STARDUST

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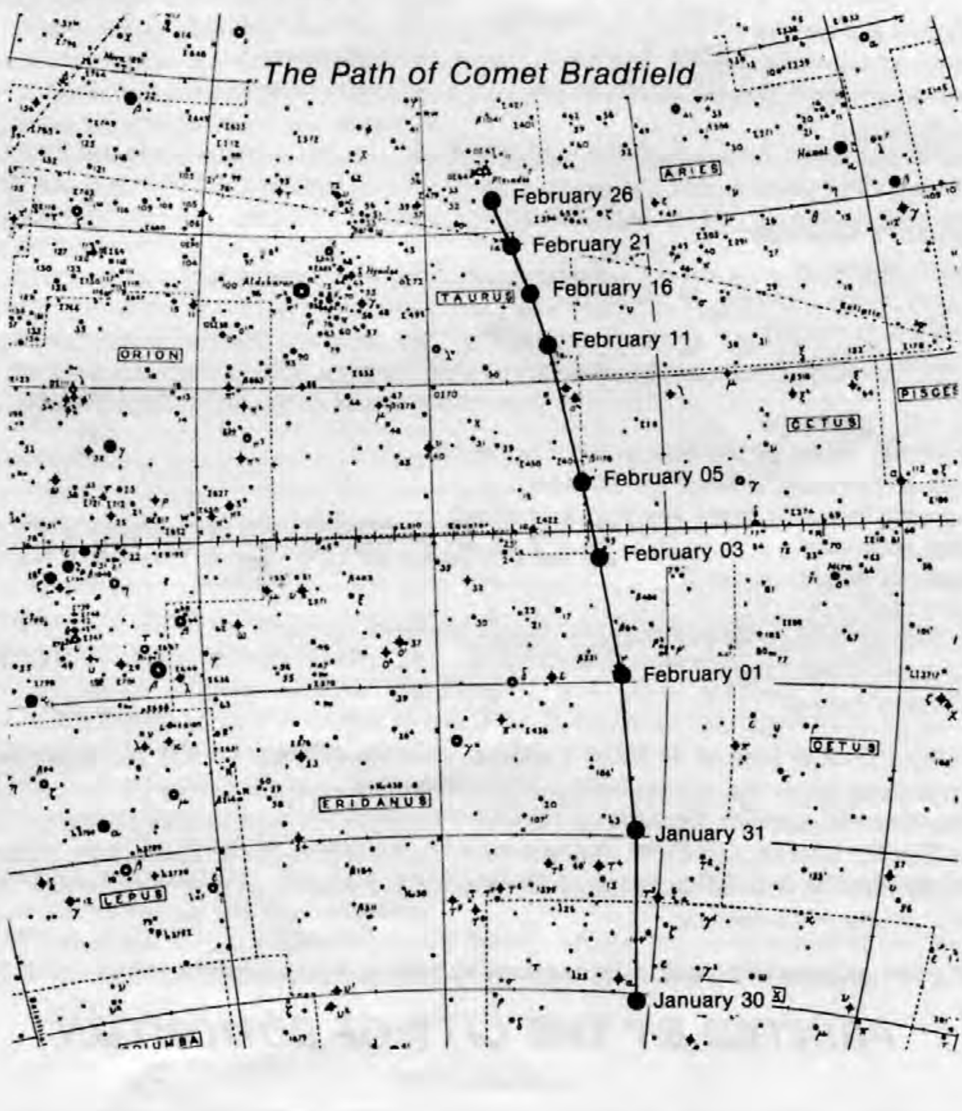

STARDUST

February, 1980

Volume 25, Number 05

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Assistance: *Alan Dyer*

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***STARDUST** is published 11 times a year. It is available to all R.A.S.C. members as well as by subscription ($3.50 per year) and at the Planetarium Bookstore ($0.35 per issue). Make all subscriptions payable to:* Queen Elizabeth Planetarium *and send them to:* The Editor, Queen Elizabeth Planetarium, Coronation Park, Edmonton, Alberta. *Articles dealing with all aspects of astronomy are wlecome, and may be sent to the Editor at the Planetarium.*

DEADLINE FOR THE MARCH ISSUE IS FEBRUARY 11, 1980

PRINTED BY THE CITY OF EDMONTON

PRESIDENT'S MESSAGE

Welcome to the start of a new decade and my first "President's Message".

The past few years have shown that we as a Centre, can accomplish quite a lot, once we set our minds to the task at hand. Activities such as a successful General Assembly, the securing of a centre observing site, and the completion of the shopping centre displays readily come to my mind.

A special vote of thanks is due Franklin Loehde, Alan Dyer, Lori Walton and many others for their work on these projects.

The coming year will see us again calling on every one for assistance in further developing some of these and other projects. Buck Mountain will have to be cleared and observing pads installed. The Shopping Centre Displays will be going on show, requiring people to 'man' the displays.

With the completion of a successful 1979 and looking towards 1980, this all leads up to the R.A.S.C - Edmonton Centre Annual Banquet. The activities this year take place at the Chateau Lacombe, commencing at 6:30 p.m. on Friday, March 21st, 1980. Tickets will cost about $10.00.

Our special guest speaker will be Dr. Werner Israel. He will be talking about 'Black Holes'. Dr. Israel is one of the world's leading experts on the subject. There will be more information on the banquet, etc., at the next meeting, February 11, 1980.

In the meantime should anyone have any questions I can be reached during the day at work), or at home).

Ted Cadien

EDITOR'S MESSAGE

This is a one item message because it is extremely important that anyone who wishes to submit an article for any future ***STARDUST*** know what is happening. Due to circumstances entirely beyond my control, the usual method of reproducing ***STARDUST*** is no longer available to me. I have, however, managed to come up with what seems to be a workable alternative. **HOWEVER**, it is now important that all contributers adhere to the submission deadline -- that being each and every meeting. It is now very likely that ***STARDUST*** will begin being typset within a few days of the meeting, and the finished product will be shipped off to be reproduced within 10 - 14 days after the meeting. So...late submissions may not make it in any more. I will elaborate further at the next meeting.

To all those who contributed to this issue -- thank you. If you sent something in and don't see it in these pages, hang in until next month. The problem of reproduction forced me to put the whole thing together in 3 days (in order to get it out before the meeting) and as a result I had to postpone a few items. Please remember that the **deadline** for the **March** issue is the meeting of **February 11**.

Paul Deans

MINUTES OF JAN 14 MEETING

The meeting was held in the Music Room of the Edmonton Public Library, beginning at 8:00 pm. The meeting was called to order by the President, Alan Dyer. The Treasurer, Christine Kulyk, presented her Annual Report, which was to be published in ***STARDUST***. Acceptance was moved by Dave Beale, seconded by Diana Wood, carried.

Alan Dyer reported that at the last Council meeting it was decided that there would be monthly Star Parties for members at the Ellerslie or Buck Mountain sites. He also announced that the Annual Banquet will be held towards the end of March.

John Hault gave a progress report on the proposed new planetarium.

Alan Dyer read the report of the Nominating Committee and the list of officers and councilors for the 1980 calendar year. The slate was elected by acclaimation.

The new President, Ted Cadien, introduced the evening's guest speakers: Dave Beale, Rod McConnell and Dave Belcher, who gave a slide-illustrated talk about their tour of Arizona and California Observatories.

45 members and guests signed the attendance book.

Anthony Whyte
Secretary

PLANETARIUM REPORT

EXPLORATIONS: A New View of the Solar System is now showing in the Star Theatre. The programme looks at the planets Mercury, Venus, Mars, Jupiter and Saturn as seen through the eyes of various camera-carrying unmanned spaceprobes. The majority of the show deals with Jupiter and its moons since the Voyager probes returned a fantastic amount of information about and photographs of the giant planet and its four largest satellites. The show is divided into five parts (one per planet) with each section being introduced by an 'action scene' (for example, re-creations of the flyby's of Mercury and Jupiter, a landing on Mars and a probe drifting down through the clouds of Venus). The Saturn opening is a simple dissolve of what Galileo saw

Continued on Page 5

TREASURER'S REPORT

STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR JAN 1/79 TO DEC 31/79

Opening Balance January 1, 1979		$3284.30
RECEIPTS:		
Adult Memberships	$1462.50	
Student Membership	80.00	
Associate Membership	24.00	
Life Membership	225.60	
STARDUST (Newsletter)	193.00	
Grant From National Office (for Shopping Centre Displays)	350.00	
Grant From National Office (for Victoria Centre Exchange Speaker)	123.00	
Astro-photography Seminar	329.00	
Lunar Eclipse Seminar	166.00	
Sale of Eclipse Slide Sets	738.00	
Donations	1097.59	
Sale of Handbook	4.00	
Bank Interest	286.90	
U.S. Exchange	4.00	
	$5083.59	$5083.59
		$8367.89
DISBURSEMENTS:		
National Office Dues	$1027.85	
STARDUST (Newsletter)	283.65	
Astro-photography Seminar	73.99	
Lunar Eclipse Seminar	87.33	
Eclipse Slide Sets	482.63	
Shopping Centre Displays	638.90	
STARNIGHT	43.17	
Exchange Speakers	198.00	
Public Education	11.35	
Film Rental	23.80	
National Council Meeting	7.80	
Incorporation Fees	42.50	
General Administration (supplies)	77.00	
Treasurer's Expenses	33.54	
	$3031.51	-$3031.51
	New Balance	$5336.38

ASSETS:

General Account	$1386.35
Observing Site Fund	1944.73
Term Deposits	2000.00
Cash On Hand	5.30
	$5336.38
Balance As Per Bookkeeping	$5336.38

Summary of expenses and earnings from special projects in 1979:

ECLIPSE SLIDE SETS:

	EXPENSES	RECEIPTS	PROFITS
BATCH #1 (110 sets)	$201.68	$270.00	$ 68.32
BATCH #2 (150 sets)	220.95	348.00	127.05
BATCH #3 (50 sets)	60.00	120.00	60.00
	$482.63	$738.00	$255.37

(There are still a few sets unsold from Batch #2)

ASTROPHOTOGRAPHY SEMINAR:

EXPENSES	RECEIPTS	PROFITS
$ 73.99	$329.00	$255.01

(The profits from this seminar were placed in the Observing Site Fund.)

LUNAR ECLIPSE SEMINAR:

EXPENSES	RECEIPTS	PROFIT
$ 87.33	$166.00	$ 78.67

SHOPPING CENTRE DISPLAYS:

BUDGET:	$700
EXPENSES:	
Display Boards and Mountings	$119.10
Posters and Prints	293.80
Captions	211.04
Tape	14.96
Total	$638.90

Grant Received From National Office: $350.00
Donation From J. Anderson: $ 50.00

Christine Kulyk
Treasurer

WANTED

10" Equatorial Head. Phone Bob Parker,

Continued from Page 2

when he viewed Saturn -- the ending sequence for Saturn (and for the show) is the big scene with a look ahead to the Voyager flyby of Titan. The programme continues until the end of March.

The operation of the Planetarium Bookstore has officially changed hands. No longer will R.A.S.C. members be treated to great deals by Discount John...he has been replaced by **Fast Freddie**! Yes friends, Fast Freddie will continue to provide those great bargains you have all come to know and love. Who is Fast Freddie? you ask! Well, it happens to be none other than Stew Krysko. Maybe if you buy a C-8 from him, he may tell you how he came to acquire the name Fast Freddie! Seriously though, Stew is now taking care of the Bookstore, so if you have any questions, suggestions or just have money burning a hole in your pocket, see Stew about any and all astronomical items.

Paul Deans

SOL III

As though satellites, power transmission lines and automobile ignition systems did not present enough problems, radio astronomers face an increasingly serious amount of interference from microwave ovens. Three workers at Britain's Jodrell Bank Radio Observatory present in a recent issue of ***Nature*** their case for asking for stricter governmental controls on the amount of permitted radiation leakage from the ovens. The authors of the paper tested two new and one ten-year old microwave oven and found that all three leaked radiation over the range of 1 to 6 GHz. This range includes four of the most important frequency bands used in radio astronomy, including the 1.4 GHz (21 cm.) radiation emitted by neutral hydrogen atoms. The Jodrell Bank team calculates that a radio telescope tracking an object in space will be affected by any microwave oven within 25 kilometers.
(***New Scientist***, Vol. 84, No. 1184, p. 758.)

From 1982 through at least 1985, planetary astronomers will receive no new data from U.S. spacecraft visiting other planets. The main reason for this unprecedented lull in the exploration of the planets is the tremendous strain placed on NASA's budget by the Space Shuttle. A more subtle but important cause of space program trouble, many researchers feel, is a waning public support of planetary exploration. It is possible that after the views of Mars' rock-strewn surface and the recent mind-boggling tour of Jupiter and its satellites, people are beginning to take things for granted. At any rate, the strain on the goodwill of the U.S. Congress created by the Shuttle and the perceived decline in public (read: voter) enthusiasm has resulted in

one budgetary crisis after another. The only planetary missions likely to be completed over this decade are two Voyager flybys of Saturn and one of Uranus (all of which are already en route), the Galileo Jupiter Orbiter and Probe (JOP), a surface-mapping radar orbiter of Venus, and visits to Halley's Comet and Comet Temple II. One way to cope with the scarcity of new discoveries may be to analyze throughly the data that are already in hand, or will be obtained shortly. Most researchers agree that there is lots of data to analyze, but many are worried that NASA will not be able to provide sufficient funds. That happened in fiscal year 1979 when U.S. Congress slashed NASA funding for moon rocket analysis from $5.7 million to $1.0 million.
(***Science,*** Vol. 206, No. 4424, pp. 1289.)

Anthony Whyte

50 & 100 YEARS AGO

February, 1930

"Prof. Dinsmore Alter gave an address at the meeting on Jan. 1 of the British Astronomical Association, in which he described researches on the effects of the different planets on sunspot activity. The method adopted was that described by Prof. E. Brown in vol. 69 of **Mon. Not. Roy. Ast. Soc.** Prof. Brown noted that the sunspot period was not very different from the period of Jupiter; he found that by combining the tidal influences of Jupiter and Saturn he could get a curve that followed that of the observed sunspot activity very closely. His prediction of a late maximum in 1907 was fulfilled; since then the curve has been carried on to 1955.... Later, the inner planets were introduced; since tidal action varies as the inverse cube, this partially compensates for their smaller masses; the fact of the tidal influence being appreciable is explained by the approximate equilibrium between surface gravitation and lightpressure at the sun's surface."

February 1880:

"A second telegram from Dr. Gould, received by Prof.C.A.F. Peters at Kiel the day after the first one, assigns a **southerly** motion to the great comet, or contrary to that mentioned in the previous one. Both statements may possibly be correct for the times to which they refer, as the case may be similar to that of the great comet of 1843, which sweeping around the sun with a velocity of 350 miles a second, and almost grazing his surface, passed from ascending node to descending node in two and a quarter hours."
Edited from ***Nature***

Anthony Whyte

THE EARLIER YEARS OF THE EDMONTON CENTRE

Part 4: 1950 - 1959

In 1951 the idea was mooted of having a public star night, and the new President, Mr. S. G. Deane, along with Prof. Gads of Engineering promised to look into it. The practice of having a question box available at meetings, into which members could drop questions to be answered later, was also started this year.

By 1953 the younger generation was coming forward in the Centre. In October that year, Franklin Loehde gave a talk on the summer observing programme in aurorae, sun-spots, meteors and eclipses, and Earl Milton gave the main address on *Our Cosmic Neighbours.* Later Dr. P.M. Millman of the Dominion Observatory, Ottawa, spoke on *An Astronomical Pilgrimage.* This was mainly about Flagstaff, the Arizona meteor crater and the four Schmidt meteor cameras operating in New Mexico.

In 1954 the observing programme was organized in four main divisions:

(1) Atmospheric phenomena, including the aurora, meteors and solar and lunar haloes, under Earl Milton.

(2) Solar and lunar observations of sun-spots, faculae, eclipses, lunar features and occulations, under Franklin Loehde.

(3) Planetary and comet observations under Arthur Dalton.

(4) Photographic observations (of the moon, star trails, Messier objects, etc.) under Ian McLennan, later director of the Planetarium.

In 1954, Dr. Campbell showed signs of failing health and he died in January 1955, at the age of 65. He had from the beginning taken the keenest interest in the Edmonton Centre, and he constantly promoted public interest in astronomy by writing weekly notes for the Edmonton Journal and showing visitors the beauties of the night sky through the Wates telescope.

A new era for the Centre began in October 1954 with the first issue of ***STARDUST***, originally a single dittoed sheet. This issue recorded the observation of the solar eclipse of June 30, 1954, which was partial in Edmonton and was enthusiastically watched at 4:00 a.m. from the roof of the Macdonald Hotel, by the observers group. Dr. Campbell, Dr. Grayson-Smith of Physics, and Prof. Gads travelled east to different places on the path of totality, but only Dr. Grayson-Smith was lucky enough to have a clear sky at the time of the total eclipse.

In 1955 at one of our meetings, Earl Milton directed an astronomical quiz game, based on the Handbook. The meeting was divided into two groups, the observers in one and the professors in the other, with the laity split between the two. The Professors finally came out ahead by five points, and according to ***STARDUST*** this result was mainly due to my own ability to remember such numbers as Planck's constant, the gravitational constant, and Pi to ten decimal places!

One of the more ambitious projects of 1955 was an organized hunt for a meteorite that was beleived to have fallen into Lake Wabamun the previous December. A farmer near Seba Beach reported hearing a terrific blast from the direction of the lake and found a large hole in the ice with debris strewn around. In June, Ian McLennan and Willy Hrudey went out to investigate the report and they felt that quite possibly a large meteorite had actually fallen there. A large search party nicknamed Operation W.H.A.M. (Wabamun Hunt for Aqua Meteorite) was set to work, but even with the help of a mine detector and aqua-lungs the meteorite, if it was really in the lake, was never found.

In the fall of 1955 a debate was held on the possibility of successful human interplanetary space travel. The affirmative side was taken by Dr. Grayson-Smith and Arthur Dalton, the negative by myself and Franklin Loehde. I doubt whether we on the negative side were completely convinced of our case, but we did bring up all the arguments we could as to the possibilities of human error or malfunctioning of machinery leading to disaster, as well as the risks from meteorites and cosmic radiation. The debate, as might be expected, was inconclusive and it was felt that time alone would tell.

In 1955 the observers' group acquired a welcome meeting place in which to warm up after a spell in the cold observatory. Because currents of hot air spoil good seeing, observatories are not heated, and that, in an Edmonton January, is quite a consideration. The University moved a hut to the site, and fixed it up so that it could be used for small meetings. In 1956, a whole series of weekly lectures from the beginning of May to the end of September was organized, given in the new hut by members of the observers' group. Two of them were by Franklin Loehde.

By 1958 the sputnik age had begun, and the public had a new interest in astronomy. An overflow crowd of about 125 persons jammed the Physics Lecture Theatre to hear the first of a series of lectures on space, sponsored by the Society. I gave the talk, on "What makes the Solar System Tick?". These monthly talks were intended to foster public interest in establishing a new observatory.

At this time the old observatory was showing signs of wear and tear and vandals wrecked the furniture and contents of the observers' hut. Also the construction of the auditorium and the proposed demolition of the University rink made it imperative to find a new site. In the summer of 1959, I went out with Mr. Earl Milton to look at a piece of land north of Devon, recently acquired by the University and used by the Department of Field Crops. A small hill with tree shelter on the east, appeared a suitable site and we so recommended. The Department of Field Crops agreed to stake off a piece of land 60 ft. by 200 ft. to be reserved for the observatory. The Observatory Committee headed by Dr. Grayson-Smith drew up plans and a sum was put into the estimate to provide for construction. However, this item did not survive the subsequent economy drive and paring of the budget. Dr. Grayson-Smith tried for some years to get it back again but was never successful.

The old observatory was pulled down in 1961 and the Wates telescope was housed temporarily in the Physics Building. We have never since then had adequate observing facilities and this has certainly had a detrimental effect on the observing programme.

NEXT MONTH: (1959 - 1962) The Planetarium dream becomes a realilty; Ian McLennan presents the first show; the Chant Medal is awarded to Earl Milton; the Bruderheim Meteorite falls to earth; the Centre begins meeting at the Q.E.P.; the first STARNIGHT is held at the Planetarium; the Centre hosts the first western General Assembly.

Prof. E.S. Keeping

IF THIS IS TUESDAY, IT MUST BE TUCSON

On Wednesday, October 31 at 8:33 pm a battered and dirty Aristocrat motor home limped eastward across the Edmonton city limits and into the city itself. Aboard were three haggard crew members, two of whom were still mildly incapacitated after suffering the ravages of some sub-tropical disease. However, all considered themselves fortunate to be home after a three week journey fraught with problems.

So ended the trail of one of the great astronomical odysseys of our time. The three had survived their own cooking, the freezing cold of Balzak, Alberta, the deserts of Utah and Arizona, the smog and freeways of Los Angeles and the raging snow storms of Crater Lake. Not to be forgotten of course were the suicidal antics of a diseasecrazed driver.

The story actually began nearly a year before with the conception of the bold, new Dyer Consequences Travel Bureaucracy, a maxi-profit organization dedicated to the taking of astronomical travellers whenever possible. After the first "voyage of discovery" to Hawaii (the famous ASTRO-TOUR '78) talk was heard of possible excursions to other astronomical installations in the known world. Over late night ale and under the dim glow of incadescent lights a proposal came forth for a great overland trek to the astronomical oases of the American Southwest. Though flying south was considered at one point, "jet-setting it" was eventually ruled out as being too expensive. (The Dyer Consequences Travel Bureaucracy has never been known for its posh accommodations and travel arrangements.) However, ideas flowed fast and free and fell as seeds on fertile dirt (or is it soil?).

People began to take the concept seriously. Dreams were spun of star studded nights under coal-black skies as lonely coyotes howled forlornly in the background. There were visions of shirt-sleeve observing as gila monsters scampered across star charts and road runners peeled out with cable releases held in firmly clenched beaks. Ah yes. Such trivia are dreams made of. But, let us continue with the true story of the ordeal and the fate worse than death which awaited our crew.

In true bureaucratic fashion meetings were arranged for interested individuals. Planning was complex and had to be carried out in the areas of time periods, possible routes, preferred sites, as well as transportation and costs. After research and consideration the time of year was set. Not only did we have to consider the period of time when everyone could leave on holidays, but the phase of the moon and average temperature of the desert regions. (Try telling your supervisor that you would like to leave on holidays at a certain time as the phase of the moon is just right!). All these considerations finally brought the size of the group down to three people: Dave Beale, Dave Belcher and myself. Eventually the route was agreed upon, the date set and letters of inquiry sent to the various facilities we wished to visit.

For transportation we chose a 21 foot motor home as it would have essential facilities on board and there would still be enough room for the equipment that had to go along as well. We thought at the time this choice would be ideal. Little did we know what waited in store for us.

October 11 arrived with a flurry of phone calls and last minute preparations. One by one each of us loaded our luggage and equipment into the motor home, and at 7:30 p.m. we were off! A quick meal at the beautiful and luxurious Saratoga Restaurant on the Calgary Trail delayed us slightly, but soon we were headed into the darkness with Dave Beale at the wheel. The first night saw us camped near Balzak, just north of Calgary, as heavy fog and cold temperatures closed in.

The next day we crossed the border into the United States about noon, after removing any undeclared equipment from the vehicle and registering it.

Our basic plan was to cover as many kilometres as possible both going south and returning. Thus in the first few days we travelled through Montana, Idaho and Utah rather quickly, the rolling hills and forests giving way to semi-desert and gradually to the desert itself. Also during the first few days, I suffered from some strange virus, a malady which would eventually keep Dave Beale "under the weather" for most of the trip.

In Montana we had our first night of good observing as our southward trek brought objects rarely seen from our latitude into view. In Idaho we saw our first desert plants. The dry air chapped our lips and increased our liquid consumption.

In Utah we paused to visit the famous Zion National Monument, an exceptionally beautiful spot in the midst of arid hills, an area surrounded by colorful cliffs and cooled by a small river winding its way through tall graceful trees.

Next stop: the Grand Canyon. After driving across more desert and through a gradual rise to a forest of tall trees the motor home arrived at the north rim. Darkness had already fallen. The telescopes were unloaded since the sky was clear and the evening was spent observing the southern sky through the large trees surrounding our campsite.

We arose well before dawn and hiked the three kilometres along the canyon's rim to a lookout point giving an excellent view of the canyon and the desert on the horizon. As the sun rose the earth's shadow could be seen receding in the west and the deep blues hiding the depths of the canyon mellowed and vaporized. Warm oranges, reds and browns splashed over the canyon walls, revealing the true beauty of the vast barren landscape.

The drive to the east began after a brief breakfast and before noon the bridge leading to the south side of the canyon was crossed. At the south rim we paused briefly to stare at the mule train ascending the steep path leading up to the rim from the bottom. A few photos were quickly taken and the motor home proceeded through the forest south to Flagstaff.

Before camping for the night we located the Lowell Observatory, situated on top of Mars Hill near downtown Flagstaff. A slow drive up a steep hill covered with pines eventually took us to the top -- several acres dotted with a variety of buildings. Everything was closed for the day.

We returned next morning at 8:30, first visiting the old observatory where Lowell did so much of his planetary work with the 24 inch (61 cm) refractor. Nearby is located his tomb, appropriately designed in the shape of an observatory building and situated to overlook the old part of the town. Our guide, Mr. Norman Thomas, also took us to the Administration building, where the work of Lowell and his associates is on display. Here the public is able to view the blink comparator used by Clyde Tombaugh in his search for Pluto as well as models and photographs of various astronomical phenomena. In the basement we had an opportunity to view the plates on which Pluto was discovered and the notes that Mr. Tombaugh made regarding the plates. A brief tour of the Planetary Laboratory completed our visit to the site.

Next on the itinerary was the U.S. Naval Observatory, located just outside Flagstaff. Here we had the opportunity to go onto the observing floor of the main observatory's 61 inch (155 cm) telescope and see other small instruments located nearby as well.

Leaving the lush forests of Flagstaff, our group travelled eastward into a very barren desert. The objective: the Barringer Meteor Crater. From a distance it looks like a very low mesa; nothing very exciting to view. Once the vehicle had been parked, we climbed the stairs to the museum and then proceeded out the other side to a lookout over the edge itself. A truly impressive hole, it measures 4000 ft. (1.2 km) wide and 570 ft. (174 m) deep. It is approximately 3 miles (4.8 km) in circumference. The crater is believed to have been blasted out of solid rock 22,000 years ago as a meteorite 81 ft. (25 m) in diameter streaked in from the north, striking the earth at approximately 33,000 miles per hour (53,122 km/hr).

Our journey continued on to the east, taking us through the Painted Desert at sunset and culminating for the day at a beautiful campsite near the small town of St.

John in eastern Arizona. The equipment was quickly set up as the sky was extremely clear. This was the first night I wished to do astrophotography and the results were well worth the effort. The nights were now warmer and for the first part light jackets could be worn, though warmer clothing would be required later in the night.

By now a routine had become well established. The day would start with a quick breakfast and then all equipment would be loaded on board. Then the all-day drive would begin. Our destination for the day would be reached near dusk and we would prepare for a night's observing. This would continue until the observers were too exhausted to carry on. After a brief sleep early morning observing would be undertaken until the sun blotted the stars from the sky.

Mount Lemmon Observatory was the next objective. However, the route to the site led through Tucson which was reached near noon as the last remnants of a heat wave blasted the town. The motor home struggled under the load as it climbed the steep twisted trail to the top of the ridge. Through the trees the domes of the Catalina Observatory could be seen in flashes of white through the green of the forest. We drove the last few meters up the dirt road to a small opening in the trees dominated by two domes. No one could be found at the site and we tried to start the motor home to leave. However, it just would not start, a problem which was to plague us for the duration of the journey. After deciding to wait for awhile, we strolled about the grounds. Suddenly a figure appeared. It must be an astronomer. It was!

After brief introductions he let us into the larger of the two domes, the home of the 61 inch (155 cm) telescope. In a smaller dome to the side resided a 16 inch (41 cm) Schmidt, no longer in use due to lack of funds.

The night we arrived at a campsite approximately sixty-five kilometres south of Tucson -- a small town called Amato. With clear skies overhead we decided to set up in the darkness. However, barking dogs and alarmed women did not make this chore any easier. Explaining who we were and what we were up to did not impress the female camper to the south of us. Her obnoxious Doberman Pinscher continued his barking on into the night at the least sign of movement. Dave Belcher was heard to utter under his breath some sentence connecting dogs, women and guns. However, in the melee I could not discern the exact text. To keep peace in the campsite we eventually decided to retreat for the night.

The Multi-Mirror Telescope was next on the itinerary. The ride up to Mount Hopkins began at 9:30 a.m. in a white school bus aptly christened "The White Poodle" driven by Mr. Dan Brocius, our host and guide. As the bus rose from the desert floor Dan pointed out the many varieties of plant and animal life in the area and related colorful localal history, perhaps in an attempt to relieve the tension of the passengers as the bus climbed the tortured, narrow road into the mountains.

The first stop on the way up was the site of the 60 inch (152 cm) reflector. From here the MMT could be easily seen, so close and yet so far. Reboarding the bus we set off for the top, only to have to transfer to a four-wheel-drive vehicle to traverse the last few hundred meters to the top.

A wide, squat telescope, the MMT is almost cubic in shape. However, it is still a very impressive instrument. The size of the building it is housed in belies the fact that the telescope is equivalent to the size of an instrument 175 inches (445 cm) in aperature. Of course, one of the unique features of this installation is that both the instrument and the building rotate together. At this time approximately 30% of the instrument's time is devoted to astronomical research with the remainder being used for engineering studies. After a lecture on the telescope and its operation, we returned to the lower site. Here, along with the 60 inch (152 cm) reflector, is located various other small domes and the famous 10 meter optical reflector, formerly used to detect Cerenkov radiation. A unique instrument, it has 248 hexagonal mirrors which are collimated and used as a huge "light bucket". The tour ended back at Amato in mid-afternoon.

Returning to Tucson we were able to visit the famous Flandrau Planetarium, located on the University of Arizona campus. Our group, along with an alumni group, were treated to a local production titled "The Islands of Katmandu", a general introduction to spaceflight and astronomy. An informal tour of the rest of the facility completed the afternoon. It was then decided to spend the night away from the light and pollution of the city and to drive south to a campsite in the mountains. Though it was very clear there were high winds but the telescopes were set up anyway.

Near Mount Hopkins it was expected that the observing conditions would be excellent and they were, so long as the light pollution dome of Tucson to the northwest was avoided. The next morning dawned bright and beautiful. We were on our way back to Tucson when disaster struck.

(To be concluded next month)

Rod McConnell

OBSERVING VARIABLE STARS FOR FUN AND PROFIT©

PULSATING VARIABLES

After the discovery of β Lyrae, John Goodricke went on to discover several more bright variables, including δ Cephei, the prototype of the *pulssating variables.* He suggested that δ Cephei was a rotating variable, but by the late 1800's most astronomers believed that it - and most other variables - were eclipsing variables. In 1914, however, Harlow Shapley showed that the light, color and velocity curves of this star were inconsistent with eclipses, but were consistent with *pulsation*, a periodic expansion and contraction of the star.

The most important property of a pulsating variable is its period -- the time required for one complete cycle of expansion and contraction. In δ Cephei, the period is about five days. As in any other pulsating (or vibrating) object, this time depends on the size of the object. A larger object vibrates more slowly; a smaller object vibrates more quickly. The size of a star in turn determines its intrinsic luminosity or energy output, so that the period of a pulsating variable is a measure directly related to its intrinsic luminosity. If this *intrinsic* luminosity is compared with the star's *apparent* luminosity (as seen from Earth), the difference between the two can tell us the distance to the star. This is one reason why pulsating variables are so useful.

The period of pulsation depends to a lesser extent on the mass and the internal structure of the star. Therefore if the size of the star can be measured independently (from its luminosity and surface temperature, for instance), then the additional measurement of the period allows us to calculate the mass of the star.

Some stars pulsate with several periods simultaneously. The pulsation of these "multiperiodic" stars is in many ways similar to the vibration of a musical instrument (or the human voice) displayed on the screen of an oscilloscope. The vibration is a complex mixture of overtones and harmonics. The light curve of a multiperiodic variable is also a complex mixture of overtones and harmonics but if the periods can be sorted out, they can tell us a great deal about the size, mass and structure of the star. In a way, the study of these stars could be thought of as "stellar seismology", analogous to the study of the Earth using vibrations set up by earthquakes.

Almost any kind of star can be an eclipsing variable, as long as it has a second star in orbit around it and as long as the orbit is seen nearly edge-on. In contrast, only certain kinds of stars can be pulsating variables. This is best shown by means of the *Hertzsprung-Russell* (or H-R) diagram, which is a graph of luminosity against "surface" temperature of a star. (Figure 3 shows an H-R diagram.) The vast majority of normal stars lie in a restricted region called the *main sequence.* Pulsating variables lie only within the dotted regions, called instability regions. There are two instability regions: the nearly vertical *Cepheid instability region* and the *cool instability region* on the right. If a star's luminosity and surface temperature place it within one of these regions, then the star may become a pulsating variable. This is because at certain temperatures, the material of which stars are made (mostly hydrogen and helium) has the property of converting heat energy into mechanical energy, like an engine. Actually, not every star within these regions is a conspicuous pulsating variable. Some stars (Polaris is an example) pulsate only slightly and some do not pulsate at all. These microvariables and nonvariables are only gradually being discovered, using sensitive photoelectric techniques.

How does a star become a pulsating variable? Only a few stars are "born" with a luminosity and surface temperature which place them within an instability region. Other stars evolve into and through the instability regions, as shown in Figure 3. As these stars shine, they use up nuclear fuel; their internal composition and structure change and so do their luminosity and surface temperature. Most stars reach the

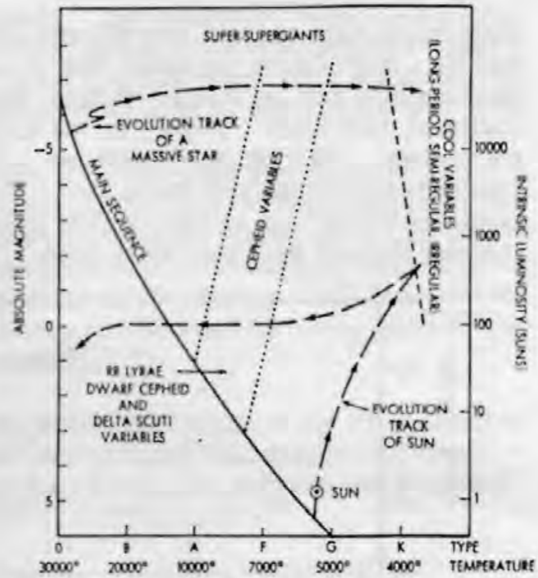

Figure 3 A Hertzsprung-Russell diagram. The star's absolute magnitude or intrinsic luminosity is plotted vertically, and its "spectral type" or surface temperature is plotted horizontally. The instability regions are shown as dotted outlines, and the locations of some classes of pulsating variables are shown. The dashed lines are "evolution tracks" (much simplified) for a typical massive star and for a star like our Sun. These evolution tracks represent the changes in luminosity and temperature which occur because of the evolution of the star.

instability regions rather late in their lifetime, and stay there for a few percent of their lifetime at most. In fact, a given star may pass through the instability regions several times during the rapid and complex phases at the end of its life.

When a star enters or leaves an instability region, it may start or stop pulsating within a few years. It is unlikely that we would see a previously nonvariable star as it begins to vary, but - by systematic study - we might possibly see a pulsating star cease to pulsate. Such an event occurred in the 1960's when the star RU Camelopardalis essentially stopped pulsating. Clearly there are many dividends to be gained from the systematic study of variable stars, but the time involved is more than can be invested by professional astronomers. Here again, the amateur or student can be of great help.

Even within the instability region a star can evolve, and its size and hence its period can change. These period changes, though small, can be detected and measured through systematic studies and provide a direct measure of the evolution of the star. Such studies by amateurs are coordinated in North America by the A.A.V.S.O. especially its Cepheid committee.

Pulsating variables are classified according to where in the instability regions they lie. At the bottom of the Cepheid instability region, where it intersects the densely populated main sequence, lie the Delta Scuti stars. Most of the Delta Scuti stars have small amplitudes (changes in brightness) as we can see in Figure 4. Those with large amplitudes are called Dwarf Cepheids. At a slightly higher luminosity lie the RR Lyrae stars. These have periods of about half a day and large amplitudes. They are very old stars which have evolved into the instability region in the semifinal stages of their lifetime. Both Dwarf Cepheids and RR Lyrae stars are interesting to the amateur because they can be studied visually, and they go through one or more complete cycles in one night. Higher in the Cepheid instability region lie the Cepheids themselves. Population I Cepheids are generally massive stars; population II Cepheids are old stars of lesser mass. Both have periods of days or weeks and are living out the last few percent of their lifetime. Most have large amplitudes but a few (notably Polaris) have very small ones.

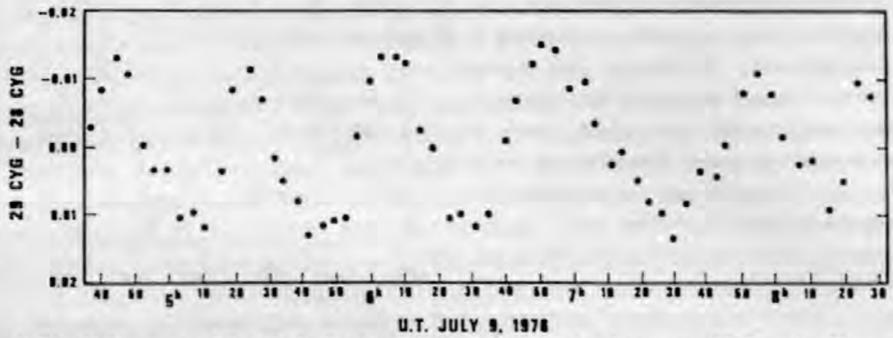

Figure 4 The light curve of the Delta Scuti star V1644 Cygni (also known as 29 Cygni). The period is 45 minutes and the amplitude is only 0.03 magnitude. (Photoelectric photometry by undergraduate student Douglas Gies using the 0.4 metre reflector on the University of Toronto campus.)

In the cool instability region lie red variables of many kinds. The most conspicuous of these *long-period variables* are stars with periods of hundreds of days and amplitudes of several magnitudes. These stars are enormous "giant stars," hundreds of times bigger than the Sun. The prototype is o Ceti, better known as *Mira*. Since these stars can easily be studied using visual techniques, amateurs can make an important contribution by observing these stars. A.A.V.S.O. members, for instance, make tens of thousands of observations of these variables each year. To add to the interest, many of these variables are slightly irregular in their pulsation; others are *quite* irregular. To monitor these irregular variations would be completely beyond the resources of professional astronomers. This is one task which can be conveniently and safely left to amateur observers.

At the top of the H-R diagram the Cepheid instability region and the cool instability region merge into a single, broad region of instability, and it is here that some of the most interesting variables are found. Cool supergiants (like Betelgeuse and Antares) vary slowly and irregularly, as do most supergiants of moderate temperature. Hotter supergiants also seem to vary irregularly in both brightness and radial velocity (as if their outer layers were "sloshing around"), but the study of these variables has just begun. Among the *very* largest, brightest supergiants, variability may occur on a time scale of many decades. The remarkable stars P Cygni and η Carinae are examples of super-giants which have undergone spectacular changes in brightness in the last few centuries. In other galaxies, such stars stand out like beacons and are called *Hubble-Sandage variables* after Edwin Hubble and Allan Sandage who first studied them in detail.

The variability of the super-supergiants is so complex and irregular that it is difficult to classify or explain. It may be due to a "heat engine" instability similar to that in pulsating variables. The gradual transition from regular supergiant variables (like Cepheids) through semiregular supergiant variables (like the stars 89 Herculis and R Puppis) to the irregular super-supergiant variables (like P Cygni, η Carinae and the Hubble-Sandage variables) supports the connection between pulsating variables and the irregular variability of the super-supergiants.

ERUPTIVE VARIABLES

Another group of variables which defy simple classification are the R Coronae Borealis stars. These stars suddenly and unpredictably *decrease* in brightness by many magnitudes (like novae in reverse), then slowly return to normal (Figure 5).

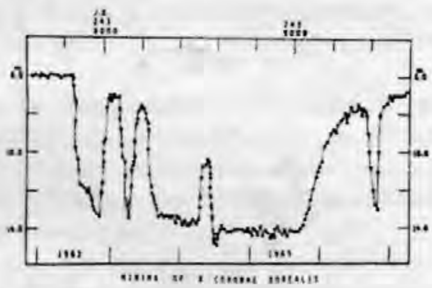

Figure 5 The light curve of R Coronae Borealis, showing the deep, extended "drop-out" in the mid-1960's. The light curve is based on visual observations and was provided by the A.A.V.S.O.

These "drop-outs" are so infrequent, so unpredictable and so striking that they are most easily and efficiently detected by amateurs; in fact, most drop-outs are detected in this way. When a drop-out (or any other important happening in the sky for that matter) is spotted, professional astronomers are notified by means of the telegram and circular service of the International Astronomical Union, based at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts. This unique service provides an important link between the amateur, looking for the unexpected, and the professional, waiting for the unexpected to happen.

R CrB stars are abnormally rich in carbon, and it is thought that the drop-outs are caused by the formation of large quantities of "soot" in the stars' atmospheres. The two best studied R CrB stars (R CrB and RY Sgr) both happen to be pulsating stars as well, but this may have nothing to do with the occurrence of the drop-outs.

True eruptive variability is marked by a sudden and unpredictable *increase* in the brightness of a star, followed by a (usually) slower return to normal. Eruptive variability, in one form or another, persists from a star's birth to its death. When a star first emerges from within the gas and dust from which it formed, it is by definition a variable star. It increases rapidly in brightness - but in this case does *not* return to its previous state! Several possible examples of this process have been observed, the most notable being FU Orionis which in 1936 rose from 16.2 magnitude to 10.1 magnitude.

Soon after the birth, a star begins another stage of instability called the T Tauri stage. During this stage, which may last millions of years, the star shows erratic variation in brightness. It also shows great turbulence in its atmosphere - akin to the activity in our Sun but on a grand scale. T Tau stars are numerous in regions of star formation like the Orion Nebula region (Figure 6). Amateurs could make a worthwhile contribution by taking photographs and monitoring the brightness of the T Tau stars on them. These same variables could also be monitored by visual techniques.

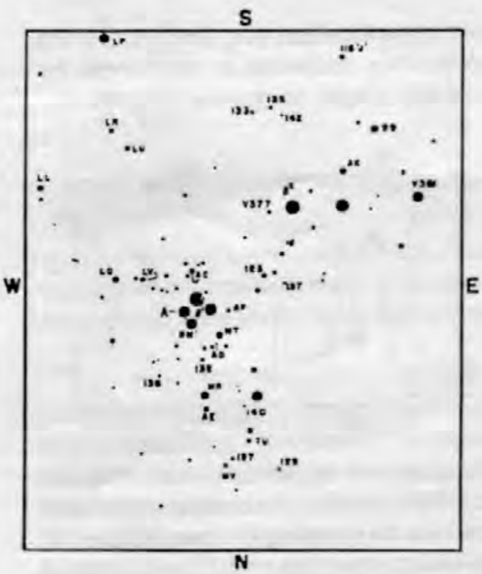

Figure 6 An A.A.V.S.O. chart of the Orion Nebula region showing variable stars (lettered) and comparison stars (numbered; the numbers are their apparent magnitudes with the decimal point removed). Most of the variables are T Tauri stars.

After the T Tau stage, a star settles down for a long period of stable and relatively uneventful existence. Even then, however, it may undergo *stellar flares*. The Sun undergoes flares quite frequently but these would not be visible from a great distance because they raise the Sun's total brightness only slightly. Flares are much more conspicuous on faint red dwarf stars, partly because the flares themselves are brighter and partly because the stars are fainter. The brighter flares can be detected visually and amateurs can do useful and interesting work by monitoring them. Incidentally, this work - like many other types of variable star observation - is often more interesting and enjoyable if done by a *group* of amateurs.

The most spectacular eruptive variables are stars near the end of their life: novae and *supernovae*. These are stars which (to a lesser or greater extent, respectively) brighten suddenly and spectacularly, then slowly fade away. There the resemblance between novae and supernovae ends. The nova instability is a superficial thing; the supernova instability is a terminal affair.

Novae are fairly frequent in our galaxy and a naked eye nova appears every year or two. Unfortunately, no one can predict where! Therefore observers must search the sky patiently and systematically, and this is work which can profitably be done by amateurs. About half of all naked eye novae are discovered by amateurs as a result of systematic searches; the other half are discovered purely by accident. A nova rises in brightness by ten or more magnitudes in a few days, then slowly fades back to normal. Studies show that every nova is in fact a binary star system. One member of the system is a normal star; the other member is a compact star called a white dwarf, a million times denser than the Sun. The nova eruption occurs because gases are driven by evolutionary pressure from the normal star to the white dwarf. They gradually accumulate on the surface of the white dwarf, compressing, heating and eventually igniting the hydrogen atoms in the gas. Since this process could occur repeatedly, it is not surprising that nova eruptions can recur in the same star. Perhaps all novae are recurrent; only time will tell.

There is some tendency for the recurrent novae to have smaller eruptions. In fact there is one group of stars called *dwarf novae* which have small eruptions every few weeks. These are a favorite object of study for amateur observers. The eruptions, though somewhat regular, are still unpredictable, but when they occur they can easily be detected visually in a small or medium-sized telescope.

The most spectacular eruptive variables are the rarest - the *supernovae*, a supernova results from the gravitational collapse of a massive star. In the process, the outer parts of the star are driven off at thousands of km/sec, while the inner parts are compressed to nuclear densities. At maximum brightness a supernova shines with the power of a billion suns and can be seen even in distant galaxies. In an average galaxy, supernovae occur every few decades, and since thousands of galaxies are within the range of our telescopes several supernovae are discovered in other galaxies each year. This would be an interesting project for an amateur astrophotographer. If he or she photographed a hundred galaxies each year there would be a reasonable chance of recording a supernova in one of them![6]

In our own galaxy, supernovae seem to appear once every century or so, though none have been recorded visually since about 1600. The next galactic supernova is therefore long overdue and it will likely as not be discovered by an amateur observer, patiently and systematically searching the sky. This represents the amateur's only chance to attain lasting "fame"because - at least in the case of Tycho and Kepler - the discoverer's name has been attached to the supernova. However, most variable star observers are satisfied simply to know that, by watching the ever fascinating changes in the stars, they are contributing in a unique way to astronomical research.

Further Reading

There is no single book on variable stars which is both authoritative and up-to-date. A useful reference is the **Cambridge Encyclopaedia of Astronomy**, edited by Simon Mitton (1977, Crown Publ. Inc.), particularly the chapters on *Intrinsic Variable Stars* and *Binary Stars*.

The primary source of information on all aspects of variable star observing is the American Association of Variable Star Observers, 187 Concord Ave., Cambridge, Mass. 02138. The A.A.V.S.O. publishes a regular *Journal*, a *Manual for Observing Variable Stars*, a*Manual for Astronomical Photoelectric Photometry*, as well as useful charts, circulars and bulletins.

The following articles are also of interest:

Gilman, C.: "John Goodricke and His Variable Stars" in *Sky and Telescope*, November, 1978

Coutts-Clement, C.M. and Sawyer-Hogg, H.: "The Bright Variable Stars In M5" in the *Journal of the Royal Astronomical Society of Canada*, August, 1977.

Upton, E.K.L.: "The Night of the Nova" in the *Griffith Observer*, November 1975.

Mayer, B.: "The Blinking Astronomer" in the *Griffith Observer", December 1977.*

Zeilik, M. et al: "The Strange RS CVn Stars" in *Sky and Telescope*, February 1979.

Dr. John Percy
University of Toronto

6. After this article was written, A.A.V.S.O. member Gus Johnson of Swanton, Maryland discovered a supernova in the galaxy NGC 4321 (also known as M 100).

COMET BRADFIELD

This comet was discovered by Australian William Bradfield on Dec. 24th. There was some speculation that this might be Comet 1770 II, but new orbital calculations show that this is not the case. It's maximum magnitude was 3.7 around Jan. 26.

Feb.	1	3 11.92	- 9 45.9	0.310	1.040	5.1
	2	3 14.89	- 5 37.3			
	3	3 17.36	- 2 10.5	0.374	1.073	5.7
	4	3 19.46	+ 0 43.0			
	5	3 21.28	+ 3 10.1	0.441	1.106	6.2
	6	3 22.88	+ 5 16.0			
	7	3 24.31	+ 7 04.8	0.511	1.138	6.6
	8	3 25.60	+ 8 39.7			
	9	3 26.79	+10 03.1	0.583	1.171	7.0
	10	3 27.90	+11 16.9			
	11	3 28.94	+12 22.7	0.655	1.203	7.4
	13	3 30.85	+14 14.9			
	15	3 32.61	+15 47.3	0.802	1.268	8.1
	17	3 34.26	+17 04.8			
	19	3 35.85	+18 10.8	0.948	1.333	8.6
	21	3 37.40	+19 07.9			
	23	3 38.91	+19 57.9	1.094	1.396	9.1
	25	3 40.41	+20 42.1			
	27	3 41.90	+21 21.6	1.239	1.460	9.6
	29	3 43.39	+21 57.3			
Mar.	2	3 44.87	+22 29.7	1.382	1.522	10.0
	4	3 46.37	+22 59.3			
	6	3 47.87	+23 26.6	1.523	1.585	10.4

OBSERVING NOTES

Mercury: comes to a favorable position for observing this month. Look for it low in the southwest just after sunset between Feb. 10 and 25. Its magnitude will be about 0.
Venus: is the very bright (-3.6 magnitude) object visible in the southwest after sunset.
Mars: reaches opposition on February 25, when its diameter will be nearly 14 seconds of arc. The north polar cap is already clearly visible in an 80 mm refractor. Mars is near Jupiter this month, but Mars is clearly identifiable by its red hue.
Jupiter: is at opposition on February 25. It is near Mars and is rising in the east after sunset. Jupiter is the 4th brightest object in the sky,behind the Sun, Moon and Venus.
Saturn: is a faint, yellowish object in Virgo rising about 3 hours after sunset. From now until March 3, and from March 12 until July 23, the Earth and the Sun are on opposite sides of the plane of Saturn's rings. The rings will be invisible in all but large telescopes until the end of July, which gives Saturn an unusual appearance. If we **could** see the rings during this time, they would be back lit, and would appear as they did in the Pioneer 11 images.

For more detailed information on the planets, please consult the Observer's Handbook.

Mark Leenders

WHAT'S UP?

Since the winter sky is very well placed for evening observing, I have chosen the Orion/Taurus area for this month's column. I decided to concentrate on Orion for the Double Star section as there are more than enough doubles to keep one busy all winter long. The Deep Sky section covers both constellations. Class I lists all the "popular" objects -- the ones everyone observes at one time or another. Class II are some of the more obscure (but fairly bright) objects. Class III are the difficult ones. I must confess that I've only seen one of these objects myself (NGC 1514), but that's why the list is here -- to help people like myself plan for future observing sessions. May I suggest for any of the Class III objects that you try a Nebular Filter. That's the only way I picked NGC 1514 out of the background sky-glow at Ellerslie.

Stew Krysko

OC — Open Cluster
PL - Planetary Nebula
DN - Dark Nebula
N - Diffuse Nebula

Deep-Sky Objects (Orion and Taurus)

CLASS I

Name	Mag	Size	Type
M42 Orion Nebula	5	66'x60'	N
M43	9.1	20'x15'	N
M1 Crab	8.4	6'x4'	PL
NGC 1758	6	45'	OC

CLASS II

Name	Mag	Size	Type
NGC 2194	9.1	8'	OC
NGC 2169	6.4	6'	OC
M78	10.3	8'x6'	N

CLASS III

Name	Mag	Size	Type
NGC 2022	12	25"	PL
B33 Horsehead	--	--	DN
NGC 1514	11	2'	PL

Double Stars (Orion)

CLASS I

R.A.	Dec	Name	Mag. 1 - 2	Separation
5h 32m	5°	θ	6.8 - var	08.8"
5h 32m	5°	θ	6.8 - 5.3	13.6"
5h 32m	5°	θ	6.8 - 6.8	21.6"
5h 36m	2°	σ	3.7 - 7.2	12.8"
5h 36m	2°	σ	3.7 - 6.5	41.6

CLASS II

R.A.	Dec	Name	Mag. 1 - 2	Separation
5h 45m	6°	52	6.1 - 6.2	1.5"
5h 32m	9°	λ	3.6 - 5.5	4.4"
5h 10m	2°	P	4.6 - 8.6	7.0"
5h 22m	2°	η	3.7 - 5.1	1.5"

FIRST ANNUAL REPORT OF THE ELLERSLIE OBSERVATORY, 1979

The Ellerslie Observatory is a private, non-profit institution for the fostering of the advancement of the science of astronomy. It is administered by a Board of Directors. The Observatory is registered with the International Astronomical Union's Central Bureau for Astronomical Telegrams and receives both the Bureau's telex messages and airmailed circulars. It also regularly receives the publications of many major astronomical observatories.

The highlights for 1979 include the Observatory's expedition to observe the February 26th total solar eclipse east of Estevan, Saskatchewan. The expedition's report has appeared elsewhere (***STARDUST***, vol. 24, no. 7, pp. 12-14). The total lunar eclipse of September 6th was observed from Ellerslie under excellent seeing conditions.

In 1979 the Ellerslie Observatory was officially designated as the 'Near Site' of the Edmonton Centre of the Royal Astronomical Society of Canada. As the result of this arrangement the Observatory's 20-cm. refractor is freely available for use by any RASC member who has been familiarized with the instrument's operation. In turn, this ensures a greater utilization of the telescope and ancillary facilities. From August (when the keeping of an Observatory Logbook was instituted) to the end of the year recorded observations were made on eighteen occasions. Observations were logged of twenty-three Messier objects, forty-five NGC objects, and nine double or multiple star systems. The four components of Epsilon Lyrae, the 7th magnitude companion of Beta Orionis, and the three components of Gamma Andromedae were resolved. The double cluster in Perseus was also observed. Numerous lunar and planetary observations were recorded. Unsuccessful attempts were made to observe Comet Meier 1979i and Stephan's Quintet. Full aperature solar projection was attempted on one occasion with great success; much sunspot penumbral and surface granulation detail was visible on the approximately one-metre projected solar disc.

It is hoped and expected that use of the Ellerslie Observatory's facilities by members of the RASC will continue to increase in the coming year.

Anthony Whyte
Director

1980 ASTRONOMY CAMP

From July 27 to August 16 there will be an international Workshop for Amateur Astronomers (IWAA) held in the Netherlands. In order to participate you have to have a basic knowledge of astronomy, be between 16 and 22 years old, and be able to speak and understand English. The price of the camp is $225 (Canadian) which will have to be paid in Dutch currency. The plane fare you pay yourself -- when I went in 1978 is was $560.00. The information booklet with application form may be obtained from:

IWAA 1980, c/o Wilfried Boland, Damstraat 27, 3531 BR Utrecht, Netherlands

All application forms must be in by March 15, 1980.

There have been three other camps held in the Netherlands. I went to the one in 1978 and would strongly urge anyone able to attend this summer to do so. The intention of the IWAA is to give young people from around the world an opportunity to involve themselves in the observational techniques and scientific methods of work in the astronomical field. There are five working groups to chose from (astrophysics, astrophotography, galactic structure, meteors and the general group). Each meets daily, and members can collect observational data at night. There are also other things going on, including games, films, contests, discussions plus two free days during which you can travel.

Lori Walton

UPCOMING EVENTS

Observer's Corners

The Observer's Corner meetings continue as usual, with two interesting speakers coming up, but more on that later. The Observer's Corner meets on the fourth Monday of every month in room 445, at 8:00 pm, in the University of Alberta Physics Building. All interested members and guests are invited, and as usual, refreshments will be available after the meeting. At the February 25th meeting, Dave Beale will speak on the operation of radio telescopes, a topic which reflects the rising interest in amateur Radio Astronomy.

The February O. C. will also feature the premiere showing of the brand new film *Mirrors on the Universe - the MMT story.* Produced by the University of Arizona, this film details the construction and operation of the newly-completed Multiple-Mirror Telescope on Mount Hopkins near Tuscon. This unique telescope uses 6 laseraligned 1.8 metre mirrors to give the equivalent light-gathering power of a 4.5 metre telescope, making it the 3rd largest optical telescope in the world.

At the following meeting on March 24th, Bob King will tell us about his solar prominence observing project, using a Daystar Hydrogen-alpha filter mounted on the University of Alberta's Celestron 14 telescope. The talk will undoubtedly be illustrated with many slides taken through the Daystar filter, so this would not be an Observer's Corner to miss

If you're a new member and would like to attend the Observer's Corner, and want more detailed directions as to how to get there, please phone me (Dave Holmgren) at . I am also sending out a call for topics for upcoming Observer's Corner meetings. If you have been doing any sort of observing related project, no matter how simple or complex, or have been constructing a telescope, we would like to hear about it. If you have any ideas, please contact me at the number above.

Observing Sessions

Our February Star Party takes place at Ellerslie on Friday, February 22. There is a first quarter moon (the best phase for lunar observation) and Mars and Jupiter are both only 2 days away from opposition. These planets will therefore rise at sunset, at about 6:00 p.m. The observing session gets underway at about 9:00 p.m., allowing time for the planets to rise to a decent altitude. Saturn should be coming up about then as well. Beside lunar and planetary observing, we'll be viewing some of the brighter winter deep-sky objects. Bring your telescope! For directions to the Ellerslie Observatory, see the December, 1979 issue of ***STARDUST***, **or** give me a call at the above number. If you require a ride to the site, please ask, as there are a number of Centre members more than happy to provide transportation. If the weather is cloudy, the Session will be postponed to Sat. February 23, same time, same place. If the weather looks doubtful, give me a call to find out if the Session is on or not. Come on out to view the winter sky!

Dave Holmgren
Observing Coordinator

QUEEN ELIZABETH PLANETARIUM

The Queen Elizabeth Planetarium was built by the citizens of Edmonton to commemorate the 1959 royal visit of Her Majesty Queen Elizabeth and Prince Philip. Officially opened in October 1960, the Planetarium became the first such facility in Canada devoted to the popularization of astronomy.

The planetarium offers a wide range of astronomically-oriented programming. Within the Star Theatre, hour-long shows dealing with all aspects of astronomy are presented using a battery of slide projectors, special effects projectors and the Goto Star Projector itself. By projecting some 2,800 stars through thirty-two optical trains, the Star Projector can be used to transport the audience to any point on the surface of the Earth while passing through any time sequence from a minute to an eon.

In addition, the Planetarium offers Astronomy courses on a regular basis throughout the year. The Bookstore, located in the Planetarium's front lobby, specializes in a wide range of telescopes, books and publications on Astronomy and related sciences.

For further information about any of the programmes offered by the Queen Elizabeth Planetarium, please call 455-0119. Office hours are 8:30 am to 4:30 pm Monday through Friday. Showtimes are Tuesday through Friday evening at 8:00 pm, and Saturdays, Sundays and Holidays at 3:00 pm and 8:00 pm. Admission is charged.

EDMONTON CENTRE, ROYAL ASTRONOMICAL SOCIETY OF CANADA

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 R.A.S.C. General meetings are held in the Music Room of the Edmonton Public Library on the **second Monday** of each month (except July & August). These meetings feature guest speakers whose topics cover all aspects of amateur and professional astronomy. The Observer's Group of the Edmonton Centre meets on the **fourth Monday** of each month at the University of Alberta Physics Building (room 445) starting at 8:00 pm. Anyone interested in observational astronomy or astrophotography is invited to attend.

Enquiries regarding membership in the Edmonton Centre may be directed toward the President (Ted Cadien, , or come to one of the regular monthly meetings and enquire at that time (the Treasurer is Mel Rankin Sr.). Guests are always welcome! Currently, annual membership fees for the Edmonton Centre are: **$20.00** for adults, **$12.00** for those age 17 and under.

STARDUST
EDMONTON CENTRE, Royal Astronomical Society of Canada
c/o Queen Elizabeth Planetarium
10th Floor, C.N. Tower
Edmonton Alberta

GENERAL MEETING

Monday February 11, 1980 at 8:00 pm
Music Room, Edmonton Public Library

SPEAKER AND TOPIC
Paul Deans, Queen Elizabeth Planetarium
The Golden Age of Planetary Exploration
(A look at the past 15 years of Solar System exploration as seen through the camera eyes of various unmanned interplanetary spacecraft.)

OBSERVER'S CORNER

Monday, February 25 at 8:00 pm
Room 445, Physics Building, U of A

SPEAKER AND TOPIC
Film: *Mirrors on the Universe*
Dave Beale: *How Radio Telescopes Work*

OBSERVING SESSION

Friday February 22 at 9:00 pm
Ellerslie Observatory
(Feb 23 if the 22nd is clouded out)

TO: