

STARDUST

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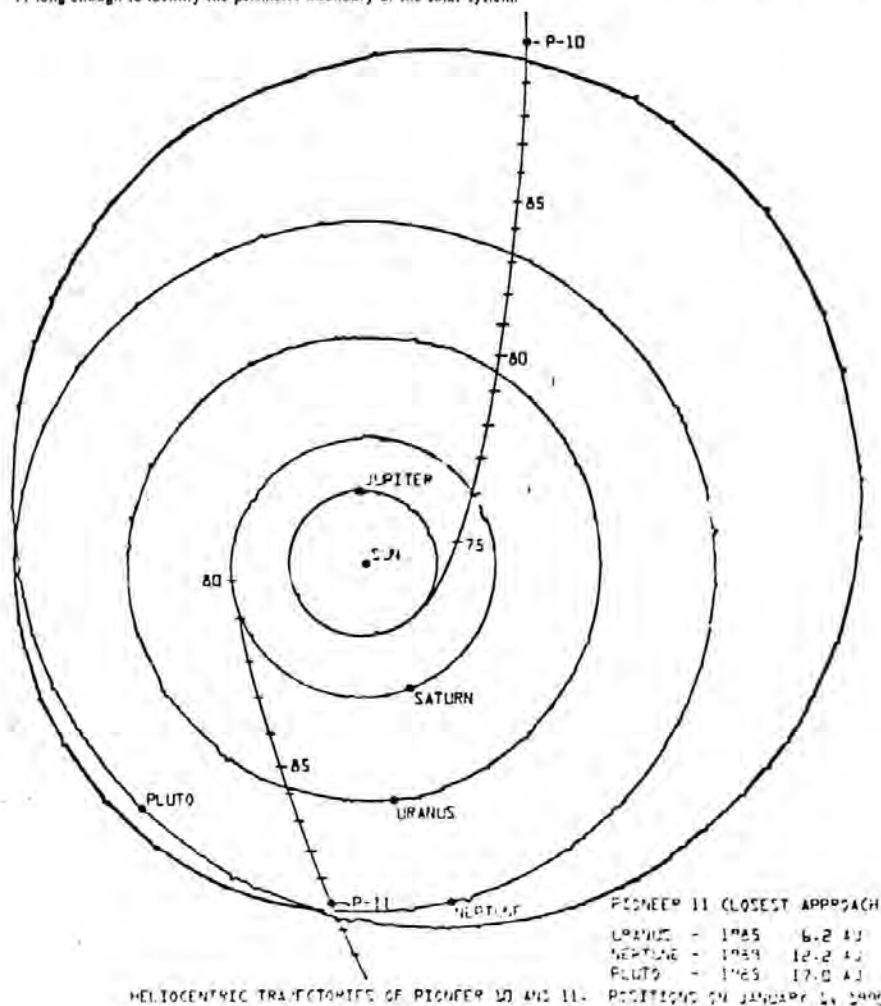
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1990 PIONEER 10 AND 11 PROFILE

The computer-generated time line below identifies the approximate positions of the Pioneer 10 and 11 spacecraft as they exit the solar system. Deep Space Network (DSN) tracking capability and life of the Pioneer spacecraft RTGs are calculated to permit tracking until the late 1980s. If these projections hold, a long-term objective of the DSN will be to track Pioneer 10 and 11 long enough to identify the perimeter boundary of the solar system.



STARDUST
January, 1980
Volume 25, #04

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DEADLINE FOR THE FEBRUARY 1980 ISSUE IS JANUARY 14, 1980

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PRESIDENT'S MESSAGE

THAT WAS THE YEAR THAT WAS: 1979 was a remarkable year for astronomy and for the Edmonton Centre. It was a year that the Centre and its various members:

saw two eclipses; organized two highly successful STARNIGHTS; sold a couple of hundred Eclipse '79 slide sets; held two public seminars; hosted a National Council meeting, acquired not one, but two observing sites; built an astronomy exhibit; sent out numerous press releases; took part in radio, television and newspaper interviews; found a new meeting location; exchanged speakers with three other Centres; became incorporated under the Societies Act; held loads of observing sessions (some were even successful!); enacted the rites of Summer Solstice at our Second Annual Sacrifice and Debauchery; won a half a dozen prizes at the London G.A.; celebrated the 25th anniversary of **STARDUST**; turned on to Rocky Horror (at least some of us did!) and punk rock (even fewer of us did that!!).

It was certainly a year to remember. And in spite of the arguments and frustrations that inevitably arose, I guess I have to admit that it was a pleasure to have been part of it all.

To conclude this, my final President's Message (thank goodness!), I'd like to reprint a brief paragraph from a Presidential Message of almost a year ago, from the February 1979 **STARDUST**.

We have several big jobs ahead of us, and I think we are all prepared to work very hard in order to see them accomplished in 1979. But let's not forget where our priorities lie -- being able to work well together in a spirit of fun and friendship.

Ditto for 1980.

Thank you
Alan Dyer

EDITOR'S MESSAGE

What a shock! Based on the last three issues of **STARDUST**, I fully expected the President to ramble on for at least 2½ pages! Under normal circumstances, a message as short as the one above would lead to great wailing and crying, since it would mean that the issue was going to be VERY small. But not this month! Lots of goodies have magically appeared on my desk -- all of which will eventually see their way into print. The only problem is -- I really didn't want a very long issue this time! Oh well, happy reading!

This issue is being done on the same typesetter, but now loaded with a memory. Theoretically, this means that I will be able to typeset in most of the issue, proofread

for mistakes, and print the entire issue (error-free) in one fell swoop. Naturally, I do not expect it to work that way, but you never know. Another change is that this is being copied on a Kodak 150 photocopier. My first impression is that it will take more time to run off, but the quality should be the same (if not slightly better).

Finally, please keep those articles flowing in. If you don't, I will be forced to send my strong-arm man (Stewart (Kamikazi) Krysko) out after you! As punishment for not submitting articles, Stew will take you for a short ride in his van -- a fate that is certainly worse than death!

DEADLINE FOR THE FEBRUARY ISSUE IS THE MEETING OF JANUARY 14, 1979

Paul Deans

PLANETARIUM NEWS

Starting early in February, the Planetarium will return to full strength. At that time, we will have our new Chief Technician. John Findlay has been lured from Calgary by an assortment of lurid promises and threats. (Now let's get this straight right off the bat. That's **FINDLAY** as opposed to the **FINLEY** that has now departed from the Q.E.P.) Anyway, John has been with the Calgary Centennial Planetarium as Technician for about 12 years, and some of you may know of him from his efforts on behalf of the Calgary Centre of the R.A.S.C. Welcome to Edmonton (eventually) John, and I'm sure that the Edmonton Centre will be **delighted** to welcome an experienced RASC'er to the fold.

Meanwhile, back in the Star Theatre, we find *The Case of the Christmas Star* ending on December 31. From January 2 to 6 inclusive, it's the Joan and Lori show (known to most folks as *Under the Pleiades*). Finally, after a semi-shutdown of 4 days, the new programme opens on January 12. *EXPLORATIONS: A New View of the Solar System* examines the planets that have been explored by unmanned spacecraft. The show deals heavily with Jupiter and Saturn, since these are the worlds that have been recently scrutinized by spaceprobes. That show continues until the end of the first week in April.

Paul Deans

FROM OTHER CENTRES

This cartoon has been lifted from **NOVA NOTES**, the bi-monthly publication of the Halifax Centre, R.A.S.C. It came from Volume 10, No. 6, the Nov/Dec Issue.



SOL III

This coming March, observers in North and South America will be able to witness another spectacular barium cloud experiment. A joint venture of NASA and the European Space Agency, the experiment (called Project Firewheel) will consist of the explosive detonation of canisters of barium and lithium about 60,000 kilometres above the Earth. The Firewheel Satellite, weighing 1,100 kilograms, will be launched by a E.S.A. Ariane rocket from the French space centre at Kourou, French Guiana. The actual launch will occur sometime during a ten-day interval on either side of the new moon, while the experiment will be conducted on the first night after launch when the light levels are low during the satellite's apogee. (*Spaceflight*, Vol. 21, No. 10, p. 420)

Canada has become the first country to initiate a television broadcasting service via satellites that relay signals directly into people's homes, using small rooftop antennas rather than the large radio telescope-like Earth receiving stations. The King family of MacDiarmid, Ontario, was selected to be the first to receive television programmes from the Anak B communications satellite in geosynchronous orbit 36,000 kilometres overhead. The direct-broadcast TV was largely made possible by the experience and knowledge gained from the earlier U.S.-Canadian

Communications Technology Satellite. The TV signals are broadcast in the 12-14 GHz frequency band which makes possible the reception of bright, clear pictures with antennas only 1.2 or 1.8 metres in diameter. The household receiving apparatus, including the antenna, is made by Sed Ltd. in Saskatoon and costs \$3600 with a \$200 installation fee.

(*New Scientist*, Vol. 84, No. 1180, p. 442)

The on-again, off-again comet space mission is apparently on again. Early last November, NASA asked scientists to suggest experiments for a proposed unmanned spacecraft that would be launched on July 23, 1985 by the Space Shuttle. On November 28 of that year, at a distance of about 120 million kilometres from Earth, the spacecraft would release a probe into the head of Halley's Comet and then pass through the comet's gaseous "coma", about 1,500 kilometres from the nucleus. The spacecraft would then continue onward to a July 1988 rendezvous with Temple's Comet. The large velocity changes required to match speeds and directions with the comet will be accomplished by means of a mercury-ion engine using only 1,000 kilograms of fuel. The spacecraft's camera, similar to that soon to be employed on the Galileo Jupiter spacecraft, will be able to photograph objects as small as a baseball on the comet's nucleus. In addition, a radar altimeter will help measure the size and shape of the nucleus to within a predicted accuracy of 23 metres.

(*Science News*, Vol. 116, No. 20, p. 343)

Anthony Whyte

50 & 100 YEARS AGO

January, 1930:

"There have been many attempts to find whether there is any law governing the orientation of the planes of revolution of the binary stars. The conclusions have been curiously inconsistent, some observers finding a concentration of the poles of the planes in the plane of the galaxy, others in the pole of the galaxy, others related to the ecliptic or the solar apex. Such discordance is not surprising when we note that when the orbits of binaries are determined simply from measures of position angle and distance, there are two possible positions of the orbit plane...Mr. Y.C. Chang notes in *Astr. Jour.* No. 932, that (the difficulty) can only be eliminated in the case of binaries for which radial velocities have been obtained with the spectroscope over a sufficient arc of the orbit. He was able to collect the necessary observations for twelve binaries and has added four more. Mr. Chang concludes that the evidence favors the fission theory of generation of double stars, rather than those of stellar appulse, or adjacent nuclei in a primitive nebula. These would be likely to show grouping related either to

the direction of the streams of stellar motion, or to the plane of the galaxy."

January, 1880:

"The author (W. Huggins) describes the special apparatus and the methods of working which have been employed to obtain photographic spectra of stars. In consequence of the very limited amount of light received from the stars, it was of great importance to spread out the spectrum to a greater extent than was necessary for a sufficient separation of the principle lines of the spectrum. The spectrum apparatus finally adopted consists of one prism of Iceland spar and lenses of quartz. The length of the spectrum taken with this apparatus is about half an inch, from G to O in the ultraviolet. The definition is so good that in photographs of the solar spectrum at least seven lines can be counted between H and K. Though there is considerable loss of light in employment of a slit, still, for the great advantage which it affords in obtaining spectra of comparison, a narrow slit 1/350th of an inch in width was always employed. Various photographic methods were tried, but the great sensitiveness which may be given to gelatine plates, together with the special advantages under long exposures of dry plates led finally to the exclusive adoption of this method. The photographs were examined and the lines measured by means of a micrometer attached to a microscope of low power. Photographs have been obtained of the stars Sirius, Vega, alpha Cygni, alpha Virginis, Altair, Arcturus, Algol, Betelgeuse, Capella, alpha Herculis, Rigel and alpha Pegasi."

Edited from **Nature**

Anthony Whyte

THE ELLERSLIE OBS. MAILBAG

Most people think of the European Southern Observatory at La Silla, 600 kilometres north of Santiago, Chile, as a purely optical and infrared astronomical observatory. However, a group of French astronomers have just published a report in the **ESO Messenger** giving the preliminary results of what might be called very short wavelength **radio** observations of Venus, Jupiter and Saturn with the 3.6 metre telescope. The observations were made at wavelengths of 0.7 to 4.0 mm and they provided some information on the atmospheric structure of the planets.

(*ESO Messenger*, No. 18, pp. 17-19)

For several years now astronomers have been obtaining sharper astronomical photographs by means of speckle interferometry that has allowed them to separate very close binary stars and to photograph the surface of such red giant stars as Betelgeuse. So far, however, the speckle technique (which is based on very short exposures and very long focal lengths) has been limited to comparatively bright objects. Now two

German astronomers at La Silla report that work there indicates that objects as faint as magnitude 16 or even fainter may soon be within reach of speckle interferometry. (*ESO Messenger*, No. 18, pp. 24-27)

During a recent visit to Europe by the astronomer-in-charge at La Silla (H.E. Schuster), the smooth running of the ESO Schmidt telescope was assured by night assistants Oscar and Guido Pizarro. Checking through a night's plates they came upon a comparatively bright planet trail. They marked the trail and were able to find trails of the same planet on further plates that were taken for the same programme on following nights. The first plate was taken on May 19, 1979, and the new planet has been given the preliminary designation 1979 KA. Further observations were obtained on three otherwise useless nights in June and a preliminary orbit has been computed by the Minor Planet Bureau. The mean distance from the Sun is about 400 million kilometres and the size of the new planet is probably about 10 kilometres in diameter. (*ESO Messenger*, No. 18, p. 11)

Anthony Whyte

NEWS FROM SATURN

A. Dollfus, Observatoire de Paris, reports that a search for an outer ring of Saturn has been made using a focal coronagraph with the Pic du Midi reflector. A faint lineament was suspected on two plates taken around November 1. It extends eastward in the ring plane from the outer edge of ring A up to 3.40 Saturn radii, where the image of Saturn II (Enceladus) is located. Its yellow magnitude could be estimated as ~18 per linear arcsecond. The line is not seen on the western side of Saturn.

From I.A.U. Circular No. 3426.

THE EARLIER YEARS OF THE EDMONTON CENTRE

Part 3: 1940 - 1949

At this time the post of Librarian was created, and I took on the job and kept it until 1957. In 1940, I gave a paper on early astronomical instruments illustrated by slides and by a model astrolabe which I constructed myself. In November there was a transit of the planet Mercury across the face of the Sun, which was observed in clear weather with Mr. Wates' telescope and the University refractor.

One of our members, Mr. K. Angus, while looking through an old volume of sermons printed in 1578, came on a poem about the then recent new star, Tycho's nova (or supernova) of 1572-73. The writer called it a comet, but there is no doubt that he meant Tycho's star, and he asserted that this was the star of Bethlehem and wondered what great event its reappearance portended. An article by Mr. Angus appeared in our Journal for July, 1941.

By the end of 1941, the Centre had acquired a locked glass-fronted cupboard for our books and journals. This was kept in the old Physics lecture room and continued in use for many years.

In 1942 the University agreed to accept the gift of Mr. Wates' 12 1/2 inch telescope and to build a small observatory to house it and some smaller telescopes, including the 4 inch refractor. The site chosen was on land now occupied by the Jubilee Auditorium parking lot, but at that time it was in among trees and bush, and relatively far from bright lights. The Observatory was built during the fall of 1942 and in February 1943 the Centre adjourned after the Handbook talk to the Observatory to see the new set-up. The clock-drive for the telescope had not then been installed, but the telescopes were all mounted on solid concrete piers and the mechanism for rotating the dome and opening the shutters was functioning. The building was one of frame construction, 20 feet by 32 feet with the Wates telescope housed in a 16 foot dome at the north end. In the south end were located the 4 inch refractor, a 2 inch zenith telescope and a transit telescope. The finder for the big telescope was a 4 inch richestfield telescope also made by Mr. Wates.

The formal opening took place on May 20, 1943, with Dr. Pearce and Dr. McKellar from Victoria, the Lieut. Governor of Alberta, and the President of the University in attendance. Dr. Pierce gave the main address, complimenting the Centre on having the sixth largest telescope in Canada and complimenting Mr. Wates on the excellence of the mirror which he had tested the evening before.

This observatory continued in use until the construction of the Jubilee Auditorium, although towards the end it was becoming less useful as city lighting in the neighbourhood increased. For many years Dr. Campbell was unwearied in holding public nights for viewing the moon, planets and star clusters, and the public responded very well. Time and again the little observatory was packed with people, young and old, waiting their turn to climb up the movable wooden steps and peer through the Newtonian eyepiece.

In 1943 the Chant Medal of the Society was awarded to Mr. Wates for his contributions to astronomy. This was the first time the medal had come to Edmonton, and it was only once awarded here since, to Mr. Earl Milton in 1960. Mr. Wates wrote a paper in our Journal for 1944 on the method of adjusting the polar axis of the telescope. He also reported in the same issue on observations made on the occultation of Jupiter by the moon on the morning of January 13, 1944. Dr. Campbell

was at the 12 1/2 inch, I was at the 4 inch, and Mr. Wates was at his private observatory with a 9 inch reflector. He almost missed the show, as a Chinook thaw, followed by a hard frost, had clogged the door of the observatory with ice which had to be chipped away with a screwdriver before he could get in. The moon was hidden by heavy clouds until 10 minutes before first contact, but at the critical time seeing was excellent. A remarkable feature of the emersion of Jupiter from behind the moon was a narrow greyish-blue band apparently separating the moon and the planet. Could it have been due to some thin and localized atmosphere on the moon, illuminated by the planet?

In 1944, Mr. Wates' own observatory was relocated just south of the existing University observatory, so yet another conveniently placed telescope was available for amateur observations. At the banquet that year the talk was given by Dr. J.M. MacEachran, one of the earliest faculty members. His subject was ancient Greek ideas on the nature of the Universe.

Also in 1944, the Society in Toronto decided to name prominent astronomers as Honorary Members of the R.A.S.C. The first of these was to have been Sir Arthur Eddington, but he died in November before he could accept the award. I gave a paper on his life and work at a meeting early in 1945, and Professor Stansfield, at that meeting, contributed some personal recollections of Eddington.

In July 1945 there was a solar eclipse, nearly 90% total at Edmonton, and total in a narrow band crossing Manitoba and Saskatchewan. As this was war-time, and gasoline was rationed, a special application was made for extra gas to make an expedition to Saskatchewan. Dr. Campbell went to Bredenbury, where various pieces of apparatus were set up, but the eclipse itself was clouded out. Dr. Campbell made several trips during his life to observe a total eclipse, but was never lucky enough to see one. He and Dr. H.E. Johns, then of the Physics Department, wrote a paper in our Journal describing a convenient graphical method of predicting the extent of a forthcoming eclipse.

At the 1945 banquet, Dr. Wyman (*now the former President of the University. Ed.*) became our President, and the talk was given by Dr. Heber Jamieson, a well-known medical man, on *Astrology and Medicine*. The membership was still about 50, and remained fairly constant for a good many years.

Early in 1946, Mr. C.G. Wates, our most active and productive member, died. He was a gifted writer and speaker, composed science fiction, verse and music, contributed many articles to the Scientific American and to our Journal, and was President of the Alpine Club of Canada. He gave the Handbook talks for several years and often the main address at our meetings. A framed photograph and a brass tablet were placed in the observatory to commemorate him.

During the summer of 1945 I was employed as an astronomer at the Dominion Observatory in Victoria. Dr. Pearce, the Director, visited the Centre the following May and spoke of the work going on at Victoria. He mentioned the studies by Jean

McDonald and by myself on some extremely hot double stars of the Wolf-Rayet type, and also the work he had recently been doing on the Pleiades cluster. At the annual banquet in 1946, Dr. Walter Johns, then a Professor of Classics, gave the main talk on *Nature and the Ancient World*.

In February 1947 I commemorated the hundredth anniversary of the discovery of Neptune by a talk on *Adams and Leverrier*, and later that year Dr. Gowan commemorated the jubilee of the discovery of the electron. In February 1948, Dr. Campbell gave a talk on space travel which he had delivered in January as the Presidential address to the general meeting of the Society in Toronto. This talk was printed in our Journal. In view of what has been accomplished since, it is interesting to see how sceptically rocket flight to the moon was viewed by a competent mathematician. Dr. Campbell's calculations were based on sound mechanical principles, but did not of course take into account the tremendous technological improvements in fuels, materials, circuitry, and computerization that have since occurred. Also, in 1947, it seemed most unlikely that even the United States would be prepared to put billions of dollars into so fanciful a scheme as flight to the moon. In his talk, Dr. Campbell made many references to a book on *Rockets and Space Travel* by Willy Ley who, in a later number of the Journal, replied to some of these criticisms. He pointed out that a rocket could be maneuvered satisfactorily by vanes in the exhaust, and he concluded: "Like Dr. Campbell I do not believe that anyone will make a landing on the moon within the next ten years. But I do believe that the engineering fundamentals for such a feat are solved right now, and that there is no need to wait for the discovery of new principles." I think we must concede that Willy Ley was right.

An interesting talk was given that year by Major Rex Gibson, "one of those crazy people", as he described himself, "who climb mountains for fun", on *Lunar Mountaineering*. He pointed out that conditions on the moon would be in many respects ideal for mountaineering -- low gravity, long days, no bad weather, and so on. Of course, the absence of an atmosphere would make it necessary to climb in a space suit, and there would be a risk of being hit by meteorites, but then every ascent would be a "first ascent", with all the glory that implies to a mountaineer.

In 1949, Dr. Campbell was again President of the main society and gave an address on *The Universe -- Whence?* This was printed in our Journal and discussed the still unsettled question of the beginnings of the Universe. I followed this the next month with *The Origin of the Solar System*, another vexing question in astronomy, and Dr. Folinsbee of the Department of Geology spoke in May on *The Origin of the Moon*. It was certainly a year for speculation.

NEXT MONTH: (1951 - 1959) *Franklin Loehde and Earl Milton join the Centre; a talk on An Astronomical Pilgrimage to Arizona; STARDUST begins; an astronomical quiz game; a meteorite hunt; a space travel debate; meeting attendance soars; Devon is selected as the new Observatory Site.*

Prof. E.S. Keeping

OBSERVING VARIABLE STARS FOR FUN AND PROFIT. ©

For centuries, it was believed that the stars were fixed and unchanging. Enlightenment and observation shattered that belief, however, as Renaissance astronomers discovered stars which changed noticeably in brightness. Tycho and Kepler, for instance, found stars which rose from obscurity to rival Venus in brightness, then slowly faded away. (These stars are now called *supernovae*.) By 1850, about two dozen *variable stars* (or *variables* for short) had been found, some by eye and telescope, others by eye alone.

Soon afterwards, photography revolutionized the search for and study of variable stars. The light from thousands of stars could be stored up on a single photographic plate, providing an accurate, objective, and lasting record of the star's brightness. At the same time, spectroscopy provided a new tool to analyze the light from the variables and find out what kind of stars they were. The astrophysical revolution had begun.

By about 1920, the development of the photoelectric cell enabled astronomers to measure and compare star brightnesses with unprecedented accuracy: one percent or better. Changes in brightness (and colour) could be studied in great detail, and *microvariables* -- with only very small brightness changes -- could be detected. We now know that a significant fraction of all stars are variables, and their study is one of the major fields of astronomical research today.

Variable stars are important not only because of their ubiquitous and fascinating nature, but also for the information which they can provide about stars in general. Depending on the type of variable, they can tell us the star's mass, radius, luminosity, temperature, composition, internal structure, and evolutionary state!

Discovery and Observation

Although stars may vary in many respects, the variation in their brightness is usually the easiest to observe. This variation may be discovered and studied in three ways: visually, photographically and photoelectrically.

The first few dozen variables were discovered visually, mostly by amateur astronomers. Some variables -- the most conspicuous ones -- so changed the pattern of the familiar stars that they could be discovered by anyone with a good knowledge of the sky. Today there are many amateurs who have learned the patterns of the stars and who carry out regular searches for variables. Many *novae* are discovered in this way.

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Other variables were (and are) discovered in the course of systematic measures of star brightness: the brightness turned out not to be constant.

Once a variable has been discovered, it can be studied systematically, and if the variation is more than about 0.5 magnitude, it can be studied visually¹. A careful observer can measure brightness visually to ± 0.1 magnitude by comparing the variable with nearby *comparison stars* (see Figure 1, for instance). Since professional astronomers do not have the resources to keep track of all of the thousands of variables we know, these observations have become the domain of scores of dedicated amateurs, who make hundreds of thousands of visual estimates of variables each year. These observations are coordinated in North America by the American Association of Variable Star Observers (A.A.V.S.O.), 187 Concord Ave., Cambridge, Mass. 02138. Anyone interested in joining the effort should write them for further information.

Nowadays, as we mentioned, thousands of stars both bright and faint can be recorded on a single photograph. By comparing this photograph with earlier ones of the same field, the astronomer can identify any stars which have changed in brightness. The majority of known variables have been discovered in this way. The brightness of the variables can then be measured -- to ± 0.03 magnitude in the best cases -- by measuring the size and density of the photographic image. Photography is particularly efficient for studying variables in richly populated regions: star clusters, the Milky Way and external galaxies.

Although there are thousands of capable amateur astrophotographers, not very many use their photographs to study variable stars -- which is a pity. (There are exceptions: Ben Mayer of Los Angeles, for instance, has developed a successful technique for discovering variables on 35 mm slide photographs.)²

Photoelectric techniques were developed in the early 1900's. The first photoelectric photometers were crude by present-day standards, but they were operated with great care, and the results were often surprisingly accurate. Brightness changes could be studied with high precision, and by inserting colour filters into the light beam, small colour changes could also be studied. Hundreds of microvariables have been discovered with this technique, although their brightness changes only a few percent or less. These microvariables include whole new classes of variable stars.

Nowadays, electronic components are cheap enough to be accessible to many schools, amateur groups and individuals. There is much to do in this field -- as we shall see -- and there is a lesson to be learned from the pioneers of photoelectric photometry: simple equipment used with *care* can produce surprisingly accurate and useful results.

Naming and Classification

A newly discovered variable is named according to a systematic but complicated scheme in which a letter, a pair of letters or a number is combined with the genitive

name (RR Lyrae, for instance). We shall meet some other variables by name as we go along.

The variable is then classified -- usually according to its *light curve*, the graph of its brightness plotted against time. Often, the light curve is sufficient to classify the variable, but it also helps to observe the *colour curve* (colour against time) and the *velocity curve* (radial velocity against time) as well. Radial velocity is the speed in the line of sight, which can be determined by the Doppler shift of the lines in the star's spectrum. Other useful information includes the star's average colour or spectral type (which measures its temperature), its luminosity and its chemical composition. These data are needed to answer the more general questions astronomers ask such as "What kinds of stars are variable?" and "How is the type of star related to the type of variability?" Ultimately, astronomers want to learn the causes of stellar variability and how it is related to the star's evolution.

The classification system for variable stars is complicated and often confusing, in part for historical reasons and in part because of astronomers' natural tendency to want to attach names to things. There are four major classes of variables: eclipsing and rotating (which are "geometric") and pulsating and eruptive (which are "intrinsic"). Some stars fall into two or more classes, and others defy classification entirely.

Eclipsing Variables

Eclipsing variables are actually *pairs* of stars in mutual orbit. We see the orbit edge-on, or nearly so. Periodically, one star passes in front of the other, and the total brightness of the pair appears to decrease.

The most famous eclipsing variable is Algol in the constellation Perseus. Figure 1(a) shows a diagram of the Algol pair (with our sun shown to scale). Every 69 hours, a larger, cooler, fainter star passes in front of a smaller, hotter, brighter one, and the total brightness decreases by over a magnitude. Between these *primary eclipses* there are secondary eclipses as the smaller star covers part of the larger one. The secondary eclipses can only be detected with photoelectric techniques. Figure 1(b) also shows the actual light curve for this system. The predicted times of primary eclipses are listed in such publications as *Sky and Telescope* and the *Observer's Handbook*.³ You can observe the primary eclipse, if it occurs at a suitable time, by comparing the brightness of Algol with that of the nonvariable comparison stars in Figure 1(a). Measurements should be made every few minutes, as accurately as possible. Times should be noted and recorded within ten seconds if possible. If you can observe the eclipses in Algol, then you can probably observe the eclipses in any other suitable eclipsing variable.

The eclipses in Algol are only *partial*, because the stars do not pass centrally across each other. If they did, the bottoms of the eclipses in the light curve would be almost flat. But only "almost", because the center of a star's disc is brighter than the edge. This effect, called *limb darkening*, makes the bottom of the eclipse curve slightly bowl-shaped.

Figure 1(a) A finding chart for Algol, also known as Beta Persei; it is shown as a circled dot. The stars with numbers beside them are suitable comparison stars; the numbers are their apparent magnitudes, with the decimal points removed (decimal points look like stars). (Diagram courtesy of the A.A.V.S.O.)

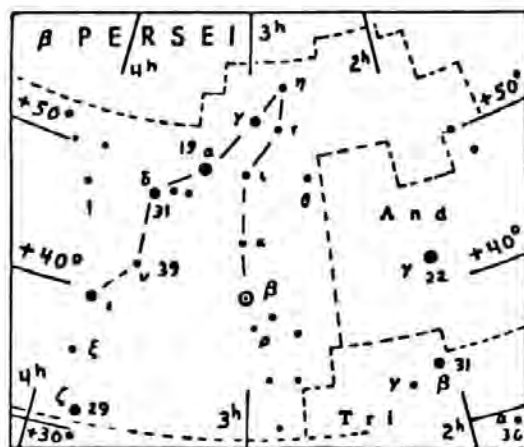
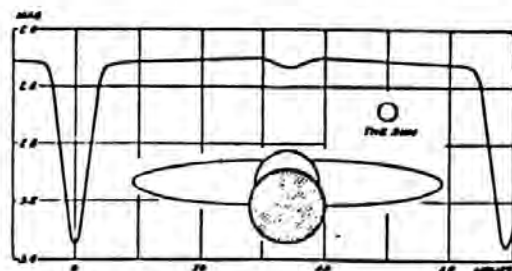


Figure 1(b) A sketch of the Algol system, with the Sun shown to scale. The light curve is also shown. The primary eclipse occurs every 69 hours, with a small secondary eclipse inbetween. (Based on photometry by J. Stebbins.)



If the stars are very close together, they may gravitationally distort each other into egg shapes -- with the points of the eggs together. Then as the stars revolve in orbit, we see the eggs from different angles and the brightness changes continuously, even when an eclipse is not occurring. The light from one star may reflect off the near side of the other, further complicating the light curve. In Algol, the orbital motion is complicated even more by the presence of a third star which orbits the other two with a period of 1.6 years.

You can see from Figure 1(b) that the stars in Algol are only a few diameters apart. This is quite common in eclipsing variables, because if the stars were far apart, the chances of seeing eclipses would be very small. There are exceptions, of course: we know of a class of eclipsing variables called VV Cephei stars, in which one member is a supergiant star.⁴ The second member orbits the supergiant slowly, at great distance, so that the eclipses last several weeks and recur with a period of several years. (These are ideal variables for observers with lots of patience but very few clear nights!)

The closeness of stars in Algol has an important consequence: they interact gravitationally and affect each other's evolution. Matter flows from one star to the

other, or may leave the system completely. This causes the period of the orbit to change, which in turn causes the eclipses to occur earlier or later than predicted. The period change can therefore be measured by timing the mid-point of the primary eclipse and comparing it with the predictions.

These eclipse timings can be made by amateurs -- even using visual techniques -- as long as they are made carefully. There are literally thousands of eclipsing variables known. Some of them have been well-studied by professional astronomers, but professionals do not have the resources to monitor every eclipsing variable for period changes. A.A.V.S.O. members observe dozens of variables, making hundreds of timings each year. Some use visual techniques, which are simpler and faster, but others use photoelectric techniques, which are more accurate. This work is coordinated by a special committee of the A.A.V.S.O. and the results are published regularly in the Association's *Journal*.

Rotating Variables

One of the most remarkable figures in the history of variable star astronomy was John Goodricke, an Englishman. He was a deaf-mute and lived only from 1764 to 1786, but in this time he laid much of the framework for the study of variable stars. He was the first to study Algol systematically and was the first to suggest that its variation was due to eclipses. Goodricke also observed another bright eclipsing variable, β Lyrae, whose light curves had troughs of large but unequal depths. With his rather limited conception of stellar eclipses, he was unable to explain the unequal depths, and so he advanced a different hypothesis: that "the phenomenon seemed to be occasioned by a rotation on the star's axis, under the supposition that there are several large dark spots upon its body, and that its axis is inclined to the earth's orbit."

Goodricke turned out to be wrong in this case, but he unknowingly anticipated the discovery of *true* rotating variables nearly two centuries later. These stars are among the most interesting and bizarre objects in the astrophysical zoo. The "dark (or sometimes bright) spots upon its body" are usually caused by strong magnetic fields, as in sunspots. The variation in brightness is very small in most cases and can only be detected using photoelectric techniques. Nevertheless, skilled amateur astronomers can (and do) study these stars.

One group of stars -- currently of great interest among astronomers -- combines both eclipsing and rotating variability. These are the RS Canum Venaticorum stars (or "spotted dogs" as one of my amateur colleagues suggested). They are pairs of sun-like stars in close orbit. Figure 2(a) shows the prototype pair to scale and Figure 2(b) shows the light curve. In addition to the eclipse -- which is prominent -- there is a smaller wave of variability in the light curve. The size and position of this wave varies slowly. The wave is probably due to patches of starspots, and the variation of the size and position of the wave would therefore be due to changes in the extent of the patches (as in the sunspot cycle) and to changes in their position relative to the second star.

Figure 2(a) A sketch of the RS Canum Venaticorum system, with the Sun drawn to the same scale.

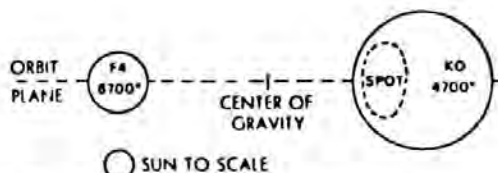
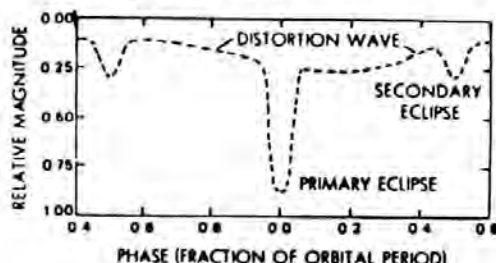


Figure 2(b) The light curve of the system. The primary and secondary eclipses are shown, as is the "distortion wave" which extends throughout the entire light curve. (Based on a light curve by E. W. Ludington, published in *Sky and Telescope*, Feb. 1979)



Amateurs can contribute to the study of the RS Canum Venaticorum stars in two ways. First, they can time the eclipses. These often occur earlier or later than predicted, because of period changes caused by matter streaming between and away from the stars. Second, they can study the changes in the size and position of the wave. This requires photoelectric equipment -- which many amateurs have -- and great care -- which many amateurs can provide. Dr. Douglas S. Hall of the Dyer Observatory has successfully coordinated a programme of this sort for many years. (See the section on "further reading" (that will appear next month at the conclusion of this article) for an excellent article by M. Zeilik on these stars and on Dr. Hall's programme.)

NEXT MONTH: The conclusion of this article which will deal with *Pulsating Variables and Eruptive Variables*. Also included will be a list for further reading on the subject.

Dr. John R. Percy
University of Toronto

1. Magnitudes are traditional units used by astronomers to define the brightness of objects in the sky. The *smaller* the magnitude, the *brighter* the object. A star which is one magnitude brighter than another gives off about 2.5 times more light.
2. For more information on Mr. Mayer's innovative *Problicom* survey techniques and his search programme, in which even beginning amateurs can participate, readers are urged to send a stamped, self-addressed envelope to: Ben Meyer, 1940 Cotner Avenue, Los Angeles, California. 90025.
3. The Observer's Handbook is available from the Royal Astronomical Society of Canada, 124 Merton Street, Toronto, Ontario, Canada. M4S 2Z2. It is an extremely useful compilation of astronomical data.
4. Many classes of variable stars are named after the first star of the class to be discovered.

The Astronomical Society of the Pacific is a world-wide non-profit astronomy education group, founded in 1899, which brings together professional astronomers, teachers, and amateurs and makes available information about all facets of astronomy and space science.

The Society publishes a wide-ranging but authoritative nontechnical magazine on astronomy called **Mercury**, which offers regular reports of the latest observations and theories from the major observatories and universities (explained in terms a nonprofessional can understand). Members are sent a discount mail order catalogue of astronomical prints, slides, star finders, tapes, books and the infamous astronomy T-shirts and bumper stickers.

Currently the Society is compiling a series of regional astronomy directories, listing amateur groups, planetariums, observatories, courses and stores. Many of these offer a discount to anyone showing an A.S.P. membership card. (The directory for their area of the country is sent free to all A.S.P. members.)

The Society also sponsors an annual scientific symposium and meeting and several astronomy awards, one of which recognizes amateur achievement.

To obtain a free illustrated brochure describing their publications and programmes in more detail, send a self-addressed legal-size envelope to:
Membership Department, A.S.P., 1290 24th Avenue, San Francisco, California. 94122

CENTRE NEWS

A Productive National Council Meeting: On Sunday December 9, the Edmonton Centre was host to a business meeting of the RASC National Council. Representatives were in attendance from the Victoria, Calgary, Saskatoon, Winnipeg, Toronto and Ottawa Centres (and of course from Edmonton, with several Centre members sitting in on the meeting as observers). The four hour meeting was held at the Four Seasons Hotel and was preceded by an informal luncheon.

While a number of important items of business were dealt with during the meeting, the most enjoyable benefit of such a gathering comes from the conversations with other representatives before and after the meeting, since it is not very often that members from our widespread Centres get a chance to meet face-to-face. The recent meeting was the first time that a National Council meeting had been held in the west without being part of some other special event such as a General Assembly or (as with last February's meeting in Winnipeg), an eclipse. The attendance at the December 9 meeting has proven that National Council meetings need not always be held in Toronto, and in fact **should** be held occasionally out west in order to give the Western Centres a better chance to represent themselves.

A special feature of the meeting was the "premiere" showing of the newly completed 18 panels of the Shopping Centre Display, a project that was 50% funded by a grant from the National Council. In addition, two Centre Representatives who arrived early enough on Saturday December 8 were able to learn a bit more about the Edmonton Centre by taking part in one of our informally organized social activities. Del Stevens from Winnipeg and Jim Young from Saskatoon joined about a dozen or so Edmonton Centre members and friends for our trek to see *Star Trek -- The Movie*. A good time was had by all including, we trust, our out-of-town guests!

Finally, many thanks go out to Paul Deans, Doug and Joan Hube and Franklin and Audrey Loehde for their hospitality in providing accommodation for our visitors, and to Andrew Lowe for his many trips to and from the airport -- the service was very much appreciated.

An official report on the minutes of the December 9 meeting will appear in a future MERTON STREET NEWS column.

Shopping Centre Displays Complete(!!): All of our readers who were present at the December 10 General Meeting were able to see first hand the results of many months of work by the shopping centre display group. All 18 panels were on exhibit, all complete save for some minor cosmetic improvements and modifications to make them more durable. We trust that the rest of the Centre was suitably pleased with their appearance and content. We hope Centre members were so pleased that we will have no trouble attracting volunteers to man (person?) the displays in the near future! As of this writing arrangements are being made to book the displays into their first public appearance. Shopping Centres will be their principle venue for the first few months, but at Dr. Percy's suggestion, we will also be trying to have them on exhibit at February's teachers' convention. In April we will do our best to squeeze them into the Planetarium lobby for **STARNIGHT 1980**. Then in July we hope to get them into the Sportex arena for a 10-day stint at Klondike Days, a deadline we missed last year. Any other suggestions for potential display venues would be more than welcome.

At this stage of the project it is appropriate that we note the specific contributions of the various project members, all of whom sacrificed many an evening and weekend for the cause. In alphabetical order, thanks are due to:

Dave Beale: who became our expert in cutting matte board with no light to see by. If you detect an overcut in a couple of matte openings, don't blame Dave -- he did his best!

Dave Belcher: if you think the board titles and captions look professional, that's because they are professional. Dave Belcher did them, using a camera the size of your living room!

Kevin Berglund: for starting it all 18 months ago, an event we sometimes regretted.

Ted Cadien: for typing, re-typing and sometimes re-re-typing the many captions using his trusty IBM Selectric.

Alan Dyer: who dug out many of the visuals (some of them his own), worried about the overall layout, and who always seemed to be around when brows needed beating. *Dave Holmgren:* for the design and drafting work, and for being there whenever assistance was needed.

Mark Leenders: if you wonder why *our Skalnate Pleso* charts look different than *your* charts, it's because Mark meticulously hand coloured them -- red for nebulae, blue for galaxies, green for planetaries, orange for globulars etc., etc. And he never went over the line once! (Well, maybe once.)

Andrew Lowe: who will be quite happy if he never sees another sheet of blank Cibachrome paper or smells those lovely chemicals for many months to come.

Keith Montgomery: for insisting that the moon and planets really *were* interesting to look at, contrary to the deep-sky observers who outnumbered him.

Lori Walton: who never really wanted to supervise the project, but who sort of got stuck with the job by default; for deciding what to leave out in many of the display captions; and for providing a hospitable house in which to work on Saturdays (even if she had been out punk-rocking the night before!).

Finally, we owe a great debt of thanks to the Walton family for tolerating boisterous RASC people tromping through their house and littering their basement with our paraphernalia as we slowly progressed through the display construction. Plus, we note the contributions of Pazder Graphics, Ltd., without whose generous assistance our project would never have turned out looking so slick on such a limited budget. And to everyone else who helped out in one way or another, **THANK YOU!**

Good News for Buck Mountaineers: Through a phone conversation with the director of the Lands Disposition Branch of the Provincial Government, we have learned that our lease application for land at Buck Mountain has been approved in principle. It looks as if we now have our Dark Site! Our work in developing the Site is now set out before us -- a pleasant state of affairs compared to the past 2 years when we had no idea if all the weekends of searching and surveying the countryside would pay off. Now we know they have.

Dr. John Percy Addresses the Centre: In December, Dr. Percy, National President of the RASC visited all the Centres west of Manitoba, fulfilling what has become a Presidential duty -- to speak to all RASC Centres during the two-year term of office. On December 10, Dr. Percy presented a talk to the Edmonton Centre entitled: *Observing*

Variable Stars For Fun and Profit, a review of the many varieties of variable stars and how the amateur can observe them. It was a talk enjoyed by all, and may well inspire a few members to take up variable star studies. In particular, Dr. Percy emphasized "nebular variables" as being worthy of observation since they fluctuate very rapidly (several periods per night) and many are contained within the same field, allowing lots of observations to be made with relative ease.

Centre Members Receive Membership Certificates: At the December General Meeting, Membership Certificates were presented to the following members: Barry Arnold, Paul Deans, Gary Finley, John Hault, Dr. Doug Hube, Christine Kulyk, Mark Leenders, Andrew Lowe, Gary Prideaux, Jenny Rusch, and Anthony Whyte. The Certificates, issued by the RASC National Office upon the recommendation of the local Centre, are awarded to those who have been members of a Centre for at least the past 5 consecutive years and who have contributed their time and energies in service to the RASC and to astronomy. Congratulations to all of this year's recipients!

Nominations for the 1980 Council: The Centre's nominating committee, composed of Christine Kulyk, Mark Leenders and Alan Dyer, have proposed a slate of officers for the 1980 Council. The nominees are:

President -- Ted Cadien
 Vice-President -- Dave Belcher
 Secretary -- Anthony Whyte
 Treasurer -- Mel Rankin, Sr.
 Observing Chairperson -- Dave Holmgren
 Editor, **STARDUST** -- Paul Deans
 National Council Rep. -- Alan Dyer
 Councillors -- Dave Beale, Mark Leenders, Andrew Lowe,
 Lori Walton, Diana Wood

Further nominations for any of the above positions will be accepted by phone prior to the January General Meeting (Phone Alan Dyer at 488-1092). Nominations will also be accepted from the floor at the meeting itself. Speak now, or forever hold your peace (at least for another year)!

FOR SALE

One 3" equatorial refractor, manufactured by Carl Wetzlar. Comes with motor drive and 3 eyepieces. Asking price -- \$500. Phone between Thursdays and Sundays only. Larry Fraser

OBSERVING NOTES

Mercury -- may be glimpsed low in the southeast just before sunrise at the beginning of the month, but later on it is too close to the sun to be seen.

Venus -- is well up in the southwest at sunset and sets about 3 hours later.

Mars -- rises 4 hours after sunset and is low in the west at sunrise.

Jupiter -- also rises 4 hours after sunset. It is in Leo, just west of Mars.

Saturn -- in Virgo between Regulus and Spica, it rises after Mars and Jupiter and can be found in the southwest at sunrise.

During January, watch for: Jupiter 0.3° north of the Moon on the 6th, Mars 2° north of the moon on the 7th, Saturn 0.2° south of the moon on the morning of the 8th, Venus 1° south of the moon on the morning of the 20th, and Jupiter, Mars and Saturn again near the moon on February 3rd and 4th.

There will be an occultation of Aldebaran by the moon on January 26th (a Saturday evening). Disappearance occurs at 22:49.7 M.S.T, with reappearance at 23:19.0. However, prior to this, the moon will be passing through the Hyades star cluster. Since the moon will be 10 days old, disappearances of a number of stars in the cluster should be easy to watch (since they will, of course, vanish on the dark limb). Check the Handbook for some sample occultation times. The first one listed occurs at 18:07.8 on the 26th. Obviously, as soon as it is dark enough, you should be able to see the moon in the middle of the Hyades. Don't forget that the Handbook only lists the brighter stars in the cluster (and it only deals with disappearances), but a medium-sized telescope should be able to pick up a number of unlisted occultations of dimmer stars. Another occultation of Hyades stars will occur on February 23rd, but both the cluster and the moon will be setting while the event is in progress.

A EUROPEAN FIREBALL REPORT

An interesting description of a bright fireball over Europe was contained in a letter I received from my friend, Peter Segaar, who lives in Holland.

Coming back on our mutual hobby Astronomy -- when I was on my bike back home one evening a few weeks ago, I saw the most brilliant fireball I've ever seen in my life! When I came home from work a few days later, I discovered an article in the newspaper about this meteor. Some hundred people must have seen this meteor at the time of about a quarter to one in the morning local time. My interpretation of the phenomenon was:

I saw right through my field of vision a flash of about 2 seconds; the fireball had a white to yellowish nucleus, followed by a bright yellow to "poison-green" tail which

fell apart in blood-red drops. These enormous and fantastic colours have made a very deep impression on me and I went home as soon as possible to write all necessary data on paper before I'd forget them. Later, I got a report on it and concluded that the fireball must have been of magnitude -12!!! with a purple-white explosion of magnitude -15, causing shadows under lanterns! I must admit I was very lucky to see this enormous spectacle which I shall not forget soon.

1

Lori Walton

UPCOMING EVENTS

January General Meeting: On Monday, January 14, we will be treated to a long awaited talk from the Arizona trio -- Rod McConnell, Dave Belcher and Dave Beale. Entitled: *If This is Tuesday, This Must Be Kitt Peak*, their slide show and talk will review their recent 3-week tour of the observatories, planetariums and natural wonders of Arizona and Southern California. Included are slides and stories of their visits to the Grand Canyon, Flagstaff, Barringer Meteor Crater, Mount Hopkins and the Multiple Mirror Telescope, Mount Lemmon, Kitt Peak, Mount Palomar, Los Angeles and the Celestron factory, the Griffith Observatory, Lick Observatory, Goldendale Observatory, and yes, even Winslow, Arizona (for all you **Eagles** fans!). Knowing our trio of speakers the way we do, I'm sure we can count on an entertaining and colourful presentation -- rumour has it they have some very spectacular photographs. Be sure to attend our first meeting of the new decade.

If it arrives on time, January's meeting will also feature the brand new film *Mirrors on the Universe*, the story of the Multiple Mirror Telescope. Should it arrive as promptly (!) as the Kitt Peak film did in October, the MMT film will be delayed until the February meeting.

The January General Meeting will also feature our annual election of officers, plus brief annual reports from the Secretary and Treasurer.

January Observer's Corner: The October and November O.C.'s, the first in the new monthly Monday night time slot, proved very popular, with about 15 to 20 people in attendance each time. Both Dave Holmgren and Ivan Rogers gave very interesting talks at their respective meetings. All new members should be aware that the Observer's Corner gatherings are generally smaller, less formal affairs with short presentations from various Centre members on all aspects of amateur observing, telescope making and equipment, and astro-photography. Everyone is welcome.

The next O.C. is Monday January 28 at 8:00 pm. The location is the fourth floor of the Physics Building (Room 445), University of Alberta. (Park in the Windsor Carpark) The topic will be *Telescope Performance*, a talk by Mark Leenders. Mark will be

covering the characteristics of various telescope optical and mechanical designs, including factors like aberrations, stability of mounts, photographic suitability etc.

As is always the case, if anyone has any astro-photography to show, please bring it along, since the object of any O.C. is to allow for lots of time for off-the-cuff reports of observing results.

January Council Meeting: One last meeting of the old, outgoing Centre Council will be held on Sunday, January 6 at the North-Side RASC Home Office (ie: Stew & Al's establishment at 10236 123 Street (Apartment #1 of course)). An official agenda will be sent out to all Council members prior to the meeting, but any RASC member is quite welcome to attend a Council meeting, even if you are not on Council. The meeting gets underway at 7:30 pm and lots of important items of business will be discussed, delegated, deferred and disposed of...perhaps even voted on!

January Observing: NO official observing sessions are planned for January -- however Centre members are reminded that the Ellerslie Site is available at any time for their use. Currently, about 15 people are "qualified" to use the Observatory and telescope itself, though any member may use the Site. Keys to the Observatory for a night's use may be borrowed from either Dave Belcher, Mark Leenders or Alan Dyer. Please phone for more information.

WHAT'S UP?

You may remember a year or two ago, a monthly article in **STARDUST** called *Observe*. It was designed to get RASC members active in observing and recording their observations of deep-sky objects. The article was cancelled because only one person ever submitted reports and drawings to be published in **STARDUST**. However, I believe the article succeeded in another way. It gave people a list of objects to look for each month -- some fairly easy to find and others more challenging.

Dave Holmgren and I have decided to revive the idea. We will choose one area of the sky each month and list not only the deep-sky objects, but the interesting double and multiple stars as well. The deep-sky list will be divided into 3 classes. The objects in Class I will be the bright, easy to find Messiers. Class II will include the fainter Messiers and the better known objects of the NGC list. Class III will be what Alan Dyer calls "challenge" objects.

At the end of the list each month will be a special supplement. This will discuss any special events occurring that month, like meteor showers, occultations, grazes, or even just information on observing the planets (which will be well-placed for viewing during the upcoming few months). So often I have heard people (myself included) say: "Well, what should we look at tonight?". With the increase in observing activity

thanks to two (count 'em) two observing sites, these lists will give all members some suggestions for an evening session.

This month's area will be Perseus and Cassiopeia.

Class I

Name	Constellation	Mag	Size
NGC 8444	Perseus	4.0	35' OC
NGC 8699	Perseus	4.0	34' OC
M34	Perseus	6.0	20' OC
M52	Cassiopeia	7.0	12' OC

OC -- Open Cluster
GC -- Globular Cluster
PL -- Planetary Nebula
N -- Diffuse Nebula
G -- Galaxy

Class II

Name	Constellation	Mag	Size	
M76	Perseus	11.0	140"x70"	PL
NGC 1023	Perseus	11.0	4.5'x1.3'	G
*NGC 185	Cassiopeia	11.8	3.5'x2.8'	G

Class III

Name	Constellation	Mag	Size	
NGC 1499	Perseus		145'x40'	N
*NGC 147	Cassiopeia	12.1	6.5'x3.8'	G
NGC 281	Cassiopeia		23'x27'	N

*Distant companion to M31

The double star list is divided into two classes: Class I (the colourful, easy doubles) and Class II (the 'test' objects).

Class I

R.A.	DEC.	Name	Mag. 1 - 2	Separation"	Constellation
00h 46m	57°	η	3.6 - 7.5	10.1*	Cassiopeia
02h 47m	55°	η	3.9 - 8.6	28.4*	Perseus
00h 00m	65°	E3053	6.0 - 7.4	15.3*	Cassiopeia
00h 24m	49°	E30	6.9 - 8.7	17.3	Cassiopeia

Class II

R.A.	Dec.	Name	Mag. 1 - 2	Separation"	Constellation
03h 13m	40°	E369	6.8 - 7.8	3.4*	Perseus
02h 24m	67°	ι	4.7 - 7.0	2.3*	Cassiopeia
23h 56m	55°	α	5.1 - 7.2	3.1*	Cassiopeia
02h 25m	55°	6.8 - 8.2	2.6		Perseus

*There is a marked colour difference in the pair.

Since we are already poking around the Perseus region of the sky (and being mindful of Dr. Percy's talk), I thought it would be appropriate to mention the star beta Persi (Algol) in this final section. Algol is a variable star which changes in brightness from magnitude 2.3 to 3.5. For 59 out of its 69 hour period, the star sits, rather constant, at magnitude 2.3. It then decreases to magnitude 3.5 in about 5 hours, and

immediately returns to its original brightness during the next 5 hours. This change is the result of two stars (a bright and faint pair) revolving around one another. As the fainter star passes in front of the brighter one (yes, another eclipse!) we observe a rapid drop in Algol's total brightness. (There is, of course, a lesser drop in light level when the brighter star passes in front of the fainter one.) Algol is, therefore, what is known as an eclipsing binary star.

The dates and times for Algol's minimum brightness level are listed below.

January:	3rd...13h 20m	6th...10h 10m	9th...7h 00m	12th...03h 50m
	15th...00h 40m	17th...21h 30m	20th...18h 20m	23rd...15h 10m
	26th...11h 50m	29th...08h 40m.		

Stew Krysko

CECILIA PAYNE-GAPOSCHKIN

Astronomer Cecilia H. Payne-Gaposchkin, recognized for her research on stars of variable brightness and on the Milky Way Galaxy, died December 6th. She was 79.

Prof. Payne-Gaposchkin, a leading authority on stars of variable brightness, was Phillips Professor of Astronomy, emeritus at Harvard University.

She served as chairman of the university's astronomy department from 1956 to 1960. The first tenured female professor on the faculty, she was also the first woman to earn a Ph.D. in astronomy at Harvard.

In the 1930's, Prof. Payne-Gaposchkin and her husband Sergel, made several million observations of thousands of variable stars. The results of this extensive survey of the night sky were published in the Annals of the Harvard Observatory.

Dr. George Field, director of the Harvard-Smithsonian Centre for Astrophysics, said, "From her work on variable stars, Cecilia contributed a great deal to the model of the nova as an exploding star. Since her pioneering work, we've discovered why this explosion takes place and how the novae fit into the current picture of stellar evolution".

Pro. Payne-Gaposchkin was known as a popular, often inspired lecturer, and she taught many courses during her years at Harvard. Her books and papers on variable stars and galactic novae were widely read and highly regarded by students and astronomers.

(This edited version of Cecilia Payne-Gaposchkin's obituary was taken from the December 8 edition of **The Boston Globe** and was sent to me by John Marelli.)

ROYAL ASTRONOMICAL SOCIETY OF CANADA, EDMONTON CENTRE

Anyone with an interest in the many facets of astronomy can find opportunities for sharing and increasing those interests by becoming associated with the Edmonton Centre of the Royal Astronomical Society of Canada. Membership includes: The annual RASC Observer's Handbook, the bi-monthly Journal and Newsletter of the RASC, Stardust (the monthly newsletter of the Edmonton Centre), plus complimentary admission to all Planetarium shows.

*General Meetings of the Centre are held in the Music Room of the Edmonton Public Library on the **second Monday** of each month (except July and August) at 8:00 PM. These meetings feature guest speakers whose topics cover all aspects of amateur and professional astronomy.*

*The Observers' Group of the Edmonton Centre meets on the **fourth Monday** of each month at the University of Alberta in Room 445 of the Physics Bldg. starting at 8:00 PM. Anyone with an interest in observational astronomy and astro-photography is invited to attend. Each month also features regularly scheduled group observing sessions at one of the Centre's dark Sites in the country. Members also have the use of the Centre's **Ellerslie Observatory** and 20cm refractor telescope. For details of these activities, please feel free to call the Observing Chairperson.*

Enquires regarding membership in the Edmonton Centre may be directed toward the President or the Treasurer, or come to one of our regularly monthly meetings and enquire at that time. Guests are always welcome. Currently, annual membership fees are: \$20.00 for Adults, \$12.00 for those age 17 and under.

President: Alan Dyer.....
Vice-President: Ted Cadien.....
Secretary: Ivan Rogers.....
Treasurer: Christine Kulyk.....
Editor, STARDUST: Paul Deans.....
Observing Chairperson: Mark Leenders.....

STARDUST
EDMONTON CENTRE, Royal Astronomical Society of Canada

c/o Queen Elizabeth Planetarium
10th Floor, C.N. Tower
Edmonton, Alberta

GENERAL MEETING

Monday January 14, 1980 at 8:00 pm
Music Room, Edmonton Public Library

SPEAKER AND TOPIC

Rod McConnell, Dave Beale, Dave Belcher
If This is Tuesday, This Must Be Kitt Peak

OBSERVER'S CORNER

Monday January 28, 1980 at 8:00 pm
Room 445, Physics Building, U. of A.

SPEAKER AND TOPIC

Mark Leenders
Telescope Performance

TO:

