments of this sort. "Thus, on the one hand, he was content with less than thirty trials with some of his subjects, neglecting the questions of the statistical significance of such small samples, while, on the other hand, he made no allowance for the effects of practice and fatigue and for the influence of these factors on the order in which the experiments were conducted" (Flugel, 1945, p.187).

Other investigators, adopting Donders' subtractive method, found that subjects differed in the speed of their reactions, and even different experimenters seemed to get varying results. Such discordant findings soon led to the investigation of the errors which apparently were contaminating the general method. There were, as well, criticisms of the whole procedure, with the argument being made that one cannot say, with certainty, that "one process exactly fills its assigned span of time and is instantly superseded by another process when it ceases" (Murphy & Kovach, 1972, p.109).

Despite such problems and doubts, Donders' work has been of permanent significance in several respects. It was he who showed that some of the variability of results which had been bothering investigators for decades was due to central psychological processes rather than to simple differences in the speed of conduction. To him must also be given the credit for beginning the examination of the time relations of psychological processes. As Boring (1963, p.147) points out, there were a group of scientists in Germany in the 1860's who were looking for psychological variables that are measurable. "It was not so much that measurment intruded itself upon psychology as that these new psychologists were seeking out psychic measurables and dragging them triumphantly into psychology." If psychology was to become scientific, it must measure its variables. With Donders' discovery of a means of measuring the higher mental processes, a new era had begun.

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FROM THE CENTRES—OTTAWA

A NEW WAY TO BUILD A TELESCOPE

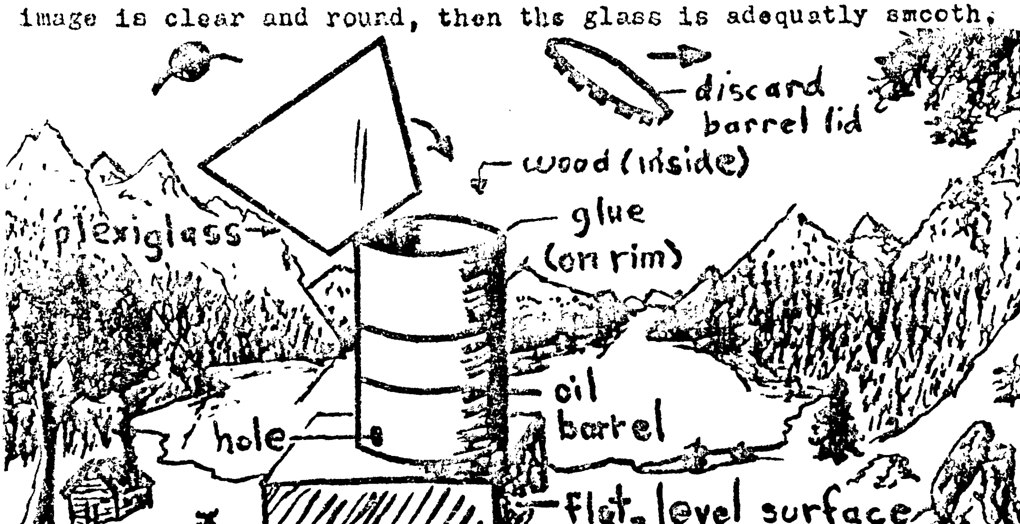
Steve Amin

Has it ever occured to you that you are wasting hundreds of dollars and over 60 hours every time you make a telescope? Well, it's true. As I point out in my book(of the same title as this article), "...most telescopes can be made by ingenious methods which can save up to 95% of the cost of a telescope. These miraculous time and money savers which I designed entirely myself, are not only cheaper and faster, but are easier to do, require less knowledge, testing of optics, and worry."

Making mirrors is almost the most important part of building your telescope, therefore the most care must be taken in order to insure a quality job.

The materials you will require are an 18 inch square piece of 1/2" thick plexiglas, an oil barrel, a supply of wood,, someloose change (no pennies), "grinding solution", and other odds and ends.

First you must be sure that the reflecting surface of your plexiglas is absolutely smooth. Choose the best side, and then as a test, hold the glass up so that the sun just glances off at the steepest possible angle of incidence. If the sun's image is clear and round, then the glass is adequatly smooth,



but if not you will have to smooth it yourself. A good way is to use steel wool or sand paper and repeat the test until the proper reflection is achieved.

Next, you will have to prepare the oil barrel. Remove the top lid and drill a 2 inch hole in the side near the bottom. Drop in the wood. Cleanliness is the utmost concern in any kind of mirror making. Therefore it is stronly ecommended that the plexiglas be washed in your dishwasher, hen hand scrubbed using a soft J-cloth and Comet, Janitor in Drum, or some other industrial strength cleaner.

After cleaning carefully, pat dry with fresh paper towels. hen go out to your oil barrel and squeeze some Krazy Glue round the rim of the open top of the barrel, which should be et on a flat, level surface.*

Next, place the plexiglas refector-surface down on the op of the oil barrel, making sure that there is a good glue ond between the plexiglas and the barrel rim all the way round. (see diagram)

When you are sure that the seal is complete you are eady to mix up your "grinding solution". The standard ormula is 2 parts gasoline to one part kerosene to one part ethanol with the volume being one over the f/ratio times 10 or a value in gallons. The solution should be poured into he hole you drilled near the bottom of the can, and then lit ith a match. You will then notice that the intense heat and xpanding hot air inside the barrel pushes the plexiglas out nto the shape of a parabola. Carbon deposits from the ncomplete combustion will give the inside of the tube a flat lack appearance.

Now quickly, before the barrel and plexiglas cools, get a an opener, and turning the barrel on its side, cut off the ottom, making sure the barrel doesn't roll away, and watching ut for any still burning wood which may fall out. While olding the barrel mirror-side down, drop some of your loose hange onto the mirror's concave surface and swirl the barrel around to allow the melted coins to cover the entire surface. llow the silvered surface to dry and cool.

If you were too slow in opening the bottom of the barrel, hen you lost too much heat. The coins probably didn't melt; nstead just sank into the soft plexiglas. If this happened, ut the plexiglas from the end of the barrel. It makes a nice inner plate, coaster, paper weight, or can be sold to local souvenir shops as an example of canadian coins preserved forever in plastic.

For your diagonal, a rear view mirror is best. Not only does it come with its own mount (which enables it to be bolted to the inside of your barrel), but it has a ball joint, letting it be aimed as you wish.

For a focussing mount, close fitting toilet paper tubes can be used. To achieve a flat black surface, they may be placed in the oil barrel during the wood burning.

The entire telescope is, of course, hand held.

*(I am slightly confused; do you set the rim of the open top of the oil barrel on a flat, level surface, or just the Krazy Glue?) ed.

COMET 1976(d)

In April, the forth comet to be discovered this year was found on plates taken at the European Southern Observatory by Drs. Paul Izzit-Hardly and Ian Worthit. It appeared as a 10" diffuse disc on plates taken in the direction of the constellation Dorado near RA -68° Dec 6^h 30^m. The discovery was made while searching for planet-X. From just two measures of its position two weeks apart, the orbit has been calculated. Unfortunately the positions are only accurate to ¼' and the path will more than likely deviate considerably from the prediction. If it doesn't then we could be in for a spectacular apparition next spring. Brian Marsden of the SAO in Cambridge Mass. has, from the observations, predicted a path between the Earth and Moon about two weeks after it passes perihelian on 1 April 1977. As has been the case since Kohoutek, he does not want to speculate on the brightness of the Comet as it nears Earth but he at least suggests it may be at least as bright as Venus and the tail of Comet Izzit-Hardly-Worthit will more than likely exceed that of Kohoutek--not terribly difficult I would suggest.

If these unsubstantiated reports turn out to be correct astrologers--yes that's right astrologers--and sooth-sayers will have a field day as its closest approach to Earth is predicted to be on Friday the 13th. Comet Izzit-Hardly-Worthit may be one of the unforgetable events of the century so keep your eyes open for information and let me know as soon as possible if the Comet is predicted to hit close by.

The effects of a comet striking the earth are of course unknown althought some people have suggested that the great Tunguska event of 1908 may have been caused by the impact of a small comet. The earth has however passed throught the tail of a comet with no apparent effects. That happened at the last passage of Halley's in 1910.

(The report on Comet Izzit-Hardly-Worthit which came from Nova, Vancouver Centre's Newsletter is a hoax--I think)

STEADY STATE ASTRONOMY

From: Journal of the British Astronomical Association, 21 May, 1908.

At a recent meeting of the BAA, E.Walter Maunder, regarding the origin of the divisions of time, said "he might refer to the suggestion made to him by his wife whilst he was writing the book on the Astronomy of the Bible, which he had just brought out. If there are any inhabitants upon Venus they are in a rather bad way for all divisions of time, if the theory be true that Venus always turns the same face towards the Sun. They would, in that case, have no 'day'. Next as they had no Moon, they would have no 'month'; and, thirdly, as the axis of Venus was supposed to be perpendicular to the orbit, which was practically a circular one, there would be no 'year' and, therefore, they had no means of dividing the time at all. He did not know how Mr. Lowell would find that state of affairs fitted in with the habitability of Venus, but if there were inhabitants of Venus, and they managed to measure time, they must be accomplished mathematicians, and this should help when they came to cover Venus with canals like those on Mars."

Scintillate, scintillate, globule orific,

Fain would I ponder thy nature specific.

Loftily placed in ether capacious,

Strongly resembling a gem carbonaceous.

Scintillate, scintillate, globule orific,

Fain would I ponder thy nature specific.

Anon, JRASC 1936

OBSERVING REMINDERS

Oct/Nov/Dec	The asteroids Vesta and Pallas are now both visible although Pallas is a bit south and headed in that direction. Its observation will necessitate an early exit from bed. Vesta is brighter and further north but lies in a crowded field between Cancer and Gemini. See Pg. 74 Obs. Hdbk.
Wed 22 Sept.	Equinox at 18:48 ADT
Sun 3 Oct.	Occultation of the 5.3 mag. star 46 Cap
Thurs 7 Oct.	Greatest Western elongation of Mercury when it will be 18° from the rising morning sun. This is one of the more favorable apparitions and will be visible a week before and a week following this date.
Sun 10 Oct.	Possible occultation of 8.9 mag. star SAO 153844 by asteroid Pallas for viewers in Western North America. Such events should be watch in case of error in the prediction. Time the disappearance and reappearance should they be observed.
Thurs 21 Oct	Orionids and at new moon no less!
Sat 23 Oct	Solar eclipse for our lucky friends down under--one of the best for a long time since the moon is at perigee (357,150 km)
Thurs 4 Nov.	Taurids
Sat 6 Nov.	Penumbral (0.86 mag.) eclipse of the moon. Starts at 16:46 AST but even at Mid-eclipse (17:01) don't expect to see any great change in the appearance of the shadowed body.
11/12 Nov.	Occultation of the 3.6 mag star, Lambda Gem
Tues 16 Nov.	Leonids--erratic shower but deserves at least a summary observation, just in case.

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